

Owner: Njord ApS
No.: MD-23203-EN
Issued: 16-04-2024
Valid to: 16-04-2029

3rd PARTY VERIFIED

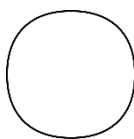
EPD

VERIFIED ENVIRONMENTAL PRODUCT DECLARATION | ISO 14025 & EN 15804



Owner of declaration

NJORD ApS
Esterhøjvej 57, 4550 Asnæs
Danmark DK41075686



NJORD
Space to grow

Issued:
16-04-2024

Valid to:
16-04-2029

Programme

EPD Danmark
www.epddanmark.dk



- Industry EPD
- Product EPD

Basis of calculation

This EPD is developed in accordance with the European standard EN 15804+A2.

Comparability

EPDs of construction products may not be comparable if they do not comply with the requirements in EN 15804. EPD data may not be comparable if the datasets used are not developed in accordance with EN 15804 and if the background systems are not based on the same database.

Validity

This EPD has been verified in accordance with ISO 14025 and is valid for 5 years from the date of issue.

Use

The intended use of an EPD is to communicate scientifically based environmental information for construction products, for the purpose of assessing the environmental performance of buildings.

Declared product(s)

The declared unit is 1 piece of a 21.5 m² Terra. Dome with manual window openers. The dome mainly consists of 100% recycled acrylic panels and aluminium. The Dome comes in different sizes varying from 12.5 m² to 100 m². This EPD covers the size 21.5 m².

Number of declared datasets/product variations: 1

Production site

Esterhøjvej 57, 4550 Asnæs, Denmark

No green electricity or biogas certificates are used.

EPD type

- Cradle-to-gate with modules C1-C4 and D
- Cradle-to-gate with options, modules C1-C4 and D
- Cradle-to-grave and module D
- Cradle-to-gate
- Cradle-to-gate with options

Product use

The Njord Terra Dome House is a greenhouse-like building system. The dome house is particularly suitable for public urban spaces, playgrounds, hospitals, communities, or institutions that want to create a hyper-local natural space for e.g. citizens, pupils, guests, patients or employees. The dome can also be placed on a roof.

Declared unit

1 piece of 21.5 m² dome by the model Terra.

Year of production site data (A3)

2023

EPD version

Version 1

CEN standard EN 15804 serves as the core PCR

Independent verification of the declaration and data, according to EN ISO 14025

- internal
- external

3. parts verifikator:

Kim Christiansen

Martha Katrine Sørensen
EPD Danmark

Life cycle stages and modules (MND = module not declared)

| Product | | | Construction process | | Use | | | | | | | | End of life | | | | Beyond the system boundary |
|---------------------|-----------|---------------|----------------------|----------------------|-----|-------------|--------|-------------|---------------|------------------------|-----------------------|----------------------------|-------------|------------------|----------|--|----------------------------|
| Raw material supply | Transport | Manufacturing | Transport | Installation process | Use | Maintenance | Repair | Replacement | Refurbishment | Operational energy use | Operational water use | De-construction demolition | Transport | Waste processing | Disposal | Re-use, recovery and recycling potential | |
| A1 | A2 | A3 | A4 | A5 | B1 | B2 | B3 | B4 | B5 | B6 | B7 | C1 | C2 | C3 | C4 | D | |
| X | X | X | MND | MND | MND | MND | MND | MND | MND | MND | MND | X | X | X | X | X | |

Product information

Product description

The main product components are shown in the table below.

| Component | Weight-% of declared product |
|-----------------------|------------------------------|
| Frame | 22,2% |
| Door | 3,3% |
| Windows | 9,1% |
| Acrylic panels (PMMA) | 31,8% |
| Bottom | 33,5% |

Product packaging:

The composition of the sales- and transport packaging of the product is shown in the table below.

| Material | Weight-% of packaging |
|-----------------|-----------------------|
| Moving blankets | 100% |

The only accompanying packaging material is the moving blankets, which serve as transport packaging. The moving blankets consist of cotton and polyester.

Representativity

This declaration, including data collection and the modeled foreground system including results, represents the production of the Terra Dome House of 21.5 m² facilitated on the production site located in Asnæs.

Product specific data is based on average values collected in the period June 2023 to September 2023. Background data is based on Ecoinvent (version 3.9.1) and is less than 10 years old. Generally, the used background datasets consists of good quality, and the majority of the datasets are only a couple of years old. However, the dataset used for aluminum is relatively old and since the aluminum is a rather import material to the results due to the high weight-percentage, it is assessed that the overall data quality is fair. To determine the energy use for the process of recycling PMMA the most relevant source were found to from a PE Report from 2005.

Hazardous substances

The Terra Dome does not contain substances listed on the "Candidate List of Substances of Very High Concern for authorisation", which exceeds the limit of 0,1 weight percentage.

(<http://echa.europa.eu/candidate-list-table>)

Essential characteristics

The structure is documented as being stormproof according to the Eurocode system with assumed weather conditions that correspond to a location on an open field in Denmark (Eurocode 1 - Laster på konstruktioner EN 1991). The Dome house is designed for the heaviest snowfall and the heaviest storm, respectively, which occur every 50 years on average.

The Terra Dome house can be manufactured in different fixed sizes ranging from 12,5 m² to 100 m². However, the present EPD only covers the 21,5 m² due to varying material compositions.

Further technical information can be obtained by contacting the manufacture or on the manufacturer's website:

<https://njord.green/>

Reference Service Life (RSL)

The RSL is not covered in the present EPD as the use stage is not declared.

Picture of product



LCA background

Declared unit

The LCI and LCIA results in this EPD relate to the declared unit of 1 piece of Terra Dome House (21,5 m²).

The dome mainly consists of aluminium and 100% recycled acrylic panels.

| Name | Value | Unit |
|----------------------------|-----------|--------|
| Declared unit | 1 | Pcs |
| Density | 651,5 | kg/Pcs |
| Conversion factor to 1 kg. | 0,0015117 | - |

PCR

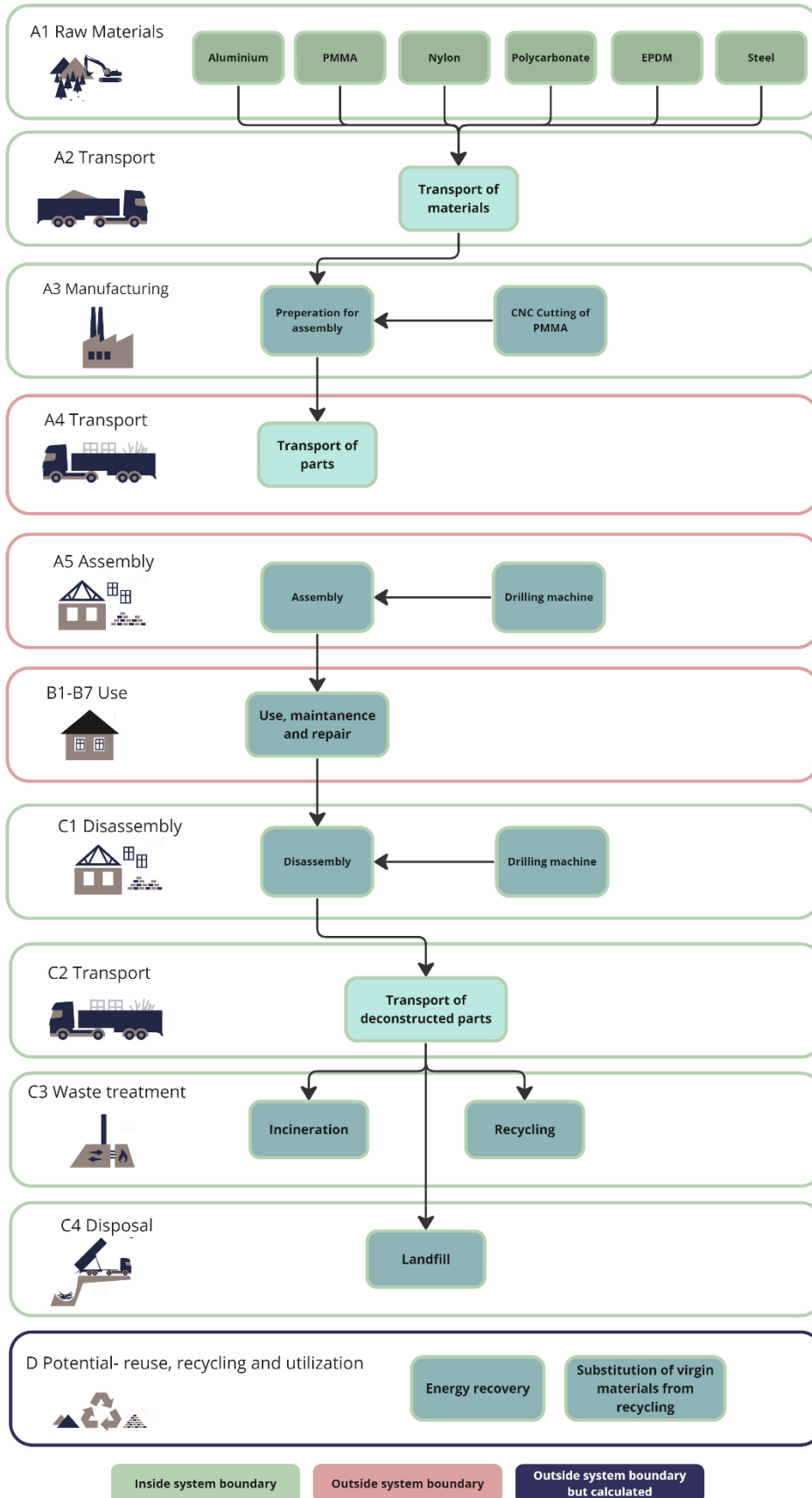
This EPD is developed according to the core rules for the product category of construction products in EN 15804:2012 as no other relevant PCRs were found.

Guarantee of Origin – certificates

The product is produced using Danish residual electricity mix as no Guarantees of Origin are utilized in the foreground system.

Upstream and downstream processes are modelled using electricity country mixes to each component according to the relevant origin.

Flow diagram of Terra dome house



System boundary

This EPD is based on a Cradle-to-gate with modules C1-C4 and D in which 100 weight-% has been accounted for.

The general rules for the exclusion of inputs and outputs follows the requirements in EN 15804, 6.3.5, where the total of neglected input flows per module shall be a maximum of 5 % of energy usage and mass and 1 % of energy usage and mass for unit processes.

Product stage (A1-A3) includes:

A1 – Extraction and processing of raw materials

A2 – Transport to the production site

A3 – Manufacturing processes

The product stage comprises the acquisition of all raw materials, products and energy, transport to the production site, packaging and waste processing up to the “end-of-waste” state or final disposal. The LCA results are declared in aggregated form for the product stage, which means, that the sub-modules A1, A2 and A3 are declared as one module A1-A3.

Njord gets all parts of the Dome sent to the production site in Asnæs. The components are delivered in predetermined sizes except for the acrylic (PMMA) panels, which are cut with a CNC machine at the facility. The acrylic panels and polycarbonate (PC) panels are transported from the same supplier which resides both in Italy and Austria. The aluminium used in the frame, door and bottom parts comes from Germany. The rest of the components are transported from Asia, and differs between Japan, China and Türkiye.

An electric forklift truck is used internally at Njord’s facility for movement of components.

The packaging from the delivered parts, comprising pallets and packaging film, is waste treated via incineration and recycling.

Construction process stage (A4-A5) includes:

This module is not declared in this EPD. The components of the Dome are transported via delivery van from the production site to the installation location where the components are carefully wrapped in moving blankets for added protection.

After wrapping the Dome’s components together, they are carefully transported from Asnæs to the customer. The components are unwrapped at the location of the customer, then the base frame gets assembled on top of the moving carpets, to protect it, whereafter the carpets are removed when the base frame has been assembled. The only machinery needed for assembling is a drilling machine.

Use stage (B1-B7) includes:

This module is not declared in this EPD. The Dome house is almost maintenance-free. The only needed maintenance is cleaning of the acrylic panels 1-2 times a year – but without the use of cleaning products containing ethanol.

End of Life (C1-C4) includes:

The Dome is designed for easy disassembly which can be done with the use of a screwing machine. Therefore, all components can be waste managed separately. The acrylic panels are returned to the manufacturer through an already established take-back solution. Here, the panels will undergo a recycling process. 10% of the aluminium is sent to incineration, 85% to recycling, and 5% to landfill according to waste statistics. In terms of PC panels, it has been calculated that 0.6% of all Danish plastic waste is recycled from building sites while the rest is assumed incinerated. EPDM is also incinerated as well as the small amount of PCV and Nylon. Steel is recycled.

Re-use, recovery and recycling potential (D) includes:

Energy credits from components that are incinerated are accounted for in this module. Credits from avoiding production of virgin plastic, steel and aluminum are also credited in this module. However, it does not credit already recycled content of PMMA.

LCA results

| ENVIRONMENTAL IMPACTS PER PIECE | | | | | | | |
|---------------------------------|--|----------|----------|----------|----------|----------|-----------|
| Indicator | Unit | A1-A3 | C1 | C2 | C3 | C4 | D |
| GWP-total | kg CO2 eq. | 1,04E+04 | 9,66E-02 | 1,02E+02 | 8,44E+01 | 8,09E-01 | -6,46E+03 |
| GWP-fossil | kg CO2 eq. | 1,04E+04 | 9,63E-02 | 1,02E+02 | 8,44E+01 | 8,08E-01 | -6,43E+03 |
| GWP-biogenic | kg CO2 eq. | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 |
| GWP-luluc | kg CO2 eq. | 2,11E+01 | 3,06E-04 | 5,42E-02 | 9,22E-03 | 8,66E-04 | -2,42E+01 |
| ODP | kg CFC 11 eq. | 1,49E-04 | 2,08E-09 | 2,23E-06 | 2,36E-07 | 9,34E-09 | -6,36E-05 |
| AP | mol H+ eq. | 6,44E+01 | 3,78E-04 | 2,21E-01 | 7,17E-02 | 5,15E-03 | -4,47E+01 |
| EP-freshwater | kg P eq. | 3,38E+00 | 7,65E-05 | 7,82E-03 | 3,32E-03 | 2,38E-04 | -2,46E+00 |
| EP-marine | kg N eq. | 1,04E+01 | 9,12E-05 | 5,41E-02 | 3,02E-02 | 1,36E-03 | -6,98E+00 |
| EP-terrestrial | mol N eq. | 1,07E+02 | 1,04E-03 | 5,49E-01 | 2,55E-01 | 1,42E-02 | -7,11E+01 |
| POCP | kg NMVOC eq. | 3,52E+01 | 2,45E-04 | 3,37E-01 | 7,61E-02 | 4,72E-03 | -2,24E+01 |
| ADPm1 | kg Sb eq. | 4,35E-01 | 6,33E-07 | 3,78E-04 | 1,58E-04 | 1,62E-06 | -6,64E-03 |
| ADPf1 | MJ | 1,17E+05 | 1,60E+00 | 1,45E+03 | 1,35E+02 | 1,15E+01 | -6,00E+04 |
| WDP1 | m3 world eq. deprived | 1,76E+03 | 1,53E-02 | 5,97E+00 | 4,01E+00 | 2,98E-01 | -1,05E+03 |
| Caption | GWP-total = Global Warming Potential - total; 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 = Ozone Depletion; AP = Acidification; EP-freshwater = Eutrophication – aquatic freshwater; EP-marine = Eutrophication – aquatic marine; EP-terrestrial = Eutrophication – terrestrial; POCP = Photochemical zone formation; ADPm = Abiotic Depletion Potential – minerals and metals; ADPf = Abiotic Depletion Potential – fossil fuels; WDP = water use | | | | | | |
| Disclaimer | 1 The results of this environmental indicator shall be used with care as the uncertainties on these results are high or as there is limited experienced with the indicator. | | | | | | |

| ADDITIONAL ENVIRONMENTAL IMPACTS PER PIECE | | | | | | | |
|--|--|----------|----------|----------|----------|----------|-----------|
| Parameter | Unit | A1-A3 | C1 | C2 | C3 | C4 | D |
| PM | [Disease incidence] | 7,02E-04 | 2,68E-09 | 6,76E-06 | 1,08E-06 | 8,00E-08 | -5,50E-04 |
| IRP2 | [kBq U235 eq.] | 6,78E+02 | 3,62E-02 | 2,32E+00 | 1,04E+00 | 5,04E-02 | -1,11E+02 |
| ETP-fw1 | [CTUe] | 8,07E+04 | 6,91E-01 | 1,47E+03 | 5,64E+02 | 3,41E+02 | -3,99E+04 |
| HTP-c1 | [CTUh] | 1,74E-05 | 9,45E-11 | 9,74E-08 | 3,90E-08 | 1,45E-09 | -1,53E-05 |
| HTP-nc1 | [CTUh] | 3,07E-04 | 2,67E-09 | 2,04E-06 | 9,35E-07 | 1,86E-08 | -2,25E-04 |
| SQP1 | - | 3,64E+04 | 2,21E+00 | 7,68E+02 | 3,65E+02 | 1,43E+01 | -1,19E+04 |
| Caption | PM = Particulate Matter emissions; IRP = Ionizing radiation – human health; ETP-fw = Eco toxicity – freshwater; HTP-c = Human toxicity – cancer effects; HTP-nc = Human toxicity – non cancer effects; SQP = Soil Quality | | | | | | |
| Disclaimers | 1 The results of this environmental indicator shall be used with care as the uncertainties on these results are high or as there is limited experienced with the indicator. 2 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. | | | | | | |

| RESOURCE USE PER PIECE | | | | | | | |
|------------------------|---|----------|----------|----------|----------|----------|-----------|
| Parameter | Unit | A1-A3 | C1 | C2 | C3 | C4 | D |
| PERE | [MJ] | 1,28E+04 | 1,59E+00 | 2,62E+01 | 4,26E+00 | 7,77E-01 | -2,56E+03 |
| PERM | [MJ] | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 |
| PERT | [MJ] | 1,28E+04 | 0,00E+00 | 2,62E+01 | 4,26E+00 | 0,00E+00 | -2,56E+03 |
| PENRE | [MJ] | 1,17E+05 | 1,60E+00 | 1,45E+03 | 5,98E+01 | 1,15E+01 | -1,82E+04 |
| PENRM | [MJ] | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 |
| PENRT | [MJ] | 1,17E+05 | 1,60E+00 | 1,45E+03 | 5,98E+01 | 1,15E+01 | -1,82E+04 |
| SM | [kg] | 2,11E+02 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 |
| RSF | [MJ] | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 |
| NRSF | [MJ] | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 |
| FW | [m3] | 7,23E+01 | 3,01E-03 | 2,19E-01 | 1,13E-01 | 8,61E-03 | -1,33E+01 |
| Caption | 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 = Net use of fresh water | | | | | | |

| WASTE CATEGORIES AND OUTPUT FLOWS PER PIECE | | | | | | | |
|---|------|----------|----------|----------|----------|----------|-----------|
| Parameter | Unit | A1-A3 | C1 | C2 | C3 | C4 | D |
| HWD | [kg] | 1,32E+01 | 2,68E-06 | 9,20E-03 | 7,29E-04 | 3,82E-05 | -1,63E-01 |
| NHWD | [kg] | 1,47E+03 | 8,57E-03 | 6,18E+01 | 8,99E+00 | 2,09E+01 | -1,14E+03 |
| RWD | [kg] | 1,69E-01 | 8,48E-06 | 5,68E-04 | 2,65E-04 | 1,23E-05 | -2,80E-02 |

| | | | | | | | |
|-----|------|----------|----------|----------|----------|----------|----------|
| CRU | [kg] | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 |
| MFR | [kg] | 5,70E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 3,58E+02 | 0,00E+00 |
| MER | [kg] | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 |
| EEE | [MJ] | 1,13E+02 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 1,20E+02 | 0,00E+00 |
| EET | [MJ] | 2,30E+02 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 2,35E+02 | 0,00E+00 |

Caption HWD = Hazardous waste disposed; NHWD = Non hazardous waste disposed; RWD = Radioactive waste disposed; CRU = Components for re-use; MFR = Materials for recycling; MER = Materials for energy recovery; EEE = Exported electrical energy; EET = Exported thermal energy
The numbers are declared in scientific notation, fx 1,95E+02. This number can also be written as: 1,95*10² or 195, while 1,12E-11 is the same as 1,12*10⁻¹¹ or 0,0000000000112.

| BIOGENIC CARBON CONTENT PER PIECE | | |
|--|---|---------------------|
| Parameter | Unit | At the factory gate |
| Biogenic carbon content in product | [kg C] | 0,0 |
| Biogenic carbon content in accompanying packagaing | [kg C] | 0,0 |
| Note | 1 kg biogenic carbon is equivalent to 44/12 kg of CO ₂ | |

As there is no biogenic carbon in the declared product nor in the packaging the biogenic carbon content table is left blank.

Additional information

LCA interpretation

In general, the lifecycle stage of A1, is the most contributing stage. The production of acrylic panels made from recycled PMMA together with the large amount of aluminum constitute the majority of the different impact categories.

Technical information on scenarios

End of life (C1-C4)

| Scenario information | Value | Unit |
|--------------------------------------|--------|----------------|
| Collected separately | 661,47 | kg |
| Collected with mixed waste | 0,00 | kg |
| For reuse | 0,00 | kg |
| For recycling | 568,90 | kg |
| For energy recovery | 72,00 | kg |
| For final disposal | 20,59 | kg |
| Assumptions for scenario development | | As appropriate |

Re-use, recovery and recycling potential (D)

| Scenario information/Materiel | Value | Unit |
|---|--------|------|
| Displaced material | 358,20 | kg |
| Energy recovery from waste incineration | 357,14 | MJ |

The amount of displaced material is lower than the amount of material that is send to recycling in C1-C4. This is because of the fact that, the PMMA acrylic panels already contain 100% recycled content. Therefore, these related amounts cannot be credited which results in differently stated amounts.

Indoor air

The EPD does not give information on release of dangerous substances to indoor air because the horizontal standards on the relevant measurements are not available. Read more in EN15804+A1 chapter 7.4.1.

The EPD does not give information on release of dangerous substances to soil and water because the horizontal standards on the relevant measurements are not available. Read more in EN15804+A1 chapter 7.4.2.

Soil and water

References

| | |
|---------------------------------------|--|
| Publisher |  www.epddanmark.dk <small>Template version 2023.1</small> |
| Programme operator | Danish Technological Institute Buildings & Environment Gregersensvej DK-2630 Taastrup www.teknologisk.dk |
| LCA-practitioner | Transition ApS Mariane Thomsens Gade 2F, 11. 8000 Aarhus C Att.: Kristine Sofie Holse Hansen, Lukas Blander Enevoldsen & Mehmet Erdogmus |
| LCA software / background data | Simapro 9.5.0 / Ecoinvent v. 3.9.1 database |
| 3rd party verifier | Kim Christiansen kimconsult.dk |

General programme instructions

General Programme Instructions, version 2.0, spring 2020
www.epddanmark.dk

EN 15804

DS/EN 15804 + A2:2019 - "Sustainability of construction works – Environmental product declarations – Core rules for the product category of construction products"

EN 15942

DS/EN 15942:2011 – " Sustainability of construction works – Environmental product declarations – Communication format business-to-business"

ISO 14025

DS/EN ISO 14025:2010 – " Environmental labels and declarations – Type III environmental declarations – Principles and procedures"

ISO 14040

DS/EN ISO 14040:2008 – " Environmental management – Life cycle assessment – Principles and framework"

ISO 14044

DS/EN ISO 14044:2008 – " Environmental management – Life cycle assessment – Requirements and guidelines"