



# ENVIRONMENTAL PRODUCT DECLARATION

IN ACCORDANCE WITH EN 15804+A2 & ISO 14025

**EPD HUB, HUB-7887**

Published on 21.10.2026, last updated on 21.10.2026, valid until 20.10.2031

## Rondo Surface Ø145 mm

Fagerhults Belysning AB



This EPD is intended for business-to-business communication. Life Cycle Assessment study has been performed in accordance with the requirements of EN 15804, EPD Hub PCR version 1.2 (24 Mar 2025) and JRC characterization factors EF 3.1. The manufacturer has the sole ownership, liability, and responsibility for the EPD. EPDs within the same product category but from different programs may not be comparable. EPDs of construction products may not be comparable if they do not comply with EN 15804 and if they are not compared in a building context.

## MANUFACTURER AND SITE

|                                  |                               |
|----------------------------------|-------------------------------|
| Manufacturer                     | Fagerhults Belysning AB       |
| Address                          | Åvägen 1, 566 80 Habo, Sweden |
| Contact details                  | info@fagerhult.se             |
| Website                          | www.fagerhult.com             |
| Place of production              | Habo, Sweden                  |
| Place(s) of raw material origin  | Global, mainly EU             |
| Place(s) of installation and use | Global                        |
| Period for data                  | Calendar year 2025            |

## EPD STANDARDS, SCOPE AND VERIFICATION

|                    |                                                                                                                                                                                    |
|--------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Program operator   | EPD Hub, <a href="mailto:hub@epdhub.com">hub@epdhub.com</a>                                                                                                                        |
| Reference standard | EN 15804:2012+A2:2019/AC:2021 and ISO 14025                                                                                                                                        |
| PCR                | EPD Hub Core PCR version 1.2, 24 Mar 2025                                                                                                                                          |
| Sector             | Electrical product                                                                                                                                                                 |
| Category of EPD    | Third party verified EPD                                                                                                                                                           |
| Parent EPD number  |                                                                                                                                                                                    |
| Scope of the EPD   | Cradle to gate with options, A4-A5, B6, and modules C1-C4, D                                                                                                                       |
| EPD author         | Josefin Carlsson, Fagerhults Belysning AB                                                                                                                                          |
| EPD verification   | Independent verification of this EPD and data, according to ISO 14025:<br><input type="checkbox"/> Internal verification <input checked="" type="checkbox"/> External verification |
| EPD verifier       | Yazan Badour                                                                                                                                                                       |

## PRODUCT SPECIFICATION

|                                            |                       |
|--------------------------------------------|-----------------------|
| Product name                               | Rondo Surface Ø145 mm |
| Product number / reference                 |                       |
| GTIN (Global Trade Item Number)            | -                     |
| NOBB (Norwegian Building Product Database) | -                     |
| A1-A3 Specific data (%)                    | 45,3                  |

## PRODUCT CLASSIFICATION

|                                          |                                                                                                                      |
|------------------------------------------|----------------------------------------------------------------------------------------------------------------------|
| Declared operating voltage, Volt         | 220-240                                                                                                              |
| Light source color temperature, Kelvin   | 3000                                                                                                                 |
| Protection index for water and dust (IP) | 65                                                                                                                   |
| Impact resistance index (IK)             | 8                                                                                                                    |
| Luminous flux, Lumen                     | 1458                                                                                                                 |
| Electrical power, Watt                   | 12                                                                                                                   |
| Luminous efficiency, Lm/W                | 124                                                                                                                  |
| Additional characteristics               | Dali driver. For more information, please go to our website <a href="http://www.fagerhult.com">www.fagerhult.com</a> |

## PRODUCT DESCRIPTION

With energy-efficient luminaires made from sustainable materials, the Rondo family is a long-term choice for attractive and modern outdoor environments. The luminaires highlight the architecture and create defined spaces in the outdoor setting, offering high visual comfort and a consistent expression. Rondo Surface is a robust downlight available with several light distribution options. This EPD represents the size of 145 mm in diameter. Rondo's optics are based on advanced lens and reflector technology, providing controlled light distribution with smooth luminance transitions. This results in energy-efficient, functional, and comfortable lighting that makes it easy to navigate the surroundings. The luminaire offers a wide selection of light distributions and luminous flux, making it easy to create different effects and expressions in any environment.

## ABOUT THE MANUFACTURER

Fagerhult creates premium lighting solutions that enhance human well-being in professional and public environments. With sustainability and connectivity at heart, we focus on office, education, healthcare, retail and outdoor applications. We work closely with customers and partners in the European market and provide lighting solutions globally – with tailor-made solutions for our customers. The Fagerhult brand includes two manufacturing sites and eleven sales companies located around Europe.

## ENVIRONMENTAL DATA SUMMARY

|                                             |                                                                                                                                 |
|---------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------|
| Declared unit                               | 1 unit                                                                                                                          |
| Declared unit mass, kg                      | 1,97                                                                                                                            |
| Mass of packaging, kg                       | 0,4                                                                                                                             |
| Functional unit                             | Provide lighting that delivers an outgoing artificial luminous flux of 1,000 lumens during a reference lifetime of 35,000 hours |
| Reference service life (years)              | 20                                                                                                                              |
| Assigned lifetime (hours)                   | 100000                                                                                                                          |
| GWP-total, A1-A3 (kg CO <sub>2</sub> e)     | 12,2                                                                                                                            |
| GWP-fossil, A1-A3 (kg CO <sub>2</sub> e)    | 12,5                                                                                                                            |
| Secondary material, inputs (%)              | 0                                                                                                                               |
| Secondary material, outputs (%)             | 62                                                                                                                              |
| Total energy use, A1-A3 (kWh)               | 70,5                                                                                                                            |
| Net freshwater use, A1-A3 (m <sup>3</sup> ) | 4,36E-01                                                                                                                        |

# LIFE CYCLE ASSESSMENT

## SYSTEM BOUNDARY

This EPD covers the life-cycle modules listed in the following table.

| Beyond the system boundaries |    | D  | X                      | Reuse, Recovery, Recycling |
|------------------------------|----|----|------------------------|----------------------------|
| End of life stage            | C4 | X  | Disposal               |                            |
|                              | C3 | X  | Waste processing       |                            |
|                              | C2 | X  | Transport              |                            |
|                              | C1 | X  | Deconstr./demo.        |                            |
|                              | B7 | ND | Operational water use  |                            |
| Use stage                    | B6 | X  | Operational energy use |                            |
|                              | B5 | ND | Refurbishment          |                            |
|                              | B4 | ND | Replacement            |                            |
|                              | B3 | ND | Repair                 |                            |
|                              | B2 | ND | Maintenance            |                            |
| Assembly stage               | B1 | ND | Use                    |                            |
|                              | A5 | X  | Assembly               |                            |
|                              | A4 | X  | Transport              |                            |
|                              | A3 | X  | Manufacturing          |                            |
|                              | A2 | X  | Transport              |                            |
| Product stage                | A1 | X  | Raw materials          |                            |

Not declared = ND

## CUT-OFF CRITERIA

The study does not exclude any modules or processes which are stated mandatory in EN 15804+A2 and EN 50693 and the EPD Hub PCR. The study does not exclude any hazardous materials or substances. No single neglected unit process exceeds 1% of the total mass or energy flows. The module-specific total neglected input and output flows also do not exceed 5% of energy usage or mass.

The production, maintenance and operation of capital equipment and infrastructure, and construction activities are excluded from the assessment unless considered in the background database. Personnel-related activities as well as energy and water use related to company management and sales activities are also excluded from this EPD.

## VALIDATION OF DATA

Data collection for production, transport, and packaging was conducted using time and site-specific information, as defined in the general information section on page 1 and 2. Upstream process calculations rely on generic data as defined in the Bibliography section. Manufacturer-provided specific and generic data were used for the product's manufacturing stage. The analysis was performed in One Click LCA EPD Generator, with the 'Cut-Off, EN 15804+A2' allocation method, and characterization factors according to EN 15804:2012+A2:2019/AC:2021 and JRC EF 3.1.

## ALLOCATION, ESTIMATES AND ASSUMPTIONS

All allocations are done as per the reference standards and the applied PCR. In this study, allocation has been done in the following ways:

| Data type           | Allocation    |
|---------------------|---------------|
| Raw materials       | No allocation |
| Packaging materials | No allocation |
| Ancillary materials | No allocation |

Manufacturing energy and waste      Physical Properties

## PRODUCT AND MANUFACTURING SITES GROUPING

|                                      |                |
|--------------------------------------|----------------|
| Type of grouping                     | No grouping    |
| Grouping method                      | Not applicable |
| Variation in GWP-fossil for A1-A3, % | -              |

This EPD is product and factory specific.

## PRODUCT RAW MATERIAL MAIN COMPOSITION

| Raw material category | Amount, mass-% | Material origin   |
|-----------------------|----------------|-------------------|
| Metals                | 83             | Global, mainly EU |
| Minerals              | 0              | -                 |
| Fossil materials      | 10             | Global, mainly EU |
| Bio-based materials   | 0              | -                 |
| Electronic parts      | 6              | Global, mainly EU |

## BIOGENIC CARBON CONTENT

Product's biogenic carbon content at the factory gate.

|                                            |        |
|--------------------------------------------|--------|
| Biogenic carbon content in product, kg C   | 0      |
| Biogenic carbon content in packaging, kg C | 0,2157 |

## SUBSTANCES, REACH - VERY HIGH CONCERN

The product does not contain any REACH SVHC substances in amounts greater than 0,1 % (1000 ppm).

## LCA SOFTWARE AND BIBLIOGRAPHY

This EPD has been created using One Click LCA Luminaire EPD Generator v2.2.9. The LCA and EPD have been prepared according to the reference standards, EN 50693, and ISO 14040/14044. Ecoinvent v3.10.1 and One Click LCA databases were used as sources of environmental data. Allocation used in Ecoinvent 3.10.1 environmental data sources follow the methodology 'allocation, cut-off, EN 15804+A2'.

- EPD Hub Core Product Category Rules version 1.2, March 2025
- EPD Hub General Program Instructions version 1.3, March 2025
- EN 15804:2012+A2:2019/AC:2021 Sustainability of construction works - Environmental product declarations - Core rules for the product category of construction products
- EN 50693:2020 Product category rules for life cycle assessments of electronic and electrical products and systems
- EN 15941:2024 Sustainability of construction works - Data quality for environmental assessment of products and construction work - Selection and use of data
- EN 15942:2011 Sustainability of construction works - Environmental product declarations - Communication format business-to-business
- ISO 14025:2006 Environmental statements and programmes for products - Principles and general requirements
- ISO 14040:2006 Environmental management - Life cycle assessment - Principles and framework

- ISO 14044:2006 Environmental management - Life cycle assessment - Requirements and guidelines
- Paper and cardboard packaging waste treatment: EUROSTAT, [https://ec.europa.eu/eurostat/data-browser/view/env\\_waspac\\_\\_custom\\_8519259/default/table?lang=en](https://ec.europa.eu/eurostat/data-browser/view/env_waspac__custom_8519259/default/table?lang=en)
- Wooden packaging waste treatment: EUROSTAT, [https://ec.europa.eu/eurostat/data-browser/view/env\\_waspac\\_\\_custom\\_8519174/default/table?lang=en](https://ec.europa.eu/eurostat/data-browser/view/env_waspac__custom_8519174/default/table?lang=en)
- Plastic packaging waste treatment: EUROSTAT, [https://ec.europa.eu/eurostat/data-browser/view/env\\_waspac\\_\\_custom\\_8519242/default/table?lang=en](https://ec.europa.eu/eurostat/data-browser/view/env_waspac__custom_8519242/default/table?lang=en)
- Steel packaging waste treatment: EUROSTAT, [https://ec.europa.eu/eurostat/data-browser/view/env\\_waspac\\_\\_custom\\_13967225/default/table?lang=en](https://ec.europa.eu/eurostat/data-browser/view/env_waspac__custom_13967225/default/table?lang=en)
- ecoinvent 3.10.1
- One Click LCA database

# PRODUCT LIFE CYCLE

## MANUFACTURING (A1-A3)

The environmental impacts considered for the manufacturing stage accounts extraction, refining, and processing of all primary raw materials used in the production. The product is made of metals, plastics, and electronic components, including driver. The product is composed by components that arrive to the factory fully or semi-fabricated, as well as components that are manufactured and processed inhouse at production site.

All components and raw materials are transported from supplier to the production site. The transport distances vary depending on origin, typically ranging between 3 km to 1500 km. Distances are calculated taking the supplier's location with the manufacturing facility as the destination. Transportation modes include mainly road freight and container shipping are applicable, in rare cases also air.

The material losses occurring during the manufacturing processes are treated as per the waste handling practices in the factory, while scenario assumptions are made in the absence of exact data. The study also considers the fuels used by machines as well as losses during electricity transmission.

A market-based approach is used in modelling the electricity mix utilized in the factory. The use of renewable energy in manufacturing is demonstrated through contractual instruments (GOs, RECs, etc), and its use is ensured throughout the validity period of this EPD.

The product is packaged in a corrugated cardboard box. The product is being sent to the installation site on a wooden pallet wrapped in plastic film.

Co-product allocation is neglected as revenue of co-product is very low. Hence, the waste undergoes a conservative waste treatment as per the default end-of-life values of EN 50693.

## TRANSPORT AND INSTALLATION (A4-A5)

Transportation distances from manufacturing site to customer locations are based on sales volume-based weighted averages. In the absence of exact data, conservative assumptions are made.

Environmental impacts from packaging waste generated at the installation site is included. The packaging waste is modelled using EUROSTAT waste treatment statistic, where paper and cardboard packaging end-of-life is split into 83% recycling, 8% incineration, and 9% landfilling. Transport distance to local treatment facilities is assumed to be 50 km. The impacts of energy consumption and the used ancillary materials during installation are considered negligible.

## PRODUCT USE AND MAINTENANCE (B1-B7)

Operational environmental impacts and resource consumption occur exclusively from operational energy use, module B6. All other modules within the use stage (B1–B5 and B7) have zero operational impacts or resource consumption.

The product consume electricity during use phase and the energy consumption is calculated using the following formula:

Energy consumption = Wattage x Assigned lifetime (hours)

The results do not include any energy savings from using controls. If a light management system is applicable, the following reduction factors of energy consumption are to be applied:

- Dimming: 0,90
- Presence detection: 0,75
- Daylight sensing: 0,75
- Combination of dimming and presence detection: 0,70
- Combination of presence sensor and daylight: 0,55
- Combination of dimming, presence detection and daylight sensing: 0,55
- Comprehensive Lighting Control: 0,50

Impacts due to electricity production include direct emissions to air, transformation, and transmission losses.

## PRODUCT END OF LIFE (C1-C4, D)

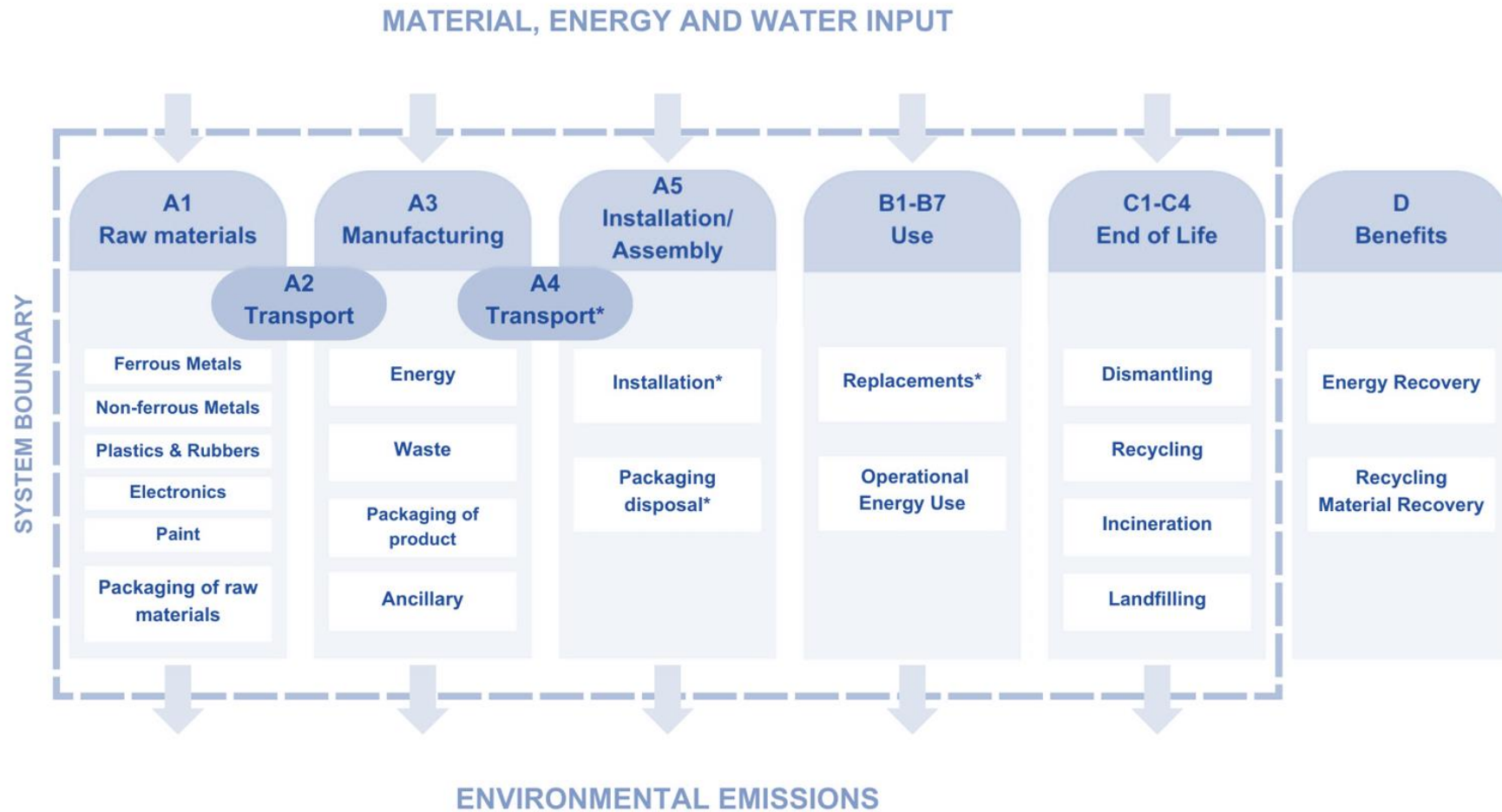
Consumption of energy and natural resources in demolition process is assumed to be negligible. It is assumed that the waste is collected separately and transported to the waste treatment centre. According to EN 50693:2019, waste treatment includes depollution, dismantling, crushing, shredding, sorting,

recycling, energy recovery, and final disposal using default values from Table G.4 of EN 50693. The transport distance is 150 km while the transportation method is assumed to be lorry.

Recovered materials displace primary raw materials via recycling. Incineration with energy recovery displaces grid electricity and thermal energy production. Module D incorporates net benefits and loads resulting from both product end-of-life (Module C) and installation packaging disposal (Module A5).

The scenarios applied for Modules C1–C4 and D represent current industry practice and reflect a realistic baseline.

# LIFE CYCLE FLOW DIAGRAM



\*If module declared as per scope of the EPD

# ENVIRONMENTAL IMPACT DATA, RESULTS PER DECLARED UNIT

The following results refers to one unit of the luminaire, with declared lumens for 100 000 hours.

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.

## CORE ENVIRONMENTAL IMPACT INDICATORS – EN 15804+A2, EF 3.1

| Impact category                     | Unit                   | A1       | A2       | A3        | A1-A3     | A4       | A5       | B1 | B2 | B3 | B4 | B5 | B6       | B7 | C1       | C2       | C3        | C4        | D         |
|-------------------------------------|------------------------|----------|----------|-----------|-----------|----------|----------|----|----|----|----|----|----------|----|----------|----------|-----------|-----------|-----------|
| GWP – total <sup>1)</sup>           | kg CO <sub>2</sub> e   | 1,17E+01 | 3,35E-01 | 1,00E-01  | 1,22E+01  | 1,39E-01 | 7,97E-01 | ND | ND | ND | ND | ND | 4,48E+01 | ND | 0,00E+00 | 5,77E-02 | 2,55E-01  | 1,25E-01  | 4,82E+00  |
| GWP – fossil                        | kg CO <sub>2</sub> e   | 1,17E+01 | 3,34E-01 | 5,35E-01  | 1,25E+01  | 1,39E-01 | 2,90E-02 | ND | ND | ND | ND | ND | 3,97E+01 | ND | 0,00E+00 | 5,77E-02 | 2,55E-01  | 1,25E-01  | -2,36E+01 |
| GWP – biogenic                      | kg CO <sub>2</sub> e   | 6,52E-02 | 8,12E-05 | -8,89E-01 | -8,24E-01 | 3,16E-05 | 7,68E-01 | ND | ND | ND | ND | ND | 7,20E-01 | ND | 0,00E+00 | 1,26E-05 | -1,24E-04 | -3,13E-05 | 2,84E+01  |
| GWP – LULUC                         | kg CO <sub>2</sub> e   | 1,79E-02 | 1,02E-03 | 4,54E-01  | 4,73E-01  | 6,23E-05 | 9,76E-06 | ND | ND | ND | ND | ND | 4,46E+00 | ND | 0,00E+00 | 2,56E-05 | 5,24E-05  | 2,18E-05  | -1,70E-02 |
| Ozone depletion pot.                | kg CFC <sub>11</sub> e | 6,41E-07 | 5,42E-09 | 2,50E-08  | 6,71E-07  | 2,06E-09 | 2,22E-10 | ND | ND | ND | ND | ND | 1,19E-06 | ND | 0,00E+00 | 8,07E-10 | 4,78E-10  | 2,92E-10  | -9,78E-08 |
| Acidification potential             | mol H <sup>+</sup> e   | 9,59E-02 | 1,16E-03 | 6,65E-03  | 1,04E-01  | 4,75E-04 | 7,49E-05 | ND | ND | ND | ND | ND | 4,86E-01 | ND | 0,00E+00 | 1,92E-04 | 4,38E-04  | 1,16E-04  | -2,60E-01 |
| EP-freshwater <sup>2)</sup>         | kg Pe                  | 4,48E-03 | 3,55E-05 | 2,06E-04  | 4,72E-03  | 1,08E-05 | 3,27E-06 | ND | ND | ND | ND | ND | 3,51E-02 | ND | 0,00E+00 | 4,49E-06 | 2,14E-05  | 2,61E-06  | -1,39E-02 |
| EP-marine                           | kg Ne                  | 1,33E-02 | 3,92E-04 | 3,64E-03  | 1,73E-02  | 1,56E-04 | 7,78E-05 | ND | ND | ND | ND | ND | 7,16E-02 | ND | 0,00E+00 | 6,23E-05 | 1,13E-04  | 1,46E-04  | -3,13E-02 |
| EP-terrestrial                      | mol Ne                 | 1,38E-01 | 4,16E-03 | 2,77E-02  | 1,70E-01  | 1,70E-03 | 2,70E-04 | ND | ND | ND | ND | ND | 7,31E-01 | ND | 0,00E+00 | 6,78E-04 | 1,19E-03  | 5,03E-04  | -3,25E-01 |
| POCP ("smog") <sup>3)</sup>         | kg NMVOCe              | 4,95E-02 | 1,70E-03 | 4,30E-03  | 5,55E-02  | 7,00E-04 | 9,81E-05 | ND | ND | ND | ND | ND | 1,95E-01 | ND | 0,00E+00 | 2,68E-04 | 3,41E-04  | 1,50E-04  | -1,02E-01 |
| ADP-minerals & metals <sup>4)</sup> | kg Sbe                 | 1,48E-03 | 9,65E-07 | 4,21E-06  | 1,49E-03  | 3,89E-07 | 7,44E-08 | ND | ND | ND | ND | ND | 4,77E-03 | ND | 0,00E+00 | 1,90E-07 | 2,03E-06  | 4,45E-08  | -4,93E-04 |
| ADP-fossil resources                | MJ                     | 1,67E+02 | 4,78E+00 | 7,45E+00  | 1,80E+02  | 2,02E+00 | 2,20E-01 | ND | ND | ND | ND | ND | 5,31E+03 | ND | 0,00E+00 | 8,10E-01 | 5,12E-01  | 2,50E-01  | -2,42E+02 |
| Water use <sup>5)</sup>             | m <sup>3</sup> e depr. | 5,43E+00 | 2,83E-02 | 1,46E+01  | 2,01E+01  | 9,98E-03 | 5,60E-03 | ND | ND | ND | ND | ND | 2,93E+02 | ND | 0,00E+00 | 3,76E-03 | 2,19E-02  | 1,06E-02  | -2,14E+00 |

1) GWP = Global Warming Potential. 2) EP = Eutrophication potential. Required characterisation method and data are in kg P-eq. Multiply by 3,07 to get PO<sub>4</sub>e. 3) POCP = Photochemical ozone formation. 4) ADP = Abiotic depletion potential. 5) EN 15804+A2 disclaimer for Abiotic depletion and Water use and optional indicators except Particulate matter and Ionizing radiation, human health. The results of these environmental impact indicators shall be used with care as the uncertainties on these results are high or as there is limited experience with the indicator.

## ADDITIONAL (OPTIONAL) ENVIRONMENTAL IMPACT INDICATORS – EN 15804+A2, EF 3.1

| Impact category | Unit | A1 | A2 | A3 | A1-A3 | A4 | A5 | B1 | B2 | B3 | B4 | B5 | B6 | B7 | C1 | C2 | C3 | C4 | D |
|-----------------|------|----|----|----|-------|----|----|----|----|----|----|----|----|----|----|----|----|----|---|
|-----------------|------|----|----|----|-------|----|----|----|----|----|----|----|----|----|----|----|----|----|---|

|                                  |           |          |          |          |          |          |          |    |    |    |    |    |          |    |          |          |          |          |           |
|----------------------------------|-----------|----------|----------|----------|----------|----------|----------|----|----|----|----|----|----------|----|----------|----------|----------|----------|-----------|
| Particulate matter               | Incidence | 7,50E-07 | 3,33E-08 | 7,54E-08 | 8,58E-07 | 1,39E-08 | 1,31E-09 | ND | ND | ND | ND | ND | 4,05E-06 | ND | 0,00E+00 | 4,58E-09 | 5,52E-09 | 1,91E-09 | -1,27E-06 |
| Ionizing radiation <sup>6)</sup> | kBq U235e | 1,90E+00 | 4,05E-03 | 4,40E-02 | 1,95E+00 | 1,76E-03 | 7,37E-04 | ND | ND | ND | ND | ND | 3,81E+02 | ND | 0,00E+00 | 6,55E-04 | 2,27E-03 | 3,77E-04 | -1,40E+00 |
| Ecotoxicity (freshwater)         | CTUe      | 5,75E+02 | 1,83E+00 | 7,03E+00 | 5,84E+02 | 2,86E-01 | 7,14E-01 | ND | ND | ND | ND | ND | 6,64E+02 | ND | 0,00E+00 | 1,28E-01 | 6,72E-01 | 4,16E+01 | -6,96E+01 |
| Human toxicity, cancer           | CTUh      | 1,30E-08 | 5,41E-11 | 9,17E-10 | 1,40E-08 | 2,30E-11 | 8,81E-12 | ND | ND | ND | ND | ND | 7,83E-08 | ND | 0,00E+00 | 9,81E-12 | 4,71E-11 | 2,52E-11 | -1,11E-08 |
| Human tox. non-cancer            | CTUh      | 5,01E-07 | 3,10E-09 | 2,10E-08 | 5,25E-07 | 1,31E-09 | 4,74E-10 | ND | ND | ND | ND | ND | 4,09E-06 | ND | 0,00E+00 | 5,07E-10 | 2,53E-09 | 1,74E-09 | -4,94E-07 |
| SQP <sup>7)</sup>                | -         | 5,42E+01 | 4,85E+00 | 1,02E+02 | 1,61E+02 | 2,04E+00 | 1,67E-01 | ND | ND | ND | ND | ND | 1,25E+03 | ND | 0,00E+00 | 4,83E-01 | 7,79E-01 | 3,33E-01 | -1,36E+03 |

6) EN 15804+A2 disclaimer for Ionizing radiation, human health. This impact category deals mainly with the eventual impact of low-dose ionizing radiation on the 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. 7) SQP = Land use related impacts/soil quality.

## USE OF NATURAL RESOURCES

| Impact category                    | Unit | A1       | A2       | A3       | A1-A3    | A4       | A5        | B1 | B2 | B3 | B4 | B5 | B6       | B7 | C1       | C2       | C3        | C4        | D         |
|------------------------------------|------|----------|----------|----------|----------|----------|-----------|----|----|----|----|----|----------|----|----------|----------|-----------|-----------|-----------|
| Renew. PER as energy <sup>8)</sup> | MJ   | 2,19E+01 | 6,88E-02 | 5,82E+01 | 8,02E+01 | 2,77E-02 | -4,77E+00 | ND | ND | ND | ND | ND | 3,64E+03 | ND | 0,00E+00 | 1,11E-02 | 7,37E-02  | 6,23E-03  | -1,47E+02 |
| Renew. PER as material             | MJ   | 0,00E+00 | 0,00E+00 | 6,88E+00 | 6,88E+00 | 0,00E+00 | -6,88E+00 | ND | ND | ND | ND | ND | 0,00E+00 | ND | 0,00E+00 | 0,00E+00 | 0,00E+00  | 0,00E+00  | 0,00E+00  |
| Total use of renew. PER            | MJ   | 2,19E+01 | 6,88E-02 | 6,51E+01 | 8,71E+01 | 2,77E-02 | -1,17E+01 | ND | ND | ND | ND | ND | 3,64E+03 | ND | 0,00E+00 | 1,11E-02 | 7,37E-02  | 6,23E-03  | -1,47E+02 |
| Non-re. PER as energy              | MJ   | 1,62E+02 | 4,79E+00 | 6,52E+00 | 1,73E+02 | 2,02E+00 | -2,69E-01 | ND | ND | ND | ND | ND | 5,31E+03 | ND | 0,00E+00 | 8,10E-01 | -2,79E+00 | -3,05E+00 | -2,42E+02 |
| Non-re. PER as material            | MJ   | 4,67E+00 | 0,00E+00 | 8,65E-01 | 5,53E+00 | 0,00E+00 | -8,65E-01 | ND | ND | ND | ND | ND | 0,00E+00 | ND | 0,00E+00 | 0,00E+00 | -2,33E+00 | -2,33E+00 | 0,00E+00  |
| Total use of non-re. PER           | MJ   | 1,67E+02 | 4,79E+00 | 7,38E+00 | 1,79E+02 | 2,02E+00 | -1,13E+00 | ND | ND | ND | ND | ND | 5,31E+03 | ND | 0,00E+00 | 8,10E-01 | -5,12E+00 | -5,38E+00 | -2,42E+02 |
| Secondary materials                | kg   | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00  | ND | ND | ND | ND | ND | 0,00E+00 | ND | 0,00E+00 | 0,00E+00 | 0,00E+00  | 0,00E+00  | 0,00E+00  |
| Renew. secondary fuels             | MJ   | 6,62E-03 | 2,63E-05 | 1,80E-01 | 1,87E-01 | 1,09E-05 | 1,62E-06  | ND | ND | ND | ND | ND | 4,71E-03 | ND | 0,00E+00 | 4,63E-06 | 2,53E-05  | 3,69E-06  | -9,15E-04 |
| Non-ren. secondary fuels           | MJ   | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00  | ND | ND | ND | ND | ND | 0,00E+00 | ND | 0,00E+00 | 0,00E+00 | 0,00E+00  | 0,00E+00  | 0,00E+00  |
| Use of net fresh water             | m³   | 9,54E-02 | 7,30E-04 | 3,40E-01 | 4,36E-01 | 2,99E-04 | -2,53E-04 | ND | ND | ND | ND | ND | 6,96E+00 | ND | 0,00E+00 | 1,07E-04 | 4,57E-04  | -8,47E-04 | -8,72E-02 |

8) PER = Primary energy resources.

## END OF LIFE – WASTE

| Impact category     | Unit | A1       | A2       | A3       | A1-A3    | A4       | A5       | B1 | B2 | B3 | B4 | B5 | B6       | B7 | C1       | C2       | C3       | C4       | D         |
|---------------------|------|----------|----------|----------|----------|----------|----------|----|----|----|----|----|----------|----|----------|----------|----------|----------|-----------|
| Hazardous waste     | kg   | 1,68E+00 | 2,91E-02 | 4,43E-02 | 1,75E+00 | 3,42E-03 | 1,55E-03 | ND | ND | ND | ND | ND | 5,42E+00 | ND | 0,00E+00 | 1,41E-03 | 7,33E-03 | 2,42E-02 | -4,76E+00 |
| Non-hazardous waste | kg   | 6,99E+01 | 5,70E-01 | 1,14E+00 | 7,17E+01 | 6,34E-02 | 5,55E-01 | ND | ND | ND | ND | ND | 1,79E+02 | ND | 0,00E+00 | 2,65E-02 | 2,00E-01 | 2,06E+00 | -4,92E+01 |
| Radioactive waste   | kg   | 5,15E-04 | 9,69E-07 | 1,12E-05 | 5,27E-04 | 4,31E-07 | 1,87E-07 | ND | ND | ND | ND | ND | 8,13E-02 | ND | 0,00E+00 | 1,61E-07 | 5,57E-07 | 9,26E-08 | -3,38E-04 |

## END OF LIFE – OUTPUT FLOWS

| Impact category              | Unit | A1       | A2       | A3       | A1-A3    | A4       | A5       | B1 | B2 | B3 | B4 | B5 | B6       | B7 | C1       | C2       | C3       | C4       | D        |
|------------------------------|------|----------|----------|----------|----------|----------|----------|----|----|----|----|----|----------|----|----------|----------|----------|----------|----------|
| Components for reuse         | kg   | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | ND | ND | ND | ND | ND | 0,00E+00 | ND | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 |
| Materials for recycling      | kg   | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 1,92E-01 | ND | ND | ND | ND | ND | 0,00E+00 | ND | 0,00E+00 | 0,00E+00 | 1,22E+00 | 0,00E+00 | 0,00E+00 |
| Materials for energy rec     | kg   | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | ND | ND | ND | ND | ND | 0,00E+00 | ND | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 |
| Exported energy              | MJ   | 3,64E-02 | 0,00E+00 | 0,00E+00 | 3,64E-02 | 0,00E+00 | 4,32E-01 | ND | ND | ND | ND | ND | 0,00E+00 | ND | 0,00E+00 | 0,00E+00 | 1,03E+00 | 0,00E+00 | 0,00E+00 |
| Exported energy: Electricity | MJ   | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 1,82E-01 | ND | ND | ND | ND | ND | 0,00E+00 | ND | 0,00E+00 | 0,00E+00 | 4,35E-01 | 0,00E+00 | 0,00E+00 |
| Exported energy: Heat        | MJ   | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 2,46E-01 | ND | ND | ND | ND | ND | 0,00E+00 | ND | 0,00E+00 | 0,00E+00 | 5,99E-01 | 0,00E+00 | 0,00E+00 |

## ENVIRONMENTAL IMPACTS – EN 15804+A1, CML

| Impact category      | Unit                               | A1       | A2       | A3       | A1-A3    | A4       | A5       | B1 | B2 | B3 | B4 | B5 | B6       | B7 | C1       | C2       | C3       | C4       | D         |
|----------------------|------------------------------------|----------|----------|----------|----------|----------|----------|----|----|----|----|----|----------|----|----------|----------|----------|----------|-----------|
| Global Warming Pot.  | kg CO <sub>2</sub> e               | 1,16E+01 | 3,33E-01 | 1,05E+00 | 1,30E+01 | 1,39E-01 | 5,28E-02 | ND | ND | ND | ND | ND | 4,44E+01 | ND | 0,00E+00 | 5,74E-02 | 2,55E-01 | 1,25E-01 | -2,34E+01 |
| Ozone depletion Pot. | kg CFC <sub>11</sub> e             | 5,69E-07 | 4,32E-09 | 2,51E-08 | 5,98E-07 | 1,64E-09 | 1,79E-10 | ND | ND | ND | ND | ND | 1,03E-06 | ND | 0,00E+00 | 6,45E-10 | 4,02E-10 | 2,38E-10 | -8,95E-08 |
| Acidification        | kg SO <sub>2</sub> e               | 8,13E-02 | 8,84E-04 | 4,25E-03 | 8,64E-02 | 3,63E-04 | 5,67E-05 | ND | ND | ND | ND | ND | 4,07E-01 | ND | 0,00E+00 | 1,47E-04 | 3,48E-04 | 8,40E-05 | -2,24E-01 |
| Eutrophication       | kg PO <sub>4</sub> <sup>3</sup> e  | 3,12E-02 | 2,90E-04 | 1,20E-02 | 4,35E-02 | 8,84E-05 | 3,43E-05 | ND | ND | ND | ND | ND | 5,05E-02 | ND | 0,00E+00 | 3,58E-05 | 5,69E-05 | 4,20E-05 | -1,52E-02 |
| POCP ("smog")        | kg C <sub>2</sub> H <sub>4</sub> e | 7,10E-03 | 7,82E-05 | 3,50E-04 | 7,53E-03 | 3,23E-05 | 1,02E-05 | ND | ND | ND | ND | ND | 2,20E-02 | ND | 0,00E+00 | 1,32E-05 | 2,08E-05 | 7,46E-06 | -1,37E-02 |
| ADP-elements         | kg Sbe                             | 1,48E-03 | 9,41E-07 | 4,17E-06 | 1,49E-03 | 3,79E-07 | 7,22E-08 | ND | ND | ND | ND | ND | 4,77E-03 | ND | 0,00E+00 | 1,85E-07 | 2,02E-06 | 4,06E-08 | -4,90E-04 |
| ADP-fossil           | MJ                                 | 1,45E+02 | 4,72E+00 | 6,69E+00 | 1,56E+02 | 1,99E+00 | 2,07E-01 | ND | ND | ND | ND | ND | 2,80E+02 | ND | 0,00E+00 | 7,99E-01 | 4,76E-01 | 2,44E-01 | -2,19E+02 |

### ADDITIONAL INDICATOR – GWP-GHG

| Impact category       | Unit                 | A1       | A2       | A3       | A1-A3    | A4       | A5       | B1 | B2 | B3 | B4 | B5 | B6       | B7 | C1       | C2       | C3       | C4       | D         |
|-----------------------|----------------------|----------|----------|----------|----------|----------|----------|----|----|----|----|----|----------|----|----------|----------|----------|----------|-----------|
| GWP-GHG <sup>9)</sup> | kg CO <sub>2</sub> e | 1,17E+01 | 3,35E-01 | 9,89E-01 | 1,30E+01 | 1,39E-01 | 2,90E-02 | ND | ND | ND | ND | ND | 4,41E+01 | ND | 0,00E+00 | 5,77E-02 | 2,55E-01 | 1,25E-01 | -2,36E+01 |

9) This indicator includes all greenhouse gases excluding biogenic carbon dioxide uptake and emissions and biogenic carbon stored in the product. In addition, the characterisation factors for the flows - CH<sub>4</sub> fossil, CH<sub>4</sub> biogenic and Dinitrogen monoxide - were updated. This indicator is identical to the GWP-total of EN 15804:2012+A2:2019 except that the characterization factor for biogenic CO<sub>2</sub> is set to zero.

# ENVIRONMENTAL IMPACT DATA, RESULTS PER FUNCTIONAL UNIT

The following results refers to the functional unit, with 1000 lumens for 35 000 hours.

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.

## CORE ENVIRONMENTAL IMPACT INDICATORS – EN 15804+A2, EF 3.1

| Impact category                     | Unit                       | A1       | A2       | A3        | A1-A3     | A4       | A5       | B1 | B2 | B3 | B4 | B5 | B6       | B7 | C1       | C2       | C3        | C4        | D         |
|-------------------------------------|----------------------------|----------|----------|-----------|-----------|----------|----------|----|----|----|----|----|----------|----|----------|----------|-----------|-----------|-----------|
| GWP – total <sup>1)</sup>           | kg CO <sub>2</sub> éq/FU   | 2,82E+00 | 8,05E-02 | 2,40E-02  | 2,92E+00  | 3,35E-02 | 1,91E-01 | ND | ND | ND | ND | ND | 1,08E+01 | ND | 0,00E+00 | 1,39E-02 | 6,12E-02  | 3,00E-02  | 1,16E+00  |
| GWP – fossil                        | kg CO <sub>2</sub> éq/FU   | 2,80E+00 | 8,02E-02 | 1,29E-01  | 3,01E+00  | 3,34E-02 | 6,95E-03 | ND | ND | ND | ND | ND | 9,52E+00 | ND | 0,00E+00 | 1,39E-02 | 6,12E-02  | 3,00E-02  | -5,66E+00 |
| GWP – biogenic                      | kg CO <sub>2</sub> éq/FU   | 1,56E-02 | 1,95E-05 | -2,13E-01 | -1,98E-01 | 7,57E-06 | 1,84E-01 | ND | ND | ND | ND | ND | 1,73E-01 | ND | 0,00E+00 | 3,03E-06 | -2,99E-05 | -7,52E-06 | 6,82E+00  |
| GWP – LULUC                         | kg CO <sub>2</sub> éq/FU   | 4,30E-03 | 2,44E-04 | 1,09E-01  | 1,13E-01  | 1,50E-05 | 2,34E-06 | ND | ND | ND | ND | ND | 1,07E+00 | ND | 0,00E+00 | 6,13E-06 | 1,26E-05  | 5,24E-06  | -4,08E-03 |
| Ozone depletion pot.                | kg CFC <sub>11</sub> e/FU  | 1,54E-07 | 1,30E-09 | 5,99E-09  | 1,61E-07  | 4,94E-10 | 5,32E-11 | ND | ND | ND | ND | ND | 2,85E-07 | ND | 0,00E+00 | 1,94E-10 | 1,15E-10  | 7,02E-11  | -2,35E-08 |
| Acidification potential             | mole H <sup>+</sup> e/FU   | 2,30E-02 | 2,78E-04 | 1,60E-03  | 2,49E-02  | 1,14E-04 | 1,80E-05 | ND | ND | ND | ND | ND | 1,17E-01 | ND | 0,00E+00 | 4,62E-05 | 1,05E-04  | 2,78E-05  | -6,23E-02 |
| EP-freshwater <sup>2)</sup>         | kg Pe/FU                   | 1,07E-03 | 8,52E-06 | 4,94E-05  | 1,13E-03  | 2,60E-06 | 7,85E-07 | ND | ND | ND | ND | ND | 8,43E-03 | ND | 0,00E+00 | 1,08E-06 | 5,15E-06  | 6,28E-07  | -3,34E-03 |
| EP-marine                           | kg Ne/FU                   | 3,20E-03 | 9,41E-05 | 8,74E-04  | 4,16E-03  | 3,75E-05 | 1,87E-05 | ND | ND | ND | ND | ND | 1,72E-02 | ND | 0,00E+00 | 1,50E-05 | 2,71E-05  | 3,50E-05  | -7,52E-03 |
| EP-terrestrial                      | mol Ne/FU                  | 3,31E-02 | 9,99E-04 | 6,65E-03  | 4,08E-02  | 4,08E-04 | 6,48E-05 | ND | ND | ND | ND | ND | 1,76E-01 | ND | 0,00E+00 | 1,63E-04 | 2,87E-04  | 1,21E-04  | -7,81E-02 |
| POCP (“smog”) <sup>3)</sup>         | kg NMVOCe/                 | 1,19E-02 | 4,09E-04 | 1,03E-03  | 1,33E-02  | 1,68E-04 | 2,35E-05 | ND | ND | ND | ND | ND | 4,68E-02 | ND | 0,00E+00 | 6,43E-05 | 8,18E-05  | 3,59E-05  | -2,46E-02 |
| ADP-minerals & metals <sup>4)</sup> | kg Sbe/FU                  | 3,56E-04 | 2,32E-07 | 1,01E-06  | 3,57E-04  | 9,33E-08 | 1,79E-08 | ND | ND | ND | ND | ND | 1,14E-03 | ND | 0,00E+00 | 4,55E-08 | 4,87E-07  | 1,07E-08  | -1,18E-04 |
| ADP-fossil resources                | MJ/FU                      | 4,02E+01 | 1,15E+00 | 1,79E+00  | 4,31E+01  | 4,85E-01 | 5,27E-02 | ND | ND | ND | ND | ND | 1,27E+03 | ND | 0,00E+00 | 1,94E-01 | 1,23E-01  | 6,01E-02  | -5,81E+01 |
| Water use <sup>5)</sup>             | m <sup>3</sup> e priv. /FU | 1,30E+00 | 6,78E-03 | 3,51E+00  | 4,82E+00  | 2,40E-03 | 1,34E-03 | ND | ND | ND | ND | ND | 7,03E+01 | ND | 0,00E+00 | 9,02E-04 | 5,26E-03  | 2,56E-03  | -5,15E-01 |

1) GWP = Global Warming Potential. 2) EP = Eutrophication potential. Required characterisation method and data are in kg P-eq. Multiply by 3,07 to get PO4e. 3) POCP = Photochemical ozone formation. 4) ADP = Abiotic depletion potential. 5) EN 15804+A2 disclaimer for Abiotic depletion and Water use and optional indicators except Particulate matter and Ionizing radiation, human health. The results of these environmental impact indicators shall be used with care as the uncertainties on these results are high or as there is limited experience with the indicator.

### ADDITIONAL (OPTIONAL) ENVIRONMENTAL IMPACT INDICATORS – EN 15804+A2, EF 3.1

| Impact category                  | Unit          | A1       | A2       | A3       | A1-A3    | A4       | A5       | B1 | B2 | B3 | B4 | B5 | B6       | B7 | C1       | C2       | C3       | C4       | D         |
|----------------------------------|---------------|----------|----------|----------|----------|----------|----------|----|----|----|----|----|----------|----|----------|----------|----------|----------|-----------|
| Particulate matter               | Incidence /FU | 1,80E-07 | 7,99E-09 | 1,81E-08 | 2,06E-07 | 3,35E-09 | 3,15E-10 | ND | ND | ND | ND | ND | 9,71E-07 | ND | 0,00E+00 | 1,10E-09 | 1,33E-09 | 4,59E-10 | -3,04E-07 |
| Ionizing radiation <sup>6)</sup> | kBq U235e/FU  | 4,56E-01 | 9,72E-04 | 1,06E-02 | 4,67E-01 | 4,23E-04 | 1,77E-04 | ND | ND | ND | ND | ND | 9,14E+01 | ND | 0,00E+00 | 1,57E-04 | 5,45E-04 | 9,04E-05 | -3,35E-01 |
| Ecotoxicity (freshwater)         | CTUe/FU       | 1,38E+02 | 4,39E-01 | 1,69E+00 | 1,40E+02 | 6,86E-02 | 1,71E-01 | ND | ND | ND | ND | ND | 1,59E+02 | ND | 0,00E+00 | 3,07E-02 | 1,61E-01 | 9,98E+00 | -1,67E+01 |
| Human toxicity, cancer           | CTUh/FU       | 3,13E-09 | 1,30E-11 | 2,20E-10 | 3,36E-09 | 5,52E-12 | 2,11E-12 | ND | ND | ND | ND | ND | 1,88E-08 | ND | 0,00E+00 | 2,36E-12 | 1,13E-11 | 6,05E-12 | -2,68E-09 |
| Human tox. non-cancer            | CTUh/FU       | 1,20E-07 | 7,44E-10 | 5,04E-09 | 1,26E-07 | 3,14E-10 | 1,14E-10 | ND | ND | ND | ND | ND | 9,82E-07 | ND | 0,00E+00 | 1,22E-10 | 6,08E-10 | 4,19E-10 | -1,19E-07 |
| SQP <sup>7)</sup>                | -/FU          | 1,30E+01 | 1,16E+00 | 2,45E+01 | 3,87E+01 | 4,89E-01 | 4,01E-02 | ND | ND | ND | ND | ND | 3,00E+02 | ND | 0,00E+00 | 1,16E-01 | 1,87E-01 | 8,00E-02 | -3,26E+02 |

6) EN 15804+A2 disclaimer for ionizing radiation, human health. 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. 7) SQP = Land use related impacts/soil quality.

### USE OF NATURAL RESOURCES

| Impact category                    | Unit               | A1       | A2       | A3       | A1-A3    | A4       | A5        | B1 | B2 | B3 | B4 | B5 | B6       | B7 | C1       | C2       | C3        | C4        | D         |
|------------------------------------|--------------------|----------|----------|----------|----------|----------|-----------|----|----|----|----|----|----------|----|----------|----------|-----------|-----------|-----------|
| Renew. PER as energy <sup>8)</sup> | MJ/FU              | 5,27E+00 | 1,65E-02 | 1,40E+01 | 1,93E+01 | 6,65E-03 | -1,15E+00 | ND | ND | ND | ND | ND | 8,74E+02 | ND | 0,00E+00 | 2,66E-03 | 1,77E-02  | 1,50E-03  | -3,53E+01 |
| Renew. PER as material             | MJ/FU              | 0,00E+00 | 0,00E+00 | 1,65E+00 | 1,65E+00 | 0,00E+00 | -1,65E+00 | ND | ND | ND | ND | ND | 0,00E+00 | ND | 0,00E+00 | 0,00E+00 | 0,00E+00  | 0,00E+00  | 0,00E+00  |
| Total use of renew. PER            | MJ/FU              | 5,27E+00 | 1,65E-02 | 1,56E+01 | 2,09E+01 | 6,65E-03 | -2,80E+00 | ND | ND | ND | ND | ND | 8,74E+02 | ND | 0,00E+00 | 2,66E-03 | 1,77E-02  | 1,50E-03  | -3,53E+01 |
| Non-re. PER as energy              | MJ/FU              | 3,89E+01 | 1,15E+00 | 1,56E+00 | 4,16E+01 | 4,85E-01 | -6,47E-02 | ND | ND | ND | ND | ND | 1,27E+03 | ND | 0,00E+00 | 1,94E-01 | -6,69E-01 | -7,31E-01 | -5,80E+01 |
| Non-re. PER as material            | MJ/FU              | 1,12E+00 | 0,00E+00 | 2,08E-01 | 1,33E+00 | 0,00E+00 | -2,08E-01 | ND | ND | ND | ND | ND | 0,00E+00 | ND | 0,00E+00 | 0,00E+00 | -5,60E-01 | -5,60E-01 | 0,00E+00  |
| Total use of non-re. PER           | MJ/FU              | 4,00E+01 | 1,15E+00 | 1,77E+00 | 4,29E+01 | 4,85E-01 | -2,72E-01 | ND | ND | ND | ND | ND | 1,27E+03 | ND | 0,00E+00 | 1,94E-01 | -1,23E+00 | -1,29E+00 | -5,80E+01 |
| Secondary materials                | kg/FU              | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00  | ND | ND | ND | ND | ND | 0,00E+00 | ND | 0,00E+00 | 0,00E+00 | 0,00E+00  | 0,00E+00  | 0,00E+00  |
| Renew. secondary fuels             | MJ/FU              | 1,59E-03 | 6,31E-06 | 4,33E-02 | 4,48E-02 | 2,62E-06 | 3,90E-07  | ND | ND | ND | ND | ND | 1,13E-03 | ND | 0,00E+00 | 1,11E-06 | 6,09E-06  | 8,86E-07  | -2,20E-04 |
| Non-ren. secondary fuels           | MJ/FU              | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00  | ND | ND | ND | ND | ND | 0,00E+00 | ND | 0,00E+00 | 0,00E+00 | 0,00E+00  | 0,00E+00  | 0,00E+00  |
| Use of net fresh water             | m <sup>3</sup> /FU | 2,29E-02 | 1,75E-04 | 8,17E-02 | 1,05E-01 | 7,17E-05 | -6,07E-05 | ND | ND | ND | ND | ND | 1,67E+00 | ND | 0,00E+00 | 2,57E-05 | 1,10E-04  | -2,03E-04 | -2,09E-02 |

8) PER = Primary energy resources.

## END OF LIFE – WASTE

| Impact category     | Unit  | A1       | A2       | A3       | A1-A3    | A4       | A5       | B1 | B2 | B3 | B4 | B5 | B6       | B7 | C1       | C2       | C3       | C4       | D         |
|---------------------|-------|----------|----------|----------|----------|----------|----------|----|----|----|----|----|----------|----|----------|----------|----------|----------|-----------|
| Hazardous waste     | kg/FU | 4,03E-01 | 6,97E-03 | 1,06E-02 | 4,21E-01 | 8,22E-04 | 3,72E-04 | ND | ND | ND | ND | ND | 1,30E+00 | ND | 0,00E+00 | 3,39E-04 | 1,76E-03 | 5,82E-03 | -1,14E+00 |
| Non-hazardous waste | kg/FU | 1,68E+01 | 1,37E-01 | 2,74E-01 | 1,72E+01 | 1,52E-02 | 1,33E-01 | ND | ND | ND | ND | ND | 4,30E+01 | ND | 0,00E+00 | 6,35E-03 | 4,80E-02 | 4,94E-01 | -1,18E+01 |
| Radioactive waste   | kg/FU | 1,24E-04 | 2,33E-07 | 2,68E-06 | 1,26E-04 | 1,03E-07 | 4,49E-08 | ND | ND | ND | ND | ND | 1,95E-02 | ND | 0,00E+00 | 3,85E-08 | 1,34E-07 | 2,22E-08 | -8,11E-05 |

## END OF LIFE – OUTPUT FLOWS

| Impact category              | Unit  | A1       | A2       | A3       | A1-A3    | A4       | A5       | B1 | B2 | B3 | B4 | B5 | B6       | B7 | C1       | C2       | C3       | C4       | D        |
|------------------------------|-------|----------|----------|----------|----------|----------|----------|----|----|----|----|----|----------|----|----------|----------|----------|----------|----------|
| Components for re-use        | kg/FU | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | ND | ND | ND | ND | ND | 0,00E+00 | ND | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 |
| Materials for recycling      | kg/FU | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 4,60E-02 | ND | ND | ND | ND | ND | 0,00E+00 | ND | 0,00E+00 | 0,00E+00 | 2,93E-01 | 0,00E+00 | 0,00E+00 |
| Materials for energy rec     | kg/FU | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | ND | ND | ND | ND | ND | 0,00E+00 | ND | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 |
| Exported energy              | MJ/FU | 8,74E-03 | 0,00E+00 | 0,00E+00 | 8,74E-03 | 0,00E+00 | 1,04E-01 | ND | ND | ND | ND | ND | 0,00E+00 | ND | 0,00E+00 | 0,00E+00 | 2,48E-01 | 0,00E+00 | 0,00E+00 |
| Exported energy: Electricity | MJ/FU | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 4,37E-02 | ND | ND | ND | ND | ND | 0,00E+00 | ND | 0,00E+00 | 0,00E+00 | 1,04E-01 | 0,00E+00 | 0,00E+00 |
| Exported energy: Heat        | MJ/FU | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 5,92E-02 | ND | ND | ND | ND | ND | 0,00E+00 | ND | 0,00E+00 | 0,00E+00 | 1,44E-01 | 0,00E+00 | 0,00E+00 |

## ENVIRONMENTAL IMPACTS – EN 15804+A1, CML

| Impact category      | Unit                                  | A1       | A2       | A3       | A1-A3    | A4       | A5       | B1 | B2 | B3 | B4 | B5 | B6       | B7 | C1       | C2       | C3       | C4       | D         |
|----------------------|---------------------------------------|----------|----------|----------|----------|----------|----------|----|----|----|----|----|----------|----|----------|----------|----------|----------|-----------|
| Global Warming Pot.  | kg CO <sub>2</sub> eq./FU             | 2,78E+00 | 8,00E-02 | 2,53E-01 | 3,11E+00 | 3,33E-02 | 1,27E-02 | ND | ND | ND | ND | ND | 1,07E+01 | ND | 0,00E+00 | 1,38E-02 | 6,12E-02 | 3,00E-02 | -5,62E+00 |
| Ozone depletion Pot. | kg CFC <sub>11</sub> /FU              | 1,37E-07 | 1,04E-09 | 6,02E-09 | 1,44E-07 | 3,94E-10 | 4,31E-11 | ND | ND | ND | ND | ND | 2,47E-07 | ND | 0,00E+00 | 1,55E-10 | 9,65E-11 | 5,72E-11 | -2,15E-08 |
| Acidification        | kg SO <sub>2</sub> e/FU               | 1,95E-02 | 2,12E-04 | 1,02E-03 | 2,07E-02 | 8,71E-05 | 1,36E-05 | ND | ND | ND | ND | ND | 9,76E-02 | ND | 0,00E+00 | 3,54E-05 | 8,36E-05 | 2,02E-05 | -5,37E-02 |
| Eutrophication       | kg PO <sub>4</sub> <sup>3</sup> e/FU  | 7,49E-03 | 6,96E-05 | 2,89E-03 | 1,05E-02 | 2,12E-05 | 8,23E-06 | ND | ND | ND | ND | ND | 1,21E-02 | ND | 0,00E+00 | 8,60E-06 | 1,37E-05 | 1,01E-05 | -3,64E-03 |
| POCP ("smog")        | kg C <sub>2</sub> H <sub>4</sub> e/FU | 1,70E-03 | 1,88E-05 | 8,41E-05 | 1,81E-03 | 7,76E-06 | 2,46E-06 | ND | ND | ND | ND | ND | 5,28E-03 | ND | 0,00E+00 | 3,17E-06 | 4,98E-06 | 1,79E-06 | -3,29E-03 |
| ADP-elements         | kg Sbe/FU                             | 3,55E-04 | 2,26E-07 | 1,00E-06 | 3,57E-04 | 9,10E-08 | 1,73E-08 | ND | ND | ND | ND | ND | 1,14E-03 | ND | 0,00E+00 | 4,44E-08 | 4,85E-07 | 9,75E-09 | -1,18E-04 |
| ADP-fossil           | MJ/FU                                 | 3,47E+01 | 1,13E+00 | 1,60E+00 | 3,74E+01 | 4,79E-01 | 4,97E-02 | ND | ND | ND | ND | ND | 6,72E+01 | ND | 0,00E+00 | 1,92E-01 | 1,14E-01 | 5,86E-02 | -5,26E+01 |

# ADDITIONAL INDICATOR – GWP-GHG

| Impact category       | Unit                    | A1       | A2       | A3       | A1-A3    | A4       | A5       | B1 | B2 | B3 | B4 | B5 | B6       | B7 | C1       | C2       | C3       | C4       | D         |
|-----------------------|-------------------------|----------|----------|----------|----------|----------|----------|----|----|----|----|----|----------|----|----------|----------|----------|----------|-----------|
| GWP-GHG <sup>9)</sup> | kg CO <sub>2</sub> e/FU | 2,80E+00 | 8,05E-02 | 2,37E-01 | 3,12E+00 | 3,34E-02 | 6,95E-03 | ND | ND | ND | ND | ND | 1,06E+01 | ND | 0,00E+00 | 1,39E-02 | 6,13E-02 | 3,00E-02 | -5,66E+00 |

9) This indicator includes all greenhouse gases excluding biogenic carbon dioxide uptake and emissions and biogenic carbon stored in the product. In addition, the characterisation factors for the flows - CH<sub>4</sub> fossil, CH<sub>4</sub> biogenic and Dinitrogen monoxide - were updated. This indicator is identical to the GWP-total of EN 15804:2012+A2:2019 except that the characterization factor for biogenic CO<sub>2</sub> is set to zero.

# SCENARIO DOCUMENTATION

## DATA SOURCES

### Manufacturing energy scenario documentation – A3 (Energy data source)

1. Energy supply, electricity production, hydro, Electricity production, hydro, reservoir, non-alpine region, Sweden, ecoinvent 3.10.1, 0.0506 kgCO<sub>2</sub>e/kWh
2. Manufacturing, coke and refined petroleum products, refined petroleum products, Esterification of rape oil, Albania, ecoinvent 3.10.1, -0.800003 kgCO<sub>2</sub>e/kg
3. Energy supply, electricity production, solar photovoltaic, Electricity production, photovoltaic, 3kWp slanted-roof installation, multi-Si, panel, mounted, Sweden, ecoinvent 3.10.1, 0.10 kgCO<sub>2</sub>e/kWh
4. Energy supply, heat, steam and air conditioning, heat from wood fuel co-generation, Heat and power co-generation, wood chips, 6667 kW, state-of-the-art 2014, Sweden, ecoinvent 3.10.1, 0.0026 kgCO<sub>2</sub>e/MJ

## TRANSPORT SCENARIO DOCUMENTATION – A4

| Scenario parameter                                                                                     | Value |
|--------------------------------------------------------------------------------------------------------|-------|
| Capacity utilization (including empty return) %                                                        | 50 %  |
| Bulk density of transported products / kg/m <sup>3</sup>                                               | 339   |
| Volume capacity utilization factor (factor: =1 or <1 or ≥1 for compressed or nested packaged products) | 1     |

### Transport scenario documentation - A4

1. Transport, freight, lorry >32 metric ton, EURO5, 546.0 km

## INSTALLATION SCENARIO DOCUMENTATION - A5

| Scenario parameter                                                                              | Value |
|-------------------------------------------------------------------------------------------------|-------|
| Ancillary materials for installation (specified by material) / kg or other units as appropriate | 0     |
| Water use / m <sup>3</sup>                                                                      | 0     |
| Other resource use / kg                                                                         | 0     |
| Direct emissions to ambient air, soil and water / kg                                            | 0     |

### Installation scenario documentation - A5 (Energy data source)

### Installation scenario documentation - A5 (Waste materials data source)

1. Corrugated board box production, 0.154 kg

2. Eur-flat pallet production, 0.0156 unit

3. Packaging film production, low density polyethylene, 0.0126 kg

## USE STAGES SCENARIO DOCUMENTATION – B6-B7

| Scenario information                                                                                                                            | Value          |
|-------------------------------------------------------------------------------------------------------------------------------------------------|----------------|
| Ancillary materials specified by material / kg or units as appropriate                                                                          | Not applicable |
| Net fresh water consumption / m <sup>3</sup>                                                                                                    | 0              |
| Power output of equipment / W                                                                                                                   | 12             |
| Characteristic performance, e.g., energy efficiency, emissions, variation of performance with capacity utilization, etc. / Units as appropriate |                |
| Further assumptions for scenario development, e.g., frequency and period of use, number of occupants / Units as appropriate                     |                |

### Use stages scenario documentation - B6-B7 (Energy data source)

1. Energy supply, electricity transformation and distribution, distribution low voltage, Market for electricity, low voltage, Sweden, 1200.0 kWh

## END OF LIFE SCENARIO DOCUMENTATION – C1-C4

| Scenario information                                            | Value                                  |
|-----------------------------------------------------------------|----------------------------------------|
| Collection process – kg collected separately                    | 1,97                                   |
| Collection process – kg collected with mixed construction waste | 0                                      |
| Recovery process – kg for re-use                                | 0                                      |
| Recovery process – kg for recycling                             | 1,22                                   |
| Recovery process – kg for energy recovery                       | 0                                      |
| Disposal (total) – kg for final deposition                      | 0,66                                   |
| Scenario assumptions e.g. transportation                        | Lorry, 16-32 metric ton, EURO5; 150 km |

## THIRD-PARTY VERIFICATION STATEMENT

EPD Hub declares that this EPD is verified in accordance with ISO 14025 by an independent, third-party verifier. The project report on the Life Cycle Assessment and the report(s) on features of environmental relevance are filed at EPD Hub. EPD Hub PCR and ECO Platform verification checklist are used.

EPD Hub is not able to identify any unjustified deviations from the PCR and EN 15804+A2 in the Environmental Product Declaration and its project report.

EPD Hub maintains its independence as a third-party body; it was not involved in the execution of the LCA or in the development of the declaration and has no conflicts of interest regarding this verification.

The company-specific data and upstream and downstream data have been examined as regards plausibility and consistency. The publisher is responsible for ensuring the factual integrity and legal compliance of this declaration.



Program assistant: Xinyuan Zhang



The software used in creation of this LCA and EPD is verified by EPD Hub to conform to the procedural and methodological requirements outlined in ISO 14025:2010, ISO 14040/14044, EN 15804+A2, and EPD Hub Core Product Category Rules and General Program Instructions.

### Verified tools

Tool verifier: Hai Ha Nguyen

Tool verification validity: 28 March 2025 - 27 March 2028