# Environmental Product Declaration

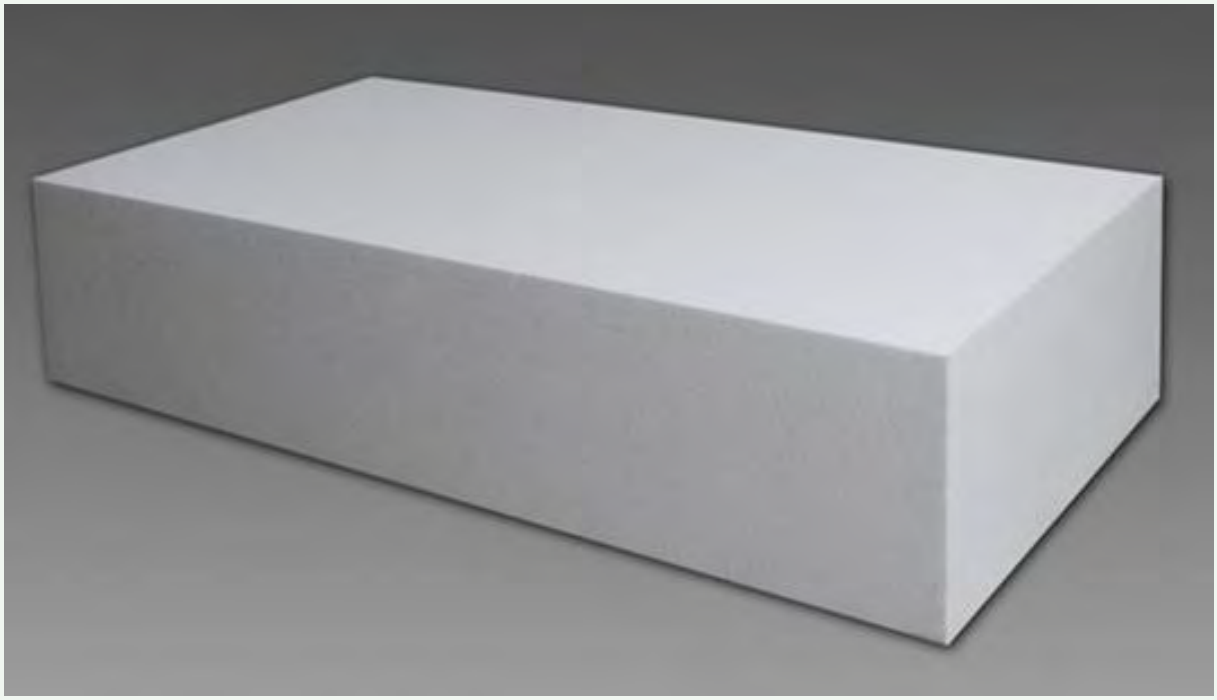
In accordance with ISO 14025 and EN 15804+A1 for:

**EPS 80 insulation**

From

**EPS Sverige, a sector group within IKEM – Innovation and Chemical Industries in Sweden**

| | |
|---|---|
| **Programme:** | The International EPD® System, www.environdec.com |
| **Programme operator:** | EPD International AB |
| **EPD owner:** | IKEM -- Innovation and Chemical Industries in Sweden. |
| **EPD registration number:** | S-P-02035 |
| **First date of publication:** | 2020-05-26 |
| **Validity date:** | 2025-05-25 |
| **Geographical scope:** | Nordic countries |
| **PCR used** | PCR 2012:01. Construction products and construction services. Version 2.3. of 2018-11-15 |
| **Sub-PCR used** | |



# General information

### Owner of the EPD:

IKEM – Innovation and Chemical Industries in Sweden.
Adress: Box 55915, SE 102 16 Stockholm. Visiting address: Storgatan 19, Stockholm, Sweden.
Telephone: +46 (0)10-455 38 50
E-mail: info@ikem.se

### Name and location of production sites:

- BeWi Insulation AB:
  - Braxenvägen 8, 761 41, Norrtälje
  - Bruksgatan 2, 312 40, Genevad
- Jackon AB
  - Järnvägsgatan 39, 274 32, Skurup
  - Hamnviksvägen 9, 872 43, Kramfors
- Sundolitt AB
  - Nordgårdsvägen 2, 44782 Vårgårda

# About the company

EPS-Sverige is a sector group within IKEM-Innovation and Chemical Industries in Sweden. EPS-Sverige promotes that EPS shall be used in a professional and building constructional right way using the technical, financial and environmental benefits in production, use, reuse, recycling or energy recovery.

IKEM is an industry and employer organization representing 1,400 companies with 70,000 employees in the chemical, plastics and materials industries. The EPS-Sverige sector group consists of the leading manufacturers of EPS for construction purposes: Bewi, Jackon and Sundolitt. Through the manufacturing of EPS insulation boards with high insulation capacity, long life, low weight, attractive price and being recyclable, the construction industry is provided with insulation that promotes sustainable building.

# Product information

### Product name

EPS insulation with compressive stress 80 kN/m², referred to as EPS 80. The following commercial products are covered by this EPD:

- Products by BeWi Insulation AB:
  - EPS 80 and EPS Grey
- Products by Jackon AB:
  - Jackopor 80
- Products by Sundolitt AB:
  - C80 and S80

### Product description

EPS insulation boards are made of white or gray polystyrene raw material, which also depends on the color of the finished EPS boards. The gray polystyrene raw material contains about 3% graphite, which gives the material a little better insulation capacity. Production of EPS insulation boards is done by heating polystyrene granules containing 4-6% pentane with water vapor in a closed block form.

After that, the block is cut with a heated wire to the desired size. A typical size is 600 mm wide, 1200 mm long and thickness between 10-200 mm. During manufacture and shortly thereafter, about half of the amount of pentane is released. Any leftovers from production is recycled in the same process.

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## Technical information

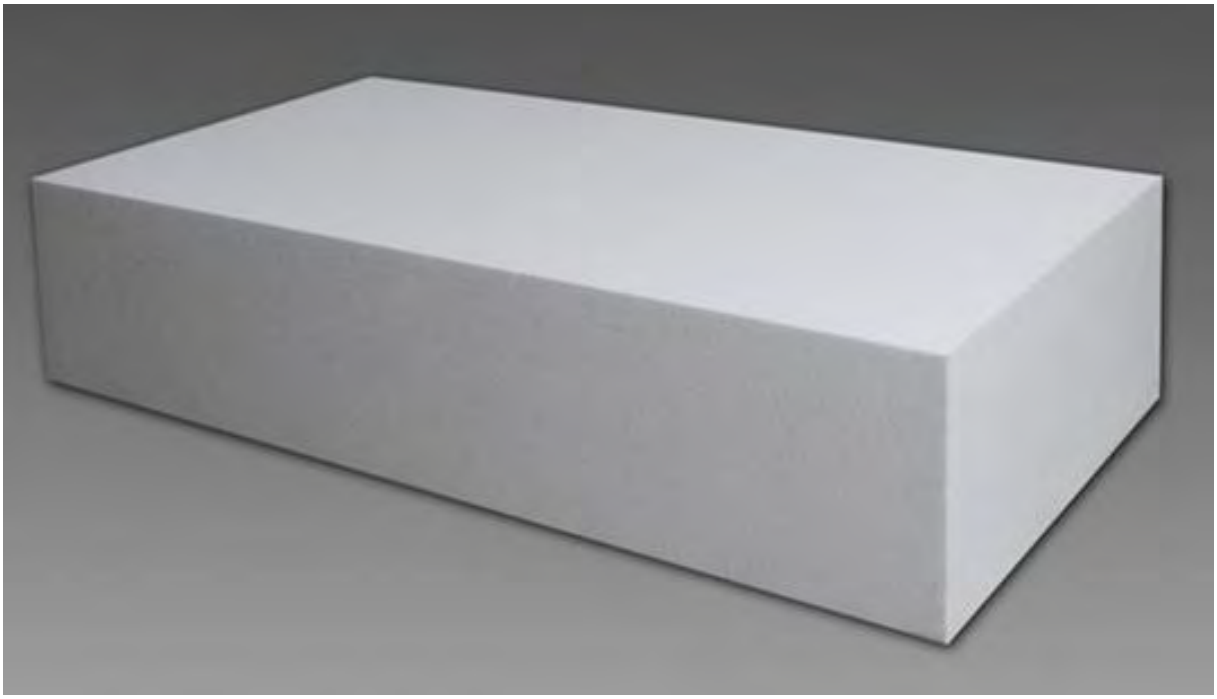
The estimated service life of the products is at least 60 years according to the manufacturer, as in principle the product is not affected at all by ageing. The product included in this EPD follows the technical standard SS-EN-13163, and has the following technical properties:

- R-value: 1 m2K/W
- Thickness: 38mm
- K-value: 0,038 W/mK

## Product content

The approximate material content (in weight %) of the product is: expandable polystyrene (90-95%), pentane (4-6%) and graphite (0-3%). This composition can vary depending of the products and manufacturer and is just an estimation.

## Picture of the product



## UN CPC code

369 – other plastic products

## Geographical scope

Nordic countries

## Conversion factors to other classes

The results presented in this EPD can be converted to other nominal densities by using conversion factors. The following conversion factors have been calculated based on the difference with the EPS80, and can be applied to the results in this EPD:

| Compressive strength class | Conversion factor |
|---|---|
| EPS 60 | 0.87 |
| EPS 80 | 1 |
| EPS 100 | 1.15 |
| EPS 120 | 1.31 |
| EPS 150 | 1.55 |
| EPS 200 | 1.88 |
| EPS 300 | 2.50 |

# LCA information

## PCR used
The PCR (Product category rules) that has been used in this EPD is PCR 2012:01. Construction products and construction services. Version 2.3. of 2018-11-15.

## Declared unit
1 $m^2$ of EPS 80 insulation with 38mm thickness, an R-value of 1 K*$m^2$/W and class 80 kN/$m^2$

## Service life
The estimated service life of the products is at least 60 years according to the manufacturer.

## Time representativeness
The data used to model product manufacturing corresponds to 2018. The data from generic databases are from 2011 – 2018. No data used is older than 10 years.

## Database(s) and LCA software used
Databases used are mainly from Thinkstep´s own database from 2019. The LCA software used is GaBi 8.

## Data quality
The quality of the data is judged to be good. The data is recent and the data to model the core process was collected directly from the production sites.

## System diagram
A basic flowchart of the system is presented in the figure below.

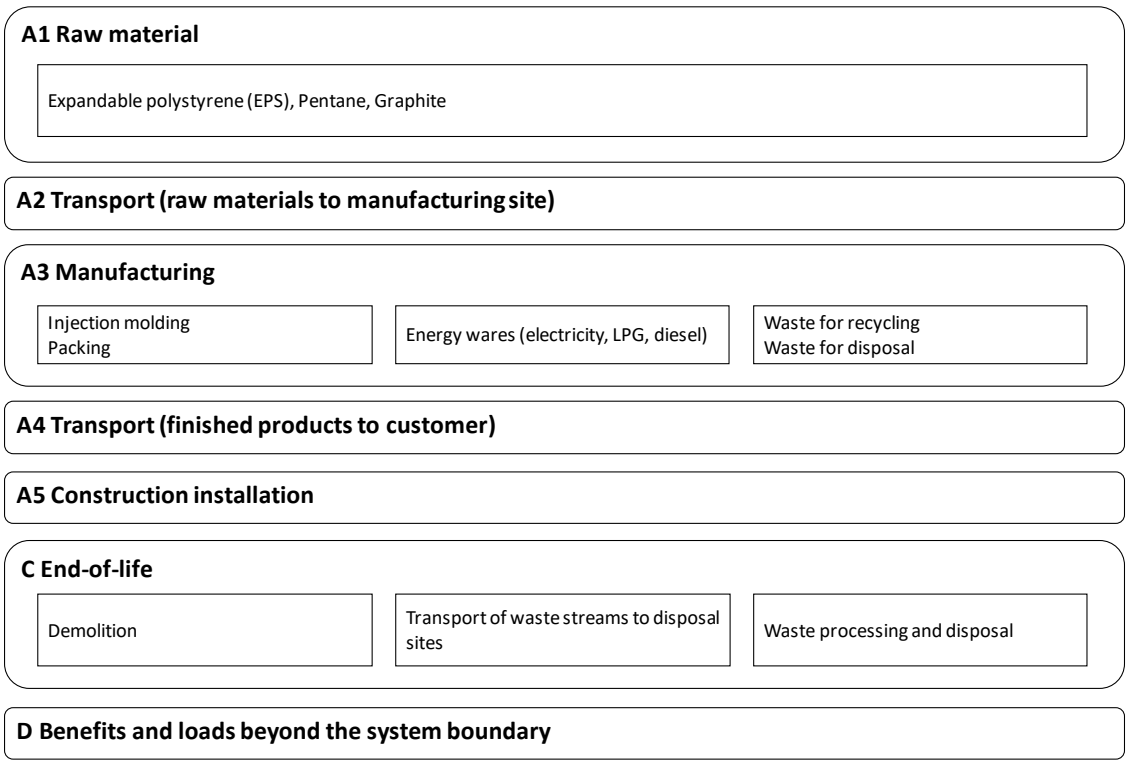



**Figure 1 – Flow chart of the system**

## Description of system boundaries and delimitations

This study is a so-called *cradle-to-gate with options* according to the definition in the PCR followed. The life cycle impacts included are as the flowchart above shows. Also, in accordance to the PCR followed, the Polluter Pays Principle was applied. The life cycle starts by extracting raw materials used for the products, which is defining the boundary towards the nature. No infrastructure products are used for the manufacturing of the product.

## Life cycle stages, included and excluded

The life cycle stages included are A1-A5, C1-C4 and D.
The life cycle stages excluded are B1-B7.

## Allocations made

Co-product allocation was not necessary in the studied system. A conservative assumption has been made that all the environmental impact is allocated to the product and not the co-product (i.e. the filling material).

## Scenarios

The analysis is carried out using factory-specific data for use of energy and utilities and waste generation, as well as product-specific data for use of raw materials. Therefore, the results represent the product system and no other scenarios were applied.

## Data used

Site-specific production data has been retrieved for 2018 from the production sites. The upstream and downstream processes have been modelled based on data from generic databases, mostly Thinkstep's database.

## Cut-off

The study applies a cut-off criterion of 1%.

## Main raw materials

The main raw materials used in the product can be seen in the flowchart in Figure 1.

## Packaging

Most of the raw materials used for the production process are transported in plastic PE bags and cardboard boxes (Oktabin) depending of the specific product, and in some cases wooden palls are used. The products are transported to the customers in polyethylene plastic bags.

## Transportation

Three types of transportation processes are included in this LCA study; the transport of raw materials and its packaging to the production sites, the transport of the final products to the customers and the transport of waste materials from the production sites to the disposal. The transport is mainly carried out by trucks and in some cases the raw materials are transported to the production site by boat.

## Energy utilities

Both electricity and heat are used at the production sites. The electricity has been modelled using the Swedish residual electricity grid mix in the Thinkstep database. As for the heat, most of the sites use local LPG boilers and, in some cases, using biomass. Some of the sites also use diesel-powered internal transports.

## Recycled materials

Some of the products use a small percentage of recycled post-consumer EPS waste as raw material. Following the polluter pays principle, only the transport of the recycled EPS to the production sites is accounted for in the calculations. The amount of recycled material used depends on the specific product and varies between 0-3% in weight of the total EPS input.

## Secondary energy

No secondary energy is used for the manufacturing of the product.

## Direct emissions from production site

The only emissions from the production sites besides the emissions from the local production of heat and the internal transports is pentane from the blow moulding process.

## Waste

Wastes are generated during the manufacturing process in all production sites. These are transported to a sorting facility. The main waste streams from production are hazardous waste (sent to incineration), inert waste (to landfill), waste sent to recycling and industrial non-hazardous waste sent to incineration.

## Scenario for module A4

The table below presents information concerning the scenario used to model the transport of the product to the customers:

| Vehicle type used for transport | Vehicle load capacity | Fuel type and consumption | Capacity utilisation (%) | Average distance to customer (km) |
|---|---|---|---|---|
| EURO5 and EURO6 | 20 tonnes | Diesel, 3.7 l/10 km. | Between 30-95% depending on manufacturer | Weighted average, varies for each manufacturer |

## End-of-life

The environmental impacts of demolition correspond to the use of machinery, using a factor of 0,8 kWh per ton of material. For C2, the waste is assumed to be transported 20km to a disposal facility by 20-ton EURO5 trucks. An end-of-life scenario has been assumed for the product as the most likely to occur in Sweden, corresponding to 98,5% of the waste going to incineration with energy recovery and 1,5% of the waste to recycling. Both of these waste streams are accounted for in module D.

## Benefits beyond the system boundaries (Module D)

The avoided emissions from incineration were modelled based on a scenario where 2,29MJ of electricity and 30,1MJ of steam are obtained per kilogram of EPS incinerated. It was assumed that the electricity output of this process substitutes electricity from the grid, and that the steam output substitutes steam from hard coal. A recovery efficiency of 40% was assumed for both processes, also to account for material losses.

To calculate the avoided emissions from recycling, it was assumed that the EPS recycled substitutes the production of EPS granulate. Here, a factor of 0,5 was applied in order to account for quality loss after each life cycle of the material. This substitution was applied to the net flow of primary material in the product, meaning that whenever the product contained recycled raw materials, these were not included in the calculation of module D.

## Product system

The life cycle stages included in the analysis is illustrated in the table below, according to EN15804. If a module is included, it is indicated with “X” and if it is excluded with a “ND” (Not Declared).

| Product stage | | | Construction process stage | | Use stage | | | | | | | End of life stage | | | | Resource recovery stage |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Raw material | Transport | Manufacturing | Transport | Construction installation | Use | Maintenance | Repair | Replacement | Refurbishment | Operational energy use | Operational water use | Deconstruction, demolition | Transport | Waste processing | Disposal | Reuse, recycling or energy recovery potentials |
| A1 | A2 | A3 | A4 | A5 | B1 | B2 | B3 | B4 | B5 | B6 | B7 | C1 | C2 | C3 | C4 | D |
| X | X | X | X | X | ND | ND | ND | ND | ND | ND | ND | X | X | X | X | X |

## Inventory and Impact categories

In accordance with the International EPD system programme instructions and the specific PCR used, the following characterization factors are used:

| PARAMETER | UNIT | Characterization factors |
|---|---|---|
| Global warming potential (GWP) | kg $CO_2$ eq. | CML2001 – Jan. 2016, baseline method. |
| Acidification potential (AP) | kg $SO_2$ eq. | |
| Eutrophication potential (EP) | kg $PO_4^{3-}$ eq. | |
| Formation potential of tropospheric ozone (POCP) | kg $C_2H_4$ eq. | |
| Ozone layer depletion potential (ODP) | kg R11-e | |
| Abiotic depletion potential – Elements | kg Sb eq. | |
| Abiotic depletion potential – Fossil resources | MJ, net calorific value | |

| PARAMETER | | UNIT |
|---|---|---|
| Primary energy resources – Renewable | Use as energy carrier | MJ, net calorific value |
| | Used as raw materials | MJ, net calorific value |
| | TOTAL | MJ, net calorific value |
| Primary energy resources – Non-renewable | Use as energy carrier | MJ, net calorific value |
| | Used as raw materials | MJ, net calorific value |
| | TOTAL | MJ, net calorific value |
| Secondary material | | kg |
| Renewable secondary fuels | | MJ, net calorific value |
| Non-renewable secondary fuels | | MJ, net calorific value |
| Net use of fresh water | | $m^3$ |

| PARAMETER | UNIT |
|---|---|
| Hazardous waste disposed | kg |
| Non-hazardous waste disposed | kg |
| Radioactive waste disposed | kg |

| PARAMETER | UNIT |
|---|---|
| Components for reuse | kg |

## Content declaration

No substances that appear in the REACH candidate list of SVHC (Candidate List of Substances of Very High Concern) are present or used in the product concerning this EPD.

## Environmental performance of the EPS80

Although there is a variation larger than 10% for some indicators modules, it would not be meaningful to report these at site level. Moreover, these variations are to a great extent caused by variation in the transport to site module (A2), which can naturally differ among sites.

### Potential environmental impact per $m^2$ of EPS insulation

| PARAMETER | UNIT | A1-A3 | A4 | A5 | A1-A5 | C1 | C2 | C3 | C4 | C1-C4 | D |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Global warming potential (GWP) | kg $CO_2$ eq. | 1.63E+00 | 8.46E-03 | 1.86E-02 | 1.66E+00 | 4.35E-02 | 9.13E-04 | 5.45E-03 | 1.94E+00 | 1.99E+00 | -9.81E-01 |
| Acidification potential (AP) | kg $SO_2$ eq. | 1.25E-10 | 1.37E-18 | 1.24E-18 | 1.25E-10 | 6.13E-18 | 1.47E-19 | 4.02E-17 | 1.16E-16 | 1.62E-16 | -1.17E-12 |
| Eutrophication potential (EP) | kg $PO_4^{3-}$ eq. | 4.30E-03 | 1.55E-05 | 2.25E-06 | 4.32E-03 | 6.28E-05 | 2.16E-06 | 4.65E-06 | 2.69E-04 | 3.39E-04 | -1.20E-03 |
| Formation potential of tropospheric ozone (POCP) | kg $C_2H_4$ eq. | 4.14E-04 | 3.67E-06 | 4.80E-07 | 4.18E-04 | 8.67E-06 | 5.23E-07 | 6.73E-07 | 6.08E-05 | 7.07E-05 | -1.51E-04 |
| Ozone layer depletion potential (ODP) | kg R11-e | 1.06E-02 | -4.40E-06 | 1.45E-07 | 1.06E-02 | 6.93E-06 | -7.37E-07 | 3.72E-07 | 1.82E-05 | 2.47E-05 | -1.24E-04 |
| Abiotic depletion potential – Elements | kg Sb eq. | 1.50E-07 | 5.89E-10 | 2.31E-11 | 1.50E-07 | 1.18E-09 | 6.32E-11 | 4.64E-10 | 2.01E-09 | 3.72E-09 | -1.63E-08 |
| Abiotic depletion potential – Fossil resources | MJ, net calorific value | 5.01E+01 | 1.12E-01 | 2.86E-03 | 5.02E+01 | 6.00E-01 | 1.21E-02 | 3.12E-02 | 2.45E-01 | 8.88E-01 | -1.00E+01 |

## Use of resources per $m^2$ of EPS insulation

| PARAMETER | UNIT | A1-A3 | A4 | A5 | A1-A5 | C1 | C2 | C3 | C4 | C1-C4 | D |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Renewable primary energy used as energy carrier | MJ, net calorific value | 2.36E+00 | 6.54E-03 | 7.32E-04 | 2.37E+00 | 1.85E-03 | 7.01E-04 | 1.03E-02 | 6.17E-02 | 7.46E-02 | -8.81E-01 |
| Renewable primary energy used as raw materials | MJ, net calorific value | 1.35E-02 | 0.00E+00 | 0.00E+00 | 1.35E-02 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 2.16E-10 |
| Total renewable primary energy | MJ, net calorific value | 2.37E+00 | 6.54E-03 | 7.32E-04 | 2.38E+00 | 1.85E-03 | 7.01E-04 | 1.03E-02 | 6.17E-02 | 7.46E-02 | -8.81E-01 |
| Non-renewable primary energy used as energy carrier | MJ, net calorific value | 5.25E+01 | 1.13E-01 | 3.42E-03 | 5.26E+01 | 6.02E-01 | 1.21E-02 | 4.14E-02 | 2.93E-01 | 9.48E-01 | -1.08E+01 |
| Non-renewable primary energy used as raw materials | MJ, net calorific value | 1.56E-04 | 5.92E-06 | 9.43E-08 | 1.62E-04 | 3.30E-07 | 6.35E-07 | 1.79E-06 | 7.60E-06 | 1.04E-05 | -4.35E-05 |
| Total non-renewable primary energy | MJ, net calorific value | 5.25E+01 | 1.13E-01 | 3.42E-03 | 5.26E+01 | 6.02E-01 | 1.21E-02 | 4.14E-02 | 2.93E-01 | 9.48E-01 | -1.08E+01 |
| Secondary material | MJ, net calorific value | 5.64E-03 | 0.00E+00 | 0.00E+00 | 5.64E-03 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| Renewable secondary fuels | MJ, net calorific value | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| Non-renewable secondary fuels | MJ, net calorific value | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| Net use of fresh water | $m^3$ | 1.18E-02 | 1.11E-05 | 4.63E-05 | 1.19E-02 | 4.29E-06 | 1.19E-06 | 2.08E-05 | 3.93E-03 | 3.96E-03 | -1.83E-03 |

## Waste production per $m^2$ of EPS insulation

| PARAMETER | UNIT | A1-A3 | A4 | A5 | A1-A5 | C1 | C2 | C3 | C4 | C1-C4 | D |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Hazardous waste disposed | kg | 5.47E-04 | 6.30E-09 | 1.82E-11 | 5.47E-04 | 7.22E-11 | 6.76E-10 | 2.53E-11 | 5.23E-10 | 1.30E-09 | -5.94E-06 |
| Non-hazardous waste disposed | kg | 2.94E-02 | 9.17E-06 | 1.96E-04 | 2.96E-02 | 7.31E-05 | 9.83E-07 | 3.89E-04 | 1.73E-02 | 1.78E-02 | -7.82E-03 |
| Radioactive waste disposed | kg | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |

## Output flows per $m^2$ of EPS insulation

| PARAMETER | UNIT | A1-A3 | A4 | A5 | A1-A5 | C1 | C2 | C3 | C4 | C1-C4 | D |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Components for re-use | kg | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 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 | 9.54E-03 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 9.54E-03 | 0.00E+00 |
| Materials for energy recovery | kg | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 6.27E-01 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 6.27E-01 | 0.00E+00 |
| Exported electrical energy | 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 | 0.00E+00 | 0.00E+00 |

# Programme-related information and verification

The EPD owner has the sole ownership, liability, and responsibility for the EPD. Environmental product declarations within the same product category from different programs may not be comparable. Environmental product declarations of construction products may not be comparable if they do not comply with EN 15804.

| | |
|---|---|
| Programme: | The International EPD® System<br><br>EPD International AB<br>Box 210 60<br>SE-100 31 Stockholm<br>Sweden<br><br>www.environdec.com<br>info@environdec.com |
| EPD registration number: | S-P-02035 |
| Published: | 2020-05-26 |
| Valid until: | 2025-05-25 |
| Product Category Rules: | PCR 2012:01. Construction products and construction services. Version 2.3. of 2018-11-15 |
| Sub-PCR used: | None |
| Product group classification: | UN CPC 369 – other plastic products |
| Reference year for data: | 2018 |
| Geographical scope: | Nordic countries |

| |
|---|
| CEN standard EN 15804 serves as the Core Product Category Rules (PCR) |
| Product category rules (PCR): PCR 2012:01. Construction products and construction services. Version 2.3 of 2018-11-15. |
| PCR review was conducted by: The Technical Committee of the International EPD® System. Chair: Massimo Marino. Contact via info@environdec.com |
| Independent third-party verification of the declaration and data, according to ISO 14025:2006:<br><br>☐ EPD process certification ☒ EPD verification |
| Third party verifier:<br>Carl-Otto Nevén<br>Approved by: The International EPD® System |
| Procedure for follow-up of data during EPD validity involves third party verifier:<br><br>☒ Yes ☐ No |

# References


- EN 15804:2012+A1:2013, Sustainability of construction works – Environmental product declarations – Core rules for the product category of construction products.
- General Programme Instructions of the International EPD® System. Version 3.1 of 18/09/2019.
- LCA Methodology Report for EPD – LCA methodology report for a sector EPD – IKEM expanded polystyrene.
- PCR 2012:01 CONSTRUCTION PRODUCTS AND CONSTRUCTION SERVICES; ver.2.3 of 2018-11-15.
- Thinkstep (2017). GaBi Databases. http://www.gabi-software.com/international/databases/gabi-databases/
- ThinkStep (2018) Gabi 8 (LCA software).

## Contact information

| | |
|---|---|
| EPD owner: | EPS Sverige a sector group within IKEM – Innovation and Chemical Industries in Sweden.<br>Adress: Box 55915, SE 102 16 Stockholm.<br>Visiting address: Storgatan 19, Stockholm, Sweden.<br>Telephone: +46 (0)10-455 38 50<br>E-mail: info@ikem.se<br>Contact: Henrik Oxfall (henrik.oxfall@ikem.se) |
| LCA author: | IVL Swedish Environmental Research Institute, Box 210 60<br>SE-100 31 Stockholm, www.ivl.se.<br>Contact: Diego Peñaloza (Diego.Penaloza@ivl.se) |
| Programme operator: | EPD International AB<br>info@environdec.com |

EPD®

www.environdec.com

epd-norge.no
The Norwegian EPD Foundation

# ENVIRONMENTAL PRODUCT DECLARATION

in accordance with ISO 14025, ISO 21930 and EN 15804

| | |
|---|---|
| Eier av deklarasjonen: | EPS-gruppen |
| Program operatør: | Næringslivets Stiftelse for Miljødeklarasjoner |
| Utgiver: | Næringslivets Stiftelse for Miljødeklarasjoner |
| Deklarasjon nummer: | NEPD-1236-244-NO |
| Publiserings nummer: | NEPD-1236-244-NO |
| ECO Platform registreringsnummer: | - |
| Godkjent dato: | 12.01.2017 |
| Gyldig til: | 12.01.2022 |

## Lavlambda EPS 80 isolasjon (trykklasse 80)

EPS-gruppen

Eier av deklarasjon

www.epd-norge.no

EPS-gruppen


BEWi JACKON ISOLASJON Sundolitt VARTDAL PLAST

## Generell informasjon

**Produkt:**
Lavlambda EPS 80 isolasjon (trykklasse 80)

**Eier av deklarasjonen:**
EPS-gruppen
Kontakt person: Bengt Bøyesen
Tlf: +47 90 97 52 55
e-post: btb@btbrad.no

**Program operatør:**
Næringslivets Stiftelse for Miljødeklarasjoner
Postboks 5250 Majorstuen, 0303 Oslo
Tlf: +47 23 08 82 92
e-post: post@epd-norge.no

**Produsent:**
BEWi, Jackon, Brødr. Sunde, Vartdal Plastindustri

**Deklarasjon nummer:**
NEPD-1236-244-NO

**Produksjonssted:**
Norge og Sverige

**ECO Platform registreringsnummer:**
-

**Kvalitet/Miljøsystem:**
3 av 4 bedrifter har ISO 9001-sertifisering, 1 av 4 har, og en er i ferd med å innføre, ISO 14001. I tillegg forvalter EPS-gruppen sin egen produktstandard: Isobest

**Deklarasjonen er basert på PCR:**
CEN Standard EN 15804 tjener som kjerne PCR
NPCR 12 rev1, *Insulation materials* , date: 10.12.2012

**Org. no.:**
985156549

**Erklæringen om ansvar:**
Eieren av deklarasjonen skal være ansvarlig for den underliggende informasjon og bevis. EPD Norge skal ikke være ansvarlig med hensyn til produsent informasjon, livsløpsvurdering data og bevis.

**Godkjent dato:**
12.01.2017

**Gyldig til:**
12.01.2022

**Deklarert enhet:**
1 m² lavlambda EPS 80 isolasjonsplate av 31 mm tykkelse med termisk resistanse R=1 K m²/W og en trykkfasthet på 80 kPa.

**Årstall for studien:**
2015

**Deklarert enhet med opsjon:**
1 m² lavlambda EPS 80 isolasjonsplate av 31 mm tykkelse med termisk resistanse R=1 K m²/W og en trykkfasthet på 80 kPa, transportert fra byggeplass til avfallshåndtering etter endt bruk, avfallsbehandlet og eventuelt gjenvunnet.

**Sammenlignbarhet:**
EPD av byggevarer er nødvendigvis ikke sammenlignbare hvis de ikke samsvarer med NS-EN 15804 og ses i en bygningskontekst.

**Funksjonell enhet:**

**Miljødeklarasjonen er utarbeidet av:**
Martin S. Melvær og Andreas Brekke

**Verifikasjon:**
Uavhengig verifikasjon av deklarasjonen og data, i henhold til ISO 14025:2010

internt ☐ eksternt ☑

Tredjeparts verifikator:
Seniorforsker, Østfoldforskning
(Uavhengig verifikator godkjent av EPD Norge)

Godkjent
Håkon Hauan
Daglig leder av EPD-Norge

## Produkt

**Produktbeskrivelse:**
Denne EPD-en beskriver EPS isolasjon, fremstilt av bedrifter i EPS-gruppen, i henhold til NS-EN 13163. Ekspandert polystyren, EPS, er den vanligste skumplastisolasjonen for isolering av bygningskonstruksjoner. EPS består av lukkede luftfylte celler, og inneholder ca. 98% luft, hvilket gir lav vekt og gode isolerende egenskaper. Produktet brukes i Norge som regel til varmeisolering av bygninger og kommer i mange dimensjoner med et stort utvalg av lambda- og trykklasser. EPS isolasjon kan brukes overalt i bygninger: til gulv på grunn, i vegger og tak.Som utgangspunkt for livsløpsvurderingen er det beregnet miljøresultater for trykklasse 80 kN/m², men det er også oppgitt en konverteringstabell for andre trykklasser. Tettheten for produktet ved 80 kN/m² er ca 16 kg/m³, og tettheten øker med økende trykklasse. Resultatene i denne EPD-en gjelder for EPS isolasjon uten tilsats av flammehemmere eller andre stoffer som påvirker materialegenskapene. EPS har svært lang levetid, utmerkede isolasjonsegenskaper, lav fuktabsorpsjon og høy trykkfasthet.

**Tekniske data:**
EPS isolasjon er CE-merket iht. NS-EN 13163

Isolasjonsplater finnes i mange størrelser og utforminger. En vanlig isolasjonsplate er ofte 600 mm bred og 1200 mm lang og kan være alt fra 10 til 2400 mm tykk. Alle plater har en bøyestyrke > 50 kN/m2 , et fuktopptak < 4 Vol% og er i brannklasse F. Konduktivitet avhenger av trykkfastheter og konverteringsfaktorer for andre trykklasser enn 80 er gitt i tabellen nedenfor. Det er linearitet mellom trykklasser og vekt, og mellom vekt og miljøbelastninger, som gjør at konverteringsfaktorene gjelder for alle produsenter. Det finnes små forskjeller i densiteter mellom produsenter og også innad hos hver enkelt produsent, men disse variasjonene er neglisjerbare.

EPS-gruppen organiserer tester av produkter hos alle produsentene hvert år, hvor tilfeldige produktprøver sendes til laboatorium for å sikre at produkter ligger innenfor kravene.

Produksjonsprosessene omfatter en kombinasjon av varme og trykk og benytter rene teknologier som er minimalt energi- og vannkrevende ettersom energien gjenvinnes i en lukket krets. Dette gjør produksjonen av EPS svært effektiv. Det dannes ikke noe fast avfall, og avkapp blir umiddelbart ført tilbake i produksjonen.

**Produktspesifikasjon:**
Materielle inngangsfaktorer per funksjonell enhet

| Materialer | kg | % |
|---|---|---|
| Polystyren | 0,476 | 90 % |
| Pentan | 0,033 | 6 % |
| Grafitt | 0,02 | 4 % |

**Markedsområde:**
Norge

**Levetid:**
60 år

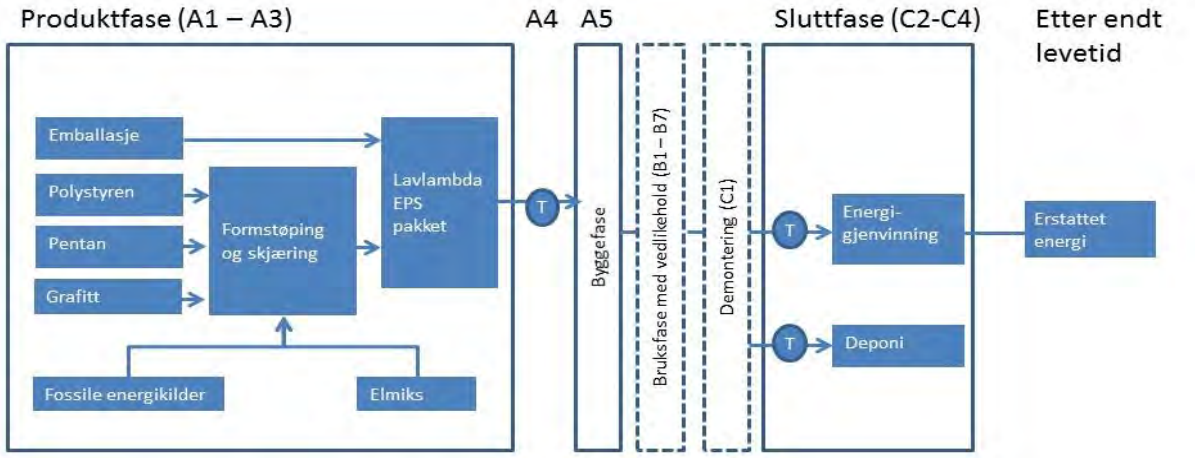
*Tabell med omregningsfaktorer for ulike produktktyper og produkttykkelser*

| | Tykkelse [mm] | | |
|---|---|---|---|
| **Trykkfasthet [kPa]** | **31** | **50** | **100** |
| **60** | 0,85 | 1,3 | 2,7 |
| **80** | 1,0 | 1,6 | 3,2 |
| **100** | 1,1 | 1,8 | 3,6 |
| **150** | 1,6 | 2,5 | 4,9 |
| **200** | 1,6 | 2,7 | 5,3 |

## LCA: Beregningsregler

**Deklarert enhet med opsjon:**
1 m² lavlambda EPS 80 isolasjonsplate av 31 mm tykkelse med termisk resistanse R=1 K m²/W og en trykkfasthet på 80 kPa, transportert fra byggeplass til avfallshåndtering etter endt bruk, avfallsbehandlet og eventuelt gjenvunnet.

**Systemgrenser:**
Modulene A1 til A5, C2-C4 og D er deklarert, mens modulene B1-B7 og C1 ikke er deklarert, da det ikke er forventet at noe vil gjøres med produktet i løpet av levetiden. Et flytskjema for inkluderte prosesser er vist nedenfor. Stiplede linjer betegner prosesser som ikke er inkludert, mens alle heltrukne linjer er innenfor systemgrensene.




Flyskjema over livsløpet til lavlambda EPS isolasjon. Figuren viser de viktigste material- og energistrømmene, hvilke livsløpsfaser som er inkludert og hvilke som er utelatt.

**Datakvalitet:**
Data for spesifikke prosesser er samlet inn i 2015 og dekker et gjennomsnitt av produksjonen for 2014. Bedriftene har sjekket tallene opp mot produksjon seneste år for å sikre at disse er representative. I et produktsystem der plast er en av hovedråvarene vil en stor andel av råvaredataene være generiske; så også her. Ecoinvent 2.2 er benyttet som datakilde for de aller fleste generiske data. Dataene er samlet inn i perioden 2002-2014 og alle er oppdatert i 2010 eller senere.

**Cut-off kriterier:**
Alle viktige råmaterialer og all viktig energibruk er inkludert.

**Allokering:**
Allokering er gjort I hht bestemmelser i EN 15804. Inngående energi og vann, samt produksjon av avfall i egen produksjon er allokert likt mellom alle produktene gjennom masseallokering. Påvirkning for primærproduksjonen av resirkulerte materialer er allokert til hovedproduktet der materialet ble brukt. Resirkuleringsprosessen og transport av materialet er allokert til denne analysen.

Allokering mellom de ulike fabrikkene er basert på produksjonsvolumer i 2014. Det vil si at alle material- og energistrømmer er vektet med hensyn til hvor mye som er produsert ved hver av fabrikkene. Ved alle fabrikkene produseres også andre produkter enn EPS isolasjon av deklarert produktkvalitet. Der er avfalls- og energimengder som ikke er spesikke for produksjonsprosessen allokert i henhold til deklarert produkts andel av totale produksjonsmengder.

## LCA: Scenarier og annen teknisk informasjon

Følgende informasjonen beskriver scenariene for modulene i EPDen.

**Tilvirkning (A3)**
I forbindelse med tilvirkning slippes alt pentanet ut.

**Transport fra produksjonssted til bruker (A4)**

| Type | Kapasitetsutnyttelse inkl. retur (%) | Kjøretøytype | Distanse km | Brennstoff/ Energiforbruk | Verdi (l/t) |
|---|---|---|---|---|---|
| Bil | 28 | Stor lastebil (>28 t) | 100 | 0,026 l/tkm | 2,6 |

**Byggefase (A5)**
Installering av lavlambda EPS 80 isolasjon krever så godt som ingen bruk av materialer eller energi. For byggefasen er det derfor bare inkludert transport og behandling av brukt produktemballasje. Ingen gevinster ved gjenvinning er inkludert her, da dette tilfaller neste produktlivsløp

**Bruksfase (B1-B7)**
Det er antatt at isolasjonsmaterialet ikke vil kreve noen form for vedlikehold eller utskifting i løpet av byggets tekniske levetid på 60 år. Det er derfor ikke regnet med noe material- eller energibruk, eller noen utslipp i denne fasen. Teknisk levetid for EPS er undersøkt i forbindelse med veifyllinger, hvor det er fastslått at EPS ikke mister noen tekniske egenskaper i løpet av 100 år (Frydenlund og Aabøe, 2001).

**Sluttfase (C1-C4)**
Det er antatt at det ikke brukes materialer eller energi for å demontere isolasjonsproduktet. Sluttfasen inneholder dermed bare transport av brukt isolasjon til avfallshåndteringssted. Deponering og forbrenning er antatt å finne sted på avfallshåndteringssted, mens resirkulering krever 1000 km transport til resirkuleringssted i Europa (inkludert i C3).

**Sluttfase (C1, C3, C4)**

| | Enhet | Verdi |
|---|---|---|
| Farlig avfall | kg | - |
| Blandet avfall | kg | - |
| Gjenbruk | kg | - |
| Resirkulering | kg | 0,21 |
| Energigjenvinning | kg | 0,25 |
| Til deponi | kg | 0,01 |

**Transport avfallsbehandling (C2)**
Avstand fra byggeplass til avfallshåndtering er antatt å være 10 km

| Type | Kapasitetsutnyttelse inkl. retur (%) | Kjøretøytype | Distanse km | Brennstoff/ Energiforbruk | Verdi (l/t) |
|---|---|---|---|---|---|
| Bil | | Avfallskjøretøy, diesel | 10 | 0,4 l/tkm | 4 |

**Gevinst og belastninger etter endt levetid (D)**
Resirkuleringsmengder er hentet fra nasjonal avfallstatistikk for 2012 (SSB 2014). Ved resirkulering er det beregnet 20% svinn i prosess etter at avfallet er utsortert. For energigjenvinning er det regnet med en virkningsgrad på 0,4 både for termisk og elektrisk energi. Det er beregnet at 75 % går til erstatning av elektrisitet og 25 % til erstatning av olje (Modahl og Lyng 2011)

| | Enhet | Verdi |
|---|---|---|
| Erstatning jomfruelig polystyren | kg | 0,17 |
| Erstatning elektrisitet | kWh | 0,89 |
| Erstatning olje | MJ | 1,06 |

## LCA: Resultater

Resultatene er beregnet ved hjelp av programvaren SimaPro 8.0.2 (Pré 2014). Miljøeffekter er beregnet ved hjelp av karakteriseringsmetoder som beskrevet i PCR og i EN 15804 i en egenutviklet karakteriseringsmodell basert på CML-IA.

### Systemgrenser (X = inkludert, MID = modul ikke deklarert, MIR = modul ikke relevant)

| Produktfase | | | Konstruksjon installasjon fase | | Bruksfase | | | | | | | Sluttfase | | | | Etter endt levetid |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Råmaterialer | Transport | Tilvirkning | Transport | Konstruksjon installasjon fase | Bruk | Vedlikehold | Reparasjon | Utskiftinger | Renovering | Operasjonell energibruk | Operasjonell vannbruk | Demontering | Transport | Avfallsbehandling | Avfall til sluttbehandling | Gjenbruk-gjenvinning-resirkulering-potensiale |
| A1 | A2 | A3 | A4 | A5 | B1 | B2 | B3 | B4 | B5 | B6 | B7 | C1 | C2 | C3 | C4 | D |
| X | X | X | X | X | MIR | MIR | MIR | MIR | MIR | MIR | MIR | MID | X | X | X | X |

### Miljøpåvirkning *

| Parameter | Enhet | A1-A3 | A4 | A5 | | C2 | C3 | C4 | D |
|---|---|---|---|---|---|---|---|---|---|
| GWP | kg CO2 -ekv | 2,2 | 5,3E-03 | 0,075 | | 0,006 | 0,93 | 1,8E-03 | -0,79 |
| ODP | kg CFC11-ekv | 5,5E-08 | 8,7E-10 | 8,7E-11 | | 9,7E-10 | 6,6E-09 | 4,6E-11 | -2,4E-08 |
| POCP | kg C2H4 -ekv | 0,007 | 4,9E-06 | 2,3E-06 | | 1,5E-05 | 4,8E-05 | 5,8E-07 | -8,3E-04 |
| AP | kg SO2 -ekv | 7,9E-03 | 1,7E-05 | 7,3E-06 | | 2,9E-05 | 1,9E-04 | 1,1E-06 | -3,0E-03 |
| EP | kg PO43--ekv | 1,9E-03 | 4,5E-06 | 1,3E-05 | | 6,5E-06 | 1,9E-04 | 8,3E-05 | -2,7E-04 |
| ADPM | kg Sb-ekv | 1,2E-06 | 2,9E-08 | 1,2E-09 | | 6,1E-09 | 2,1E-07 | 4,3E-10 | -1,7E-07 |
| ADPE | MJ | 46 | 0,086 | 9,7E-03 | | 0,09 | 0,66 | 4,4E-03 | -19 |

Det er noe variasjon i energi- og materialbruk hos de ulike produsentene, både med tanke på typer og mengder. Det gir også litt ulike resultater og størst forskjell mellom de ulike produsentene finnes i kategorien EP hvor det er rett i overkant av 20 % forskjell mellom største og minste resultat.

GWP Globalt oppvarmingspotensial; ODP Potensial for nedbryting av stratosfærisk ozon; POCP Potensial for fotokjemisk oksidantdanning; AP Forsurningspotensial for kilder på land og vann; EP Overgjødslingspotensial; ADPM Abiotisk uttømmingspotensial for ikke-fossile ressurser; ADPE Abiotisk uttømmingspotensial for fossile ressurser

### Ressursbruk

| Parameter | Unit | A1-A3 | A4 | A5 | | C2 | C3 | C4 | D |
|---|---|---|---|---|---|---|---|---|---|
| RPEE | MJ | 0,73 | 9,5E-04 | 1,3E-04 | | 4,4E-04 | 8,2E-03 | 6,9E-05 | -3,7 |
| RPEM | MJ | 0,259 | 1,0E-04 | 1,9E-05 | | 4,4E-05 | 9,0E-04 | 5,4E-06 | -0,025 |
| TPE | MJ | 0,99 | 1,1E-03 | 1,5E-04 | | 4,8E-04 | 9,1E-03 | 7,5E-05 | -3,7 |
| NRPE | MJ | 24 | 0,067 | 5,4E-03 | | 7,8E-02 | 5,0E-01 | 3,5E-03 | -10 |
| NRPM | MJ | 22 | - | - | | - | - | - | - |
| TRPE | MJ | 46 | 0,067 | 5,4E-03 | | 7,8E-02 | 5,0E-01 | 3,5E-03 | -10 |
| SM | kg | - | - | - | | - | - | - | - |
| RSF | MJ | - | - | - | | - | - | - | - |
| NRSF | MJ | - | - | - | | - | - | - | - |
| W | $m^3$ | 1,34 | 4,6E-05 | 3,5E-05 | | 2,5E-05 | 6,6E-04 | 5,4E-06 | -0,034 |

RPEE Fornybar primærenergi brukt som energibærer; RPEM Fornybar primærenergi brukt som råmateriale; TPE Total bruk av fornybar primærenergi; NRPE Ikke fornybar primærenergi brukt som energibærer; NRPM Ikke fornybar primærenergi brukt som råmateriale; TRPE Total bruk av ikke fornybar primærenergi; SM Bruk av sekundære materialer; RSF Bruk av fornybart sekundære brensel; NRSF Bruk av ikke fornybart sekundære brensel; W Netto bruk av ferskvann

## Livsløpets slutt - Avfall

| Parameter | Unit | A1-A3 | A4 | A5 | | C2 | C3 | C4 | D |
|---|---|---|---|---|---|---|---|---|---|
| HW | kg | 1,0E-05 | 9,4E-08 | 2,6E-08 | | 3,4E-08 | 9,6E-07 | 2,2E-09 | -1,4E-06 |
| NHW | kg | 0,29 | 9,5E-04 | 9,6E-04 | | 1,4E-04 | 0,016 | 0,015 | -0,047 |
| RW | kg | 1,1E-08 | 2,2E-11 | 3,3E-12 | | 1,2E-11 | 2,0E-10 | 1,6E-12 | -6,5E-10 |

HW Avhendet farlig avfall; NHW Avhendet ikke-farlig avfall; RW Avhendet radioaktivt avfall

## Livsløpets slutt - Utgangsfaktorer

| Parameter | Unit | A1-A3 | A4 | A5 | | C2 | C3 | C4 | D |
|---|---|---|---|---|---|---|---|---|---|
| CR | kg | - | - | - | | - | - | - | - |
| MR | kg | 1,8E-03 | - | 1,1E-02 | | - | 0,22 | - | -0,22 |
| MER | kg | 3,7E-03 | - | 1,3E-02 | | - | 0,26 | - | -0,26 |
| EEE | MJ | - | - | - | | - | - | - | -1,1 |
| ETE | MJ | - | - | - | | - | - | - | -3,3 |

CR-komponenter for gjenbruk, MR Materialer for resirkulering, MER Materialer for energigjenvinning, EEE Eksportert elektrisk energi; ETE Eksportert termisk energi

Lese eksempel: 9,0 E-03 = $9,0*10^{-3}$ = 0,009

## Norske tilleggskrav

**Elektrisitet**

Data for elektrisitet er laget fra statistikk publisert av ENTSO-E (2012), koblet til livsløpsinventardata for ulike energiteknologier i Ecoinvent 2.2. Utgangspunktet er nasjonal produksjonsmiks (i henhold til PCR) med fratrekk for eksport og tillegg for import. Alle nasjonale regnskap er lagt inn, slik at utvekslinger mellom ulike land er fanget opp. Infrastruktur er inkludert i alle datasett. Det er gjennomført følsomhetsanalyser for å se på betydningen av valg av strømmiks.

Klimagassutslipp: 0,0073 kg $CO_2$ - ekv/MJ

**Farlige stoffer**

Produktet er ikke tilført stoffer fra REACH kandidatliste (oppdatert 15.06.2015) eller stoffer på den norske Prioritetslisten (per 15.01.2015) eller stoffer som fører til at produktet blir klassifisert som farlig avfall. Det kjemiske innholdet i produktet er i samsvar med den norske produktforskriften. Fravær av farlige stoffer er deklarert av produserende bedrifter.

**Transport**

Transport fra produksjonssted til sentrallager i Norge er: 100 km

**Inneklima**

Produktet tilfredstiller kravene til lavt forurensende (M1) etter EN15251:2007 appendix E.
Det er ikke gjennomført tester på produktet med henblikk på inneklima. Fravær av stoffer som påvirker inneklima er deklarert av produserende bedrifter.

**Klimadeklarasjon**

Det er ikke utarbeidet klimadeklarasjon for produktet

## Bibliografi


| | |
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| NS-EN ISO 14044:2006 | *Miljøstyring - Livsløpsvurderinger - Krav og retningslinjer* |
| NS-EN 15804:2012 | *Bærekraftig byggverk - Miljødeklarasjoner - Grunnleggende produktkategoriregler for byggevarer* |
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| Frydenlund, Tor-Erik og Aabøe, Roald (2001) | *Long term performance and durability of EPS as a lightweight filling material* , 3rd International EPS geofoam conference |
| SSB (2014) | *Avfallsregnskapet 2012,Oslo: SSB* |



| | | | |
|---|---|---|---|
| epd-norge.no The Norwegian EPD Foundation | **Program operatør og utgiver**<br>Næringslivets Stiftelse for Miljødeklarasjoner<br>Postboks 5250 Majorstuen, 0303 Oslo<br>Norge | Tlf:<br><br>e-post:<br>web | +47 23 08 80 00<br><br>post@epd-norge.no<br>www.epd-norge.no |
| EPS-gruppen | **Eier av deklarasjonen**<br>EPS-gruppen<br>Postboks 7072 Majorstuen<br>0306 Oslo | Tlf:<br>Fax<br>e-post:<br>web | +47 23 08 88 00<br>+47 23 08 88 98<br>hekroger@hotmail.com<br>www.eps-gruppen.no |
| COWI | **Forfatter av Livsløpsrapporten**<br><br>COWI AS | Tlf:<br>Fax<br><br>e-post: | +47 45 48 61 22<br>+47 22 72 29 00<br><br>msme@cowi.no |

ver1 2015

epd-norge.no
The Norwegian EPD Foundation

# ENVIRONMENTAL PRODUCT DECLARATION

in accordance with ISO 14025, ISO 21930 and EN 15804

| | |
|---|---|
| Owner of the declaration: | Brødr. Sunde as |
| Program operator: | The Norwegian EPD Foundation |
| Publisher: | The Norwegian EPD Foundation |
| Declaration number: | NEPD-396-274-EN |
| Issue date: | 12.01.2016 |
| Valid to: | 12.01.2021 (validity extended to 30.06.2021) |

## Sundolitt® XPS

Brødr. Sunde as

www.epd-norge.no

## General information

**Product:**
Sundolitt® XPS Insulation board

**Owner of the declaration:**
Brødr. Sunde as
Contact person: Frank Wilhelmsen
Phone: +47 70 17 70 00
e-mail: Frank.Wilhelmsen@sundolitt.com

**Program operator:**
Næringslivets Stiftelse for Miljødeklarasjoner
P.O.Box 5250 Majorstuen, N-0303 Oslo, Norway
phone: +47 23 08 82 92
e-mail: post@epd-norge.no

**Manufacturer:**
Brødr.Sunde as

**Declaration number:**
NEPD-396-274-EN

**Place of production:**
Skedsmo, Norway

**ECO Platform reference number:**
.

**Management system:**
Brødr. Sunde is ISO 9001-certified

**This declaration is based on Product Category Rules:**
CEN Standard EN 15804 serves as core PCR
NPCR 12 rev1, *Insulation materials,* date: 10.12.2012

**Organisation no:**
916 416 784

**Statement of liability:**
The owner of the declaration shall be liable for the underlying information and evidence. EPD Norway shall not be liable with respect to manufacturerinformation, life cycle assessment data and evidences.

**Issue date:**
12.01.2016

**Valid to:**
12.01.2021 (validity extended to 30.06.2021)

**Declared unit:**
1 m² Sundolitt® XPS insulation board, 33 mm thickness with thermal resistance R = 1 m²K/W at factory gate

**Year of study:**
2015

**Declared unit with option:**
1 m² Sundolitt® XPS insulation board, 33 mm thickness with thermal resistance R = 1 m²K/W, transported to building site, handled after end of useful life and recycled

**Comparability:**
EPD of construction products may not be comparable if they not comply with EN 15804 and seen in a building context.

**Functional unit:**

**The EPD has been worked out by:**
Martin S. Melvær and Andreas Brekke

COWI

**Verification:**
The CEN Norm EN 15804 serves as the core PCR. Independent verification of the declaration and data, according to ISO14025:2010

☐ internal ☑ external

Third party verifier:

Mie Vold, Senior researcher, Østfoldforskning
(Independent verifier approved by EPD Norway)

Approved

Håkon Hauan
Managing Director of EPD-Norway

## Product

**Product description:**

Sundolitt® XPS insulation material is made from extruded polystyrene that have high compressive strength, very low water absorption, and very good insulating properties.

Areas of use for Sundolitt® XPS is insulating and frost protection for buildings and construction, as well as the technical installations. This includes protection against frost for buildings of all kinds, road, railway, sports facilities, etc.

The lifetime of the Sundolitt® XPS is long and the properties will be kept intact. The material meets the strict requirements for insulation and comfort, moisture absorption and insulating properties which are set for insulating and frost protection.

Sundolitt® XPS is produced at Skedsmo plant by Brødr. Sunde as.

**Product specification:**

Material input per functional unit

| Materials | kg | % |
|---|---|---|
| Polystyrene | 0,985 | 93,3 % |
| Blowing agent 1 | 0,018 | 1,7 % |
| Blowing agent 2 ($CO_2$) | 0,046 | 4,4 % |
| Cell regulating agents | 0,005 | 0,5 % |
| Colour | 0,002 | 0,2 % |

| | Thickness [mm] | | |
|---|---|---|---|
| **Compressive strength [kPa]** | **33** | **50** | **100** |
| **250** | 0,9 | 1,4 | 2,8 |
| **300** | 1,0 | 1,5 | 3,0 |
| **400** | 1,1 | 1,7 | 3,3 |
| **500** | 1,2 | 1,8 | 3,5 |
| **700** | 1,4 | 2,1 | 4,2 |

**Technical data:**

Sundolitt® XPS is CE-marked according to EN 13164. For technical data, look at www.sundolitt.no/sundolitt/produkter/sundolitt-xps-standard

The table at the bottom of the page specifies scaling factors for products with other thicknesses and other compressive strength values than what is calculated in the base scenario. The scaling factors may be used to calculate input quantities and environmental impacts for other compressive strengths of Sundolitt® XPS. For other thicknesses than 33 mm and other compressive strength values than 300 kPa the thermal resistance will change from 1 $m^2$ K/W. Values for conductivity (associated with resistance) and compressive strength comply with NS-EN 13164 and NS-EN 826, in accordance with CE requirements.

**Market:**

Northern Europe

**Reference service life, product:**

Minimum 50 years. It is assumed that the product will not be renewed during the theoretical 60 year life time of a building, as it is built into the construction and will not need renewal.

**Reference service life, building:**

60 years

## LCA: Calculation rules

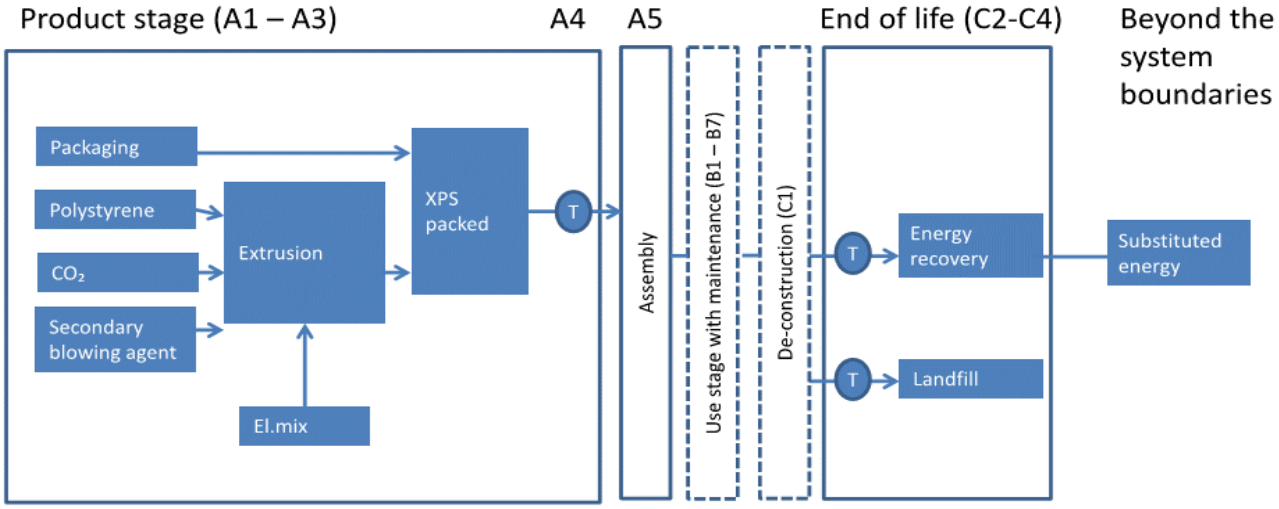
**Declared unit:**

1 m² Sundolitt® XPS insulation board of thickness 33 mm with thermal resistance R = 1 m²K/W, transported to building site.

The declared unit is found by calculating the amount of product needed to achieve the thermal resistance. In addition to the declared unit, a declared unit with options is evaluated, where further life cycle phases are included. These life cycle phases include transport to building site, assembly, waste collection, sorting, waste treatment, and benefits.

**System boundary:**

Modules A1-A5, C2-C4 and D are declared, while modules B1-B7 and C1 are not declared, as it is not expected that the product will be modified during the service life. A flowsheet for the included processes is illustrated below. Stapled lines denote processes that are not included, while all solid lines denote processes within the system boundaries.




Flowsheet showing the life cycle of Sundolitt® XPS insulation. The figure shows the most important material and energy flows, which life cycle stages that are included, and which that are left out.

**Data quality:**

All material and energy quantities for the production process and all transport distances in modules A1-A3 are based on specific data for 2014 and are of good quality. Plastic feedstock and other chemical inputs are based on generic data. The bulk of this data comes from the Ecoinvent 2.2 database and is subject to quality assurance. Data for plastic feedstock is manipulated in order to separate oil used as an energy source and oil used as material feedstock. No background data is older than 10 years and the majority of data is from the last 5 years.

**Cut-off criteria:**

All major raw materials and all the essential energy is included. The production process for raw materials and energy flows that are included with very small amounts (<1%) are not included. This cut-off rule does not apply for hazardous materials and substances.

**Allocation:**

The allocation is made in accordance with the provisions of EN 15804. Incoming energy and water and waste production in-house is allocated equally among all products through mass allocation. Effects of primary production of recycled materials allocated to the main product in which the material was used. The recycling process and transportation of the material is allocated to this analysis.

## LCA: Scenarios and additional technical information

The following information describe the scenarios in the different modules of the EPD.

The tables below specify attributes for other life cycle stages than "cradle to factory gate". The transport distance from factory gate to building site is set to 100 km. This distance is used as a basis for unknown distances in the Ecoinvent database. Waste scenarios are made with conservative estimates when it comes to transport distances and benefits that may be achieved from replacing material and energy.

**Transport from production place to user (A4)**

| Type | Capacity utilisation (incl. return) % | Type of vehicle | Distance km | Fuel/Energy consumption | Value (l/t) |
|---|---|---|---|---|---|
| Truck | 28 | Large lorry (>28 t) | 100 | 0,03 l/tkm | 2,6 |

**Assembly (A5)**

Installation of Sundolitt® requires practically no use of materials or energy. For this reason only transport and waste treatment of used product packaging is included. No benefits from recycling are included here, as such benefits are allocated to the next product life cycle.

**Use phase (B1-B7)**

It is assumed that the insulation material requires no maintenance or replacement during the technical 60 year life time of the building.

**End of Life (C1-C4)**

It is assumed that no materials or energy is used for de-constructing the insulation product. For this reason the end of life stage only includes transport of used insulation to the waste treatment location. Norwegian conditions are used for the whole market area. Land filling and incineration is assumed to take place at the waste treatment location, while recycling requires a 1000 km transport to a recycling plant in Europe (included in C3).

**End of life (C1, C3, C4)**

| | Enhet | Verdi |
|---|---|---|
| Hazardous waste | kg | - |
| Mixed waste | kg | - |
| Reuse | kg | - |
| Recycling | kg | 0,44 |
| Energy recovery | kg | 0,53 |
| Landfill | kg | 0,03 |

**Transport waste treatment (C2)**

| Type | Capacity utilisation (incl. return) % | Type of vehicle | Distance km | Fuel/Energy | Value |
|---|---|---|---|---|---|
| Truck | | Waste truck, diesel | 10 | 0,4 l/tkm | 4 |

**Benefits and loads beyond the system boundaries (D)**

Recycling values are based on the national waste accounts for 2012 (SSB 2014). During recycling and after the waste is sorted, a 20 % process material loss is assumed. For energy recovery an efficiency of 0,4 is assumed both for thermal and electrical energy. It has been calculated that 75 % replaces electricity and that 25 % replaces oil (Modahl og Lyng 2011).

| | Unit | Value |
|---|---|---|
| Replacement of virgin polystyrene | kg | 0,35 |
| Replacement of electricity | kWh | 1,84 |
| Replacement of oil | MJ | 2,21 |

## LCA: Results

The results have been calculated using the software SimaPro 8.0.2 (Pré 2014). Environmental impacts have been calculated using characterization methods as described in PCR and in EN 15804, using a self-developed characterization model based on CML-IA.

### System boundaries (X=included, MND= module not declared, MNR=module not relevant)

| Product stage | | | Assemby stage | | Use stage | | | | | | | End of life stage | | | | Beyond the system boundaries |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Raw materials | Transport | Manufacturing | Transport | Assembly | Use | Maintenance | Repair | Replacement | Refurbishment | Operational energy use | Operational water use | De-construction demolition | Transport | Waste processing | Disposal | Reuse-Recovery-Recycling-potential |
| A1 | A2 | A3 | A4 | A5 | B1 | B2 | B3 | B4 | B5 | B6 | B7 | C1 | C2 | C3 | C4 | D |
| X | X | X | X | X | MIR | MIR | MIR | MIR | MIR | MIR | MIR | MID | X | X | X | X |

### Environmental impact

| Parameter | Unit | A1-A3 | A4 | A5 | | C2 | C3 | C4 | D |
|---|---|---|---|---|---|---|---|---|---|
| GWP | kg $CO_2$-eqv | 3,7 | 1,1E-02 | 9,3E-02 | | 1,4E-02 | 1,7 | 3,7E-03 | -1,3 |
| ODP | kg CFC11-eqv | 2,5E-08 | 1,9E-09 | 1,1E-10 | | 2,1E-09 | 1,2E-08 | 9,8E-11 | -3,1E-08 |
| POCP | kg $C_2H_4$-eqv | 3,8E-03 | 6,6E-03 | 2,8E-06 | | 3,1E-05 | 9,1E-05 | 1,2E-06 | -1,1E-03 |
| AP | kg $SO_2$-eqv | 1,2E-02 | 3,5E-05 | 9,0E-06 | | 6,1E-05 | 3,5E-04 | 2,3E-06 | -4,6E-03 |
| EP | kg $PO_4^{3-}$-eqv | 1,3E-03 | 9,6E-06 | 1,7E-05 | | 1,4E-05 | 3,5E-04 | 1,8E-04 | -4,0E-04 |
| ADPM | kg Sb-eqv | 1,3E-06 | 6,3E-08 | 1,5E-09 | | 1,3E-08 | 4,0E-07 | 9,2E-10 | -3,6E-07 |
| ADPE | MJ | 83 | 0,17 | 1,1E-02 | | 0,18 | 1,2E+00 | 8,8E-03 | -32 |

GWP Global warming potential; ODP Depletion potential of the stratospheric ozone layer; POCP Formation potential of tropospheric photochemical oxidants; AP Acidification potential of land and water; EP Eutrophication potential; ADPM Abiotic depletion potential for non fossil resources; ADPE Abiotic depletion potential for fossil resources

### Resource use

| Parameter | Unit | A1-A3 | A4 | A5 | | C2 | C3 | C4 | D |
|---|---|---|---|---|---|---|---|---|---|
| RPEE | MJ | 3,9 | 2,0E-03 | 1,6E-04 | | 9,4E-04 | 1,5E-02 | 1,5E-04 | -6,9 |
| RPEM | MJ | 5,9E-02 | 2,2E-04 | 2,4E-05 | | 9,5E-05 | 1,7E-03 | 1,1E-05 | -4,7E-02 |
| TPE | MJ | 4,0 | 2,2E-03 | 1,8E-04 | | 1,0E-03 | 1,7E-02 | 1,6E-04 | -6,9 |
| NRPE | MJ | 42 | 0,17 | 1,1E-02 | | 1,8E-01 | 1,16 | 8,8E-03 | -17 |
| NRPM | MJ | 43 | - | - | | - | - | - | -16 |
| TRPE | MJ | 85 | 0,17 | 1,1E-02 | | 0,18 | 1,16 | 8,8E-03 | -33 |
| SM | kg | - | - | - | | - | - | - | - |
| RSF | MJ | - | - | - | | - | - | - | - |
| NRSF | MJ | - | - | - | | - | - | - | - |
| W | $m^3$ | 1,2E-02 | 5,3E-05 | 3,6E-05 | | 2,5E-05 | 8,9E-04 | 9,3E-06 | -4,1E-03 |

RPEE Renewable primary energy resources used as energy carrier; RPEM Renewable primary energy resources used as raw materials; TPE Total use of renewable primary energy resources; NRPE Non renewable primary energy resources used as energy carrier; NRPM Non renewable primary energy resources used as materials; TRPE Total use of non renewable primary energy resources; SM Use of secondary materials; RSF Use of renewable secondary fuels; NRSF Use of non renewable secondary fuels; W Use of net fresh water

| End of life - Waste | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Parameter** | **Unit** | **A1- A3** | **A4** | **A5** | | **C2** | **C3** | **C4** | **D** |
| HW | kg | 1,5E-05 | 2,0E-07 | 3,2E-08 | | 7,3E-08 | 1,8E-06 | 4,6E-09 | -2,5E-06 |
| NHW | kg | 0,10 | 2,0E-03 | 1,2E-03 | | 3,0E-04 | 0,030 | 0,032 | -0,084 |
| RW | kg | 1,9E-09 | 4,7E-11 | 4,1E-12 | | 2,5E-11 | 3,7E-10 | 3,4E-12 | -1,1E-09 |

HW Hazardous waste disposed; NHW Non hazardous waste disposed; RW Radioactive waste disposed

| End of life - Output flow | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Parameter** | **Unit** | **A1- A3** | **A4** | **A5** | | **C2** | **C3** | **C4** | **D** |
| CR | kg | - | - | - | | - | - | - | - |
| MR | kg | - | - | 1,4E-02 | | - | 0,44 | - | 0,44 |
| MER | kg | - | - | 1,6E-02 | | - | 0,53 | - | 0,53 |
| EEE | MJ | - | - | - | | - | - | - | 6,6 |
| ETE | MJ | - | - | - | | - | - | - | 2,2 |

CR Components for reuse; MR Materials for recycling; MER Materials for energy recovery; EEE Exported electric energy; ETE Exported thermal energy

## Additional Norwegian requirements

**Greenhous gas emission from the use of electricity**
Electricity data is derived from statistics published by ENTSO-E (2012), coupled with life cycle inventory data for different energy technologies in Ecoinvent 2.2. The basis is the national production mix (in compliance with PCR) with subtractions for exports and additions for imports. All national accounts are included, in order to include the effects of exchanges between countries. Infrastructure is included in all data sets. Sensitivity analysis has been undertaken in order to evaluate how the choice of electricity mix affects results.

Greenhouse gas emissions: 0,0073 kg $CO_2$-ekv/MJ

**Hazardous substances**
The product does not contain substances on the REACH Candidate list (updated 15.06.2015), substances on the Norwegian Priority list of hazardous substances ("Prioritetslisten", 10.06.2015), or substances that lead to the product being classified as hazardous waste. The chemical content of the product is in accordance with the Norwegian law on products regulation ("Produktforskriften"). The absence of hazardous substances is declared by Brødr. Sunde as.

**Transport**
Transport from the factory gate to construction site in Norway: 100 km

**Indoor environment**
The product has no influence on the indoor environment.

**Carbon footprint**
Carbon footprint has not been worked out for the product.

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|---|---|---|---|
| epd-norge.no The Norwegian EPD Foundation | **Program operator**<br>The Norwegian EPD Foundation<br>Post Box 5250 Majorstuen, 0303 Oslo<br>Norway | Phone:<br><br>e-mail:<br>web | +47 23 08 82 92<br><br>post@epd-norge.no<br>www.epd-norge.no |
| epd-norge.no The Norwegian EPD Foundation | **Publisher**<br>The Norwegian EPD Foundation<br>Post Box 5250 Majorstuen, 0303 Oslo<br>Norway | Phone:<br><br>e-mail:<br>web | +47 23 08 82 92<br><br>post@epd-norge.no<br>www.epd-norge.no |
| Sundolitt | **Owner of the declaration**<br>Brødr. Sunde as<br>PB 8115 Spjelkavik, 6022 Ålesund<br>Norge | Phone:<br><br>e-mail:<br>web | +47 70 17 70 00<br><br>norway@sundolitt.com<br>www.sundolitt.no |
| COWI | **Author of the Life Cycle Assessment**<br>COWI AS<br>PB 6412 Etterstad, 0605 Oslo<br>Norge | Phone:<br>Fax<br>e-mail:<br>web | +47 45 22 21 49<br>+47 22 72 29 00<br>msme@cowi.no<br>www.cowi.no |