ENVIRONMENTAL PRODUCT DECLARATION

LSA

ARCHITECTURAL LED DIRECT/INDIRECT LINEAR
NICOR, Inc.

ARCHITECTURAL LED DIRECT/INDIRECT LINEAR

An EPD should provide current information and may be updated if conditions cha
The stated validity is therefore subject to the continued registration and publicati
https://spot.ul.com/

NICOR offers more than just high-quality, reliable products, we also believe in building a trusted relationship with our customers.

NICOR provides a range of customized services and support to ensure every project goes as planned.

NICOR's vision is to provide affordable, high-performance lighting solutions for any project that customers can rely on.

Through integrity, respect, and accountability NICOR creates relationships that last.

NICOR is determined to bring you reliable products that provide real solutions. When you choose a NICOR product, you can rest assured you're getting a product that has been tested to the highest standards available.

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ENVIRONMENTAL PRODUCT DECLARATION
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ENVIRONMENTAL PRODUCT DECLARATION

LSA
Architectural LED Direct/Indirect Linear

According to ISO 14025, ISO 21930: 2017

EPD PROGRAM AND PROGRAM OPERATOR NAME, ADDRESS, LOGO, AND WEBSITE	UL ENVIRONMENT 333 PFINGSTEN ROAD NORTHBROOK, IL 60611 HTTPS://WWW.UL.COM/ HTTPS://SPOT.UL.COM/
GENERAL PROGRAM INSTRUCTIONS AND VERSION NUMBER	PROGRAM OPERATOR RULES V2.7 2022
MANUFACTURER NAME AND ADDRESS	NICOR, Inc. 2200 Midtown Place NE, Albuquerque, NM 87107, USA
DECLARATION NUMBER	4791417018.101.1
DECLARED PRODUCT & FUNCTIONAL UNIT OR DECLARED UNIT	LSA Architectural LED Direct/Indirect Linear The manufacture, distribution, installation, use and end of life of one lineal meter of (1 m) linear technical luminaire LSA has been selected as the declared unit, including the fixation components.
REFERENCE PCR AND VERSION NUMBER	ISO 21930:2017; PCR 2019: 14 Construction Products v1.3.4
DESCRIPTION OF PRODUCT APPLICATION/USE	LSA Architectural LED Direct/Indirect Linear is mainly used for lighting the interior space of the building.
PRODUCT RSL DESCRIPTION (IF APPL.)	5 years
MARKETS OF APPLICABILITY	Global
DATE OF ISSUE	May 19, 2025
PERIOD OF VALIDITY	5 years
EPD TYPE	Product specific- worst case
RANGE OF DATASET VARIABILITY	N/A
EPD SCOPE	Cradle to gate with options, modules C1–C4, module D and with optional modules (A1–A3 + C + D + A4–A5 and B1-B7)
YEAR(S) OF REPORTED PRIMARY DATA	2023
LCA SOFTWARE & VERSION NUMBER	OpenLCA 2.3.1
LCI DATABASE(S) & VERSION NUMBER	Ecoinvent 3.10
LCIA METHODOLOGY & VERSION NUMBER	EF v3.1, TRACI v2.1

The PCR review was conducted by:	El Comité Técnico del Sistema Internacional EPD®. President: Claudia A. Peña. Contact via: info@environdec.com
This declaration was independently verified in accordance with ISO 14025: 2006. ☐ INTERNAL ☒ EXTERNAL	Skye Tang, UL Solutions 
This life cycle assessment was conducted in accordance with ISO 14044 and the reference PCR by:	CECEP Eco Product Development Research Center
This life cycle assessment was independently verified in accordance with ISO 14044 and the reference PCR by:	Ik Kim, Smart-Eco 

LIMITATIONS

Exclusions: EPDs do not indicate that any environmental or social performance benchmarks are met, and there may be impacts that they do not encompass. LCAs do not typically address the site-specific environmental impacts of raw material extraction, nor are they meant to assess human health toxicity. EPDs can complement but cannot replace tools and certifications that are designed to address these impacts and/or set performance thresholds – e.g. Type 1 certifications, health assessments and declarations, environmental impact assessments, etc.

Accuracy of Results: EPDs regularly rely on estimations of impacts; the level of accuracy in estimation of effect differs for any particular product line and reported impact.

Comparability: EPDs from different programs may not be comparable. Full conformance with a PCR allows EPD comparability only when all stages of a life cycle have been considered. However, variations and deviations are possible". Example of variations: Different LCA software and background LCI datasets may lead to differences results for upstream or downstream of the life cycle stages declared.

1. Product Definition and Information

1.1. Description of Company/Organization

Created in the 1980's under the name National Industries, NICOR has grown from an affordable ceiling fan company into a solid state LED lighting supplier.

NICOR's vision is to provide affordable, high-performance lighting solutions for any project that customers can rely on.

NICOR's core value is through integrity, respect, and accountability NICOR creates relationships that last.

NICOR is determined to bring you reliable products that provide real solutions. When you choose a NICOR product, you can rest assured you're getting a product that has been tested to the highest standards available.

We believe in building a relationship you can trust.

1.2. Product Description

Product identification: LSA – Altair Architectural LED Direct/Indirect Linear

UN CPC code: 4653 Lighting Equipment

NICOR's Altair Architectural LED Direct/Indirect Linear is a stylish 6' fixture designed for individual units or continuous runs in commercial and architectural interiors. Delivering over 140 lumens per watt, Altair provides 90% direct and 10% indirect lighting and achieves a full range of dimming from 0-10 volts, enabling the flexibility to create the ideal ambience for a variety of environments and applications. The Altair's highly reflective optical chamber and diffused polycarbonate lens provide wide, direct light distribution while three windows in the extruded aluminum body offer uplight with a single piece diffuser for soft distribution. Using a spring steel mounting bracket, installation is easy with several different mountings available – surface, pendant, and aircraft cable and unistrut. Altair is available in integral or remote driver configurations.

Figure 1 LSA – Altair Architectural LED Direct/Indirect Linear

Product Specification

- Available in Driver Integrated and Remote Power System Configurations and Dali driver optional.
- Efficiency greater than 140 lumens per watt
- Universal Input of 120-277V
- Driver delivers full range dimming via 0-10VDC or Dali control.
- 10kA Surge Suppression Standard on Integral Version
- Finish colors available in White, Satin Clear, and Silver and custom

The references available on the market are differentiated by a combination of codes. These codes indicate a series of characteristics such as type of installation, version, length, wattage, color temperature , color rendering index , driver configuration, sensor type, and UGR option. The references studied by this EPD are listed in the table below:

Table 1. Technical data

Series	Version	Length (ft)	Output	Light Pattern	Input Voltage	CCT	CRI	Finish Color	Driver Configuration	Mounting	Sensor	UGR level
LSA	1	4	Blank(standard version)	I(Direct/ Indirect)	U (120-277)	35 (3500K)	9(CRI90)	W (White)	I (Integral)	S (Surface)	M(MV sensor)	Blank (standard version)
	2	6	S(Wattage selectable)			XX(Can be any character, representing different CCT)	X(Can be any character, representing different CRI)	S(Satin Clear)	W/R(Remote)	P (Pendant)	N(nlight sensor)	X(Can be any character, representing different UGR levels)
		8	X(Can be any character, representing different power or lumens)					V (Sliver)	D(Dali)	C(Cable)	D(Dali sensor)	
								C(Custom)		U (Unistrut)	Blank (none)	
						S(CCT select able)	Blank(standard version)	B(Black)		Blank (standard version)	X(Can be any character)	

LSA of version 1 and version 2 represent their different dimensions, in three lengths, three types of driver configurations and different color option, covering the light pattern of ”Direct and Indirect”.

1.3. Application

The product applies to commercial, retail, educational, healthcare, or data center application. Accessories for each fixture are available to meet your unique application requirements.

1.4. Declaration of Methodological Framework

This EPD report adopts Life Cycle Assessment (LCA) method specified in the international standard ISO14040/14044,

ISO 21930:2017, Product Category Rule (PCR) 2019: 14 Construction Products v1.3.4 as the research methods. Life Cycle Inventory Assessment Model are selected according to ISO 21930:2017 and EN15804:2012+A2:2019+AC:2021, the characterization factors from EF v3.1 and TRACI v2.1 are applied.

This EPD is product-specific and cover “cradle to grave”.

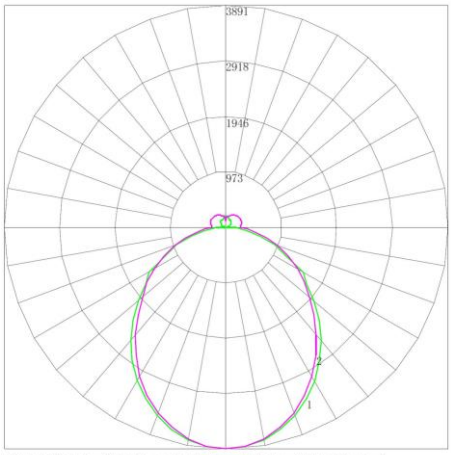
1.5. Technical Requirements

Technical requirements of the LSA – Altair Architectural LED Direct/Indirect Linear represented in this EPD are listed in the following table:

Table 2. Technical requirements for LSA − Altair Architectural LED Direct/Indirect Linear

NAME	VALUE	UNIT
Input Voltage (VAC)	120-277	VA
System Level Power	78.94	W
Delivered Lumens	11401.84	Lm
System Efficacy	144.44	Lm/W
Correlated Color Temp	3942	K
Color Rendering Index(CRI)	93.2	-
Beam Angle (0°)	99.0	°
Beam Angle (90°)	102.6	°
Spacing Criteria (0°)	1.20	-
Spacing Criteria (90°)	1.18	-

The photometric data is:



Maximum Candela = 3891.156 Located At Horizontal Angle = 0, Vertical Angle = 0
1 - Vertical Plane Through Horizontal Angles (0 - 180)
2 - Vertical Plane Through Horizontal Angles (90 - 270)

Zone	Lumens	%Lamp	%Fixt
0-20	1400.31	12.30	12.30
0-30	2920.51	25.60	25.60
0-40	4682.42	41.10	41.10
0-60	7945.31	69.70	69.70
0-80	9858.72	86.50	86.50
0-90	10189.46	89.40	89.40
10-90	9822.75	86.20	86.20
20-40	3282.11	28.80	28.80
20-50	5022.26	44.00	44.00
40-70	4434.39	38.90	38.90
60-80	1913.4	16.80	16.80
70-80	741.91	6.50	6.50
80-90	330.74	2.90	2.90
90-110	377.55	3.30	3.30
90-120	577.43	5.10	5.10
90-130	765.19	6.70	6.70
90-150	1056.08	9.30	9.30
90-180	1212.37	10.60	10.60
110-180	834.82	7.30	7.30
0-180	11401.83	100.00	100.00

Total Luminaire Efficiency = 100.00%

1.6. Material Composition

The LSA – Altair Architectural LED Direct/Indirect Linear is physically composed of major modules such as the

housing, support, driver, LED light source, connector board, sensors, and power module. The table displays the material composition of the LSA, detailing the weight distribution of materials like aluminum, steel, etc.

Table 3. Material composition of LSA

Product components	Weight (%)	Post-consumer material, weight-% of one meter of (1 m) linear technical luminaire LSA	Biogenic material, weight-% of (1 m) linear technical luminaire LSA	Biogenic material, kg C/one meter of (1 m) linear technical luminaire LSA	Biogenic material, kg CO_2 eq/one meter of (1 m) linear technical luminaire LSA
Aluminum alloy	59%~73%	0	0	0	0
Steel	1%~5%	0	0	0	0
Driver	5%~10%	0	0.035~0.048	9.55E-04	3.50E-03
LED	＜1%	0	0	0	0
LED module	1%~5%	0	0	0	0
PC	5%~10%	0	0	0	0
SPD	＜1%	0	0.0035~0.0048	9.55E-05	3.50E-04
Sensor	0%~5%	0	0~0.014	0~3.82E-04	0~1.40E-03
PET	1~2%	0	0	0	0
Copper	＜1%	0	0	0	0
Others	＜5%	0	0	0	0

Note： "0.0" indicates that the percentage is less than "0.1". Others include delivery accessories, etc.

The product does not include in its life cycle any dangerous substances included in the "Very High Impact Candidate List for Authorization (SVHC)" in a percentage greater than 0.1% of the weight of the product.

All LSA models understudy are fabricated by extruding aluminum alloy. Different models of the LSA series of products are different in the amount and weight ratio of aluminum caused by different shell sizes, as well as the amount and weight ratio of PC material (the main material of the lens), steel.

According to the tables 1, LSA has multiple product models, the typologies available for each model are differentiated by (1) the length of the aluminum profile (2) types of lens and (3) type of sensor and (4) type of driver.

1.7. Manufacturing

The production process of LSA – Altair Architectural LED Direct/Indirect Linear mainly includes the assembly of final products. The process flow can be simply summarized as LSA assembly, testing, and packaging. The entire production process will be completed in two factories, each factory is responsible for a part of the product output, but the distance between the two factories is very close (19 km), and the sensitivity analysis of the transportation distance is detailed in the LCA report.

1.8. Packaging

The packaging of the product consists of corrugated carton, box sealing tape and stickers. Weight of product packaging is allocated to individual products according to the number of packaged items. Package composition can be found in the Table .

Table 4. Packaging material composition of LSA

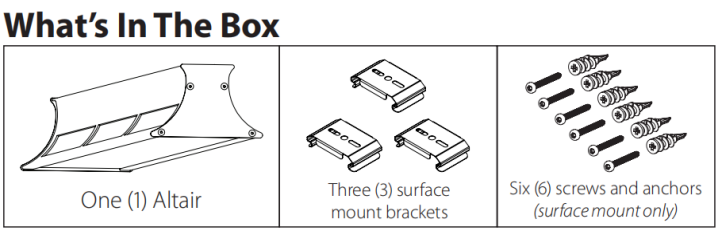
PACKAGING	WEIGHT OF DECLARED PRODUCT	WEIGHT-% (VERSUS THE PRODUCT)	POST-CONSUMER MATERIAL OR PRE-CONSUMER RECYCLED MATERIAL, WEIGHT-%	BIOGENIC MATERIAL, KG C/ ONE METER OF (1 M) LINEAR TECHNICAL LUMINAIRE LSA	BIOGENIC CARBON, KG CO_2EQ/ ONE METER OF (1 M) LINEAR TECHNICAL LUMINAIRE LSA
Paper box	0.3~0.36 kg	12.7~12.9%	0	0.125~0.153	0.46~0.56
Box sealing tape and stickers	0.008~0.01 kg	0.32~0.36%	0	0	0

1.9. Transportation

The product is assumed to be used in US, the distribution stage is modeled from NICOR assembly location Guangdong province, China to use location US. The distance and mode of transportation are provided by the manufacturer.

1.10. Product Installation

The different installation methods require the auxiliary materials and tools shown in the following figure:



In order to simplify the installation model, the basic auxiliary materials used in different mounting methods (such as surface mounting brackets, etc.) are considered at the product manufacturing stage and shipped with the product and packaging by default.

Please refer to the following link for detailed steps and methods of installation: https://nicorlighting.com/installs/LSA_ii.pdf

1.11. Use

In the case that the LSA is properly installed and used normally during the reference service life, the LSA does not require maintenance or repair operations, there is no application use, the product does not use water in use, only the electricity consumption needs to be considered, the calculation of electricity consumption refers to other published EPD reports. In the guaranteed useful life of 5 years, the total electricity consumption has been estimated for a power of 80 W, 8 hours a day and 250 days a year. Therefore, the conventional 2.4m LSA product has an operating energy consumption value of 800 kWh in stage B6, and the corresponding declared unit 1m product has an operating energy consumption value of 333 kWh in stage B6. For details, please refer to Table 8 below.

1.12. Reference Service Life and Estimated Building Service Life

Reference Service life is assumed to be 5 years based on quality grantee offered to clients.

It should be noted that the useful life of LED can be up to 60,000 hours. in normal operational regime of 8 hours per day for 250 working days per year, the product lasts up to 30 years.

1.13. End-of-Life

The End-of-Life treatment stage includes De-construction and demolition (Model C1), the transport from use location to waste treatment site (Model C2), waste processing (Model C3) and disposal (Model C4).

Similar to the installation phase, the LSA is mechanical de-construction and demolition.

Considering that it was not possible to determine the specific collection and treatment location, it was assumed that the average distance of the product from the collection place to final treatment place was 100 km.

According to the relevant information[1], it is assumed that the aluminum metal in the dismantled LSA are recovered, the recycled rate is 97%, and the remaining material is landfill disposal.

2. Life Cycle Assessment Background Information

2.1. Declared Unit

The declared unit is that quantification of a function offered by the object of study according to which all the inputs (resources and necessary energy) and outputs (emissions and waste) of the studied system will be referred. In this case, the manufacture, distribution, installation, use and end of life of one lineal meter of (1 m) linear technical luminaire LSA has been selected as the declared unit, including the fixation components.

2.2. System Boundary

The system boundary of this study is cradle-to-grave, i.e., from the acquisition of raw materials stage to equipment end-of-life treatment stage, including the following life cycle stages:

Module A1-A3: Production stage

The production stage includes the environmental impacts associated with raw materials extraction and processing, transport to, between and within the manufacturing site, and the manufacturing of product. Module A includes provision of all materials, products and energy, as well as waste processing up to the end-of waste state or disposal of final residues during the product stage.

Module A4-A5: Construction stage

The construction process stage includes the transportation from the production gate to construction site and energy consumption and waste generated during installation.

Module B6: Use stage

The use stage covering the period from the product operation to when it is deconstructed or demolished.

Module C1-C4: End-of-life stage

The end-of-life stage of the product starts when it is replaced, dismantled or deconstructed from the installation location to final disposal.

Module D: Benefits and avoided loads beyond the product system boundary

[1] Taken from International Aluminum Institute (IAI) Report: Aluminium Recyclability and Recycling – Towards Sustainable Cities, April 2015, p. 37 Table 2.4. Includes commercial and residential buildings

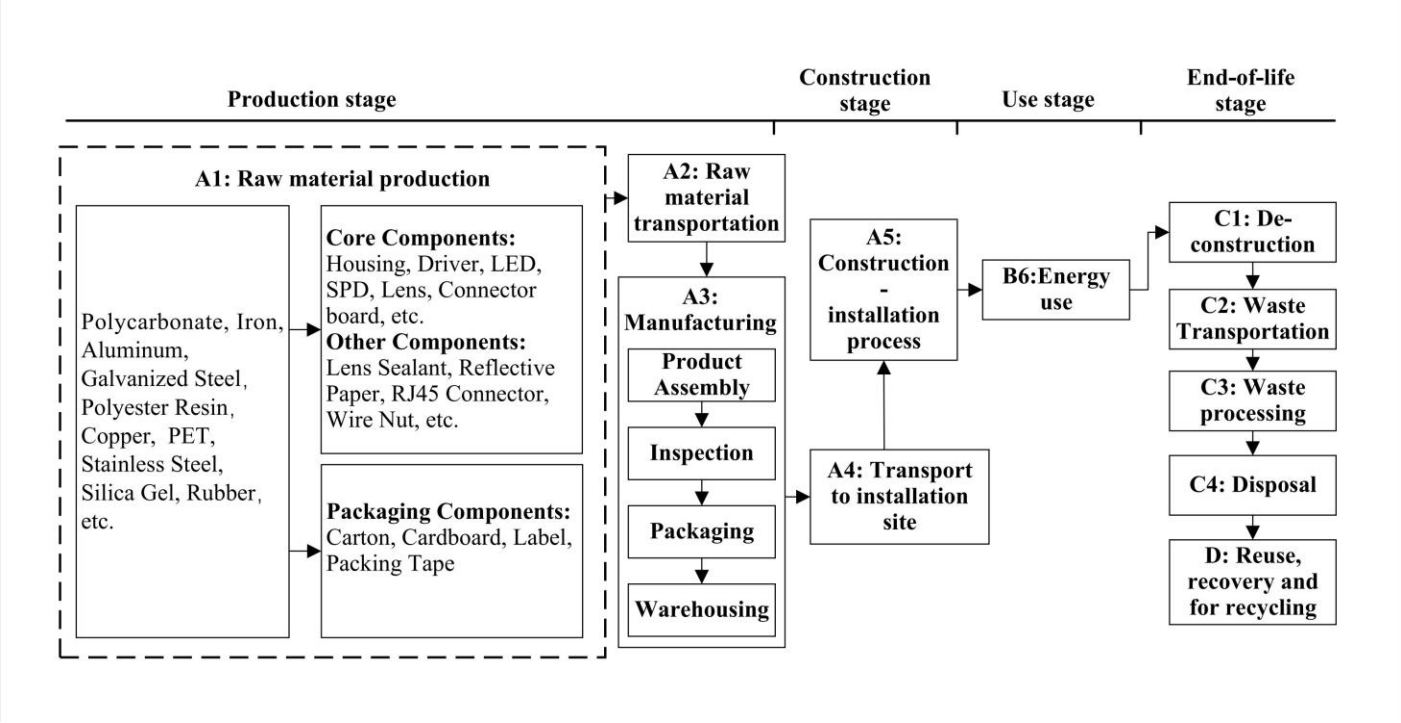


Figure 2. The Life Cycle Process Map of LSA − Altair Architectural LED Direct/Indirect Linear

2.3. Estimates and Assumptions

In the absence of a matching lifecycle inventory to represent flow, proxy data is applied based on conservative assumptions about environmental impacts. The key assumptions of this LCA are summarized below.

- The production process of some raw materials is not investigated because of the restriction of research time and control of supply chain, which leads a certain deviation from the actual situation. It is suggested that in the case of enough research time and availability of primary data, further investigation of the production process of raw materials can improve the quality of data and provide data support for enterprises to promote collaborative improvement in the supply chain, e.g. driver.

- Assuming that the power consumption during de-construction (module C1) and installation (module A5) is 0.33kWh due to drilling process (Using relevant tools for 16 minutes).

- Accessories consumption varies greatly between different installation modes, so only the basic installation accessories shipped with the product are considered in order to simplify the model.

- Assuming that packaging waste is incinerated together with domestic waste, the burden of incineration process and the benefits of generating heat substituted of electricity are reflected in Module D.

- To be conservative, the further downstream processes such as aluminum scrap be sorted and pressed into blocks and ready to be used for other specific purposes be included as burden in the module D. After that the recycled aluminum alloy has been modelled to avoid use of primary materials (aluminium alloy, AlMg3), to be conservative, assume a quality correction factor of 0.5.

- Modules C1 – C4 and module D scenario assumptions were made based on PCR requirements and other published EPD reports, see section 3 below for details.

2.4. Cut-off Criteria

This study adopts the data selection criteria described in ISO 14040/14044, and these selection criteria are as follows:

- All energy consumption should be included.
- Less than 1% of the weight of the product ordinary material consumption can be ignored, or the material consumption of a high purity substance which is less than 0.1% of the weight of the total product can be ignored. Nevertheless, the total ignored consumption cannot exceed 5% of the total weight of the product.
- In principle, all environmental emissions associated with the specific type of environmental impact should be included, the report will stipulate in which cases the data is not available or missing.
- General solid waste that it's less than 1% of total solid waste discharge can be ignored.
- The consumption and emissions of road and plant's infrastructure, capital goods, equipment in various processes, personnel in the plant and living facilities are excluded from the study.

No known flows were deliberately excluded that may cause significant change in the results in this study.

2.5. Data Sources

Primary data were collected as far as possible for the manufacturing stage, including the amount of raw materials, material information, transportation distance, etc. The activity data comes from the Bill of Materials (BOM), Product Data Management (PDM), and Material Environmental Information Management System Insight. The emission factors come from the Ecoinvent database, and the secondary data sources that do not use the software database are collected from other reliable sources, such as government reports, etc.

2.6. Electricity modelling

The data for the generation of electricity applied in A3 is electricity mixes on the market, namely the China Southern Power Grid Mix, medium voltage in the Ecoinvent 3.11 (cut-off) database. Its GWP-GHG impact is 0.583 kgCO2eq/kWh. The reference year of electricity dataset is 2021-2024.

The data for the generation of electricity applied in B6 is electricity mixes on the market, namely the United States of America Power Grid Mix, low voltage in the Ecoinvent 3.11 (cut-off) database. Its GWP-GHG impact is 0.487 kgCO2eq/kWh. The reference year of electricity dataset is 2015-2024.

2.7. Data Quality

During data collection, primary data directly provided by suppliers are preferred, and secondary data that represent geographical and technical average level are selected as far as possible if primary data are not available. The secondary data mostly come from the latest applicable Ecoinvent database, while industry data obtained from reliable sources are used if there is no applicable secondary data in the database. The Ecoinvent database is one of the most widely used databases in the field of LCA research worldwide. It has been used in LCA models in industrial and scientific applications worldwide and has been used in many critically reviewed and published studies.

2.8. Period under Review

The activity data (primary data) collected from the manufacturing facility and provided by enterprise are representative for the calendar year 2023.

2.9. Allocation

Multi-output allocation

The production process of the product is mainly assembly process, no other by-product are produced from the assembly process. Therefore, the distribution of energy and water is not involved. The power consumption is allocated to multi-output systems according to the production time in the product assembly and testing processes.

EoL allocation

EOL allocation follows the requirements of ISO 21930:2017, the reuse, recovery, and/or recycling allocation follows the polluter pays principle (No burdens are allocated across the system boundary with secondary material, secondary fuel, or recovered energy flows arising from waste) should be followed when it comes to upstream secondary material input. In the same time, the potentials are reported separately in module D.

Background database allocation

For those front-end processes used in the ecoinvent database, “Allocation, cut-off by classification” is used here to apply the assumptions to determine the supply and the distribution of impacts (allocation and substitution).

2.10. Comparability (Optional)

Environmental declarations EPDs within the same product category but from different programmes may not be comparable, as such comparisons would require that the assumptions and context of each LCA are equivalent.

Comparing environmental performance using EPD information should consider all relevant information modules throughout the entire lifecycle. For two EPDs developed based on the same PCR comparable, at least: a) having the identical functions, technical characteristics, and uses; b) The purpose and scope definition of life cycle impact assessment are the same, including equivalent functional units, system boundaries, and cut-off criteria; c) The same data quality requirements and background database, including data collection methods, allocation methods; d) Equivalent impact assessment methods, including feature factors of the same version.

3. Life Cycle Assessment Scenarios

Table 5. Transport to the building site (A4)

NAME	VALUE	UNIT
Lorry transportation	4.52	t▪km
Ship transportation	31.42	t▪km

Table 6. Installation into the building (A5)

NAME	VALUE	UNIT
Ancillary materials	0	kg
Net freshwater consumption	0	m^3
Other resources	0	kg
Electricity consumption	0.138	kWh

Other energy carriers	0	MJ
Waste materials at the construction site before waste processing, generated by product installation	0.367	kg
Output materials resulting from on-site waste processing	0	kg
Direct emission to ambient air, soil, and water	0	kg
VOC content	0	ug/m^3
Product loss per declared unit	0	kg
Packing waste per declared unit	0.367	kg
Biogenic carbon contained in packaging	0.561	kg $CO_{2\ eq}$

Note: 1 kg biogenic Carbon is equivalent to 44/12 kg of CO_2

Table 7. Reference Service Life

NAME	VALUE	UNIT
RSL	5	years

Table 8. Operational energy use (B6)

NAME	VALUE	UNIT
Estimated electricity consumption per hour	80	W
Total usage hours of RSL	10000	hours
Electricity input per m	333	kWh

Table 9. End of life (C1-C4)

NAME		VALUE		UNIT
Electricity consumption		0.138		kWh
Assumptions for scenario development (description of deconstruction, collection, recovery, disposal method and transportation)		100		km
Materials recovery, energy recovery and disposal/landfill rate	**Materials**	**Recycling rate**	**Landfill rate**	**Incineration rate**
	Aluminium	97%	3%	0%
	Electronic part/Others	0%	100%	0%

Table 10. Reuse, recovery and/or recycling potentials (D), relevant scenario information

NAME	VALUE	NAME	VALUE
Mass incinerated from packaging materials at stage A5	0.117kg	Heat burned from packaging materials	0.699MJ
Paper mass recycled from waste packaging materials at stage A5	0.251kg	Recycled paper box replaces raw pulp	0.125kg
Aluminium mass recycled from waste product in phase C3	1.97kg	Recycled aluminium replaced aluminium alloy (AlMg3)	0.983kg

4. Life Cycle Assessment Results

Table 1. Description of the system boundary modules

	PRODUCT STAGE			CONSTRUCT-ION PROCESS STAGE		USE STAGE							END OF LIFE STAGE				BENEFITS AND LOADS BEYOND THE SYSTEM BOUNDARY
	A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
	Raw material supply	Transport	Manufacturing	Transport from gate to site	Assembly/Install	Use	Maintenance	Repair	Replacement	Refurbishment	Building Operational Energy Use During Product Use	Building Operational Water Use During Product Use	Deconstruction	Transport	Waste processing	Disposal	Reuse, Recovery, Recycling Potential
EPD Type	X	X	X	X	X	ND	ND	ND	ND	ND	X	ND	X	X	X	X	X
Geography	GLO	GLO	CN	GLO	GLO	GLO	GLO	GLO	GLO	GLO	GLO	GLO	GLO	GLO	GLO	GLO	GLO
Share of specific data	>90% GWP-GHG			-	-	-	-	-	-	-	-	-	-	-	-	-	-
Variation – products	The variation of declared impacts is less than 10% for each product group					-	-	-	-	-	-	-	-	-	-	-	-
Variation – sites	Two production plant, the difference of GWP-GHG is<10%			-	-	-	-	-	-	-	-	-	-	-	-	-	-

4.1. Life Cycle Impact Assessment Results

Table 2. Core Environmental Impact Category Indicators Assessment Results (TRACI v2.1)

INDICATOR	UNIT	A1-A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
GWP	kg $CO_{2\ eq}$	3.64E+01	1.01E+00	1.27E-01	0	0	0	0	0	1.61E+02	0	6.64E-02	4.27E-02	0.00E+00	1.68E+00	-8.53E+00
ADP-fossil	MJ, LHV	4.03E+02	1.36E+01	8.61E-01	0	0	0	0	0	2.00E+03	0	8.23E-01	6.00E-01	0.00E+00	7.99E+00	-8.17E+01
ODP	kg CFC 11 $_{eq}$	1.16E-06	1.46E-08	3.81E-10	0	0	0	0	0	7.90E-07	0	3.26E-10	6.07E-10	0.00E+00	2.66E-08	-6.51E-08
SFP	kg $O_{3\ eq}$	3.12E+00	2.28E-01	2.92E-03	0	0	0	0	0	4.77E+00	0	1.97E-03	4.88E-03	0.00E+00	3.53E-02	-5.86E-01
AP	Kg $SO_{2\ eq}$	3.24E-01	1.08E-02	2.14E-04	0	0	0	0	0	4.39E-01	0	1.81E-04	1.81E-04	0.00E+00	2.10E-03	-4.72E-02
EP	kg N $_{eq}$	3.08E-01	1.49E-03	5.54E-04	0	0	0	0	0	1.08E+00	0	4.44E-04	6.69E-05	0.00E+00	4.29E-03	-3.83E-02

Acronyms:[GWP - Global Warming Potential]; [ODP – Ozone Depletion Potential]; [AP – Acidification Potential]; [EP – Eutrophication Potential]; [POCP – Photochemical Oxidant Creation Potential]; [ADP-fossil – Abiotic Resource Depletion Potential of non-renewable (fossil) resources]; [SFP – Smog Formation Potential]

Disclaimer: These six impact categories are globally deemed mature enough to be included in Type III environmental declarations. Other categories are being developed and defined and LCA should continue making advances in their development. However, the EPD users shall not use additional measures for comparative purposes

Table 3. Core Environmental Impact Category Indicators Assessment Results (EF v3.1)

INDICATOR	UNIT	A1-A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
AP	mol H^+_{eq}	3.96E-01	1.24E-02	2.53E-04	0	0	0	0	0	5.28E-01	0	2.18E-04	1.98E-04	0	2.45E-03	-5.54E-02
GWP-biogenic	kg $CO_{2\,eq}$	-6.66E-01	1.87E-04	6.46E-01	0	0	0	0	0	5.57E-01	0	2.30E-04	1.48E-05	0	1.39E-03	2.86E-01
GWP-fossil	kg $CO_{2\,eq}$	3.66E+01	1.02E+00	1.27E-01	0	0	0	0	0	1.62E+02	0	6.70E-02	4.33E-02	0	1.68E+00	-8.57E+00
GWP-luluc	kg $CO_{2\,eq}$	9.07E-02	4.96E-04	3.63E-05	0	0	0	0	0	8.11E-02	0	3.34E-05	2.00E-05	0	4.90E-04	-2.17E-02
GWP – total	kg $CO_{2\,eq}$	3.60E+01	1.02E+00	7.73E-01	0	0	0	0	0	1.63E+02	0	6.72E-02	4.33E-02	0	1.68E+00	-8.30E+00
ADP-fossil	MJ, net calorific value	4.56E+02	1.38E+01	1.22E+00	0	0	0	0	0	2.87E+03	0	1.18E+00	6.08E-01	0	8.31E+00	-9.31E+01
EP-freshwater	kg P eq	3.17E-02	8.96E-05	6.20E-05	0	0	0	0	0	1.37E-01	0	5.66E-05	4.79E-06	0	4.64E-04	-2.95E-03
EP-marine	kg N eq	5.13E-02	3.48E-03	5.98E-05	0	0	0	0	0	9.86E-02	0	4.07E-05	7.31E-05	0	6.00E-04	-9.67E-03
EP-terrestrial	mol N_{eq}	5.58E-01	3.84E-02	4.97E-04	0	0	0	0	0	8.05E-01	0	3.32E-04	7.97E-04	0	5.96E-03	-1.01E-01
ADP minerals & metals	kg Sb_{eq}	7.58E-03	2.65E-06	5.78E-07	0	0	0	0	0	1.37E-03	0	5.66E-07	1.42E-07	0	4.41E-06	-1.00E-04
ODP	kg CFC 11_{eq}	1.16E-06	1.38E-08	3.51E-10	0	0	0	0	0	7.23E-07	0	2.98E-10	5.74E-10	0	2.58E-08	-6.04E-08
POCP	kg NMVOC $_{eq}$	1.96E-01	1.14E-02	1.76E-04	0	0	0	0	0	3.23E-01	0	1.33E-04	2.75E-04	0	2.19E-03	-3.15E-02
WDP*	m^3 world $_{eq}$.deprived	1.16E+01	6.68E-02	2.35E-02	0	0	0	0	0	3.68E+01	0	1.52E-02	3.41E-03	0	1.52E-01	-2.28E+00

Acronyms: GWP-fossil = Global Warming Potential fossil fuels; GWP-biogenic = Global Warming Potential biogenic; GWP-luluc = Global Warming Potential land use and land use change; ODP = Depletion potential of the stratospheric ozone layer; AP = Acidification potential, Accumulated Exceedance; EP-freshwater = Eutrophication potential, fraction of nutrients reaching freshwater end compartment; EP-marine =Eutrophication potential, fraction of nutrients reaching marine end compartment; EP-terrestrial = Eutrophication potential, Accumulated Exceedance; POCP = Formation potential of tropospheric ozone; ADP-minerals & metals = Abiotic depletion potential for non-fossil resources ; ADP-fossil = Abiotic depletion potential for fossil resources; WDP = Water (user) deprivation potential, deprivation-weighted water consumption

Table 14. Additional Environmental Impact Category Indicators Assessment Results

INDICATOR	UNIT	A1-A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
GWP-GHG[1]	Disease incidence	3.67E+01	1.02E+00	1.27E-01	0	0	0	0	0	1.62E+02	0	6.70E-02	4.33E-02	0	1.68E+00	-8.59E+00

Disclaimer: This indicator accounts for all greenhouse gases except biogenic carbon dioxide uptake and emissions and biogenic carbon stored in the product. As such, the indicator is identical to GWP-total except that the CF for biogenic CO_2 is set to zero

Table 4. Additional Environmental Impact Category Indicators Assessment Results

INDICATOR	UNIT	A1-A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
ETP-fw [2]	CTUe	6.64E+02	2.08E+00	3.82E-01	0	0	0	0	0	4.13E+02	0	1.70E-01	1.11E-01	0.00E+00	2.36E+01	-4.74E+01
HTP-c [2]	CTUh	2.54E-08	2.37E-10	4.01E-11	0	0	0	0	0	3.33E-08	0	1.37E-11	1.04E-11	0.00E+00	1.83E-09	-5.74E-09
HTP-nc [2]	CTUh	9.02E-07	7.74E-09	1.45E-09	0	0	0	0	0	1.89E-06	0	7.81E-10	4.16E-10	0.00E+00	5.78E-09	-8.52E-08
SQP [2]	Dimen-sionless	2.01E+02	7.61E+00	2.03E-01	0	0	0	0	0	4.31E+02	0	1.78E-01	4.48E-01	0.00E+00	1.55E+00	-2.39E+01
PM [1]	Disease incidence	3.95E-06	7.56E-08	1.56E-09	0	0	0	0	0	2.95E-06	0	1.22E-09	4.06E-09	0.00E+00	2.87E-08	-1.26E-06
IRP [1]	kBq U235 $_{eq}$	2.68E+00	1.01E-02	2.36E-02	0	0	0	0	0	5.71E+01	0	2.36E-02	5.15E-04	0.00E+00	2.05E-02	-4.05E-01

Acronyms: PM = Potential incidence of disease due to PM emissions; IRP = Potential Human exposure efficiency relative to U235; Potential Comparative Toxic Unit

for ecosystems; HTP-c = Potential Comparative Toxic Unit for humans; HTP-nc = Potential Comparative Toxic Unit for humans; SQP = Potential Soil quality index

Disclaimer 1: This impact category deals mainly with the eventual impact of low dose ionizing radiation on human health of the nuclear fuel cycle. It does not consider effects due to possible nuclear accidents, occupational exposure nor due to radioactive waste disposal in underground facilities. Potential ionizing radiation from the soil, from radon and from some construction materials is also not measured by this indicator.

Disclaimer 2: The results of this environmental impact indicator shall be used with care as the uncertainties on these results are high or as there is limited experience with the indicator.

4.2. Life Cycle Inventory Results

Table 5. Resource Use

INDICATOR	UNIT	A1-A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
PENRE	MJ, LHV	4.48E+02	1.38E+01	5.22E-01	0	0	0	0	0	2.87E+03	0	1.18E+00	6.09E-01	0.00E+00	-2.92E+00	-9.31E+01
PERE	MJ, LHV	4.93E+01	1.72E-01	-9.08E-01	0	0	0	0	0	3.95E+02	0	1.63E-01	8.72E-03	0.00E+00	3.41E-01	-9.42E+00
PENRM	MJ, LHV	8.01E+00	0.00E+00	7.02E-01	0	0	0	0	0	0.00E+00	0	0.00E+00	0.00E+00	0.00E+00	1.12E+01	0.00E+00
PERM	MJ, LHV	5.39E+00	0.00E+00	1.07E+00	0	0	0	0	0	0.00E+00	0	0.00E+00	0.00E+00	0.00E+00	0.00E+00	-1.66E+00
PENRT	MJ, LHV	4.56E+02	1.38E+01	1.22E+00	0	0	0	0	0	2.87E+03	0	1.18E+00	6.09E-01	0.00E+00	8.31E+00	-9.31E+01
PERT	MJ, LHV	5.47E+01	1.72E-01	1.64E-01	0	0	0	0	0	3.95E+02	0	1.63E-01	8.72E-03	0.00E+00	3.41E-01	-1.11E+01
FW	m3	3.01E-01	1.66E-03	4.96E-04	0	0	0	0	0	8.96E-01	0	3.70E-04	8.60E-05	0.00E+00	3.67E-03	-6.22E-02
SM	kg	6.58E-01	6.18E-03	2.32E-04	0	0	0	0	0	4.53E-01	0	1.87E-04	2.66E-04	0.00E+00	2.49E-03	-1.32E-01
RSF	MJ, LHV	4.18E-02	6.03E-05	1.73E-06	0	0	0	0	0	2.29E-03	0	9.46E-07	3.44E-06	0.00E+00	4.72E-05	-3.19E-04
NRSF	MJ, LHV	0.00E+00	0.00E+00	0.00E+00	0	0	0	0	0	0.00E+00	0	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Acronyms: PENRE = Use of non-renewable primary energy excluding nonrenewable primary energy resources used as raw material; PERE = Use of renewable primary energy excluding renewable primary energy resources used as raw material; PENRM = Use of non-renewable primary energy resources used as raw material; PERM = Use of renewable primary energy resources used as raw material; PENRT = Total use of non-renewable primary energy resources (primary energy and primary energy resources used as raw materials); PERT = Total use of renewable primary energy resources (primary energy and primary energy resources used as raw materials); FW = Net use of fresh water; SM = Use of secondary materials; SF = Use of renewable secondary fuels; NRSF = Use of non-renewable secondary fuels; LVH=Lower Heating value

Table 6. Output Flows and Waste Categories

INDICATOR	UNIT	A1-A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
HWD	kg	5.73E+00	2.77E-02	8.20E-03	0	0	0	0	0	8.35E+00	0	3.44E-03	1.38E-03	0.00E+00	1.55E-01	-1.62E+00
NHWD	kg	1.35E+02	5.10E-01	4.25E-01	0	0	0	0	0	6.68E+02	0	2.76E-01	2.66E-02	0.00E+00	8.01E-01	-1.40E+01
RWD	kg	6.63E-04	2.47E-06	5.36E-06	0	0	0	0	0	1.30E-02	0	5.34E-06	1.26E-07	0.00E+00	5.32E-06	-1.01E-04
MER	kg	8.33E-05	7.15E-07	1.85E-08	0	0	0	0	0	3.70E-05	0	1.53E-08	3.92E-08	0.00E+00	6.95E-07	-7.17E-06
MFR	kg	1.55E-01	3.67E-03	1.46E-03	0	0	0	0	0	3.19E-01	0	1.31E-04	7.09E-06	0.00E+00	2.36E-04	-4.29E-02
CRU	kg	0.00E+00	0.00E+00	0.00E+00	0	0	0	0	0	0.00E+00	0	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
ETE	MJ	7.66E-02	1.32E-03	4.26E-05	0	0	0	0	0	8.77E-02	0	3.62E-05	7.36E-05	0.00E+00	1.64E-03	-9.08E-03
EEE	MJ	2.82E-01	1.06E-03	1.69E-03	0	0	0	0	0	4.08E+00	0	1.68E-03	5.37E-05	0.00E+00	2.07E-03	-4.21E-02

Acronyms: HWD = Hazardous waste disposed; NHWD = Non-hazardous waste disposed; RWD = Radioactive waste disposed; MER = Materials for energy recovery; MFR = Material for recycling; CRU = Components for reuse; ETE = Exported thermal energy; EEE = Exported electricity energy

Table 7. Biogenic Carbon Content

RESULT PER DECLARED UNIT	UNIT	AMOUNT
Biogenic Carbon Content in product	kg $CO_{2\,eq}$	3.81E-03
Biogenic Carbon Content in packing	kg $CO_{2\,eq}$	5.57E-01

5. LCA Interpretation

According to the impact assessment results, it can be seen that the Use stage (B6) of LSA- Altair Architectural LED Direct/Indirect Linear fixture is the main source of environmental contribution, contributed over 40% of environmental impact in all categories. The production of the product (A1-A3) has the second highest environmental impact.

Since the two production plants of the product are located in Guangdong Province, China, the difference in environmental impact results caused by different factories is almost negligible.

The LCA study has been carried out based on available data, information, regional and global knowledge and experience to achieve more possible accuracy, completeness and representative of the results.

6. References

1) ISO 14040:2006 Environmental management — Life cycle assessment —Principles and Framework

2) ISO 14044:2006 Environmental management- Life cycle assessment Principles and guidelines

3) ISO 21930: Sustainability in buildings and civil engineering works - Core rules for environmental product declarations of construction products and services

4) EN 15804:2012+A2:2019/AC:2021 Sustainability of construction works – Environmental product declarations - Core rules for the product category of construction products

5) EN 50693:2019 Product category rules for life cycle assessments of electronic and electrical products and systems

6) EPD System PCR 2019:14 Construction products, version 1.3.4

7) General Programme Instructions of the International EPD® system. Version 5.0

7. Contact Information

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