



ENVIRONMENTAL PRODUCT DECLARATION

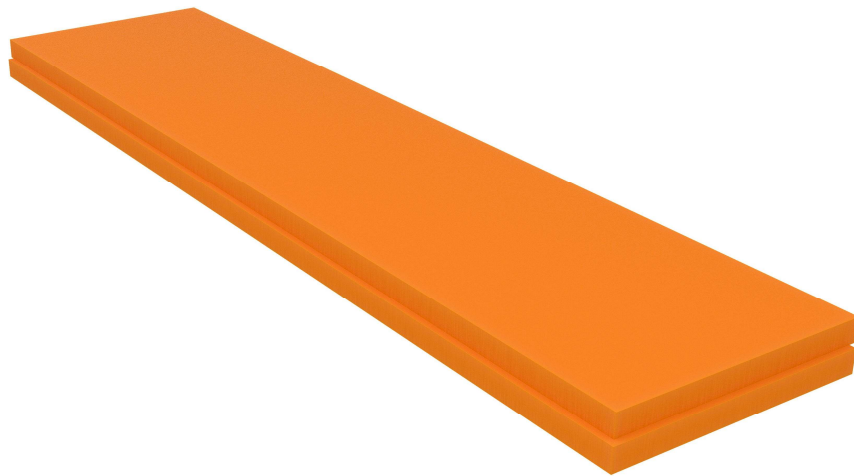
in accordance with ISO 14025, ISO 21930 and EN 15804

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Program operator:	The Norwegian EPD Foundation
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Valid to:	27.01.2027

Sundolitt XPS insulation board

Brødr. Sunde AS

www.epd-norge.no



General information

Product

Sundolitt XPS insulation board

Program operator

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Declaration number

NEPD-3336-1961-EN

ECO Platform reference number

Product Category Rules

EN 15804:2012 + A1:2013 serves as core PCR
NPCR 012:2018 Part B for Thermal insulation products

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 manufacturer information, life cycle assessment data and evidences.

Declared unit

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Declared unit with options (cradle-to-gate: A1-A3, A4, C1-C4, D)

1 m² XPS insulation board with 33 mm thickness at R=1 K m²/W, transportation to site, waste handling and recovery.

Functional unit

-

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:

Jane Anderson

Jane Anderson, ConstructionLCA Ltd
Independent verifier approved by EPD Norway

Owner of the declaration

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Manufacturer

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Place of production

Norway

Management system

NS-EN ISO 9001
NS-EN ISO 14001

Organisation number

916,416,784

Issue date

27.01.2022

Valid to

27.01.2027

Year of study

2021

Comparability

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

The EPD has been worked out by

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Approved

Håkon Hauan

Håkon Hauan
Managing Director of EPD-Norway

Product

Product variation and calculation of averages

The insulation board is provided in several dimensions and thicknesses. Please use the conversion table below for other sizes than the declared unit.

The declared product is manufactured at a single production at Skedsmo. Specific data was collected for this site. No averaging has therefore been performed.

Product description

Extruded polystyrene (XPS) is a common material used for thermal insulation of buildings, and constructions. This includes protection against frost blistering and frost penetration for buildings, road, railway etc. It is a polymer foam, consisting of air-filled polystyrene cells. As most of the material is air, XPS provides good insulating properties at a low weight. Other characteristics of the material include low moisture absorption, long service life and high compressive strength.

XPS is manufactured through an extruder where polystyrene (GPPS and EPS) granulates are mixed with additives and foaming agents to produce the foam mass. The foam mass is pressed out flat to a block which is cut in desired dimensions. Some of the remaining blowing agents are aired out before the product leaves the factory gate.

The amount of raw material going into the product determines the density of the block. This LCA is based on pressure class 300, which provides a density at approximately 33 kg/m³ of insulation.

Weight per declared unit is approximately 1,089 kg given a density of 33 kg/cubic meter with a thickness of 33 mm.

Technical data

CE marking	XPS insulation boards are CE certified according to NS-EN 13164
Typical size	600 x 1200 and 600 x 2400 mm
Thickness	30, 50, 70, 80 ,100, 120, 150mm
Fire class	Euroclass F

Conversion factors

XPS insulation is provided in different densities and thicknesses depending on the intended use. The relationships between density and weight, and between weight and environmental impacts are linear. Results for various densities and thicknesses can be converted based on the following factors (factor * environmental impact):

Pressure [kPa]	Thickness [mm]						
	33	50	70	80	100	120	150
200	0.9	1.4	2.0	2.3	2.8	3.4	4.3
250	1.0	1.5	2.1	2.4	3.0	3.6	4.5
300	1.0	1.5	2.1	2.4	3.0	3.6	4.5
400	1.1	1.7	2.3	2.6	3.3	4.0	5.0
500	1.2	1.7	2.4	2.8	3.5	4.2	5.2
700	1.3	2.0	2.8	3.2	4.0	4.8	6.1

Product specification

Material use per declared unit	kg	%
Polystyrene	1.030	94.6 %
Foam agent 1 (CO ₂)	0.048	4.4 %
Foam agent 2	0.004	0.4 %
Cell regulating agents	0.005	0.4 %
Colour	0.002	0.2 %

Market

Norway

Reference service life, product

60 years

Reference service life, building

60 years

LCA: Calculation rules

Declared unit

1 m² XPS insulation board with 33 mm thickness at R=1 K m²/W, transportation to site, waste handling and recovery.

System boundary

Modules are declared according to NPCR 012 Part B. Declared units include A1-A3, A4, C1-C4, and D and are shown in *Figure 1*. Gray boxes denote modules not declared.

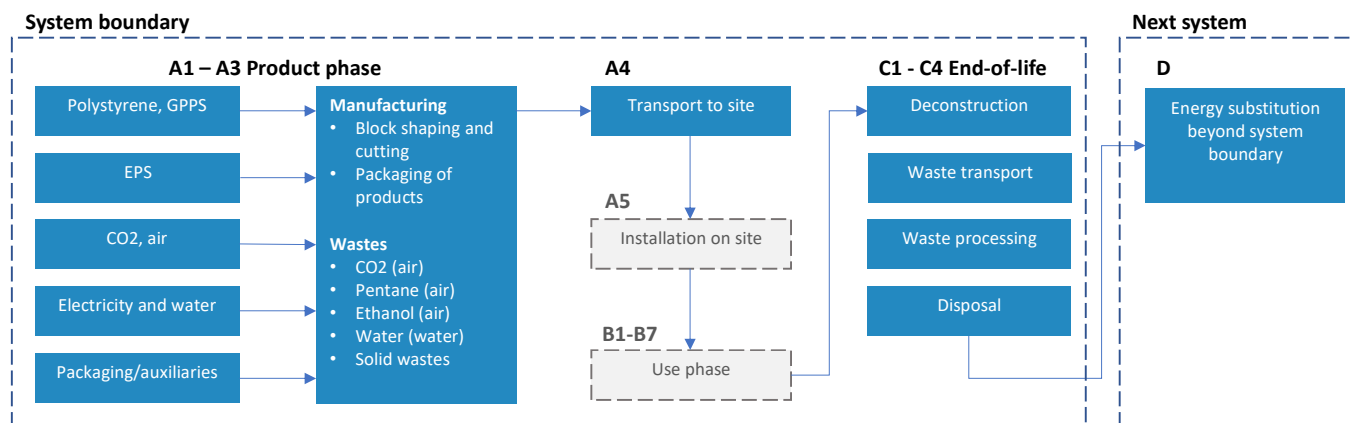


Figure 1: System boundaries

Data quality

General requirements and guidelines concerning the use of generic and specific data and the quality of those are as described in EN 15804: 2012+A1:2013, clause 6.3.6 and 6.3.7., including ISO14044:2006, 4.2.3.6. The data is representative according to temporal, geographical and technological requirements. Databases used have been ecoinvent v3.7 (2021). Upstream data for polystyrene from Plastics Europe (2010). Calculations have been carried out using Simapro v9.

Temporal:

Data for use in module A3 is supplied by the EPD owner and consists of recorded and calculated amounts of specific material and energy consumption. Specific data has been collected for 2021. Generic data has been created or updated within the last 10 years. Any exceptions are documented in the LCA-report.

Geographical:

The product included in this EPD is manufactured in Norway and is representative for the Norwegian market. Best available approximations are used where Norwegian-specific data are unavailable.

Technological:

Data represents technology in use.

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. Waste treatment of packaging materials used during transportation of the product is allocated to module A3 as module A5 is not

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% energy, mass, impact) are not included. This cut-off rule does not apply for hazardous materials and substances.

Benefits and loads beyond the system boundary (Module D)

The scenario for Module D follows the conservative scenario provided in NPCR 012 Part B. XPS insulation recovered at the end of life is incinerated with energy recovery and substitutes Norwegian electricity and district heat mixes.

LCA: Scenarios and additional technical information

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

Transport from production place to user (A4)

Type	Capacity utilisation (incl. return) %	Type of vehicle	Distance km	Fuel/Energy consumption	Value (l/t)
Truck	10.2 %	100 m ³ jumbo trailer	100	0.19 l/tkm	19.3

The scenario for transportation to building site follows the default scenario provided in NPCR 012 Part B. XPS is a bulky product, resulting in a low capacity utilization (10.2 %).

End of Life (C1, C3, C4)

	Unit	Value
Hazardous waste disposed	kg	
Collected as mixed construction waste	kg	
Reuse	kg	
Recycling	kg	
Energy recovery (C3)	kg	1.089
To landfill (C4)	kg	0.004

Benefits and loads beyond system boundaries (D)

	Unit	Value
Substitution of electricity	MJ	2.86
Substitution of district heating	MJ	23.32

Due to a lack of reliable data for the removal of XPS insulation from buildings, C1 is assumed to not require energy or material inputs. The scenario for end-of-life treatment of collected XPS follows the default conservative scenario provided in NPCR 012 Part B, which is municipal incineration with energy recovery (C3). Ashes and solids after incineration is landfilled (C4). Recovered energy from C3 is assumed to substitute electricity and district heating (D).

Transport to waste processing (C2)

Type	Capacity utilisation (incl. return) %	Type of vehicle	Distance km	Fuel/Energy consumption	Value (l/t)
Truck	9.5%	90 m ³ box trailer	83	0.19 l/tkm	15.6

The scenario for transportation to waste processing is assumed to be 83 km (Raadal et al., 2009). Insulation is assumed compressed at the waste handling facility. A standard box trailer with a 90 m³ cubic capacity is assumed.

LCA: Results

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

Product stage			Assembly 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	MND	MND	MND	MND	MND	MND	MND	MND	X	X	X	X	X

Environmental impact

Parameter	Unit	A1-A3	A4	C1	C2	C3	C4	D	
GWP	kg CO ₂ -eqv	3.70E+00	3.66E-02	0.00E+00	3.09E-02	3.46E+00	6.50E-05	-1.56E-02	
ODP	kg CFC11-eqv	1.74E-08	8.41E-09	0.00E+00	7.47E-09	2.24E-09	2.97E-11	-5.60E-10	
POCP	kg C ₂ H ₄ -eqv	1.48E-03	3.82E-06	0.00E+00	2.92E-06	3.87E-06	1.53E-08	-1.89E-06	
AP	kg SO ₂ -eqv	1.19E-02	1.02E-04	0.00E+00	6.10E-05	2.86E-04	3.93E-07	-3.79E-05	
EP	kg PO ₄ ³⁻ -eqv	8.84E-04	1.74E-05	0.00E+00	7.70E-06	9.34E-05	7.49E-08	-7.56E-06	
ADPM	kg Sb-eqv	2.34E-06	2.80E-08	0.00E+00	2.33E-08	7.59E-08	1.97E-10	-5.26E-07	
ADPE	MJ	8.65E+01	5.30E-01	0.00E+00	4.70E-01	2.69E-01	2.03E-03	-2.15E-01	

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	C1	C2	C3	C4	D	
RPEE	MJ	3.97E+00	2.90E-03	0.00E+00	2.47E-03	8.66E-03	6.35E-05	-3.10E+00	
RPEM	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
TPE	MJ	3.97E+00	2.90E-03	0.00E+00	2.47E-03	8.66E-03	6.35E-05	-3.10E+00	
NRPE	MJ	4.42E+01	5.30E-01	0.00E+00	4.70E-01	2.69E-01	2.03E-03	-2.15E-01	
NRPM	MJ	4.24E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
TRPE	MJ	8.65E+01	5.30E-01	0.00E+00	4.70E-01	2.69E-01	2.03E-03	-2.15E-01	
SM	kg	0.00E+00	0.00E+00	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	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	
W	m ³	7.07E-02	2.09E-05	0.00E+00	1.75E-05	9.91E-04	2.24E-06	-2.31E-02	

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	C1	C2	C3	C4	D	
HW	kg	3.56E-03	1.50E-05	0.00E+00	1.29E-05	3.25E-02	4.83E-06	-4.54E-05	
NHW	kg	1.17E-01	1.38E-02	0.00E+00	1.13E-02	1.83E-02	7.02E-03	-1.80E-02	
RW	kg	1.03E-05	3.76E-06	0.00E+00	3.34E-06	4.84E-07	1.36E-08	-2.11E-06	

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

End of life - Output flow

Parameter	Unit	A1-A3	A4	C1	C2	C3	C4	D	
CR	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
MR	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
MER	kg	1.32E-03	0.00E+00	0.00E+00	0.00E+00	1.09E+00	0.00E+00	0.00E+00	
EEE	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.86E+00	0.00E+00	0.00E+00	
ETE	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.33E+01	0.00E+00	0.00E+00	

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

Reading example: $9,0 \text{ E-03} = 9,0 \cdot 10^{-3} = 0,009$

Additional Norwegian requirements

Greenhouse gas emission from the use of electricity in the manufacturing phase

Norwegian market mix, medium voltage (production of transmission lines, in addition to direct emissions and losses in grid) of applied electricity for the manufacturing process (A3).

Data source	Amount	Unit
Ecoinvent v3.7	0.0196	kg CO ₂ -eqv/kWh

Dangerous substances

- The product contains no substances given by the REACH Candidate list or the Norwegian priority list
- The product contains substances given by the REACH Candidate list or the Norwegian priority list that are less than 0,1 % by weight.
- The product contain dangerous substances, more then 0,1% by weight, given by the REACH Candidate List or the Norwegian Priority list, see table.
- The product contains no substances given by the REACH Candidate list or the Norwegian priority list. The product is classified as hazardous waste (Avfallsforsikten, Annex III), see table.

Indoor environment




No tests have been carried out on the product concerning indoor climate - Not relevant.

Carbon footprint

Carbon footprint has not been worked out for the product.

Bibliography

ISO 14025:2010	<i>Environmental labels and declarations - Type III environmental declarations - Principles and procedures</i>
ISO 14044:2006	<i>Environmental management - Life cycle assessment - Requirements and guidelines</i>
EN 15804:2012+A1:2013	<i>Sustainability of construction works - Environmental product declaration - Core rules for the product category of construction products</i>
ISO 21930:2007	<i>Sustainability in building construction - Environmental declaration of building products</i>
Bjordal, K. (2021)	<i>LCA report: sundolitt XPS insulation board, for Brødr. Sunde AS</i>
NPCR 012:2018	<i>Part B for Thermal insulation products</i>
Raadal et al. (2009)	<i>Klimaregnskap for avfallshåndtering. Fase I og II: Glassemballasje, metallemballasje, papir, papp, plastemballasje, våtorganisk avfall, treavfall og restavfall fra husholdninger. ISBN: 82-8035-073-X.</i>

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