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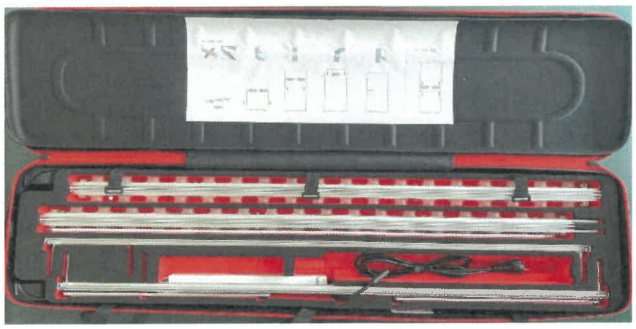
Forschungsprojekte: *Study item:*	Life Cycle Assessment			
Inhalt der Forschung: *Study content:*	Life Cycle Assessment of LUP Series Portable Lightboxes			
Anforderung: *Specification:*	EN 15804+A2:2019, *Sustainability of construction works - Environmental product declarations - Core rules for the product category of construction products* ISO 14044:2006+A1:2018+A2:2020, *Environmental management — Life cycle assessment — Requirements and guidelines*			
Dauer der Forschung: *Study period:*	2024-11-04 – 2025-01-23			
Ort der Forschung: *Place of study:* TUV Rheinland (Shanghai) Co., Ltd. No.177, Lane 777, West Guangzhong Road Jingan District, Shanghai, China, 200072				

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Diese studie, die Von TÜV Rheinland auf der basis eines kundenverzeichnisses erstellt wurde, dient dazu, ein klares bild Von den CO_2-emissionen der gewünschten produkte zu gewinnen und eine grundlage für eine künftige verringerung der CO_2-emissionen zu schaffen.
This study was prepared by TÜV Rheinland based on the customer's life cycle inventory in order to clearly understand the carbon emissions of the customer's target product and to provide a basis for future carbon reduction of that product.

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1 Product Specifications

The LUP series lightboxes are LED aluminum alloy lightbox produced by EXPO D&P LTD, available in four specifications: LUP-85-200-ABS, LUP-85-200-cardboard, LUP-100-200-ABS and LUP-100-200-cardboard. This series of lightboxes can be equipped with height/width extension accessories, including LUP-EXT-30 and LUP-EXT-45. The dimensions, luminous flux, and reference service life (RSL) of the lightboxes and its accessories are shown in the table below.

Specification of lightbox	Dimension (cm*cm)	Net weight of lightbox (kg)	Packaging weight (kg)	Luminous flux (lumen)	Reference service life (hour)
LUP-85-200-ABS	85*200	8.388	6.242	8412.800	50,000
LUP-85-200-cardboard	85*200	8.378	3.942	8412.800	50,000
LUP-100-200-ABS	100*200	8.679	6.242	8412.800	50,000
LUP-100-200-cardboard	100*200	8.669	3.942	8412.800	50,000

Specification of accessory	Dimension (cm)	Net weight of accessory (kg)	Luminous flux (lumen)	Reference service life (hour)
LUP-EXT-30	30	0.866	1,342.080	50,000
LUP-EXT-45	45	1.210	2,069.600	50,000

EXPO D&P LTD is a subsidiary of BEST SYSTEMS GMBH.

2 Goal and Scope

2.1 Goal

According to ISO 14044:2006, in defining the goal of an LCA, the following items shall be unambiguously stated:

– the intended application;

– the reasons for carrying out the study:

– the intended audience, i.e. to whom the results of the study are intended to be communicated:

– whether the results are intended to be used in comparative assertions intended to be disclosed to the public.

Remark: The goal of this Life Cycle Assessment (LCA) study is to get a clear picture of the carbon emission of the company's lightbox products at the present stage, and provide a provide a basis for industry comparisons.The results reported in the LCA study are used for self-declaration of BEST SYSTEMS GMBH.

Industry comparison is only applicable between lightboxes. Lightboxes with accessories are not suitable for industry comparison because the declared/functional unit of lightbox and accessory are different.

2.2 Functional unit

This report based on the EN 15804+A2:2019 shall use a functional unit (FU). All subsequent analyses then refer to that FU, as all inputs and outputs in the life cycle inventory (LCI) and consequently the life cycle impact assessment (LCIA) profile are related to the FU.

- The function of the lightbox is to provide lighting within the Reference Service Life(RSL). The lightbox is characterized for an outgoing artificial luminous flux of [V] lumens with a RSL of [H].

- The FU is defined as a lightbox providing lighting that delivers an outgoing artificial luminous flux of 1,000 lumens during a RSL of 50,000 hours.

- The outgoing artificial luminous flux [V] of the device is measured by the manufacturer. The uint of [V] is lumen.
- The RSL of the lightbox is the lightbox life expectancy as declared by the manufacturers according to the conditions of use provided by them. It is declared in hours of operation[H] by the manufacturer.

The FU is calculated as:

([V]/1,000) x ([H]/50,000)

Consequently, the FU of the following product corresponds to:

Specification	FU
LUP-85-200-ABS	(8412.800/1,000) x (50,000/50,000) = 8.413
LUP-85-200-cardboard	(8412.800/1,000) x (50,000/50,000) = 8.413
LUP-100-200-ABS	(8412.800/1,000) x (50,000/50,000) = 8.413
LUP-100-200-cardboard	(8412.800/1,000) x (50,000/50,000) = 8.413

Remark: In LCA, the declared unit shall be applied if a functional unit cannot be defined. The basic role of the declared unit is to provide a baseline for statistical measurement inputs and outputs in the LCA.

According to EN 15804+A2:2019, this study uses 1 piece of accessory as the declared unit.

2.3 System boundary

Life-cycle stages	Information modules	Included/Excluded
A1-A3 Product stage	A1) Raw material supply	Included
	A2) Transport	Included
	A3) Manufacturing	Included
A4-A5 Construction process stage	A4) Transport	Included
	A5) Construction installation	Included
B Use stage	B1) Use	Excluded
	B2) Maintenance	Excluded
	B3) Repair	Excluded
	B4) Replacement	Excluded
	B5) Refurbishment	Excluded
	B6) Energy use to operate building integrated technical systems	Included
	B7) Operational water use by building integrated technical systems	Excluded
C End of life stage	C1) Deconstruction	Included
	C2) Transport	Included
	C3) Waste processing	Included
	C4) Waste disposal	Included
D Benefits and loads beyond the product system boundary	D) Reuse, recovery, recycling, potential	Included

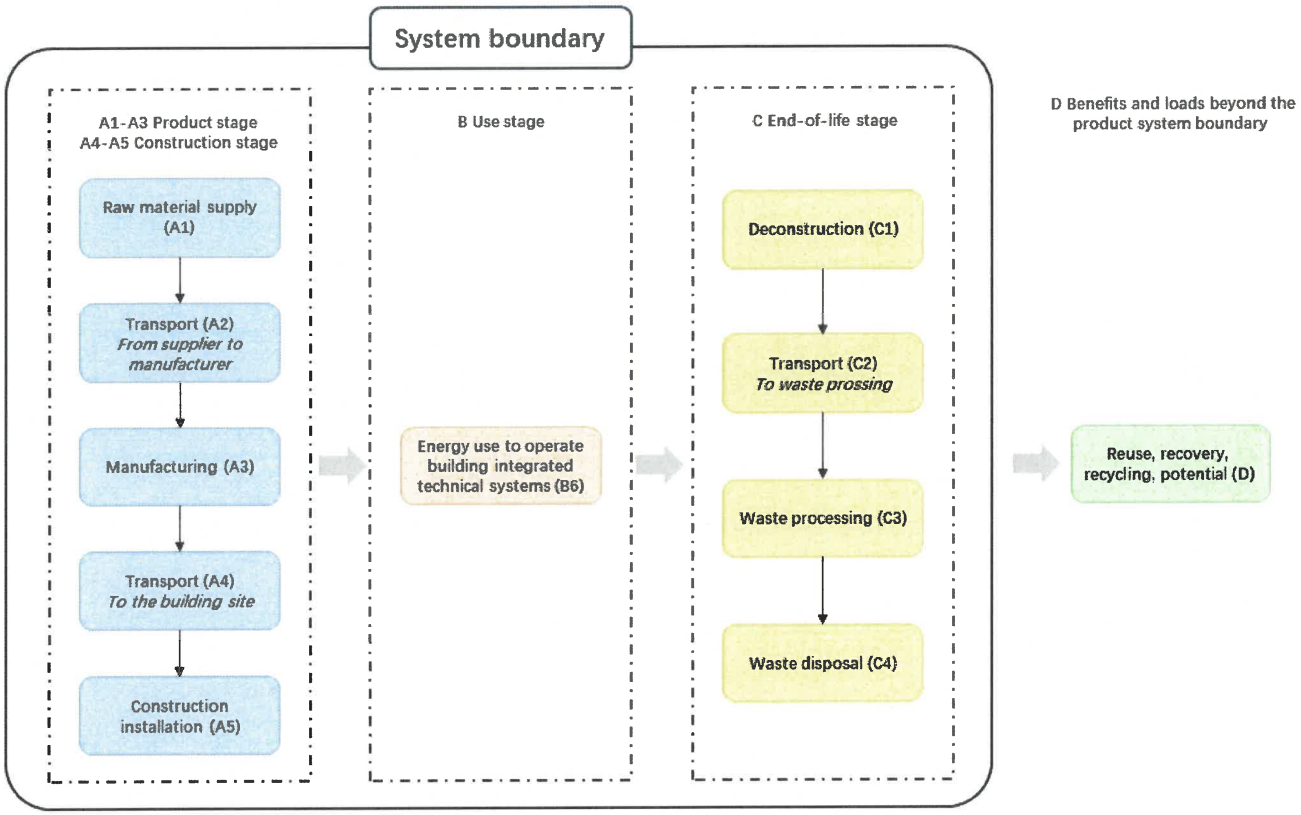
Interpretation of modules not taken into account in the boundary:

- Lightboxes do not relate to modules B1 and B7;

- Due to lack of information, modules B2, B3, B4 and B5 are not involved in this calculation. It is anticipated that the downstream supply chain will provide relevant information in the future to enhance the calculation of the product's life cycle assessment.

Processes in stages can be excluded are:

- business travel of personnel and travel to and from work by personnel;
- indirect activities (like administration, sales, research and development activities etc.).



* The system boundary of accessory includes A1-A5,B6,C1-C4 and D.

2.3.1 Information modules

- Raw material supply (A1):

  Extraction and processing of raw materials and biomass production and processing;

  Production and processing of semi-finished components.

- Transport (A2):

  Transportation up to the factory gate.

- Manufacturing (A3):

  Manufacturing of products;

  Processing up to the end-of-waste state or disposal of final residues including any packaging not leaving the factory gate with the product.

- Transportation (A4):

Transportation from the production gate to the construction site.

- Installation (A5):

  Waste processing of the waste from product packaging and product wastage during the construction processes up to the end-of-waste state or disposal of final residues;

  Installation of the product into the building including manufacture and transportation of ancillary materials and any energy or water required for installation or operation of the construction site. It also includes on-site operations to the product.

- Energy use to operate building integrated technical systems (B6):

  Energy use during the operation of the product (the integrated building technical system), together with its associated environmental aspects and impacts including processing and transportation of any waste arising on site from the use of energy.

- Deconstruction (C1):

  Deconstruction, including dismantling or demolition, of the product from the building, including initial on-site sorting of the materials;

- Transport (C2):

  Transportation of the discarded product as part of the waste processing, e.g. to a recycling site and transportation of waste e.g. to final disposal.

- Waste processing (C3):

  Waste processing e.g. collection of waste fractions from the deconstruction and waste processing of material flows intended for reuse, recycling and energy recovery.

- Waste disposal (C4):

  Waste disposal including physical pre-treatment and management of the disposal site.

- Benefits and loads beyond the product system boundary (D):

  The environmental benefits or loads resulting from reusable products, recyclable materials and/or useful energy carriers leaving a product system.

2.4 Cut-off rules

General cut off rules: a process or activity that contributes 1% or less of the total mass and 1% or less of the total energy use may be omitted from the inventory analysis for any particular module. The sum of the excluded material flows must not exceed 5% of mass, energy or environmental relevance.

The cardboard packaging of the upstream raw materials accounts for 1% of the total product weight, therefore, this activity is cut off in accordance with the cut off rules.

2.5 Selection of data

The report boundary of the lightbox is set from cradle to grave. The product life cycle stage is from resource extraction to final disposal. Information on data selection of this study is shown in the table below.

Modules	Module A1-A3		A4 and A5	B6	C1-C4
	Production of commodities, raw materials	Product manufacture	Installation processes	Use process	End-of-life processes
Process type	Upstream processes	Processes the manufacturer has influence over	Downstream processes		
Data type	Generic data	Manufacturer's specific data	Manufacturer's specific data	Manufacturer's specific data	Generic data

- Background data is an embedded database based on Ecoinvent database version 3.9.1.

Module A1-A3:

- The data used for raw material supply stage, raw material transportation stage and manufacturing stage comes from data collection tables (Annex 1), provided by EXPO D&P LTD.
- The geographical scope of A1-A3 is Suzhou, Jiangsu, China.
- The time boundary of module A1-A3 specific data is from 2023.10.01 to 2024.10.01.
- The specific data on material losses (cutting, wastage, residues, etc.) is provided by the manufacturer. See Annex 1 for details.

Module A4 and A5:

- The data on transport distances and carrier types for the distribution stage comes from data collection tables (Annex 1), provided by EXPO D&P LTD.

Module B6:

- In B6 module, the data on the energy consumption of different specification of lightboxes are provided by the manufacturer.

Module C1-C4:

- The manufacturer claims that lightboxes are distributed to the EU. Lightboxes are subject to waste management according to the requirements of the EU or German health authorities. It can be considered that, in the end of life (EoL) stage, the products are collected and recycled according to the EU Directive 2012/19/EU on Waste Electrical and Electronic Equipment (WEEE).
- In module C1, the manufacturer claims that the lightbox is manually dismantled, without energy consumption.
- The manufacturer does not provide data on modules C2, C3 and C4 of the product to support the evaluation of the EoL, it was estimated based on the input materials and generic data.
- The generic data on modules C2, C3 and C4 is selected based on the EU Directive 2012/19/EU on WEEE. It comes from the most up-to-date Eurostats database.

2.6 Data quality

According to EN 15804+A2:2019, the data quality assessment information shall cover at least the following elements:

a) time-related coverage (TiR): age of data and the minimum length of time over which data should be collected

b) geographical coverage (GeR): geographical area from which data for unit processes

c) technology coverage (TeR): specific technology or technology mix

Data quality requirements are listed in the table below.

Criteria	Options	Quality level	Score
Time-related coverage	Less than 3 years difference between the reference year according to the documentation, and the time period for which data are representative.	Very good	1
	Less than 6 years of difference between the reference year according to the documentation, and the time period for which data are representative	Good	2
	Less than 10 years of difference between the reference year according to the documentation, and the time period for which data are representative	Fair	3
	Less than 15 years of difference between the reference year according to the documentation, and the time period for which data are representative	Poor	4
	Age of data unknown or more than 15 years of difference between the reference year according to the documentation, and the time period for which data are representative	Very poor	5
Geographical coverage	Data from area under study.	Very good	1
	Average data from larger area in which the area under study is included	Good	2
	Data from area with similar production conditions	Fair	3
	Data from area with slightly similar production conditions	Poor	4
	Data from unknown or distinctly different area (North America instead of Middle East, OECDEurope instead of Russia)	Very poor	5
Technology coverage	Data from processes and products under study. Same state of technology applied as defined in goal and scope (i.e. identical technology)	Very good	1
	Data from processes and products under study (with similar technology). Evidence of deviations in state of technology, e.g. different by-product.	Good	2
	Data from processes and products under study but from different technology. This score is also applied when not technology is specified; e.g. wheat (no further specification)	Fair	3
	Data on related processes or products; organic wheat under study, data for organic rye provided.	Poor	4
	Data on related processes on but with a different scale or from different technology; organic wheat under study, data for conventional wheat provided.	Very poor	5

Calculate the DQR score of the declared value as:

$$\frac{\mathrm{TeR} + \mathrm{TiR} + \mathrm{GeR}}{3}$$

The final score of data should not be higher than 3 in this study.

The final scores are shown in the table below.

Data quality scores of different specification

Specification	Score
LUP-85-200-ABS	1.993
LUP-85-200-cardboard	1.978
LUP-100-200-ABS	1.993
LUP-100-200-cardboard	1.978
LUP-EXT-30	1.917
LUP-EXT-45	1.917

The assessments of data quality are shown in Annex 2.

2.7 Units

Accroding to EN15804+A2:2019, SI units shall be used.Basic units are: metre (m), kilogram (kg), molecular weight in grams (mol). With the exceptions noted below, all resources are expressed in kg.

Exceptions are:

— Resources used for energy input (primary energy), which are expressed as kWh or MJ, including renewable energy sources e.g. hydropower, wind power;

— Water use, which is expressed in m^3 (cubic metres)

— Temperature, which is expressed in degrees Celsius;

— Time, which is expressed in practical units depending on the assessment scale: minutes, hours, days, years.

All figures displayed in this study should be rounded to 3 decimal places.

2.8 Allocation rules

If mass criteria are applied, the allocation factor shall be calculated as the total mass of the lightbox or component divided by the total mass of all lightboxes or components produced at the given production site.
The use of economic allocation criteria should be avoided, because of its sensibility to market specific conditions.

According to EN 15804+A2:2019, for using economic allocation according to the different contributions to the overall revenue are described. If economic allocation has been used, a specific sensitivity analysis shall be provided to the verifier and the monitoring of the relationship between results and current economic value shall be documented and updated.

In this study, the results of the product stage are calculated based on the data provided by the manufacturer, without allocation.

Allocation procedure for reuse and recycling is open-loop method. An open-loop allocation procedure applies to open-loop product systems where the material is recycled into other product systems and the material undergoes a change to its inherent properties.

The collection rate is 40.1%. Data comes from the most up-to-date *collection rate* of WEEE in the European Union in 2022 (measured as the weight of WEEE collected relative to the average weight of electronic equipment put on the market in the 3 preceding years).

The recycling rate is 87.8%. Data comes from the most up-to-date Eurostats *recycling rate* (Germany, in 2022) from the large equipment (any external dimension over 50 cm) waste category.

2.9 Life Cycle Inventory

2.9.1 Calculation procedures

The modeling and calculation is based on manufacturer's specific data, generic data and background data.

The data provided by the manufacturer was preprocessed as follows before modeling:

In module A2, the formula is:

Raw material weight (kg)*Raw material transport distance (km)=Input (kg·km)

See Annex 1 for detail values.

In module A4, the formula is:

Product with package weight (kg)*Distribution distance(km)=Input (kg·km)

See Annex 1 for detail values.

In module B6, the RSL of the four specifications of lightboxes is 50,000 hours. The energy usage values for each lightbox are shown in the table below.

Operational energy use value (kWh)=Product Power Consumption (kW)* RSL(hours)

Specification	Product Power Consumption (kW)	Operational energy use value (kWh)
LUP-85-200-ABS	0.059	2,950
LUP-85-200-cardboard	0.059	2,950
LUP-100-200-ABS	0.059	2,950
LUP-100-200-cardboard	0.059	2,950

In module C1, the common scenario of manual dismantling for 100% of the product is considered. Dismantled product weight of each product is shown in below table.

In module C2, the distance to transport the deconstructed product from the construction site to the waste management site is estimated to be 100km. The formula is:

Dismantled product (kg)* Distance of transport to waste manager (km)=Input (kg·km)

Specification	Dismantled product (kg)	Distance (km)	Input (kg·km)
LUP-85-200-ABS	8.388	100	838.800
LUP-85-200-cardboard	8.378	100	837.800
LUP-100-200-ABS	8.679	100	867.900
LUP-100-200-cardboard	8.669	100	866.900
LUP-EXT-30	0.866	100	86.600
LUP-EXT-45	1.210	100	121

In module C3, the waste collection rate is 40.1%, and the waste recycling rate is 87.8%. Metal, PC, and LED are recycled. Therefore, the formula is:

Metal/PC/LED weight (kg)*40.1%*87.8%= Recycling material weight (kg)

Recycling material weight of each product is shown in below table.

Recycling material	Recycling material weight (kg)					
	LUP-85-200-ABS	LUP-85-200-cardboard	LUP-100-200-ABS	LUP-100-200-cardboard	LUP-EXT-30	LUP-EXT-45
Aluminium	2.318	2.318	2.421	2.421	0.201	0.302
Steel	0.134	0.134	0.134	0.134	0.019	0.019
Copper	<0.001	<0.001	<0.001	<0.001	/	/
PC	0.006	<0.001	0.006	<0.001	<0.001	<0.001
LED	0.270	0.270	0.270	0.270	0.048	0.068
Total	2.729	2.723	2.831	2.826	0.268	0.389

In module C4, the rest of the product that has not entered the treatment system is sent to the landfill. The formula is:

Dismantled product weight (kg) - Recycling material weight (kg) = Landfill weight (kg)

In module D, this product claims the environmental benefits due to recycling and reuse according to Directive 2012/19/ EU of WEEE. 35.208%(40.1%*87.8%) of the metals, PC, and LEDs are recycled.

There is no energy recovery and reuse.

2.9.2 Biogenic carbon content

Growing biomass removes CO_2 from the air; the carbon from the removed CO_2 is transformed into the plant tissue and is called biogenic carbon. The biogenic carbon comprises part of the product and eventually can be released into the air again as CO_2 or as CH_4.

The biogenic carbon correction approach covers modelling and evaluation of biogenic carbon dioxide for products where biogenic carbon forms part of a product from a cradle-to-gate perspective. It does not cover systems where atmospheric carbon is removed by a product during its use.

In this study, the information on biogenic carbon content of per lightbox are shown in below tables.

1. LUP-85-200-ABS:

Product components	Weight, kg	Post-consumer material, weight-%	Biogenic material, weight-% and kg C/kg
Coating	0.017	0%	/
LED	0.768	0%	/
PA6	0.022	0%	/
PC	0.016	0%	/
POM	0.002	0%	/
Glass fibre	0.098	0%	/
Stainless steel	0.028	0%	/
Connector	0.065	0%	/
Cable	0.185	0%	/
Power	0.211	0%	/
Sealing tape	0.001	0%	/
Gule	0.015	0%	/
Cold rolled steel	0.001	0%	/
Aluminium alloy	6.585	0%	/
Carbon steel	0.351	0%	/
Copper	0.001	0%	/
Rubber	0.012	0%	/
Printing	0.010	0%	/
TOTAL	**8.388**	**0%**	**/**
Packaging materials	**Weight, kg**	**Weight-% (versus the packing)**	**Weight biogenic carbon, kg C/kg**
Cardboard	1.392	22.301%	0.399 kg C/kg
ABS	3.700	59.276%	/
EVA	1.150	18.424%	/
TOTAL	**6.242**	**100%**	**/**

2. LUP-85-200-cardboard:

Product components	Weight, kg	Post-consumer material, weight-%	Biogenic material, weight-% and kg C/kg
Coating	0.017	0%	/
LED	0.768	0%	/
PA6	0.022	0%	/
PC	0.001	0%	/
POM	0.002	0%	/
Glass fibre	0.098	0%	/
Stainless steel	0.028	0%	/
Connector	0.065	0%	/
Cable	0.185	0%	/

Product components	Weight, kg	Post-consumer material, weight-%	Biogenic material, weight-% and kg C/kg
Power	0.211	0%	/
Sealing tape	0.010	0%	/
Gule	0.021	0%	/
Cold rolled steel	0.001	0%	/
Aluminium alloy	6.585	0%	/
Carbon steel	0.351	0%	/
Copper	0.001	0%	/
Rubber	0.012	0%	/
TOTAL	**8.378**	**0%**	**/**
Packaging materials	**Weight, kg**	**Weight-% (versus the packing)**	**Weight biogenic carbon, kg C/kg**
Cardboard	3.679	93.328%	0.399 kg C/kg
PE	0.108	2.740%	/
PC	0.155	3.932%	/
TOTAL	**3.942**	**100%**	**/**

3. LUP-100-200-ABS:

Product components	Weight, kg	Post-consumer material, weight-%	Biogenic material, weight-% and kg C/kg
Coating	0.017	0%	/
LED	0.768	0%	/
PA6	0.022	0%	/
PC	0.016	0%	/
POM	0.002	0%	/
Glass fibre	0.098	0%	/
Stainless steel	0.028	0%	/
Connector	0.065	0%	/
Cable	0.185	0%	/
Power	0.211	0%	/
Sealing tape	0.001	0%	/
Gule	0.015	0%	/
Cold rolled steel	0.001	0%	/
Aluminium alloy	6.876	0%	/
Carbon steel	0.351	0%	/
Copper	0.001	0%	/
Rubber	0.012	0%	/
Printing	0.010	0%	/
TOTAL	**8.679**	**0%**	**/**
Packaging materials	**Weight, kg**	**Weight-% (versus the packing)**	**Weight biogenic carbon, kg C/kg**
Cardboard	1.392	22.301%	0.399 kg C/kg
ABS	3.700	59.276%	/
EVA	1.150	18.424%	/
TOTAL	**6.242**	**100%**	**/**

4. LUP-100-200-cardboard:

Product components	Weight, kg	Post-consumer material, weight-%	Biogenic material, weight-% and kg C/kg
Coating	0.017	0%	/
LED	0.768	0%	/
PA6	0.022	0%	/
PC	0.001	0%	/
POM	0.002	0%	/
Glass fibre	0.098	0%	/
Stainless steel	0.028	0%	/
Connector	0.065	0%	/
Cable	0.185	0%	/
Power	0.211	0%	/
Sealing tape	0.010	0%	/
Gule	0.021	0%	/
Cold rolled steel	0.001	0%	/
Aluminium alloy	6.876	0%	/
Carbon steel	0.351	0%	/
Copper	0.001	0%	/
Rubber	0.012	0%	/
TOTAL	**8.669**	**0%**	**/**
Packaging materials	**Weight, kg**	**Weight-% (versus the packing)**	**Weight biogenic carbon, kg C/kg**
Cardboard	3.679	93.328%	0.399 kg C/kg
PE	0.108	2.740%	/
PC	0.155	3.932%	/
TOTAL	**3.942**	**100%**	**/**

Since the weight proportion of biological materials in packaging is relatively high. A biogenic carbon balance correction is applied to them.

Remark: The information on biogenic carbon content of per accessory is shown in Annex 3.

3 Impact assessment

The information on environmental impacts is expressed with the impact category indicators of Life Cycle Impact Assessment (LCIA) using characterisation factors in a LCIA according to ISO 14044.

In this study, core environmental impact indicators are reported.

Information on the impact categories, indicators, and units of core environmental impact indicators is listed below.

Core environmental impact indicators

Impact category	Indicator	Unit (expressed per functional unit or per declared unit)
Climate change – total [a]	Global Warming Potential total (GWP-total)	kg CO_2 eq.
Climate change - fossil	Global Warming Potential fossil fuels (GWP-fossil)	kg CO_2 eq.
Climate change - biogenic	Global Warming Potential biogenic (GWP-biogenic)	kg CO_2 eq.

Climate change - land use and land use change [b]	Global Warming Potential land use and land use change (GWP-luluc)	kg CO_2 eq.
Ozone Depletion	Depletion potential of the stratospheric ozone layer (ODP)	kg CFC 11 eq.
Acidification	Acidification potential, Accumulated Exceedance (AP)	mol H^+ eq.
Eutrophication aquatic freshwater	Eutrophication potential, fraction of nutrients reaching freshwater end compartment (EP-freshwater)	kg P eq.
Eutrophication aquatic marine	Eutrophication potential, fraction of nutrients reaching marine end compartment (EP-marine)	kg N eq.
Eutrophication terrestrial	Eutrophication potential, Accumulated Exceedance (EP-terrestrial)	mol N eq.
Photochemical ozone formation	Formation potential of tropospheric ozone (POCP);	kg NMVOC eq.
Depletion of abiotic resources - minerals and metals [c d]	Abiotic depletion potential for non-fossil resources (ADP-minerals&metals)	kg Sb eq.
Depletion of abiotic resources - fossil fuels [c]	Abiotic depletion for fossil resources potential (ADP-fossil)	MJ, net calorific value
Water use	Water (user) deprivation potential, deprivation-weighted water consumption (WDP)	m^3 world eq. deprived

[a] The total global warming potential (GWP-total) is the sum of
— GWP-fossil
— GWP-biogenic
— GWP-luluc
[b] It is permitted to omit GWP-luluc as separate information if its contribution is < 5 % of GWP-total over the declared modules excluding module D.
[c] The abiotic depletion potential is calculated and declared in two different indicators:
— ADP-minerals&metals include all non-renewable, abiotic material resources (i.e. excepting fossil resources);
— ADP-fossil include all fossil resources and includes uranium.
[d] ultimate reserve model of the ADP-minerals&metals model

The indicators are calculated based on EN 15804 +A2 (adapted) V1.00 / EF 3.1 normalization and weighting set.

Core environmental impact indicators per funtional unit of lightbox in different specifications are shown in the table below, including the calculation of biogenic carbon balance correction.

Remark: LCIA results per declared unit of accessory in different specifications are shown in Annex 4.

1. LUP-85-200-ABS:

The calculation of GWP-biogenic results (unit is kg CO_2 eq.):

	A1	A2	A3	A4	A5	C1	C2	C3
GWP-biogenic (non-biobased material/fuel in product/packaging)	3.525E-01	1.405E-04	2.957E-02	8.062E-04	1.240E+00	/	1.698E-05	-3.904E-04
GWP-biogenic (biobased material/fuel in product/packaging)	-2.683E-01	/	-7.906E-04	-7.316E-05	/	/	/	2.691E-01
GWP-biogenic (as reported in the LCA)	8.421E-02	1.405E-04	2.878E-02	7.331E-04	1.240E+00	/	1.698E-05	2.688E-01

Indicator	**A1**	**A2**	**A3**	**A4**	**A5**	**B6**	**C1**	**C2**	**C3**	**C4**
GWP-total [kg CO_2 eq.]	3.731E+01	1.268E-01	1.685E-01	7.303E-01	1.302E+00	1.307E+02	/	1.880E-02	3.358E-01	8.781E-01
GWP-fossil [kg CO_2 eq.]	3.716E+01	1.265E-01	1.397E-01	7.291E-01	6.147E-02	1.261E+02	/	1.877E-02	6.677E-02	4.148E-02
GWP-biogenic [kg CO_2 eq.]	8.421E-02	1.405E-04	2.878E-02	7.331E-04	1.240E+00	4.283E+00	/	1.698E-05	2.688E-01	8.367E-01
GWP-luluc [kg CO_2 eq.]	6.767E-02	7.908E-05	5.454E-05	5.150E-04	5.409E-07	3.149E-01	/	9.115E-06	1.826E-04	3.649E-07
OOP [kg CFC-11 eq.]	3.700E-07	2.220E-09	2.456E-10	1.321E-08	7.654E-11	2.399E-06	/	4.083E-10	9.412E-10	5.164E-11
AP [mole of H^+ eq.]	2.326E-01	5.684E-04	7.326E-04	1.203E-02	8.092E-05	7.220E-01	/	6.121E-05	4.071E-04	5.460E-05
EP-freshwater [kg P eq.]	3.292E-03	1.599E-06	3.249E-06	6.323E-06	1.367E-05	1.247E-02	/	1.502E-07	1.691E-06	9.222E-06
EP-marine [kg N eq.]	4.046E-02	1.841E-04	1.628E-04	3.154E-03	5.109E-04	9.068E-02	/	2.080E-05	1.237E-04	3.447E-04
EP-terrestrial [mole of N eq.]	4.382E-01	2.007E-03	1.661E-03	3.476E-02	2.278E-04	1.056E+00	/	2.223E-04	1.354E-03	1.537E-04
POCP [kg NMVOC eq.]	1.323E-01	7.725E-04	4.489E-04	9.965E-03	4.792E-04	3.394E-01	/	9.144E-05	4.293E-04	3.233E-04
ADF-mineral & metals [kg Sb eq.]	1.647E-03	8.653E-07	8.817E-08	1.526E-06	1.680E-09	1.505E-03	/	6.027E-08	1.431E-07	1.134E-09
ADF-fossils [MJ]	4.793E+02	1.756E+00	1.344E+00	9.683E+00	6.286E-02	2.853E+03	/	2.661E-01	9.347E-01	4.241E-02
Water use [m^3 world equiv.]	8.024E+00	8.632E-03	1.524E-02	3.583E-02	1.355E-04	3.219E+01	/	1.085E-03	1.302E-02	9.145E-05

The results per FU of module D are shown below.

Indicator	D
GWP-total [kg CO_2 eq.]	-1.953E+00
GWP-fossil [kg CO_2 eq.]	-1.948E+00
GWP-biogenic [kg CO_2 eq.]	-5.510E-03
GWP-luluc [kg CO_2 eq.]	1.128E-04
OOP [kg CFC-11 eq.]	-1.511E-08
AP [mole of H^+ eq.]	-1.177E-02
EP-freshwater [kg P eq.]	-1.085E-05
EP-marine [kg N eq.]	-8.555E-04
EP-terrestrial [mole of N eq.]	-1.653E-02
POCP [kg NMVOC eq.]	-4.786E-03
ADF-mineral & metals [kg Sb eq.]	-9.488E-07
ADF-fossils [MJ]	-2.109E+01
Water use [m^3 world equiv.]	-5.904E+00

2. LUP-85-200-cardboard:

The calculation of GWP-biogenic results (unit is kg CO_2 eq.):

	A1	A2	A3	A4	A5	C1	C2	C3
GWP-biogenic (non-biobased material/fuel in product/packaging)	3.392E-01	1.244E-04	2.957E-02	6.905E-04	1.240E+00	/	1.696E-05	-3.899E-04
GWP-biogenic (biobased material/fuel in product/packaging)	-6.451E-01	/	-7.906E-04	-7.316E-05	/	/		6.459E-01
GWP-biogenic (as reported in the LCA)	-3.058E-01	1.244E-04	2.878E-02	6.173E-04	1.239E+00	/	1.696E-05	6.455E-01

Indicator	**A1**	**A2**	**A3**	**A4**	**A5**	**B6**	**C1**	**C2**	**C3**	**C4**
GWP-total [kg CO_2 eq.]	3.432E+01	1.125E-01	1.685E-01	6.150E-01	1.300E+00	1.307E+02	/	1.878E-02	7.124E-01	8.774E-01
GWP-fossil [kg CO_2 eq.]	3.456E+01	1.123E-01	1.397E-01	6.140E-01	6.140E-02	1.261E+02	/	1.875E-02	6.669E-02	4.144E-02
GWP-biogenic [kg CO_2 eq.]	-3.058E-01	1.244E-04	2.878E-02	6.173E-04	1.239E+00	4.283E+00	/	1.696E-05	6.455E-01	8.360E-01
GWP-luluc [kg CO_2 eq.]	6.735E-02	7.000E-05	5.454E-05	4.337E-04	5.402E-07	3.149E-01	/	9.104E-06	1.824E-04	3.646E-07
OOP [kg CFC-11 eq.]	3.498E-07	1.973E-09	2.456E-10	1.112E-08	7.645E-11	2.399E-06	/	4.078E-10	9.401E-10	5.160E-11
AP [mole of H^+ eq.]	2.238E-01	5.030E-04	7.326E-04	1.013E-02	8.082E-05	7.220E-01	/	6.114E-05	4.066E-04	5.455E-05
EP-freshwater [kg P eq.]	3.259E-03	1.414E-06	3.249E-06	5.325E-06	1.365E-05	1.247E-02	/	1.500E-07	1.689E-06	9.214E-06
EP-marine [kg N eq.]	3.918E-02	1.630E-04	1.628E-04	2.656E-03	5.103E-04	9.068E-02	/	2.078E-05	1.236E-04	3.444E-04
EP-terrestrial [mole of N eq.]	4.244E-01	1.777E-03	1.661E-03	2.928E-02	2.275E-04	1.056E+00	/	2.221E-04	1.352E-03	1.536E-04
POCP [kg NMVOC eq.]	1.249E-01	6.840E-04	4.489E-04	8.391E-03	4.786E-04	3.394E-01	/	9.133E-05	4.288E-04	3.230E-04
ADF-mineral & metals [kg Sb eq.]	1.645E-03	7.644E-07	8.817E-08	1.285E-06	1.678E-09	1.505E-03	/	6.020E-08	1.429E-07	1.133E-09
ADF-fossils [MJ]	4.246E+02	1.558E+00	1.344E+00	8.154E+00	6.279E-02	2.853E+03	/	2.658E-01	9.336E-01	4.238E-02
Water use [m^3 world equiv.]	6.694E+00	7.644E-03	1.524E-02	3.018E-02	1.354E-04	3.219E+01	/	1.083E-03	1.300E-02	9.138E-05

The results per FU of module D are shown below.

Indicator	D
GWP-total [kg CO_2 eq.]	-1.953E+00
GWP-fossil [kg CO_2 eq.]	-1.947E+00
GWP-biogenic [kg CO_2 eq.]	-6.604E-03
GWP-luluc [kg CO_2 eq.]	1.130E-04
OOP [kg CFC-11 eq.]	-1.520E-08
AP [mole of H^+ eq.]	-1.177E-02
EP-freshwater [kg P eq.]	-1.086E-05
EP-marine [kg N eq.]	-8.560E-04
EP-terrestrial [mole of N eq.]	-1.653E-02
POCP [kg NMVOC eq.]	-4.787E-03
ADF-mineral & metals [kg Sb eq.]	-9.557E-07
ADF-fossils [MJ]	-2.110E+01
Water use [m^3 world equiv.]	-5.904E+00

3. LUP-100-200-ABS:

The calculation of GWP-biogenic results (unit is kg CO_2 eq.):

	A1	A2	A3	A4	A5	C1	C2	C3
GWP-biogenic (non-biobased material/fuel in product/packaging)	3.577E-01	1.409E-04	2.957E-02	8.208E-04	1.240E+00	/	1.757E-05	-4.039E-04
GWP-biogenic (biobased material/fuel in product/packaging)	-2.683E-01	/	-7.906E-04	-7.316E-05	/	/	/	2.692E-01
GWP-biogenic (as reported in the LCA)	8.942E-02	1.409E-04	2.878E-02	7.476E-04	1.283E+00	/	1.757E-05	2.688E-01

Indicator	**A1**	**A2**	**A3**	**A4**	**A5**	**B6**	**C1**	**C2**	**C3**	**C4**
GWP-total [kg CO_2 eq.]	3.772E+01	1.273E-01	1.685E-01	7.449E-01	1.347E+00	1.307E+02	/	1.945E-02	3.380E-01	9.074E-01
GWP-fossil [kg CO_2 eq.]	3.756E+01	1.270E-01	1.397E-01	7.436E-01	6.361E-02	1.261E+02	/	1.943E-02	6.909E-02	4.286E-02
GWP-biogenic [kg CO_2 eq.]	8.942E-02	1.409E-04	2.878E-02	7.476E-04	1.283E+00	4.283E+00	/	1.757E-05	2.688E-01	8.645E-01
GWP-luluc [kg CO_2 eq.]	6.861E-02	7.931E-05	5.454E-05	5.252E-04	5.596E-07	3.149E-01	/	9.431E-06	1.890E-04	3.771E-07
OOP [kg CFC-11 eq.]	3.750E-07	2.231E-09	2.456E-10	1.347E-08	7.920E-11	2.399E-06	/	4.225E-10	9.738E-10	5.336E-11
AP [mole of H^+ eq.]	2.350E-01	5.700E-04	7.326E-04	1.227E-02	8.373E-05	7.220E-01	/	6.334E-05	4.212E-04	5.641E-05
EP-freshwater [kg P eq.]	3.307E-03	1.602E-06	3.249E-06	6.449E-06	1.414E-05	1.247E-02	/	1.554E-07	1.750E-06	9.529E-06
EP-marine [kg N eq.]	4.086E-02	1.846E-04	1.628E-04	3.217E-03	5.286E-04	9.068E-02	/	2.152E-05	1.280E-04	3.562E-04
EP-terrestrial [mole of N eq.]	4.427E-01	2.013E-03	1.661E-03	3.546E-02	2.357E-04	1.056E+00	/	2.300E-04	1.401E-03	1.588E-04
POCP [kg NMVOC eq.]	1.337E-01	7.747E-04	4.489E-04	1.016E-02	4.958E-04	3.394E-01	/	9.462E-05	4.442E-04	3.341E-04
ADF-mineral & metals [kg Sb eq.]	1.650E-03	8.669E-07	8.817E-08	1.556E-06	1.739E-09	1.505E-03	/	6.236E-08	1.481E-07	1.172E-09
ADF-fossils [MJ]	4.836E+02	1.762E+00	1.344E+00	9.876E+00	6.504E-02	2.853E+03	/	2.754E-01	9.672E-01	4.383E-02
Water use [m^3 world equiv.]	8.085E+00	8.658E-03	1.524E-02	3.655E-02	1.402E-04	3.219E+01	/	1.122E-03	1.347E-02	9.450E-05

The results per FU of module D are shown below.

Indicator	**D**
GWP-total [kg CO_2 eq.]	-2.040E+00
GWP-fossil [kg CO_2 eq.]	-2.034E+00
GWP-biogenic [kg CO_2 eq.]	-5.807E-03
GWP-luluc [kg CO_2 eq.]	1.167E-04
OOP [kg CFC-11 eq.]	-1.590E-08
AP [mole of H^+ eq.]	-1.233E-02
EP-freshwater [kg P eq.]	-1.090E-05
EP-marine [kg N eq.]	-9.229E-04
EP-terrestrial [mole of N eq.]	-1.726E-02
POCP [kg NMVOC eq.]	-4.998E-03
ADF-mineral & metals [kg Sb eq.]	-9.696E-07
ADF-fossils [MJ]	-2.203E+01
Water use [m^3 world equiv.]	-6.166E+00

4. LUP-100-200-cardboard:

The calculation of GWP-biogenic results (unit is kg CO_2 eq.):

	A1	A2	A3	A4	A5	C1	C2	C3
GWP-biogenic (non-biobased material/fuel in product/packaging)	3.444E-01	1.244E-04	2.957E-02	6.905E-04	1.240E+00	/	1.696E-05	-4.034E-04
GWP-biogenic (biobased material/fuel in product/packaging)	-6.451E-01	/	-7.906E-04	-7.316E-05	/	/	/	6.459E-01
GWP-biogenic (as reported in the LCA)	-3.006E-01	1.244E-04	2.878E-02	6.173E-04	5.828E-01	/	1.696E-05	6.455E-01

Indicator	**A1**	**A2**	**A3**	**A4**	**A5**	**B6**	**C1**	**C2**	**C3**	**C4**
GWP-total [kg CO_2 eq.]	3.473E+01	1.125E-01	1.685E-01	6.150E-01	6.117E-01	1.307E+02	/	1.878E-02	7.147E-01	9.113E-01
GWP-fossil [kg CO_2 eq.]	3.496E+01	1.123E-01	1.397E-01	6.140E-01	2.889E-02	1.261E+02	/	1.875E-02	6.901E-02	4.304E-02
GWP-biogenic [kg CO_2 eq.]	-3.006E-01	1.244E-04	2.878E-02	6.173E-04	5.828E-01	4.283E+00	/	1.696E-05	6.455E-01	8.683E-01
GWP-luluc [kg CO_2 eq.]	6.830E-02	7.000E-05	5.454E-05	4.337E-04	2.542E-07	3.149E-01	/	9.104E-06	1.887E-04	3.787E-07
OOP [kg CFC-11 eq.]	3.547E-07	1.973E-09	2.456E-10	1.112E-08	3.597E-11	2.399E-06	/	4.078E-10	9.727E-10	5.359E-11
AP [mole of H^+ eq.]	2.262E-01	5.030E-04	7.326E-04	1.013E-02	3.803E-05	7.220E-01	/	6.114E-05	4.207E-04	5.666E-05
EP-freshwater [kg P eq.]	3.275E-03	1.414E-06	3.249E-06	5.325E-06	6.423E-06	1.247E-02	/	1.500E-07	1.748E-06	9.570E-06
EP-marine [kg N eq.]	3.958E-02	1.630E-04	1.628E-04	2.656E-03	2.401E-04	9.068E-02	/	2.078E-05	1.279E-04	3.577E-04
EP-terrestrial [mole of N eq.]	4.288E-01	1.777E-03	1.661E-03	2.928E-02	1.071E-04	1.056E+00	/	2.221E-04	1.399E-03	1.595E-04
POCP [kg NMVOC eq.]	1.263E-01	6.840E-04	4.489E-04	8.391E-03	2.252E-04	3.394E-01	/	9.133E-05	4.437E-04	3.355E-04
ADF-mineral & metals [kg Sb eq.]	1.649E-03	7.644E-07	8.817E-08	1.285E-06	7.897E-10	1.505E-03	/	6.020E-08	1.479E-07	1.177E-09
ADF-fossils [MJ]	4.289E+02	1.558E+00	1.344E+00	8.154E+00	2.954E-02	2.853E+03	/	2.658E-01	9.661E-01	4.402E-02
Water use [m^3 world equiv.]	6.755E+00	7.644E-03	1.524E-02	3.018E-02	6.370E-05	3.219E+01	/	1.083E-03	1.345E-02	9.491E-05

The results per FU of module D are shown below.

Indicator	D
GWP-total [kg CO_2 eq.]	-2.040E+00
GWP-fossil [kg CO_2 eq.]	-2.034E+00
GWP-biogenic [kg CO_2 eq.]	-5.807E-03
GWP-luluc [kg CO_2 eq.]	1.167E-04
OOP [kg CFC-11 eq.]	-1.590E-08
AP [mole of H^+ eq.]	-1.233E-02
EP-freshwater [kg P eq.]	-1.090E-05
EP-marine [kg N eq.]	-9.229E-04
EP-terrestrial [mole of N eq.]	-1.726E-02
POCP [kg NMVOC eq.]	-4.998E-03
ADF-mineral & metals [kg Sb eq.]	-9.696E-07
ADF-fossils [MJ]	-2.203E+01
Water use [m^3 world equiv.]	-6.166E+00

3.1 Electricity usage

The lightbox is manufactured in China. In A3 module, the electricity used in manufacturing is sourced from the Chinese mixed grid. The processes is Electricity, medium voltage {CN}| market group for electricity, medium voltage | Cut-off, U.

The geographical boundary for product installation is the European Union. In B6 module, The electricity used in operation is sourced from the EU mixed grid. The processes is Electricity, low voltage {Europe without Switzerland}| market group for electricity, low voltage | Cut-off, U.

The emission factors in this study come from SIMAPRO 9.5.0.2 software embedded with the Ecoinvent database version 3.9.1.

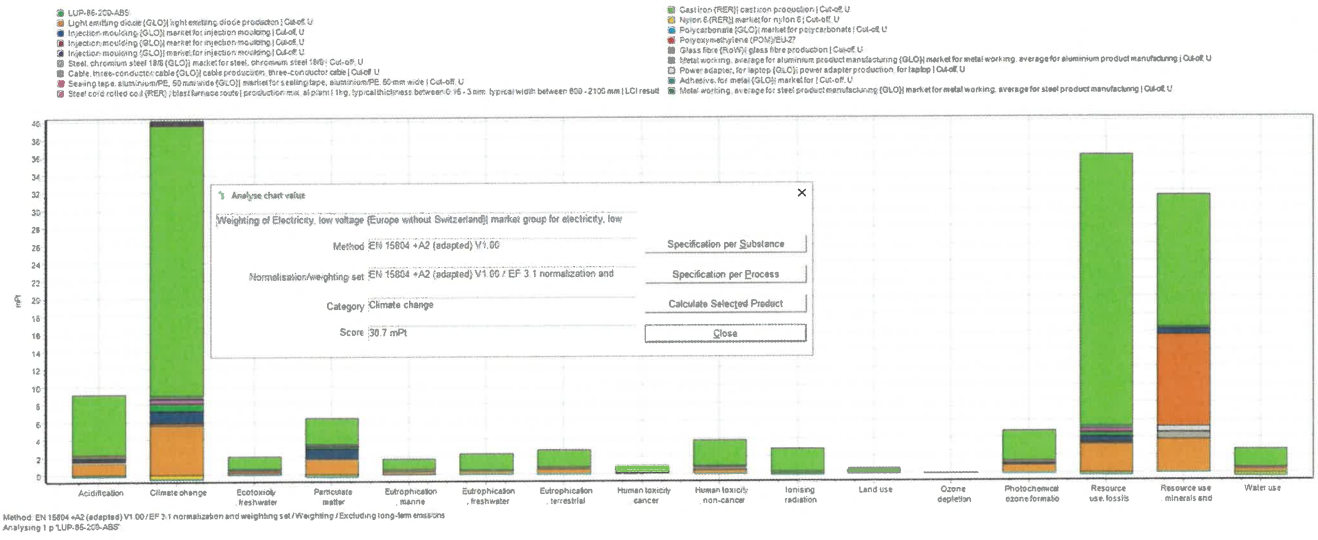
Process	Time period (year)	Energy values (kg CO_2eq /kWh)
Electricity, medium voltage {CN}| market group for electricity, medium voltage	Cut-off, U	2022	9.480E-01
Electricity, low voltage {Europe without Switzerland}| market group for electricity, low voltage	Cut-off, U	2022	3.726E-01

3.2 Contribution analysis

Identification of the significant issue is based on the result to find the most relevant process by analyzing the impact of the life cycle.

Contribution analysis for core environmental impact indicators per funtional unit of lightbox in different specifications:

1. LUP-85-200-ABS:



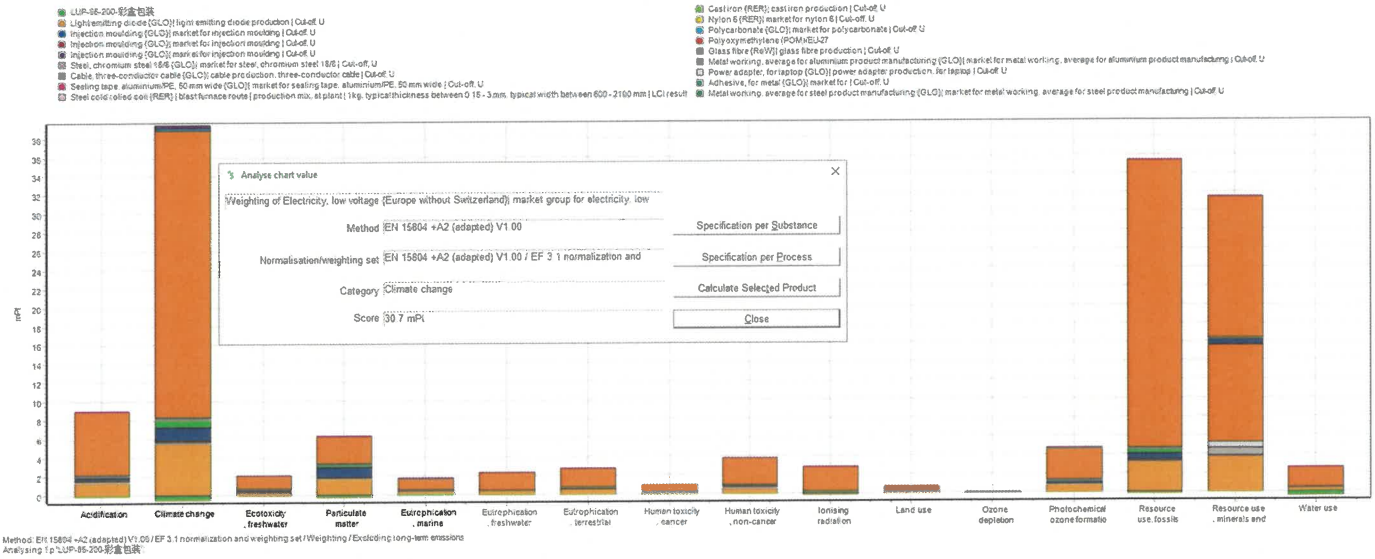
For LUP-85-200-ABS lightbox, GWP-total, ADF-fossils and ADF-mineral & metals are key environmental impact indicators. Electricity in use stage is the most significant process for GWP-total, ADF-fossils and ADF-mineral & metals.

Therefore, a sensitivity analysis of the use of electricity is carried out to understand their impact on the three indicators.

The sensitivity analysis is based on operational electricity consumption with a 15% bias.

Process		Minus 15%	100%	Plus 15%
GWP-total [kg CO2 eq.]	Electricity	1.111E+02	1.307E+02	1.503E+02
	Total	1.520E+02	1.716E+02	1.912E+02
	Contribution	73.091%	76.165%	78.609%
ADF-mineral & metals [kg Sb eq.]	Electricity	1.280E-03	1.505E-03	1.731E-03
	Total	2.929E-03	3.155E-03	3.381E-03
	Contribution	43.690%	47.721%	51.213%
ADF-fossils [MJ]	Electricity	2.425E+03	2.853E+03	3.281E+03
	Total	2.918E+03	3.346E+03	3.774E+03
	Contribution	83.095%	85.257%	86.928%

2. LUP-85-200-cardboard:



For LUP-85-200-cardboard lightbox, GWP-total, ADF-fossils and ADF-mineral & metals are key environmental impact indicators. Electricity in use stage is the most significant process for GWP-total, ADF-fossils and ADF-mineral & metals.

Therefore, a sensitivity analysis of the use of electricity is carried out to understand their impact on the three indicators.

The sensitivity analysis is based on operational electricity consumption with a 15% bias.

Process		Minus 15%	100%	Plus 15%
GWP-total [kg CO2 eq.]	Electricity	1.111E+02	1.307E+02	1.503E+02
	Total	1.488E+02	1.688E+02	1.880E+02
	Contribution	74.435%	77.403%	79.754%
ADF-mineral & metals [kg Sb eq.]	Electricity	1.280E-03	1.505E-03	1.731E-03
	Total	2.927E-03	3.152E-03	3.378E-03
	Contribution	43.725%	47.757%	51.249%
ADF-fossils [MJ]	Electricity	2.425E+03	2.853E+03	3.281E+03
	Total	2.862E+03	3.290E+03	3.718E+03
	Contribution	84.736%	86.722%	88.250%

3. LUP-100-200-ABS:

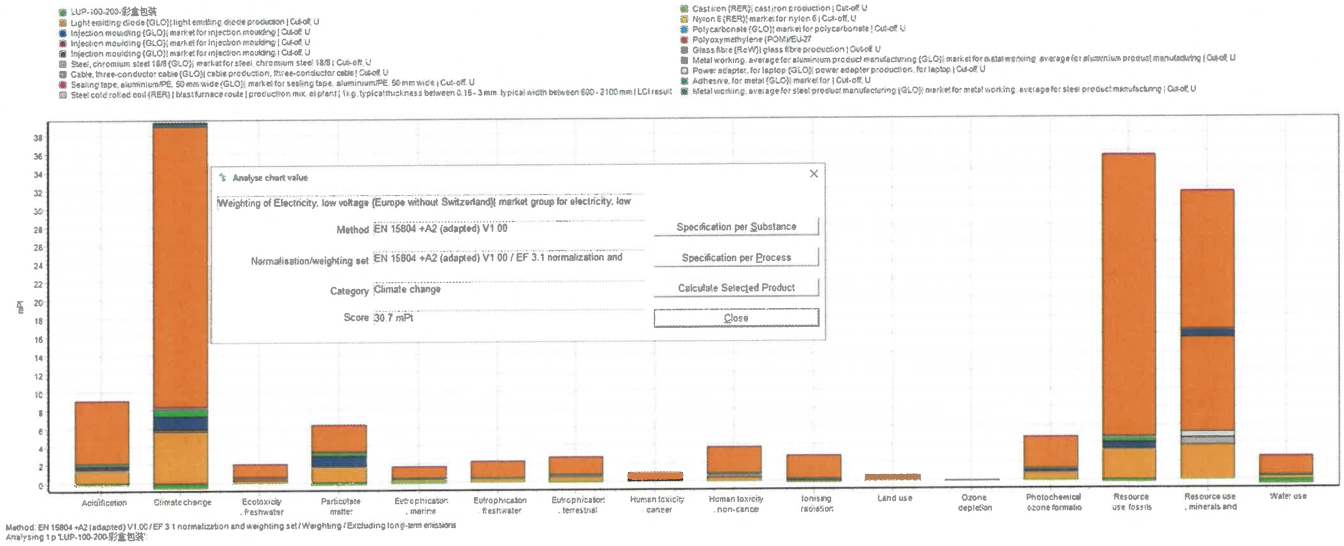
For LUP-100-200-ABS lightbox, GWP-total, ADF-fossils and ADF-mineral & metals are key environmental impact indicators. Electricity in use stage is the most significant process for GWP-total, ADF-fossils and ADF-mineral & metals.

Therefore, a sensitivity analysis of the use of electricity is carried out to understand their impact on the three indicators.

The sensitivity analysis is based on the operational electricity consumption with a 15% bias.

Process		Minus 15%	100%	Plus 15%
GWP-total [kg CO2 eq.]	Electricity	1.111E+02	1.307E+02	1.503E+02
	Total	1.525E+02	1.721E+02	1.917E+02
	Contribution	72.852%	75.944%	78.404%
ADF-mineral & metals [kg Sb eq.]	Electricity	1.280E-03	1.505E-03	1.731E-03
	Total	2.932E-03	3.158E-03	3.384E-03
	Contribution	43.645%	47.675%	51.167%
ADF-fossils [MJ]	Electricity	2.425E+03	2.853E+03	3.281E+03
	Total	2.923E+03	3.351E+03	3.779E+03
	Contribution	82.966%	85.141%	86.824%

4. LUP-100-200-cardboard:



For LUP-100-200-cardboard lightbox, GWP-total, ADF-fossils and ADF-mineral & metals are key environmental impact indicators. Electricity in use stage is the most significant process for GWP-total, ADF-fossils and ADF-mineral & metals.

Therefore, a sensitivity analysis of the use of electricity is carried out to understand their impact on the three indicators.

The sensitivity analysis is based on the operational electricity consumption with a 15% bias.

Process		Minus 15%	100%	Plus 15%
GWP-total [kg CO2 eq.]	Electricity	1.111E+02	1.307E+02	1.503E+02
	Total	1.490E+02	1.686E+02	1.882E+02
	Contribution	74.558%	77.517%	79.858%
ADF-mineral & metals [kg Sb eq.]	Electricity	1.280E-03	1.505E-03	1.731E-03
	Tota	2.930E-03	3.155E-03	3.381E-03
	Contribution	43.681%	47.711%	51.203%
ADF-fossils [MJ]	Electricity	2.425E+03	2.853E+03	3.281E+03
	Total	2.866E+03	3.294E+03	3.722E+03
	Contribution	84.609%	86.609%	88.148%

According to the results of the sensitivity analysis, the uncertainty of this series of lightboxes is ±13.008%.

4 Interpretation

- The report boundary of the portable lightbox promotional stand is set from cradle to grave. The product life cycle stage is from resource extraction to final disposal.
- The FU is defined as a lightbox providing lighting that delivers an outgoing artificial luminous flux of 1,000 lumens during a RSL of 50,000 hours. The lightbox is characterized for an outgoing artificial luminous flux of [V] lumens with a RSL of [H]. The FU is calculated as:

  ([V]/1,000) x ([H]/50,000)

- For LUP-85-200-ABS, the mass of biogenic carbon containing materials in the packaging accounts for 22.301% of the total mass of the packaging.
- For LUP-85-200-cardboard, the mass of biogenic carbon containing materials in the packaging accounts for 93.328% of the total mass of the packaging.
- For LUP-100-200-ABS, the mass of biogenic carbon containing materials in the packaging accounts for 22.301%% of the total mass of the packaging.
- For LUP-100-200-cardboard, the mass of biogenic carbon containing materials in the packaging accounts for 93.328% of the total mass of the packaging.
- After balancing the mass of biogenic carbon, the LCIA results per funtional unit of lightbox in different specifications are reported.
- Identification of the significant issue is based on the result to find the most relevant process by analyzing the impact of the life cycle. GWP-total, ADF-fossils and ADF-mineral & metals are key environmental impact indicators. The sensitivity analysis is based on the use of operational electricity consumption with a 15% bias.

  LUP-85-200-ABS:

The unit process with the most significant contribution to GWP-total is electricity in use stage with a contribution of 74.435% to 79.754%. The unit process with the most significant contribution to ADF-fossils is electricity in use stage with a contribution of 83.095% to 86.928%. The unit process with the most significant contribution to ADF-mineral & metals is electricity in use stage with a contribution of 43.690% to 51.213%.

LUP-85-200-cardboard:

The unit process with the most significant contribution to GWP-total is electricity in use stage with a contribution of 74.624% to 79.914%. The unit process with the most significant contribution to ADF-fossils is electricity in use stage with a contribution of 84.736% to 88.250%. The unit process with the most significant contribution to ADF-mineral & metals is electricity in use stage with a contribution of 43.725% to 51.249%.

LUP-100-200-ABS :

The unit process with the most significant contribution to GWP-total is electricity in use stage with a contribution of 72.852% to 78.404%. The unit process with the most significant contribution to ADF-fossils is electricity in use stage with a contribution of 82.966% to 86.824%. The unit process with the most significant contribution to ADF-mineral & metals is electricity in use stage with a contribution of 43.643% to 51.167%.

LUP-100-200-cardboard :

The unit process with the most significant contribution to GWP-total is electricity in use stage with a contribution of 74.558% to 79.858%. The unit process with the most significant contribution to ADF-fossils is electricity in use stage with a contribution of 84.609% to 88.148%. The unit process with the most significant contribution to ADF-mineral & metals is electricity in use stage with a contribution of 43.681% to 51.203%.

Value-choices:

The uncertainty of this series of light boxes is ±13.008%. This report discloses the LCIA results derived from representative data, as shown in Section 3.

4.1 Assumptions and Limited Conditions

Module A:

- Information and data about the products are provided by EXPO D&P LTD. The data was not valided by a third party. Background data is based on the embedded database of the Ecoinvent database version 3.9.1.
- In module A3, the electricity used in manufacturing is sourced from the Chinese mixed grid. The electricity factor is selected based on the mixed electricity grid emission factor in China. All solid wastes generated during the production process are disposed of in accordance with landfill. The validation of this data was not included in this study.
- In module A5, the manufacturer claims that the lightbox is manually installed, without any energy consumption. Landfilling was chosen as the method for packaging disposal in this study. There is no valid evidence to prove that the packaging has been recycled. It is recommended that the downstream supply chain conduct relevant data collection.

Module B:

- The geographical boundary for product installation is the European Union. The electricity used in operatrion is sourced from the EU mixed grid. The electricity factor is selected based on the mixed electricity grid emission factor in Europe.

Module C:

- In module C1, the manufacturer claims that the lightbox is manually dismantled, without any energy consumption.

- The manufacturer does not provide data on modules C2, C3 and C4 of the product to support the evaluation of the EoL, it was estimated based on the input materials and generic data.

Module D:

- Metals, PC, and LED are recycled according to the *collection rate* and *recycling rate* from the Eurostats. All other waste is disposed of through landfilling. The manufacturer does not provide evidence for the recycling of product to support the evaluation of module D.

The estimated impact results are only relative statements which do not indicate the end points of the impact categories, exceeding threshold values, safety margins or risks.

4.2 Additional information

☑ Luminous flux test report

☑ Type approved certificates

Attached documents
Annex 1 Data collection tables- LUP
Annex 2 Assessments of data quality – LUP
Annex 3 Information on biogenic carbon content of per accessory-LUP
Annex 4 LCIA results per declared unit of accessory- LUP

- END OF STUDY REPORT –