# Bamboo Plywood Profile **Environmental Product Declaration**

**In accordance with ISO 14025:2006 and EN 15804:2012+A2:2019/AC:2021 for Bamboo plywood profile from Assemble Studio.**

Programme: The International EPD System, www.environdec.com.
Programme Operator: EPD International AB.
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An EPD may be updated or depublished if conditions change. To find the latest version of the EPD and to confirm its validity, see environdec.com

Assemble Studio

## GENERAL INFORMATION

### Programme information


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### Product category rules (PCR)

CEN standard EN 15804 serves as the Core Product Category Rules (PCR)

Product Category Rules (PCR): PCR 2019: Construction Products, version 2.0.1 (valid until: 2030-04-07) UN CPC 3145

PCR review was conducted by: The Technical Committee of the International EPD ® System. A full list of members available on www.environdec.com for a list of members. The review panel may be contacted via support@environdec.com.

Review chair: Rob Rouwette (chair): star2see, Noa Meron (co-chair): thinksep

### Third-party verification

Independent third-party verification of the declaration and data, according to ISO 14025:2006, via:

● Individual EPD verification without a pre-verified LCA/EPD tool

Third-party verifier: Claudia A. Peña, PINDA LCT SpA, Chile

Approved by: International EPD System

Procedure for follow-up of data during EPD validity involves third party verifier:

○ YES ● NO

The EPD owner has the sole ownership, liability, and responsibility for the EPD.

EPDs within the same product category but published in different EPD programmes, may not be comparable. For two EPDs to be comparable, they shall be based on the same PCR (including the same first-digit version number) or be based on fully aligned PCRs or versions of PCRs; cover products with identical functions, technical performances and use (e.g. identical declared/functional units); have identical scope in terms of included life-cycle stages (unless the excluded life-cycle stage is demonstrated to be insignificant); apply identical impact assessment methods (including the same version of characterisation factors); and be valid at the time of comparison.

For further information about comparability, see EN 15804 and ISO 14025.

## Information about EPD owner

### Assemble Studio

We assemble natural, harvested materials to make a partition solution for workplaces. Our modular designs hero bamboo, plantation timbers, cork, straw and wool and are made to specification in Sydney.

Informed by years of industry experience this biophilic product offers a warm, sustainable alternative to aluminium and plastic fit outs. Our partitions are complemented by pavilions, privacy booths, lockers and furniture. All components are reusable, fully recyclable and biodegradable.


**Owner of the EPD**

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## PRODUCT INFORMATION

**Product name**

Bamboo plywood profile.

**Product identification**

A prefabricated modular partition system constructed from sustainably sourced bamboo plywood, incorporating both glazed and solid panel options. The system is designed for ease of assembly, disassembly, and reconfiguration, enabling flexible space planning while supporting circular design principles.

**UN CPC code**

UN CPC 3145 Plywood, veneer panels and similar laminated wood of bamboo

**Product description**

The bamboo profile manufactured by Assemble Studio is used to assemble modular partition systems for commercial buildings and offices. The bamboo plywood boards used as raw material are manufactured in South East Asia and imported to Australia.

**Name and location of production site(s)**

Woolloomooloo and Ingleburn, New South Wales, Australia

## CONTENT DECLARATION

| Product content | Mass, kg | Post-consumer recycled material, mass-% of product | Biogenic material, mass-% of product | Biogenic material, kg C/declared unit |
|---|---|---|---|---|
| Bamboo | 2.86 | 0.00% | 42.8% | 1.27 |
| Adhesive | 0.10 | 0.00% | 0.82% | 0.024 |
| Polyurethane foam | 0.0017 | 0.00% | 0.00% | 0 |
| Polypropylene | 0.0027 | 0.00% | 0.00% | 0 |
| Polyethylene | 0.0022 | 0.00% | 0.00% | 0 |
| TOTAL | 2.97 | 0.00% | 43.7% | 1.30 |

| Packaging materials | Mass, kg | Mass-% (versus the product) | Biogenic material, kg C/declared unit |
|---|---|---|---|
| Linear low-density polyethylene (LLDPE) pallet wrap | 0.00027 | <1% | 0 |
| Cardboard | 0.027 | <1% | 0.012 |
| Wooden pallet | 0.07 | <5% | 0.031 |
| TOTAL | 0.10 | 3% | 0.043 |

1 kg biogenic carbon in the product/packaging is equivalent to the uptake of 44/12 kg of CO2.

Assemble Studio's bamboo plywood profile does not contain substances in the Candidate List of Substances of Very High Concern in the European Chemicals Agency in concentrations >0.1% of the weight of the product.

Assemble Studio

LIFE CYCLE ASSESSMENT INFORMATION

## Declared unit

**Declared unit: One metre of bamboo plywood profile.**

Conversion factor to mass: One metre weighs 2.97 kg.

Time representativeness: 2024-07-01 –2025-06-30

## Database(s) and LCA software used

SimaPro® LCA software version 10.2.0.3 was used for the LCA modelling and calculation of impacts. All global generic models are sourced from ecoinvent version 3.11 [1]. Australian energy use models are based on AusLCI version 2.47 modified for compliance against EN 15804 [2]. Both databases include resource, waste and output flows as required under EN 15804. Background data is less than 10 years old or has been updated within that timeframe.

## System boundary

This system boundaries considered by the EPD are cradle-to-gate with options plus end-of-life stages (modules A1-A5, C1-C4, D).

**Module A1**

Production/extraction of raw materials used to manufacture the bamboo plywood profile and its packaging. This includes the production of bamboo plywood, polyurethane seal and staining oil, as well as packaging material used by Assemble Studio.

**Module A2**

Transport of raw material to the manufacturing plant.

**Module A3**

Includes the electricity (residual grid mix) required for the manufacturing of the profiles. Assemble Studio estimates a 5% loss as offcuts of the bamboo sheet, which is modelled as a waste used in manufacturing by third-parties.

**Module A4**

Transport of finished profiles to installation site.

**Module A5**

Installation of the profile, which only uses hand-powered tools (cordless drills and powered drop saw), and end-of-life processes for packaging including the release of any stored biogenic carbon when relevant. All packaging components are assumed to be sent to landfill from the installation site.

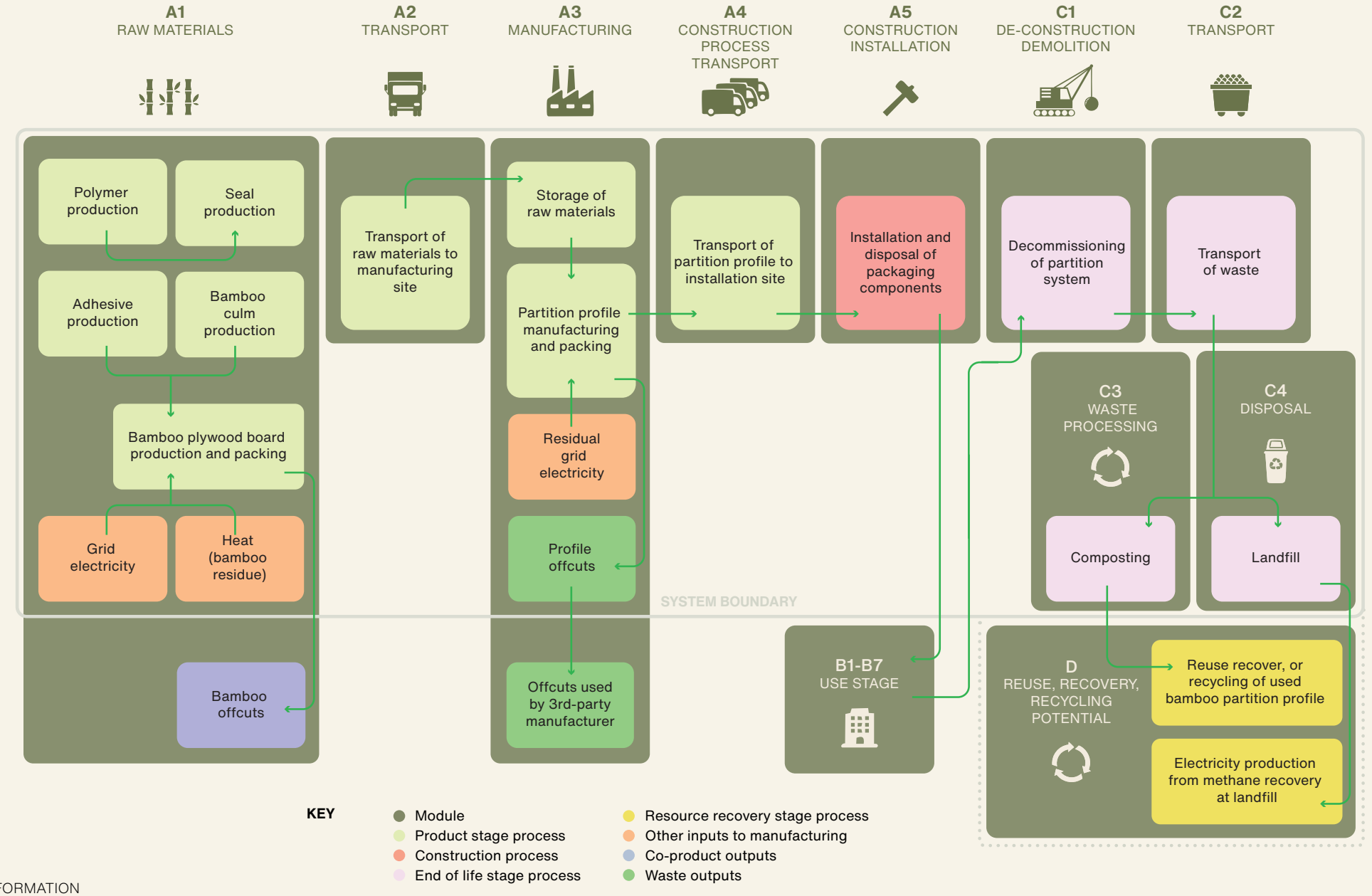
**Module C**

Decommissioning of the partition system at end-of-life (C1), transportation of bamboo profile waste (C2), waste processing (composting – C3) and disposal (landfilling – C4).

**Module D**

Reuse-recovery-recycling potential. Starting from the end-of-waste state, this module aims to show the benefit/impact from the composting of bamboo plywood. It also includes the electricity produced from methane recovered at landfill.

## PROCESS FLOW DIAGRAM



## Geographical scope

The production of bamboo plywood is modelled to represent production by Assemble Studio's supplier located in South East Asia (Module A1). The production of polymers used to manufacture the seal as well as the staining oil are modelled to represent global production (Module A1). All other steps are modelled to represent Australian conditions.

## Excluded life cycle stages

Modules B1-B7 are excluded, as once installed, the product becomes part of the partition system with no specific operational inputs. In addition, production equipment and personnel related activities are non-attributable and excluded from the system boundary. The contribution of capital goods and infrastructure was excluded from the analysis, in line with Section 4.3.6 of the PCR [3], as none of the exception cited was met.

## Cut-off criteria

Any excluded flows must fall below the cut-off threshold for this study (below 1% of any impact category included in the LCA). No flows were deliberately excluded due to this threshold.

## Allocation of co-products

Multi-functionality occurs when a single process, or group of processes, produces more than one usable output, or 'co-product'. ISO 14040 and 14044 defines a co-product as 'any of two or more products coming from the same unit, process, or product system' [4, 5]. A product is any good or service with value for the user. This is distinct from a 'waste', which is defined as 'substances or objects which the holder intends or is required to dispose of', and therefore has no value to the user.

In this LCA, the only allocation relates to the production of plywood bamboo, which yields bamboo scrap alongside the produced plywood. Given the significant difference in value of the two co-products, an economic allocation was used.

## Allocation of waste

In this product system, Assemble Studio reported a 5% loss as offcuts in its raw material inputs during the manufacturing process of the profiles. This is considered a waste flow in this analysis. The offcuts are supplied to a furniture manufacturer, where it used as an input to their manufacturing process. It was reported by Assemble Studio that the offcuts had no market value. As such, it is considered not to have reached the end-of-waste stage until it is delivered to the manufacturer, which according to the PCR means that it is a waste up until that point and thus the waste allocation procedure shall be applied. As a result, a cut-off allocation was applied, in accordance with Section 4.5.2 of the PCR.

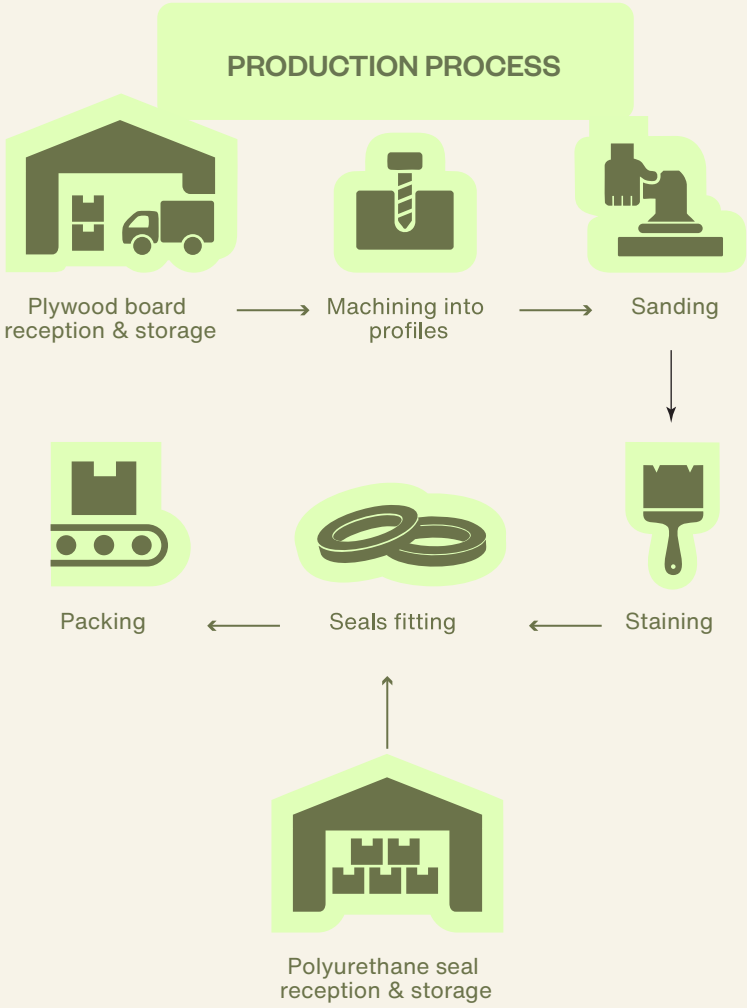
## Purchased electricity model

The electricity used at Assemble Studio's manufacturing facility is modelled as New South Wales residual grid electricity – the manufacturing site is located in Ingleburn, New South Wales.

The modelled residual mix results in climate change impacts of 0.77 kg CO2-eq / kWh against the GWP-GHG indicator. The model is sourced from the latest version of AusLCI, version 2.47 [2], aligned with EN 15804 reporting requirements. The residual electricity grid mix produced in New South Wales consists of coal (73%), solar PV (12.6%), hydropower (5.3%), wind (5.7%), natural gas (2.1%), oil (0.1%), bagasse (0.7%) and biogas (0.4%).

## Capital goods

The contribution of capital goods and infrastructure was excluded from the analysis, in line with Section A.3.1.2, as none of the exception cited in the GPI were met.



## Data quality

To ensure that the results produced by this LCA are of a reputable standard, the quality of the input data must be of sufficient standard. The data used must be the most recent and relevant as possible. Assemble Studio's bamboo plywood profile is manufactured at a single site located in Ingleburn (New South Wales, Australia). The production of bamboo plywood boards in South East Asia is modelled from primary data sourced from Assemble Studio's supplier. All primary data collected for the LCA are recent, being representative of operations from 2024-07-01 to 2025-06-30. A contribution analysis showed that the share of primary data represented 66% of the total contribution to the GWP-GHG indicator. The share of primary data is calculated on GWP-GHG results. It is a simplified indicator for data quality that supports the use of more primary data, to increase the representativeness of and comparability between EPDs. Note that the indicator does not capture all relevant aspects of data quality and is not comparable across product categories.

All secondary data used in the model was carefully selected and sourced from the latest available version of the life cycle inventory databases used at the time of the study. Regional or country-specific data was used whenever possible, covering most inputs besides transport models, fuel production models and other minor inputs which were represented using global average models. In all cases, the reference year for the data was 2025, and unit processes were selected to be technologically representative of the inputs being modelled.

## Data sources and share of primary data

| Process | Source type | Source | Reference year | Data category | Share of primary data, of GWP-GHG results for A1-A3 |
|---|---|---|---|---|---|
| Production of bamboo | Database | Ecoinvent 3.11 | 2025 | Secondary data | 26% |
| Production of bamboo adhesive | Collected data | Contracted supplier | 2025 | Secondary data | 6% |
| Manufacturing of plywood boards | Collected data | Contracted supplier | FY2025 | Primary data | 20% |
| Manufacturing of product | Collected data | EPD owner | FY2025 | Primary data | 0% |
| Generation of electricity used in manufacturing of product | Database | AusLCI v2.47 | 2025 | Primary data | 30% |
| Transport of bamboo board to manufacturing site | Database | Ecoinvent 3.11 | 2025 | Primary data | 16% |
| Manufacturing of seal | Collected data | Contracted supplier | 2025 | Secondary data | <1% |
| Production of other manufacturing inputs | Database | Ecoinvent 3.11 | 2025 | Secondary data | <3% |
| **Total share of primary data, of GWP-GHG results for A1-A3** | | | | | **66%** |

## Treatment of packaging waste at Module A5

All packaging components are assumed to go to landfill during the installation stage (Module A5). This is considered a conservative approach. Indeed, decomposition of timber pallets in landfill will result in methane emissions which would not occur with other end-of-life scenarios such as composting, thus resulting in larger impacts for indicators such as Global Warming.

## Product end-of-life scenario

The modelling of the bamboo plywood profile's end-of-life is based on two generic scenarios. The profile manufactured by Assemble Studio is a relatively novel product, such that no primary data on current end-of-life could be used. As a result, and to remain conservative, the baseline scenario considers that 100% of the bamboo plywood profile will be disposed of in landfill.

However, the profile was designed by Assemble Studio so that the seal could be separated from the profile, with the plywood able to be treated in industrial composting systems. To represent the effects this would have on the results, a second scenario is reported on, whereby 100% of the bamboo plywood profile is collected, the seal remains sent to landfill and the plywood is composted.

## Determination of the net flow

Modelling of module D relies on the estimated net flows of recovered materials or energyware, which should be considered whether positive or negative. It does not include the effects associated with landfilling or composting, which are reported in Module C3 and C4.

Once a material has reached its end-of-waste state, the recovered material can be used in a subsequent life cycle as a material input. In the case of bamboo plywood composting, the end-of-waste stage is reached once a compost has been produced and can be applied to land. While the use of compost may reduce the need for conventional fertilisers in some case, it is a difficult case to make for a bamboo product, where the proportion of nutrients brought to the compost by the bamboo itself is largely unknown, but would likely be low.

The net displacement is calculated from the equation below.

$$net\,flow = \sum Y \times \left(MR_{out} - MR_{in}\right)$$

With:

Y: the material yield, between the point of end-of-waste and point of substitution.

MRout: the amount of material exiting the system that will be recovered in a subsequent system. It is equal to the output flow of materials to recycling reported previously and is equal to zero in the baseline scenario.

MRin: the amount of input material to the product system that has been recovered from a previous system. This is equal to zero as 100% of the material used is virgin.

Two scenarios are being reported in this EPD:

**100% disposal at end-of-life**

No bamboo plywood profile reaches the end-of-waste state, as 100% is disposed of in landfill, which means that MRout is equal to zero. As no recycled material is used as an input either, MRin is equal to zero, and no substitution occur.

While bamboo is not a timber product, the LCA was conducted in line with c-PCR-006 [6], to allow comparability with similar timber products. One of the key requirements is to take into account the electricity produced from landfill gas as displacing electricity, and accounting for it in Module D. Indeed, under this scenario, bamboo plywood will decompose in landfill, producing biogenic methane and biogenic carbon dioxide which dissipates as landfill gas. A fraction of the dissipated methane is captured (43.4% according the latest National Inventory Report [7]) and combusted to produce electricity. While the combustion is considered under Module C4, the electricity displacement is accounted for under Module D.

**100% composting at end-of-life**

In this scenario, 100% of the bamboo plywood profile is collected and recycled, which means that MRin is equal to1 000 kg per tonne of bamboo plywood profile. As a result, the net flow of recovered material is equal to zero, as MRin and MRout cancel each other out. This means that no substitution occurs. While Module D is neutral under this scenario, the emission of methane is largely avoided through the reliance on an industrial composting process.

## Environmental performance indicators

The environmental indicators for the impact categories described in this EPD are summarised in the tables below. Abbreviations for each indicator are used in the result tables for simplicity.

**Mandatory potential environmental impact indicators according to EN 15804:2012+A2:2019/AC:2021. – EF 3.1 Reference Package.**

| Indicator | Abbreviation | Description | Characterisation model |
|---|---|---|---|
| Global warming potential | | Measured in kg of carbon dioxide equivalence (kg CO2 eq.).<br>This is governed by the increased concentration of gases in the atmosphere that trap heat and lead to increasing global temperatures. These gases are principally carbon dioxide, methane and nitrous oxide. | IPCC model based on 100-year timeframe based on IPCC 2021 [8] |
| - fossil | GWPF | | |
| - biogenic | GWPB | | |
| - land use/land use change | GWPL | | |
| - total | GWPT | | |
| Ozone depletion potential | ODP | Measured in kg CFC 11 eq.<br>This calculates the destructive effects in the stratospheric ozone layer over a time horizon of 100 years. | Steady-state ODPs [9] |
| Acidification potential | AP | Measured in mol H+ eq.<br>This assesses the change in critical load exceedance of the sensitive area in terrestrial and main freshwater ecosystems, to which acidifying substances deposit. | Accumulated exceedance, CML 2001 non-baseline (fate not included) [10], [11] |
| Eutrophication potential – freshwater | EPF | Measured in kg of phosphorus equivalents (kg P eq.).<br>Expresses the degree to which the emitted nutrients reach the freshwater end compartment. | EUTREND model [12], as implemented in ReCiPe |
| Eutrophication potential – marine | EPM | Measured in kg of nitrogen equivalents (kg N eq.).<br>Expresses the degree to which the emitted nutrients reach the marine end compartment. | EUTREND model [12], as implemented in ReCiPe |
| Eutrophication potential – terrestrial | EPT | Measured in mol N eq.<br>This expresses the degree to which nutrients reach sensitive terrestrial environments, resulting in changes in species composition, such as increased invasive species, reed growth, and dieback in tree species. | Accumulated Exceedance based on Seppälä, Posch [10], and Posch, Seppälä [11] |

| Indicator | Abbreviation | Description | Characterisation model |
|---|---|---|---|
| Photochemical ozone creation potential | POCP | Measured in kg NMVOC eq.<br>This measures harmful air pollutant creation by primary pollutants such as nitrous oxides and volatile organic compounds when they interact under the influence of the sun and form chemicals toxic to humans and ecosystems, including ozone. | LOTOS-EUROS [13] |
| Abiotic depletion potential – minerals & metals* | ADPE | Measured in mg of antimony equivalence (kg Sb eq.).<br>This measures the depletion of minerals based on the concentration of currently economic reserves and rate of de-accumulation. | CML-IA V4.8 [14] |
| Abiotic depletion potential – fossil fuels* | ADPF | Measured in MJ Net Calorific Value (NCV).<br>This measures the depletion of fossil fuels based on energy content. | CML-IA V4.8 [14] |
| Water deprivation potential* | WDP | Measured in cubic metres of water equivalence deprived (m3 H2O eq.).<br>This quantifies the relative available water remaining per area once the demand of humans and aquatic systems has been met. | Available water remaining (AWARE) method [15] |

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

**Additional mandatory and voluntary potential environmental impact indicators according to EN 15804:2012+A2:2019/AC:2021**

| Indicator | Abbreviation | Units | Characterisation model |
|---|---|---|---|
| Global warming potential - excluding biogenic uptake, emissions, and storage | GWP-GHG | kg CO2 eq. | IPCC model based on 100-year time-frame based on IPCC 2013 |
| Particulate Matter emissions | PM | Disease incidence (due to kg of PM2.5 emitted). | SETAC-UNEP [16] |
| Ionising Radiation – human health** | IRP | kBq U-235-eq. | Human health effect model as developed by Dreicer, Tort [17] update by Frischknecht, Braunschweig [18] |
| Eco-toxicity – freshwater* | ETPF | Comparative Toxic Unit for ecosystems (CTUe) | USEtox version 2.1 (Fantke et al. [19] and Rosenbaum et al [20]), adapted as in Saouter et al. [21] |
| Human toxicity – cancer* | HTPC | Comparative Toxic Unit for human (CTUh) | USEtox version 2.1 (Fantke et al. [19] and Rosenbaum et al [20]), adapted as in Saouter et al. [21] |
| Human toxicity – non-cancer* | HTPNC | CTUh | USEtox version 2.1 (Fantke et al. [19] and Rosenbaum et al [20]), adapted as in Saouter et al. [21] |
| Land use related impacts / soil quality* | SQP | Dimensionless | Soil quality index based on LANCA |

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

** Disclaimer: 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.

## Use of resources, waste production, and output flows.

| Indicator | | Abbreviation | Units |
|---|---|---|---|
| **Resource use** | | | |
| Primary energy resources – Renewable | Use as energy carrier | PERE | MJ, net calorific value |
| | Used as raw materials | PERM | |
| | Total | PERT | |
| Primary energy resources – Non-renewable | Use as energy carrier | PENRE | |
| | Used as raw materials | PENRM | |
| | Total | PENRT | |
| Use of secondary materials | | SM | kg |
| Use of renewable secondary fuels | | RSF | MJ, net calorific value |
| Use of non-renewable secondary fuels | | NRSF | MJ, net calorific value |
| Net use of fresh water | | FW | m3 |
| **Waste production** | | | |
| Hazardous waste disposed | | HWD | kg |
| Non-hazardous waste disposed | | NHWD | kg |
| Radioactive waste disposed | | RWD | kg |
| **Output flows** | | | |
| Components for reuse | | CRU | kg |
| Material for recycling | | MFR | kg |
| Materials for energy recovery | | MER | kg |
| Exported energy – electrical | | EEE | MJ per energy carrier |
| Exported energy – thermal | | EET | MJ per energy carrier |

**Modules declared, geographical scope, share of primary data (in GWP-GHG results) and data variation (in GWP-GHG results):**

| | | Module | Modules declared | Geography | Share of primary data | Variation – products | Variation – sites |
|---|---|---|---|---|---|---|---|
| Product stage | Raw material supply | A1 | X | CN/GLO | 66% | 0% | 0% |
| | Transport | A2 | X | AU/GLO | | | |
| | Manufacturing | A3 | X | AU | | | |
| Distribution/ installation stage | Transport | A4 | X | AU | | | |
| | Construction installation | A5 | X | AU | | | |
| Use stage | Use | B1 | ND | - | - | - | - |
| | Maintenance | B2 | ND | - | - | - | - |
| | Repair | B3 | ND | - | - | - | - |
| | Replacement | B4 | ND | - | - | - | - |
| | Refurbishment | B5 | ND | - | - | - | - |
| | Operational energy use | B6 | ND | - | - | - | - |
| | Operational water use | B7 | ND | - | - | - | - |
| End-of-life stage | De-construction demolition | C1 | X | AU | - | - | - |
| | Transport | C2 | X | AU | - | - | - |
| | Waste processing | C3 | X | AU | - | - | - |
| | Disposal | C4 | X | AU | - | - | - |
| | | | | | | | |
| Beyond product life cycle | Reuse-Recovery-Recycling-potential | D | X | AU | - | - | - |


Results of the environmental performance indicators - per declared unit: 100% landfill at the end-of-life

## Mandatory impact category indicators

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

**Mandatory impact category indicators according to EN 15804:2012+A2:2019/AC:2021. Results per declared unit.**

| Indicator | Unit | A1-A3 | A4 | A5 | C1 | C2 | C3 | C4 | D |
|---|---|---|---|---|---|---|---|---|---|
| GWP - fossil | kg CO2 eq. | 2.48E+00 | 3.04E-01 | 4.80E-02 | 1.11E-03 | 3.84E-02 | 0.00E+00 | 1.69E-02 | -1.07E-01 |
| GWP - biogenic | kg CO2 eq. | -4.89E+00 | 5.58E-05 | 1.95E-01 | 1.95E-07 | 6.93E-06 | 0.00E+00 | 6.71E+00 | -2.55E-03 |
| GWP - luluc | kg CO2 eq. | 2.11E-02 | 1.57E-05 | 3.29E-05 | 4.65E-08 | 1.98E-06 | 0.00E+00 | 1.62E-06 | -5.19E-04 |
| GWP - total | kg CO2 eq. | -2.39E+00 | 3.04E-01 | 2.43E-01 | 1.11E-03 | 3.84E-02 | 0.00E+00 | 6.73E+00 | -1.10E-01 |
| ODP | kg CFC 11 eq. | 5.42E-10 | 1.56E-11 | 2.74E-11 | 4.82E-14 | 2.06E-12 | 0.00E+00 | 1.01E-12 | -6.34E-14 |
| AP | mol H+ eq. | 2.24E-02 | 7.46E-04 | 2.04E-04 | 1.03E-05 | 1.08E-04 | 0.00E+00 | 1.78E-03 | -7.67E-04 |
| EP - freshwater | kg P eq. | 2.27E-04 | 1.53E-05 | 2.68E-05 | 9.26E-09 | 2.22E-06 | 0.00E+00 | 2.52E-05 | -4.46E-07 |
| EP - marine | kg N eq. | 5.55E-03 | 2.43E-04 | 1.06E-04 | 4.84E-06 | 3.80E-05 | 0.00E+00 | 1.95E-03 | -1.18E-04 |
| EP - terrestrial | mol N eq. | 6.27E-02 | 2.65E-03 | 4.76E-04 | 5.30E-05 | 4.14E-04 | 0.00E+00 | 1.00E-02 | -1.27E-03 |
| POCP | kg NMVOC eq. | 1.61E-02 | 1.11E-03 | 1.80E-04 | 1.58E-05 | 1.54E-04 | 0.00E+00 | 3.34E-03 | -3.38E-04 |
| ADP - minerals & metals* | kg Sb eq. | 7.16E-07 | 2.24E-08 | 2.57E-07 | 3.89E-11 | 3.14E-09 | 0.00E+00 | 5.26E-10 | -2.07E-10 |
| ADP - fossil* | MJ | 2.72E+01 | 4.04E+00 | 5.18E-01 | 1.45E-02 | 5.02E-01 | 0.00E+00 | 2.03E-01 | -5.43E-01 |
| WDP* | m3 | 8.24E-01 | 7.79E-03 | 2.01E-02 | 1.83E-05 | 9.36E-04 | 0.00E+00 | 5.02E-05 | -3.00E-02 |

**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 for fossil resources potential; WDP = Water (user) deprivation potential, deprivation-weighted water consumption.

*** Disclaimer** The results of the end-of-life stage (modules C1-C4) should be considered when using the results of the product stage (modules A1-A3).

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

## Additional mandatory and voluntary impact category indicators

**Results per declared unit**

| Indicator | Unit | A1-A3 | A4 | A5 | C1 | C2 | C3 | C4 | D |
|---|---|---|---|---|---|---|---|---|---|
| GWP-GHG[1] | kg CO2 eq. | 2.51E+00 | 3.04E-01 | 8.73E-02 | 1.11E-03 | 3.84E-02 | 0.00E+00 | 1.97E+00 | -1.07E-01 |
| PM | Disease incidence | 2.43E-07 | 1.54E-08 | 4.55E-09 | 2.96E-10 | 2.45E-09 | 0.00E+00 | 1.03E-08 | -6.77E-09 |
| IRP** | kBq U-235 eq. | 7.29E-02 | 7.00E-04 | 1.66E-03 | 2.82E-06 | 9.08E-05 | 0.00E+00 | 4.04E-05 | -5.83E-06 |
| ETPF* | CTUe | 1.02E+01 | 3.29E-01 | 1.48E+00 | 4.16E-04 | 5.06E-02 | 0.00E+00 | 3.20E-01 | -2.41E-02 |
| HTPC* | CTUh | 4.90E-10 | 1.13E-10 | 6.37E-11 | 5.94E-14 | 2.74E-12 | 0.00E+00 | 2.74E-11 | -4.49E-12 |
| HTPNC* | CTUh | 1.13E-08 | 2.28E-09 | 9.67E-10 | 1.10E-12 | 2.46E-10 | 0.00E+00 | 6.55E-09 | -3.27E-10 |
| SQP* | Dimensionless | 2.37E+02 | 3.66E-02 | 1.35E-01 | 2.47E-05 | 5.29E-03 | 0.00E+00 | 1.60E+00 | 2.23E-03 |

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

**** Disclaimer:** This impact category deals mainly with the eventual impact of low dose ionising 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.

## Resource use indicators

**Results per declared unit**

| Indicator | Unit | A1-A3 | A4 | A5 | C1 | C2 | C3 | C4 | D |
|---|---|---|---|---|---|---|---|---|---|
| PERE | MJ | 1.07E+02 | 7.87E-03 | 4.59E-02 | 3.17E-05 | 1.02E-03 | 0.00E+00 | 2.62E-03 | -3.58E-01 |
| PERM | MJ | 4.86E+01 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| PERT | MJ | 1.56E+02 | 7.87E-03 | 4.59E-02 | 3.17E-05 | 1.02E-03 | 0.00E+00 | 2.62E-03 | -3.58E-01 |
| PENRE | MJ | 2.69E+01 | 4.04E+00 | 5.18E-01 | 1.45E-02 | 5.02E-01 | 0.00E+00 | 2.03E-01 | -5.43E-01 |
| PENRM | MJ | 2.48E-01 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| PENRT | MJ | 2.72E+01 | 4.04E+00 | 5.18E-01 | 1.45E-02 | 5.02E-01 | 0.00E+00 | 2.03E-01 | -5.43E-01 |
| SM | kg | 2.12E-02 | 5.27E-06 | 7.83E-03 | 2.92E-08 | 7.43E-07 | 0.00E+00 | 4.34E-07 | -9.80E-08 |
| RSF | MJ | 3.12E-03 | 3.64E-07 | 3.00E-06 | 5.06E-09 | 4.96E-08 | 0.00E+00 | 4.52E-07 | -1.28E-08 |
| NRSF | MJ | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| FW | m3 | 1.89E-02 | 1.85E-04 | 5.00E-04 | 4.40E-07 | 2.23E-05 | 0.00E+00 | 2.08E-06 | -5.77E-04 |

**Note** primary energy indicators were modelled according to Option B, as described in Annex 3 of PCR 2019:14.

**Acronyms** PERE = Use of renewable primary energy excluding renewable primary energy resources used as raw materials; PERM = Use of renewable primary energy resources used as raw materials; PERT = Total use of renewable primary energy resources; PENRE = Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials; PENRM = Use of non-renewable primary energy resources used as raw materials; PENRT = Total use of non-renewable primary energy re-sources; SM = Use of secondary material; RSF = Use of renewable secondary fuels; NRSF = Use of non-renewable secondary fuels; FW = Use of net fresh water

## Waste indicators

| Results per declared unit | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Indicator** | **Unit** | **A1-A3** | **A4** | **A5** | **C1** | **C2** | **C3** | **C4** | **D** |
| Hazardous waste disposed | kg | 4.53E-01 | 3.50E-03 | 1.80E-02 | 1.52E-06 | 5.09E-04 | 0.00E+00 | 1.91E-04 | -1.03E-05 |
| Non-hazardous waste disposed | kg | 1.37E+00 | 7.64E-02 | 7.20E-01 | 5.21E-05 | 1.10E-02 | 0.00E+00 | 1.47E+01 | -2.14E-02 |
| Radioactive waste disposed | kg | 1.73E-05 | 1.68E-07 | 4.17E-07 | 6.77E-10 | 2.18E-08 | 0.00E+00 | 9.62E-09 | -1.40E-09 |

## Output flow indicators

| Results per declared unit | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Indicator** | **Unit** | **A1-A3** | **A4** | **A5** | **C1** | **C2** | **C3** | **C4** | **D** |
| Components for re-use | kg | 1.48E-01 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| Material for recycling | kg | 3.51E-03 | 1.58E-07 | 1.69E-06 | 3.88E-10 | 2.14E-08 | 0.00E+00 | 8.06E-06 | -1.88E-08 |
| Materials for energy recovery | kg | 1.05E-03 | 6.37E-09 | 1.42E-07 | 1.21E-11 | 9.18E-10 | 0.00E+00 | 2.72E-08 | -1.18E-10 |
| Exported energy, electricity | MJ | 1.50E-03 | 4.77E-05 | 1.67E-04 | 2.59E-07 | 6.07E-06 | 0.00E+00 | 4.05E-06 | -1.16E-06 |
| Exported energy, thermal | MJ | 1.45E-03 | 4.92E-05 | 2.04E-04 | 1.04E-07 | 7.13E-06 | 0.00E+00 | 2.38E-05 | -3.16E-07 |

Results of the environmental performance indicators
- per declared unit: 100% composting at the end-of-life

## Mandatory impact category indicators

The estimated impact results are only relative statements, which do not indicate the endpoints of the impact categories, exceeding threshold values, safety margins and/or risks

**Mandatory impact category indicators according to EN 15804:2012+A2:2019/AC:2021**

**Results per declared unit**

| Indicator | Unit | A1-A3 | A4 | A5 | C1 | C2 | C3 | C4 | D |
|---|---|---|---|---|---|---|---|---|---|
| GWP-fossil | kg CO2 eq. | 2.48E+00 | 3.04E-01 | 4.80E-02 | 1.11E-03 | 3.84E-02 | 7.28E-02 | 6.69E-04 | 0.00E+00 |
| GWP-biogenic | kg CO2 eq. | -4.89E+00 | 5.58E-05 | 1.95E-01 | 1.95E-07 | 6.93E-06 | 4.82E+00 | 7.57E-07 | 0.00E+00 |
| GWP-luluc | kg CO2 eq. | 2.11E-02 | 1.57E-05 | 3.29E-05 | 4.65E-08 | 1.98E-06 | 4.48E-06 | 3.52E-08 | 0.00E+00 |
| GWP-total | kg CO2 eq. | -2.39E+00 | 3.04E-01 | 2.43E-01 | 1.11E-03 | 3.84E-02 | 4.90E+00 | 6.70E-04 | 0.00E+00 |
| ODP | kg CFC 11 eq. | 5.42E-10 | 1.56E-11 | 2.74E-11 | 4.82E-14 | 2.06E-12 | 7.55E-12 | 1.84E-15 | 0.00E+00 |
| AP | mol H+ eq. | 2.24E-02 | 7.46E-04 | 2.04E-04 | 1.03E-05 | 1.08E-04 | 6.45E-03 | 4.00E-07 | 0.00E+00 |
| EP-freshwater | kg P eq. | 2.27E-04 | 1.53E-05 | 2.68E-05 | 9.26E-09 | 2.22E-06 | 4.70E-05 | 2.80E-09 | 0.00E+00 |
| EP-marine | kg N eq. | 5.55E-03 | 2.43E-04 | 1.06E-04 | 4.84E-06 | 3.80E-05 | 2.52E-04 | 3.63E-05 | 0.00E+00 |
| EP-terrestrial | mol N eq. | 6.27E-02 | 2.65E-03 | 4.76E-04 | 5.30E-05 | 4.14E-04 | 2.85E-02 | 1.80E-06 | 0.00E+00 |
| POCP | kg NMVOC eq. | 1.61E-02 | 1.11E-03 | 1.80E-04 | 1.58E-05 | 1.54E-04 | 2.09E-04 | 6.46E-07 | 0.00E+00 |
| ADP-minerals&metals* | kg Sb eq. | 7.16E-07 | 2.24E-08 | 2.57E-07 | 3.89E-11 | 3.14E-09 | 1.30E-09 | 1.39E-12 | 0.00E+00 |
| ADP-fossil* | MJ | 2.72E+01 | 4.04E+00 | 5.18E-01 | 1.45E-02 | 5.02E-01 | 6.16E-01 | 4.73E-04 | 0.00E+00 |
| WDP* | m3 | 8.24E-01 | 7.79E-03 | 2.01E-02 | 1.83E-05 | 9.36E-04 | -2.66E-02 | 5.71E-07 | 0.00E+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 for fossil resources potential; WDP = Water (user) deprivation potential, deprivation-weighted water consumption

**Disclaimer** The results of the end-of-life stage (modules C1-C4) should be considered when using the results of the product stage (modules A1-A3).

*** Disclaimer** 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 experienced with the indicator.

## Additional mandatory and voluntary impact category indicators

**Results per declared unit**

| Indicator | Unit | A1-A3 | A4 | A5 | C1 | C2 | C3 | C4 | D |
|---|---|---|---|---|---|---|---|---|---|
| GWP-GHG[1] | kg CO2 eq. | 2.51E+00 | 3.04E-01 | 8.73E-02 | 1.11E-03 | 3.84E-02 | 1.53E-01 | 6.69E-04 | 0.00E+00 |
| PM | Disease incidence | 2.43E-07 | 1.54E-08 | 4.55E-09 | 2.96E-10 | 2.45E-09 | 3.09E-08 | 9.16E-12 | 0.00E+00 |
| IRP** | kBq U-235 eq. | 7.29E-02 | 7.00E-04 | 1.66E-03 | 2.82E-06 | 9.08E-05 | 1.01E-04 | 9.71E-08 | 0.00E+00 |
| ETPF* | CTUe | 1.02E+01 | 3.29E-01 | 1.48E+00 | 4.16E-04 | 5.06E-02 | 2.46E+01 | 9.39E-03 | 0.00E+00 |
| HTPC* | CTUh | 4.90E-10 | 1.13E-10 | 6.37E-11 | 5.94E-14 | 2.74E-12 | 1.86E-11 | 3.40E-14 | 0.00E+00 |
| HTPNC* | CTUh | 1.13E-08 | 2.28E-09 | 9.67E-10 | 1.10E-12 | 2.46E-10 | 4.70E-10 | 9.01E-12 | 0.00E+00 |
| SQP* | Dimensionless | 2.37E+02 | 3.66E-02 | 1.35E-01 | 2.47E-05 | 5.29E-03 | 1.58E-02 | 3.57E-03 | 0.00E+00 |

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

**** Disclaimer:** This impact category deals mainly with the eventual impact of low dose ionising 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.

## Resource use indicators

**Results per declared unit**

| Indicator | Unit | A1-A3 | A4 | A5 | C1 | C2 | C3 | C4 | D |
|---|---|---|---|---|---|---|---|---|---|
| PERE | MJ | 1.07E+02 | 7.87E-03 | 4.59E-02 | 3.17E-05 | 1.02E-03 | 2.93E+01 | 2.43E-05 | 0.00E+00 |
| PERM | MJ | 4.86E+01 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | -2.92E+01 | 0.00E+00 | 0.00E+00 |
| PERT | MJ | 1.56E+02 | 7.87E-03 | 4.59E-02 | 3.17E-05 | 1.02E-03 | 5.22E-02 | 2.43E-05 | 0.00E+00 |
| PENRE | MJ | 2.69E+01 | 4.04E+00 | 5.18E-01 | 1.45E-02 | 5.02E-01 | 3.82E-01 | 4.73E-04 | 0.00E+00 |
| PENRM | MJ | 2.48E-01 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 2.34E-01 | 0.00E+00 | 0.00E+00 |
| PENRT | MJ | 2.72E+01 | 4.04E+00 | 5.18E-01 | 1.45E-02 | 5.02E-01 | 6.16E-01 | 4.73E-04 | 0.00E+00 |
| SM | kg | 2.12E-02 | 5.27E-06 | 7.83E-03 | 2.92E-08 | 7.43E-07 | 1.36E-06 | 3.60E-09 | 0.00E+00 |
| RSF | MJ | 3.12E-03 | 3.64E-07 | 3.00E-06 | 5.06E-09 | 4.96E-08 | 1.50E-07 | 1.02E-09 | 0.00E+00 |
| NRSF | MJ | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| FW | m3 | 1.89E-02 | 1.85E-04 | 5.00E-04 | 4.40E-07 | 2.23E-05 | -6.06E-04 | 7.29E-09 | 0.00E+00 |

**Note** primary energy indicators were modelled according to Option B, as described in Annex 3 of PCR 2019:14

**Acronyms** PERE = Use of renewable primary energy excluding renewable primary energy resources used as raw materials; PERM = Use of renewable primary energy resources used as raw materials; PERT = Total use of renewable primary energy resources; PENRE = Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials; PENRM = Use of non-renewable primary energy resources used as raw materials; PENRT = Total use of non-renewable primary energy resources; SM = Use of secondary material; RSF = Use of renewable secondary fuels; NRSF = Use of non-renewable secondary fuels; FW = Use of net fresh water

## Waste indicators

| Results per declared unit | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Indicator** | **Unit** | **A1-A3** | **A4** | **A5** | **C1** | **C2** | **C3** | **C4** | **D** |
| Hazardous waste disposed | kg | 4.53E-01 | 3.50E-03 | 1.80E-02 | 1.52E-06 | 5.09E-04 | 2.14E-03 | 2.81E-07 | 0.00E+00 |
| Non-hazardous waste disposed | kg | 1.37E+00 | 7.64E-02 | 7.20E-01 | 5.21E-05 | 1.10E-02 | 4.91E-01 | 3.27E-02 | 0.00E+00 |
| Radioactive waste disposed | kg | 1.73E-05 | 1.68E-07 | 4.17E-07 | 6.77E-10 | 2.18E-08 | 2.31E-08 | 2.33E-11 | 0.00E+00 |

## Output flow indicators

| Results per declared unit | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Indicator** | **Unit** | **A1-A3** | **A4** | **A5** | **C1** | **C2** | **C3** | **C4** | **D** |
| Components for re-use | kg | 1.48E-01 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| Material for recycling | kg | 3.51E-03 | 1.58E-07 | 1.69E-06 | 3.88E-10 | 2.14E-08 | 3.99E-07 | 1.79E-08 | 0.00E+00 |
| Materials for energy recovery | kg | 1.05E-03 | 6.37E-09 | 1.42E-07 | 1.21E-11 | 9.18E-10 | 1.41E-09 | 6.12E-11 | 0.00E+00 |
| Exported energy, electricity | MJ | 1.50E-03 | 4.77E-05 | 1.67E-04 | 2.59E-07 | 6.07E-06 | 9.87E-06 | 2.92E-07 | 0.00E+00 |
| Exported energy, thermal | MJ | 1.45E-03 | 4.92E-05 | 2.04E-04 | 1.04E-07 | 7.13E-06 | 7.57E-06 | 7.21E-08 | 0.00E+00 |

## ABBREVIATIONS

**General Abbreviations**

| Abbreviation | Definition |
|---|---|
| EF | Environmental Footprint |
| GPI | General Programme Instructions |
| LCA | Life Cycle Assessment |
| PCR | Product Category Rules |
| CPC | Central Product Classification |

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## VERSION HISTORY

Original Version of the EPD, 2026-03-06