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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:	‹NEPRD-396-274-EN
Issue date:	<12/01/2016>
Valid to:	<12/01/2021>

Sundolitt® XPS

General information

Product:
Sundolitt® XPS Insulation board

Owner of the declaration:
Brødr. Sunde as
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Program operator:
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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 manufacturers information, life cycle assessment data and declared evidence.

Issue date:
>12/01/2016

Valid to:
<12/01/2021>

Declared unit:
1 m² Sundolitt® XPS insulation board, 33 mm thickness with thermal resistance R = 1 Km²/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 Km²/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



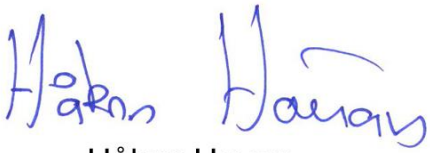
COWI

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
<Name>
(Managing Director EPD-Norway)

Product

Product description:

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

Areas of use for Sundolitt ® XPS is load-bearing and insulating protection for buildings and construction, in a wide range of applications. This includes thermal insulation for buildings of all kinds, commercial and domestic and industrial applications.

The lifetime of the Sundolitt ® XPS is declared below and the properties are not subkect to degredation during this period. The material meets the strict requirements for loa-bearing strength, moisture absorption and insulating properties which are set for insulating and moisture 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, our website www.sundolitt.co.uk has further information

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 qualities 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:

Uk & Ireland, European markets

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:

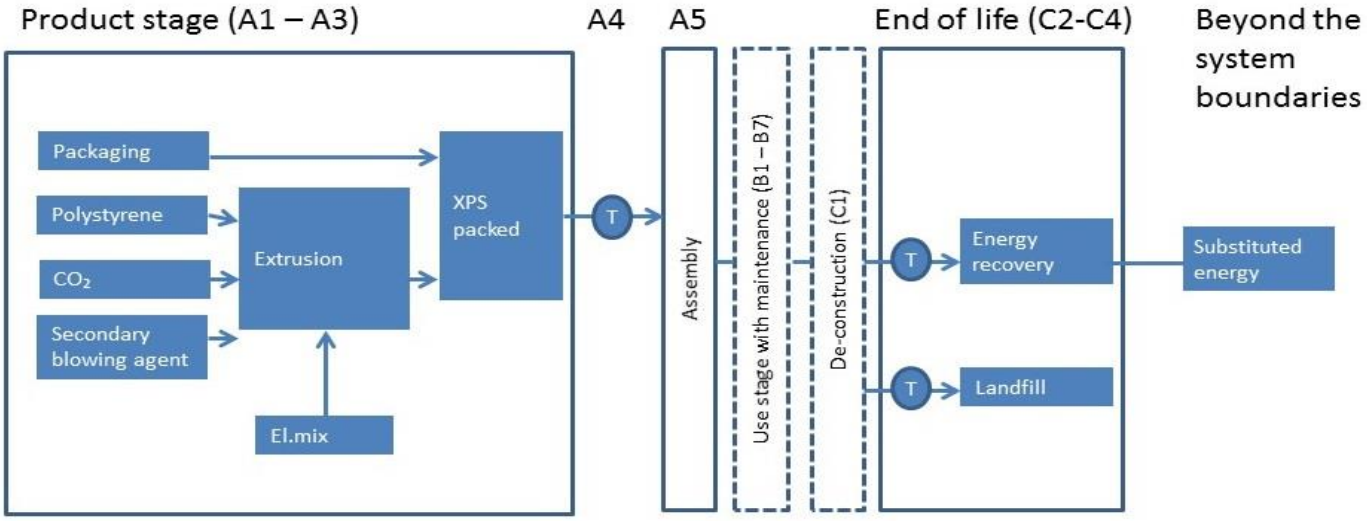
60 years

LCA: Calculation rules

Declared unit:
1 m² Sundolitt® XPS insulation board of thickness 33 mm with thermal resistance R = 1 Km²/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, were further life cycle phases are included. These life cycle phases include transport to building site, assembly, waste collection, sorting, and treatment.

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. 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	MNR	MNR	MNR	MNR	MNR	MNR	MNR	MND	X	X	X	X

Environmental impact

Parameter	Unit	A1-A3	A4	A5		C2	C3	C4	D
GWP	kg CO_2-eqv	3.7	0.0113	0.093		0.014	1.74	-1.2E+00	-1.48
ODP	kg CFC11-eqv	2.5E-08	1.9E-09	1.1E-10		2.1E-09	1.2E-08	-3.1E-09	-4.5E-08
POCP	kg C_2H_4-eqv	0.004	6.6E-03	2.8E-06		3.1E-05	9.1E-05	-1.4E-03	-1.5E-03
AP	kg SO_2-eqv	1.2E-02	3.5E-05	9.0E-06		6.1E-05	3.5E-04	-4.0E-03	-5.6E-03
EP	kg PO_4^{3-}-eqv	1.3E-03	9.6E-06	1.7E-05		1.4E-05	3.5E-04	-3.6E-04	-5.1E-04
ADPM	kg Sb-eqv	1.3E-06	6.3E-08	3.8E-10		1.3E-08	4.0E-07	2.0E-07	-3.2E-07
ADPE	MJ	77	1.8E-01	3.0E-03		0.20	1.2E+00	-3.3E+01	-35

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	-7.6E-02	-6.9
RPEM	MJ	0.06	2.2E-04	2.3E-08		9.5E-05	1.7E-03	8.9E-04	-0.047
TPE	MJ	4.0	2.2E-03	1.6E-04		1.0E-03	1.7E-02	-7.5E-02	-6.9
NRPE	MJ	37	0.14	0.01		1.7E-01	0.93	-1.6E+01	-18.6
NRPM	MJ	46	-	-		-	-	-	-
TRPE	MJ	83	0.14	0.01		0.17	0.93	-1.6E+01	-18.6
SM	kg	-	-	-		-	-	-	-
RSF	MJ	-	-	-		-	-	-	-
NRSF	MJ	-	-	-		-	-	-	-
W	m^3	0.16	9.7E-05	4.3E-05		5.4E-05	1.2E-03	-6.6E-02	-0.064

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	9.7E-07	-2.6E-06
NHW	kg	0.10	2.0E-03	1.2E-03		3.0E-04	0.030	-0.006	-0.087
RW	kg	1.9E-09	4.7E-11	4.1E-12		2.5E-11	3.7E-10	2.8E-10	-1.2E-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 meets the requirements for low emissions (M1) according to EN15251: 2007 Appendix E.

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

Bibliography

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ISO 14044:2006	*Environmental management - Life cycle assessment - Requirements and guidelines*
EN 15804:2012+A1:2013	*Sustainability of construction works - Environmental product declaration - Core rules for the product category of construction products*
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