ENVIRONMENTAL PRODUCT DECLARATION

ISO 14025 ISO 21930 EN 15804

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The Norwegian EPD Foundation

Owner of the declaration	Paroc AB
Publisher	The Norwegian EPD Foundation
Declaration number	NEPD00265E
Issue date	15.09.2014
Valid to	15.09.2019 (validity extended to 31.12.2019)

Paroc Insulation, product group with density <70 kg/m³

Product

Paroc AB

Owner of the declaration

General information

Product

Paroc Insulation, product group with density <70 kg/m³

Owner of the declaration

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Manufacturer

Paroc Oy AB

Declaration number:

NEPD00265E

Place of production:

Hällekis and Hässlehom, Sweden
Pargas, Oulu and Lappeenranta, Finland

This declaration is based on Product Category Rules:

CEN Standard EN 15804 serve as core PCR
NPCR 12 rev1
LCA of PAROC stone wool produced at Scandinavian plants

Management system:

ISO 14001 and ISO 9001

Declared unit:

1 m² stone wool with a thermal resistance (R) of 1 K m² W^{-1}.

Org. No:

887294852

Declared unit with option:

-

Issue date

15.09.2014

Functional unit:

1 m² stone wool with a thermal resistance (R) of 1 K m² W^{-1} with a reference service life of 50 years.

Valid to

15.09.2019 (validity extended to 31.12.2019)

The EPD has been worked out by:

Christer Hammarberg, Paroc AB

Comparability:

The Environmental Product Declaration is in accordance with ISO 14025 and EN 15804. EPD of construction products may not be comparable if they not comply with EN 15804 and seen in a building context.

Year of study:

2014

Verification:

Independent verification of data, other environmental information and EPD has been carried out in accordance with ISO14025, 8.1.3 and 8.1.4

externally ☑ internally ☐

Martin Erlandsson, IVL
(Independent verifier approved by EPD Norway)

Approved

Dagfinn Malnes
Managing Director of EPD-Norway

Declared unit:

1 m² stone wool with a thermal resistance (R) of 1 K m² W^{-1}.

Key environmental indicators	Unit	Cradle to gate A1 - A3	Transport *****
Global warming	kg CO_2 -eqv	1,48	0,07
Energy use	MJ	16,9	-
Dangerous substances	*	-	-

* The product contains no substances from the REACH Candidate list or the Norwegian priority list

***** Transport from production site to central warehouse in Norway

Product

Product description:
Stone wool is made from volcanic rock, typically basalt or dolomite, and an increasing proportion of recycled material. Stone wool is a wide spread building material which is mainly used for thermal insulation. It is available with different densities and thermal conductivities and is applicable in different areas of the building and industrial processes.

Materials	%
Mineral wool	96 - 99 %
Binder (phenol-formaldehyde-urea copolymer)	0 - 6 %
Dustbinding (mineral oil)	0,1 - 0,5 %

Technical data:

Representativity unit 1m² with [kg/m²]	Average Density [kg/m³]	λ-value [W/mK]	Weight [kg/m²] when R=1
<70 kg/m³	35	0,035	1,22

Market:
Scandinavia

Product specification
<70 kg/m³

Reference service life:
50 years

LCA: Calculation rules

Functional unit:
1 m² stone wool with a thermal resistance (R) of 1 K m² W^{-1} with a reference service life of 50 years.
The calculation of the weight per square meter is done as follows:

m2-weight insulation = density [kg/m³] x insulation thickness [m]
(in order to meet a specified thermal resistance) =
m2-weight insulation = density [kg/m³] x R [m²K/W] x lambda [W/m K] = [kg/m²]

Data quality:
For life cycle modeling the GaBi 6 Software System for Life Cycle Assessment, developed by PE INTERNATIONAL AG, is used (/GaBi 6 2012/). All relevant background datasets are taken from the GaBi 6 software database. To ensure comparability of results in the LCA, the basic data of GaBi database were used for energy, transportation and auxiliary materials.
The rock mineral wool production is modeled based on site specific data for five PAROC plants in Scandinavia. The datasets are complete and conform to the system boundaries and the criteria for the exclusion of inputs and outputs. Background data refer to the years 2009 till 2012 (/GaBi 6 2012/) with a country specific scope as far as available, e.g. for raw material extraction and production, transportation, fuels and energy supply.
All relevant processes (foreground and background) have been considered when modelling stone wool production. The process data and the used background data are consistent. The data quality can be qualified as good.

Allocation:
The allocation is made in accordance with the provisions of EN 15804. Incoming energy and water and waste production in-house production 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.

System boundary:
Table below identifies the modules included in this study:

According to EN 15804 any declared benefits, and loads from net flows leaving the product system not allocated as co-products and have passed the end-of waste state shall be included in module D. Module D includes reuse, recovery and/or recycling potentials.

The production stage (module A1-A3) covers the following steps:
- Raw materials production (e.g. diabase, dolomite)
- Binder components production (e.g. resin)
- Transports of raw materials and pre-products to manufacturing plant
- Product manufacturing (power, thermal energy, auxiliaries, emissions)
- Production of packaging materials
- Waste management, water treatment, end-of-life of residues

With the exception of Modules A1 to A3 (describing the manufacturing of stone wool) all other modules are calculated on the basis of assumptions or scenarios.

The following scenarios were considered in this study:
- module A4 (transport to the building site, 500 km,
- module A5 (packaging waste processing, waste generated in the installation is assumed to be 0 %.
- module C2 (transport to the EoL, 50 km and
- module C4 (landfill).

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.

The declared unit is 1 m² stone wool without any lamination.

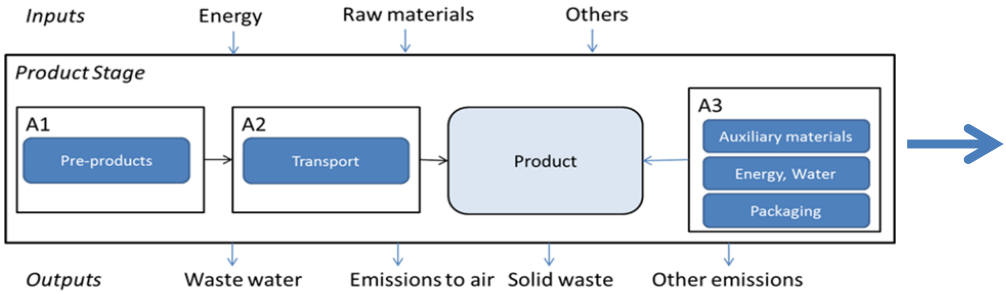

Figure 1. Schematic representation of the LCA system boundaries for the production module (A1-A3)

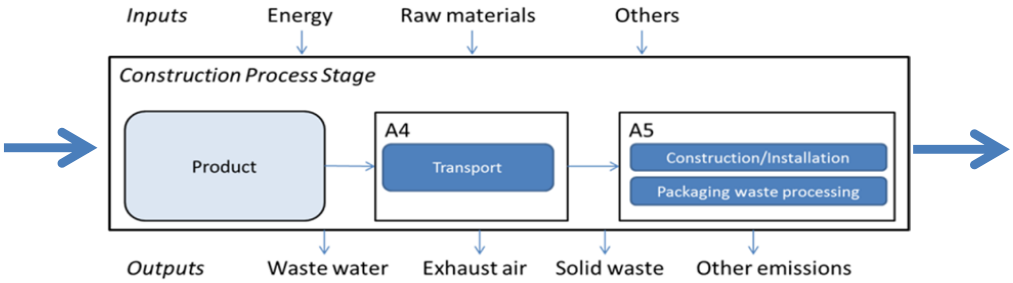

Figure 2. Schematic representation of the LCA system boundaries for the construction process stage (A4-A5)

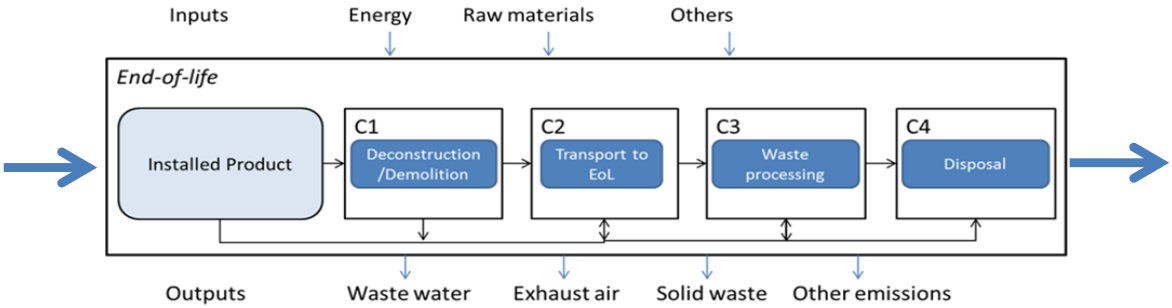

Figure 3. Schematic representation of the LCA system boundaries for the End-of-life stage (C1-C4)

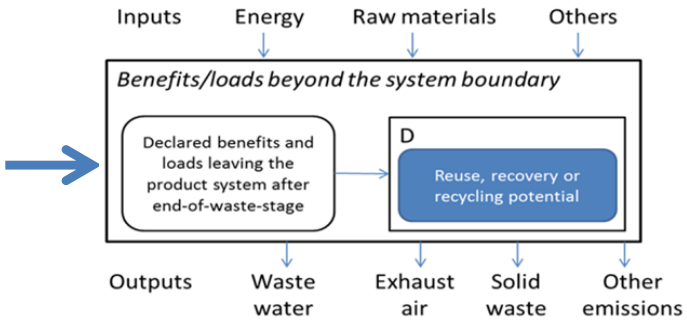

Figure 4. Schematic representation of the LCA system boundaries for the benefits and loads beyond the product system boundary in module D

LCA: Scenarios and additional technical information

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

Transports to the customer are calculated on the basis of a scenario with an average truck trailer with a 27 t payload. For the final stone wool product a loading ratio of 30 % has been set. The average transport distance to the customer in Norway is assumed to be 500 km as a basis for this study. The assumption is based on a 300 km distance for the Swedish plants and a 700 km distance for the Finnish plants. Since the two Swedish plants contribute with a share of 50% and the three Finnish plants with a share of 50%, the weighted average distance is set to 500 km.

Transport from production place to user (A4)

Type	Capacity utilisation (incl. return) %	Type of vehicle	Distance km	Fuel/Energy consumption	Value (l/t)
Truck	30	Truck fleet	500	0,038 l/tkm	18,9

Installation in the building (A5)

Parameter	Parameter expressed by functional unit
Auxiliary materials for the installation	Not applicable
Consumption of other resources	Not applicable
Quantitative description of the type of energy and consumption rate during the installation process	Not applicable
Wastes at the construction site generated from the installation of the product	0%
Material outputs as a result from waste management processes at the installation site. For example compilation for recycling, for energy recovery and	Not applicable
Emissions to air, soil and water	Not applicable

Maintenance (B2) / Repair (B3) / Replacement (B4) / Refurbishment (B5)

Parameter	Parameter expressed by functional unit
Maintenance, for example: cleaning agent, type of surfactant	Not applicable
Maintenance cycle	Not applicable
Energy inputs for the maintenance process	Not applicable
Fresh water net consumption during maintenance or reparation	Not applicable
Inspection maintenance or reparation process	Not applicable
Inspection, maintenance or reparation cycle	Not applicable
Auxiliary materials, for example lubricating	Not applicable
Component substitution during the products life cycle	Not applicable
Energy inputs during the maintenance, energy type, example: electricity and quantity	Not applicable
Energy input during the reparation, renovation and substitution processes if applicable and relevant	Not applicable
Material loss during maintenance or reparation	Not applicable
Products reference lifetime to be included as a base for the calculation of the number of substitutions required	RSL = 50 years

Operational energy (B6) and water conumption (B7)

Parameter	Parameter expressed by functional unit
Type of energy, for example: electricity, natural gas, heat use for district	Not applicable
Output	Not applicable
Fresh water net consumption	Not applicable
Characteristic performance (energy efficiency, emissions, etc.)	Not applicable
Reference lifetime	RSL = 50 years

End of Life (C1, C2, C3, C4)

Parameter	Parameter expressed by functional unit
Compilation processes district	Not applicable
Recycling Systems	Not applicable
Final disposal	Landfilling

LCA: Results

Life Cycle Impact Assessment results represent the environmental impacts for the life cycle of stone wool from cradle to grave.

The goal is to address all necessary parameters according EN 15804 for creating EPDs. In a first step the results are calculated based on 1 kg stone wool representing the PAROC average. After that the data is scaled according the provided density and lambda and fixed to the mass required for one square meter product with the respective R value = 1. The overall goal is to create 3 generic EPDs representing 3 product groups, each with a respective average density and λ-value.

In order to produce 3 generic EPDs, the PAROC products are clustered according their density into 3 product groups.
The following table shows the average density within 3 defined product groups.

Product group	Average Density	λ-value
<70 kg/m³	35,1	0,035
70 – 120 kg/m³	93,2	0,037
> 120 kg/m³	143,5	0,039

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

Product stage			Construction installation stage		Use stage							End of life stage				Beyond the system boundaries
Raw materials	Transport	Manufacturing	Transport	Construction installation stage	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	MND	MND	MND	MND	MND	MND	MND	MND	X	MND	X	X

Environmental impact	1 m² stone wool product, 35 kg/m³							
Parameter	**Unit**	**A1**	**A2**	**A3**	**A4**	**A5**	**C2**	**C4**	**D**
GWP	kg CO_2-eqv	1,48E+00			7,00E-02	0,00	0,00	2,20E-01	0,00
ODP	kg CFC11-eqv	1,24E-09			1,19E-12	0,00	7,84E-14	1,30E-11	0,00
POCP	kg C_2H_4-eqv	8,51E-04			-6,27E-05	0,00	-3,65E-06	4,67E-05	0,00
AP	kg SO_2-eqv	6,51E-03			2,12E-04	0,00	1,30E-05	1,15E-04	0,00
EP	kg PO_4^{3-}-eqv	6,50E-04			4,57E-05	0,00	2,77E-06	5,50E-05	0,00
ADPM	kg Sb-eqv	1,40E-07			2,54E-09	0,00	1,67E-10	6,28E-09	0,00
ADPE	MJ	1,49E+01			9,40E-01	0,00	6,00E-02	2,50E-01	0,00

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	1 m² stone wool product, 35 kg/m³							
Parameter	**Unit**	**A1**	**A2**	**A3**	**A4**	**A5**	**C2**	**C4**	**D**
RPEE	MJ	1,67E+00			n/a	n/a	n/a	n/a	n/a
RPEM	MJ	0,00E+00			n/a	n/a	n/a	n/a	n/a
TPE	MJ	1,67E+00			4,00E-02	0,00	0,00	2,00E-02	0,00
NRPE	MJ	1,52E+01			n/a	n/a	n/a	n/a	n/a
NRPM	MJ	0,00E+00			n/a	n/a	n/a	n/a	n/a
TRPE	MJ	1,52E+01			9,40E-01	0,00	6,00E-02	2,50E-01	0,00
SM	kg	0,00E+00			0,00	0,00	0,00	0,00	0,00
RSF	MJ	3,66E-03			0,00	0,00	0,00	0,00	0,00
NRSF	MJ	2,00E-02			0,00	0,00	0,00	0,00	0,00
W	m^3	5,09E-03			4,00E-04	0,00	1,00E-05	-4,50E-04	0,00

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	1 m² stone wool product, 35 kg/m³								
Parameter	**Unit**	**A1**	**A2**	**A3**	**A4**	**A5**	**C2**	**C4**	**D**
HW	kg	1,73E-04			0,00	0,00	0,00	1,73E-04	0,00
NHW	kg	2,48E-01			1,23E-04	0,00	8,06E-06	1,19E+00	0,00
RW	kg	9,99E-04			1,31E-06	0,00	8,64E-08	4,54E-06	0,00

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

End of life - Output flow	1 m² stone wool product, 35 kg/m³							
Parameter	**Unit**	**A1**	**A2**	**A3**	**A4**	**A5**	**C2**	**C4**	**D**
CR	kg	n/a			n/a	n/a	n/a	n/a	n/a
MR	kg	n/a			n/a	n/a	n/a	n/a	n/a
MER	kg	n/a			n/a	n/a	n/a	n/a	n/a
EEE	MJ	n/a			0,00	0,00	0,00	0,00	n/a
ETE	MJ	n/a			0,00	0,00	0,00	0,00	n/a

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

Additional Norwegian requirements

Electricity
The selection of the background data for the electricity generation is in line EN 15804. Within the different plants the country specific Swedish or Finnish power grid mix (reference year 2009) is applied.

Sweden
Greenhouse gas emissions: 0,26 kg CO_2 - eqv/MJ
Finland
Greenhouse gas emissions: 1,29 kg CO_2 - eqv/MJ

Dangerous substances
None of the following substances have been added to the product: Substances on the REACH Candidate list of substances of very high concern or substances on the Norwegian Priority list as of 01.01.2014 or substances that lead to the product being classified as hazardous waste. The chemical content of the product complies with regulatory levels as given in the Norwegian Product Regulations.

Transport
Transport from production site to central warehouse in Norway is: 500 km

The influence of the transport to site or the transport to end of life is about 0% to 6% within the considered impact categories, except for the POCP. In this case the transport shows negative values. The reasons are NO emissions which occur during transportation processes. These NO emissions have a negative characterization factor according CML 2012 and thus, transports appear with negative POCP values. Despite the paradox finding, that more transportation would increase the credits, there is no mistake in the LCA model. Other methods (for example ReCiPe) set this characterization factor to zero to avoid such misinterpretations.

Indoor environment
The product meets the requirements for low emissions (M1) according to EN15251: 2007 Appendix E.
PAROC stone wool products fulfil the most stringent requirement (M1) in the Finnish voluntary system for building material emissions developed by the Finnish Society of Indoor Air Quality and Climate in Finland. Our stone wool products are recognized as low emitting products, for which they have been tested since 1995. PAROC low emitting products are recognized by the M1 label.

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

Bibliography

ISO 14025:2006	*Environmental labels and declarations - Type III environmental declarations - Principles and procedures*
ISO 14040:2006	*Environmental management – Life cycle assessment – Principles and framework*
ISO 14044:2006	*Environmental management - Life cycle assessment - Requirements and guidelines*
EN 15804:2012	*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*
Melanie Goymann	*Background Report for Environmental product declarations for stone wool products - Part of the project: Life Cycle assessment (LCA) of stone wool*
PCR	*Product-Category Rules - NPCR 12 rev1, The Norwegian EPD Foundation 2012*
Self-declaration according to EN 15804	*Environmental Product Declaration, Declared unit: 1m³ stone wool, product group with density <70 kg/m³, average 35 kg/m³. Lambda, average 0,035 W/mK*

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