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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:	BEWI Denmark A/S
Program operator:	The Norwegian EPD Foundation
Publisher:	The Norwegian EPD Foundation
Declaration number:	NEPD-3210-1848-EN
Registration number:	NEPD-3210-1848-EN
ECO Platform reference number:	-
Issue date:	05.11.2021
Valid to:	05.11.2026

P80

EPS Insulation boards

BEWI Denmark A/S

www.epd-norge.no

General information

Product
P80

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Declaration number
NEPD-3210-1848-EN

Place of production
Maribo, Denmark

ECO Platform reference number

Management system
-

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

Organisation number
BEWI Denmark A/S
CVR: 31867304

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
05.11.2021

Valid to
05.11.2026

Declared unit
-

Year of study
2021

Declared unit (cradle-to-gate with options: A1-A3, A4, C1-C4, D)
1 m² EPS insulation board with 31 mm thickness at R=1 m² K/W, transportation to site, waste handling and recovery.

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
Michael M. Jenssen, Asplan Viak AS

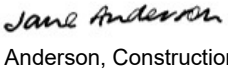
asplan viak

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, ConstructionLCA Ltd
Independent verifier approved by EPD Norway

Approved

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.

No variation between sites; single production site declared.

Product description
Expanded polystyrene (EPS) is a common material used for thermal insulation of buildings, including floors, walls and ceilings. It is a polymer foam, consisting of air-filled polystyrene cells. As 98% of the material is air, EPS provides good insulating properties at a low weight. Other characteristics of the material include low moisture absorption, long service life and high compressive strength. In grey EPS, the addition of graphite provides better insulation properties compared to white EPS. 30% recycled raw material is used in the production of the product.

EPS is manufactured through permeating polystyrene beads with pentane, allowing the beads to expand when exposed to steam. This addition of a so-called blowing agent adds 4% - 6% w/w. The expanded polystyrene (EPS) beads are then fed into a block moulding machine, where steam and pressure forms large blocks of EPS. The amount of EPS going into the mould determines the density of the block, where pressure class 80 provides a density at 80 kN/m2, which is approximately 16 kg/m3. After moulding, the remaining blowing agent, pentane, is aired out and the blocks are cut into the desired shape.

Weight per declared unit is approximately 0.608 kg given a density of 16 kg/cubic meter with a thickness of 31 mm.

Technical data

CE marking	EPS insulation boards are CE certified according to EN 13163
Typical size	600 mm x 1200 mm, 1200 mm x 1200 mm
Typical thickness	10 mm - 200 mm
Lambda	0,031 W/mK
Compressive strength	80 kN/m^2 (declared unit), see conversion factors for other values
Moisture absorption	<5 vol%
Fire class	F

Conversion factors
EPS 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):

	Thickness [mm]		
Compressive strength [kN/m^2]	**31**	**50**	**100**
60	0.8	1.3	2.6
80	1	1.6	3.2

Product specification

Raw material consumption	**kg**	**%**
Polystyrene with graphite	0.496	96%
Pentane	0.02	4%

Market
Denmark

Reference service life, product
60 years

Reference service life, building
60 years

LCA: Calculation rules

Declared unit

1 m² EPS insulation board with 31 mm thickness at R=1 m² K/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. grey boxes denote modules not declared.

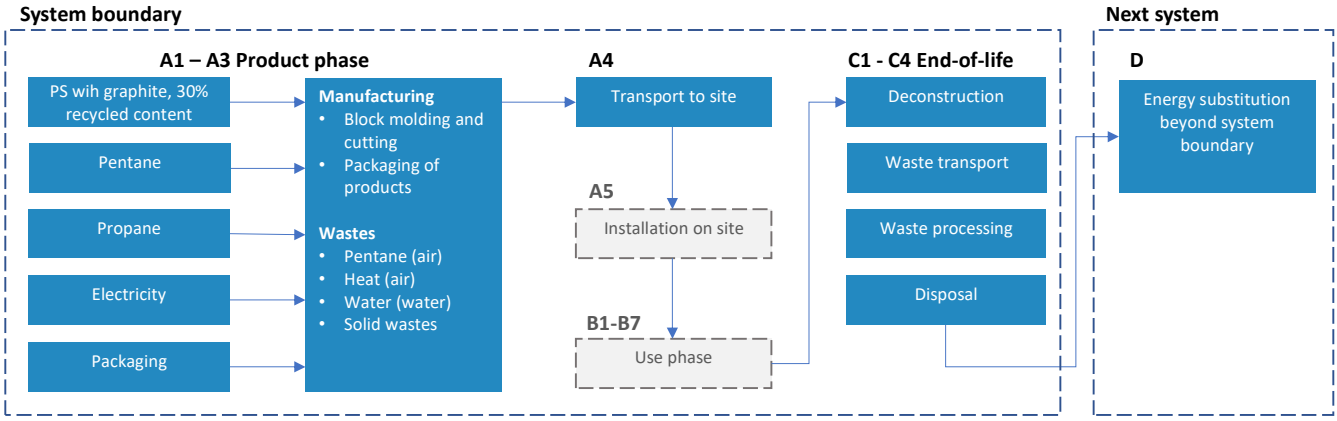


Figure 1: System boundaries

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 v3.6 (2019). Upstream data for polystyrene from Plastics Europe (2015). 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 2020. 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 Denmark and is representative for the Danish market. Best available proximations are used where Denmark-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.

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. EPS insulation recovered at the end of life is incinerated with energy recovery and substitutes Danish elecitricty 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	5.1 %	104 m^3 trailer	100	0.19 l/tkm	19.3

The scenario for transportation to building site assumes a typical distance of 100 km. EPS is a bulky product, resulting in a capasity utlization per mass at 5,1 %, with the lorry fully loaded.

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	0.496
Incineration ashes to landfill (C4)	kg	0.003

Benefits and loads beyond system boundaries (D)

	Unit	Value
Substitution of electricty	MJ	1.30
Substitution of district heating	MJ	10.62

Due to a lack of reliable data for the removal of EPS insulation from buildings, C1 is assumed to not require energy or material inputs. The scenario for end-of-life treatment of collected EPS 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 elecricity 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	4.6%	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 m^3 cubic capacity is assumed.

LCA: Results

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	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	1.32E+00	2.94E-02	0.00E+00	2.60E-02	1.57E+00	3.08E-05	-1.17E-01	
ODP	kg CFC11-eqv	8.71E-08	6.74E-09	0.00E+00	6.27E-09	1.09E-09	1.37E-11	-3.91E-09	
POCP	kg C_2H_4 -eqv	8.20E-03	3.05E-06	0.00E+00	2.43E-06	2.33E-04	2.68E-07	-1.53E-05	
AP	kg SO_2 -eqv	4.04E-03	8.05E-05	0.00E+00	4.94E-05	1.91E-04	2.41E-07	-3.41E-04	
EP	kg PO_4^{3-}-eqv	4.17E-04	1.37E-05	0.00E+00	6.08E-06	1.45E-06	1.70E-07	-6.83E-05	
ADPM	kg Sb-eqv	2.03E-06	9.53E-08	0.00E+00	8.13E-08	6.50E-08	5.07E-10	-4.88E-07	
ADPE	MJ	3.68E+01	4.20E-01	0.00E+00	3.90E-01	1.20E-01	9.31E-04	-1.54E+00	

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	9.83E-01	1.81E-03	0.00E+00	1.61E-03	4.02E-03	2.17E-05	-1.28E+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	9.83E-01	1.81E-03	0.00E+00	1.61E-03	4.02E-03	2.17E-05	-1.28E+00	
NRPE	MJ	1.54E+01	4.20E-01	0.00E+00	3.90E-01	1.20E-01	9.31E-04	-1.54E+00	
NRPM	MJ	2.15E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
TRPE	MJ	3.68E+01	4.20E-01	0.00E+00	3.90E-01	1.20E-01	9.31E-04	-1.54E+00	
SM	kg	2.62E-01	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	9.81E-03	1.25E-05	0.00E+00	1.09E-05	4.70E-04	1.02E-06	-4.92E-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	C1	C2	C3	C4	D	
HW	kg	9.04E-04	1.04E-05	0.00E+00	9.37E-06	8.32E-03	2.20E-06	-1.35E-04	
NHW	kg	9.57E-02	6.26E-03	0.00E+00	5.22E-03	2.71E-07	3.20E-03	-9.03E-03	
RW	kg	4.22E-05	3.00E-06	0.00E+00	2.78E-06	0.00E+00	6.23E-09	-4.85E-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	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.96E-01	0.00E+00	0.00E+00	
EEE	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.30E+00	0.00E+00	0.00E+00	
ETE	MJ	2.44E-01	0.00E+00	0.00E+00	0.00E+00	1.06E+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 E-03 = $9,0*10^{-3}$ = 0,009

Specific requirements of program operator

Greenhouse gas emission from the use of electricity in the manufacturing phase
Danish production mix from import, 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 v3.6	0.322	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 (Avfallsforskiften, 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 — *Environmental labels and declarations - Type III environmental declarations - Principles and procedures*

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*

ISO 21930:2007 — *Sustainability in building construction - Environmental declaration of building products*

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NPCR 012:2018 — *Part B for Thermal insulation products*

Raadal et al. (2009) — *Klimaregnskap for avfallshåndtering. Fase I og II: Glassemballasje, metallemballasje, papir, papp, plastemballasje, våtorganisk avfall, treavfall og restavfall fra husholdninger. ISBN: 82-8035-073-X.*

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