

ENVIRONMENTAL PRODUCT DECLARATION

in accordance with ISO 14025, ISO 21930 and EN 15804



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The Norwegian EPD Foundation

Owner of the declaration	Minera Skifer AS
Publisher	The Norwegian EPD Foundation
Declaration number	ÞÓÚÖß15ÈJGÈÞ
Issue date	€ì .€5.G€15
Valid to	€ì .€5.G€€€

Natural stone quartzite schist, natural cleft surface, with broken or sawn edges

Product

Minera Skifer AS
Owner of the declaration



General information

Product

Natural stone quartzite schist, natural cleft surface, with broken or sawn edges

Program holder

The Norwegian EPD Foundation
Post Box 5250 Majorstuen, 0303 Oslo
Phone: +47 23 08 8GJG
e-mail: post@epd-norge.no

Declaration number:

POU0B15BJGDP

This declaration is based on Product Category Rules:

CEN Standard EN 15804 serve as core PCR
Requirements on the EPD for Dimension stone for roof, wall and floor applications (v 1.6, 30.07.2014).

Declared unit:

Production of 1 ton of natural stone quartzite schist, natural cleft surface, with broken or sawn edges.

Declared unit with option:

Functional unit:

Production of 1 ton natural stone of quartzite schist, natural cleft surface, with broken or sawn edges, manufactured, delivered, installed, used for 60 years and disposed after end of service time.

The EPD has been worked out by:

Oddbjørn Dahlstrøm
Asplan Viak AS

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

Lars G. F. Tellnes, Norwegian Institute of Wood Technology
(Independent verifier approved by EPD Norway)

Declared unit:

Production of 1 ton of natural stone quartzite schist, natural cleft surface, with broken or sawn edges.

Owner of the declaration

Minera Skifer AS
Contact person: Terje Holstad
Phone: +47 908 57 373
e-mail: terje@mineraskifer.no

Manufacturer

Minera Skifer AS
Engan, 7340 Oppdal, Norge
Phone: +47 72 40 04 00
e-mail: info@mineraskifer.no

Place of production:

Engan at Oppdal, Norway

Management system:

No

Org. No:

NO 980 253 708 MVA

Issue date

€1 .€5.0€15

Valid to

€1 .€5.0€0€

Comparability:

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

Year of study:

Consumption data: 2013. Study performed fall of 2014.

Approved

Dagfinn Malnes
Managing Director of EPD-Norway

Key environmental indicators	Unit	Cradle to gate A1 - A3		Transport A4 - 400 km
		Broken edges	Sawn edges	
Global warming	kg CO ₂ -eqv	58,1	131	25,2
Energy use	MJ	976	2377	462
Dangerous substances	*	*	*	-
Share of renewable energy used	%	16,8 %	22,5 %	1,7 %

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

Scenario A4 – C4 is similar for all natural cleft surfaces, independent if the edges are broken or sawn.

Product

Product description:

The 750 million year old Oppdal quartzite has several shades of grey and a varying surface structure. It is very easy to shape and can be easily scored and then snapped/cut to obtain an almost right-angled rustic edge. Oppdal quartzite has a high content of quartz and feldspar.

Natural cleft surface: Pavement block, massive slabs, wall cladding, flooring tiles, brick, slabs, fireplace mantels, stone furniture, window sills, roofing and steps.

Product specification

Products with natural cleft surface, broken or sawn edges includes all products mentioned above.

Surface: Natural cleft surface.

Broken edge: A scoring nail is used to make the score line.

Thereafter the slab is broken by using hand tools. The edge is not as smooth as a sawn edge, but still quite precise.

Sawn edge: Sawn edges are completely straight, right-angled and precise. The color of the sawn edges becomes slightly lighter than the surface of the natural cleft schist.

Technical data:

Standard thickness, even thickness	30 mm
1 ton schist with even thickness	12,3 m ²

Petrography:	EN 12407	Quartzite schist
Density:	EN 1936	2,7 ton/m ³
Water absorption:	EN 13755	0,2 weight-%
Flexural strength	EN 12372	35,1 Mpa
Compressive strength	EN 1926	247,5 Mpa
Slip resistance, SRV dry	EN 14231	Antique 60/Silk 71
Slip resistance, SRV wet	EN 14231	Antique 30/Silk 49
Dowel holes, breaking load	EN 13364	1,92 kN
Frost resistance	EN 12371	Yes

Materials	%
Natural stone, quartzite schist	100 %
Quartz	35-45%
Glimmer	15-33%
Feldspar	20-25%
Epidote	2-8%
Titanite	2 %
Fe-oxides	1-2%
Packaging: Plastic film	0,01 kg
Packaging: Plastic strips	0,16 kg
Packaging: Plastic angle	0,03 kg

For Declaration of Performance (DoP) and complementary information, see www.mineraskifer.no

Market:

Main market is in Norway and the Nordic countries.

Products are also exported to Europe and other continents.

Reference service life:

Reference service life is same as for buildings and normally set to 60 years. Natural stones of quartzite schist has almost unlimited life time.

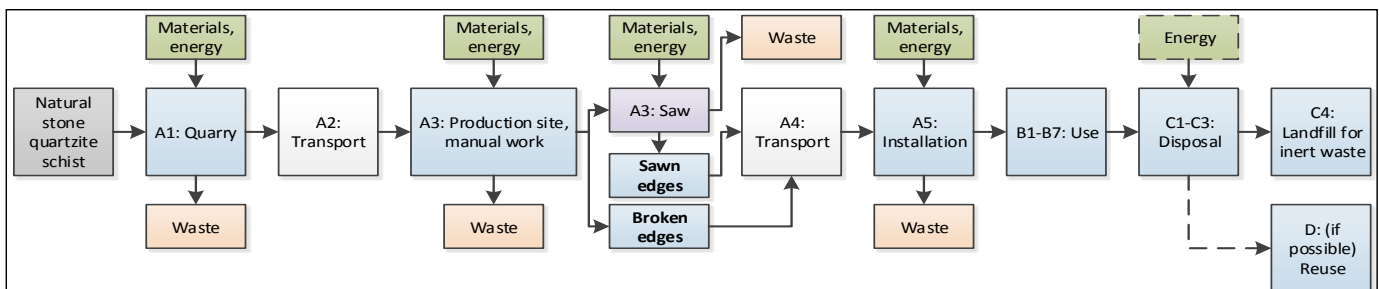
LCA: Calculation rules

Functional unit:

Production of 1 ton natural stone of quartzite schist, natural cleft surface, with broken or sawn edges, manufactured, delivered, installed, used for 60 years and disposed after end of service time.

System boundary:

Flow sheet for manufacturing of natural stone of quartzite schist is shown below. Scenario A4–C4 are similar for all products, regardless if the edges are broken or sawn.



Data quality:

Data for quarrying the schist, transport and production of natural stone (A1 – A3) are based on specific production data from Minera Skifer at Oppdal in 2013. Discharge from production and detonation of explosives are collected from safety datasheets for the actual explosive types. Generic data are use of Ecoinvent v2.2 from 2010 and SimaPro v 8.0.2. Characterization factors from EN 15804:2012+A1:2013.

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 in EN 15804. Incoming energy, water and waste production in-house production (A3 – manufacturing) is allocated equally among all products through mass allocation. Economic allocation is used upstream (A1 and A2) because machine blocks from the quarry are not subject for further processing. Price for machine blocks are significant lower compared with processed schist products.

Difference in material consumption, energy and waste production in the production of different products (floor tiles, slabs, roofing etc.) are considered to be marginal, as production processes are nearly the same.

LCA: Scenarios and additional technical information

The following information describes the scenarios for the modules in the EPD. All figures are per ton schist, i.e. 12,3 m², thickness 30 mm.

Reference service life

Reference service life is same as for buildings and normally set to 60 years. Natural stones of quartzite schists has almost unlimited life time and is therefore normally not being replaced during service life.

Schist fixed with screws or nails on a façade or on a roof can be reused. Bricks installed dry (without mortar) can be changed, rebuilt and reused. Schist installed with mortar can be reused after removal of mortar. Schist installed with adhesives on floors and walls can to a minor extent be reused and must be deposited on landfill intended for inert disposal.

Transport from production place to user (A4)

All production is normally delivered directly from Oppdal to building site. As scenario a distance of 400 km delivered by lorry (>32 t) is calculated. This is corresponding to the distance from Oppdal to Oslo.

Type	Capacity utilisation (incl. return) %	Type of vehicle	Distance km	Fuel/Energy consumption	Value (l/t)
Truck	75 %	Lorry >32t, Euro 4	400	0,0125 l/tkm	5

Installation in the building (A5)

Products of quartzite schists can be installed in various ways, from no installation on base of gravel (paving), installation with cement based adhesives (floor tiles, crazy paving and wall cladding), installation with mortar (chimney caps, and bricks) and installation as roofing with nails or screws). In this scenario it is calculated with installation with cement based adhesives (similar as for installation of ceramic tiles).

Assume 5 kg cement mortar + 1,0 liter of water pr. m² installed

schist. 20 kg of mortar mixed with an electric mixer with effect. 1,5 kW for 5 min. It is assumed 10% spillage at installation.

	Unit	Value
Auxiliary	kg	62,0
Water consumption	m ³	0,012
Electricity consumption	kWh	0,384
Other energy carriers	MJ	0
Material loss	kg	0
Output materials from waste treatment	kg	100
Dust in the air	kg	0

Use (B1 – B7)

Quartzite schists are in many cases characterized as maintenance free. Schist as roofing, crazy paving in the garden and paving on sidewalks are not being maintained. Schists installed inside are also often considered as maintenance free. Schists installed in a kitchen and a bathroom are normally impregnated with a chemical designed for this purpose. Since there are many manufacturers, products and types for surface treatment, and also the fact that some schists are not treated, impregnation of schists is not included in this scenario. This must be added where such products are considered used. All modules in the use stage (B1 – B7) are analyzed, and apart from eventual application of impregnation or other types of surface treatment the schist requires no maintenance, repair or replacement during use stage. Therefore there is no effect on the environment during use stage.

End of Life (C1, C3, C4)

Installed schists are demolished in different ways, depending of type of installation. In this scenario it is assumed installation with cement based adhesive and therefore it must be demolished by chisel. Assume electric chisel hammer with effect 2 kW, using 1 min. per 1 m² surface. The removed schist is transported 50 km to a landfill for inert disposal or used as landfill for different purpose.

	Unit	Value
Electricity consumption	kWh	0,409
Hazardous waste disposed	kg	0
Collected as mixed construction waste	kg	0
Reuse	kg	0
Recycling	kg	0
Energy recovery	kg	0
To landfill	kg	1000

Transport to waste processing (C2)

Type	Capacity utilisation (incl. return) %	Type of vehicle	Distance km	Fuel/Energy consumption	Value (l/t)
Truck	Average in Europe	Lorry >16t, average	50	0,033 l/tkm	1,65

Additional technical information

Alternation of results from per ton to per m² can be done by multiplying results with thickness in meters and density 2,7 ton/m³. Standard thickness is 30 mm. Example: 58,1 kg CO₂ e/ton * 0,030 m * 2,7 ton/m³ = 4,7 kg CO₂ e/m² schist.

LCA: Results

A1 – A3 and A5 is divided between broken or sawn edges for products with natural cleft surface.
 Scenario A4 – C4 is similar for all natural cleft surfaces, independent if edges are broken or sawn.

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	x	x	x	x	x	x	x	x	x	x	x		MND

Environmental impact

Parameter	Unit	A1-A3 Broken	A1-A3 Sawn	A4	A5 Broken	A5 Sawn	B1-B7	C1	C2	C3	C4
GWP	kg CO ₂ -ekv	58,1	131	25,2	19,3	26,6	0	9,9E-03	6,66	0	2,60
ODP	kg CFC11-ekv	7,7E-06	1,7E-05	4,4E-06	1,5E-06	2,4E-06	0	4,6E-10	1,1E-06	0	3,3E-07
POCP	kg C ₂ H ₄ -ekv	1,2E-02	2,7E-02	4,2E-03	2,2E-03	3,7E-03	0	3,0E-06	1,1E-03	0	5,0E-04
AP	kg SO ₂ -ekv	0,35	0,79	0,10	6,2E-02	1,1E-01	0	6,8E-05	3,6E-02	0	1,9E-02
EP	kg PO ₄ ³⁻ -ekv	0,09	0,21	3,1E-02	1,6E-02	2,8E-02	0	5,5E-05	9,6E-03	0	4,5E-03
ADPM	kg Sb-ekv	6,2E-05	1,9E-04	1,3E-04	1,3E-05	2,5E-05	0	3,7E-07	1,9E-05	0	4,5E-07
ADPE	MJ	792	1797	426	160	261	0	0,09	101	0	35,9

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 Broken	A1-A3 Sawn	A4	A5 Broken	A5 Sawn	B1-B7	C1	C2	C3	C4
RPEE	MJ	164	534	7,95	28,2	65,2	0	1,86	1,31	0	0,16
RPEM	MJ	8,66	19,4	INA	INA	INA	0	INA	INA	0	INA
TPE	MJ	173	553	7,95	29,0	67,1	0	1,86	1,31	0	0,16
NRPE	MJ	812	1842	454	179	282	0	0,08	106	0	37,3
NRPM	MJ	6,40	6,40	INA	INA	INA	0	INA	INA	0	INA
TRPE	MJ	818	1849	454	180	283	0	0,08	106	0	37,3
SM	kg	0,10	0,22	INA	INA	INA	0	INA	INA	0	INA
RSF	MJ	INA	INA	INA	INA	INA	0	INA	INA	0	INA
NRSF	MJ	INA	INA	INA	INA	INA	0	INA	INA	0	INA
W	m ³	0,41	20,5	0,30	0,21	2,22	0	1,6E-04	5,2E-02	0	1,0E-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 Broken	A1-A3 Sawn	A4	A5 Broken	A5 Sawn	B1-B7	C1	C2	C3	C4
HW	kg	4,6E-04	1,2E-03	6,9E-04	1,0E-04	1,8E-04	0	3,6E-07	1,1E-04	0	1,9E-05
NHW	kg	12064	28217	5,68	1307	2922	0	1,8E-02	0,76	0	1000
RW	kg	2,8E-04	6,8E-04	4,9E-04	3,5E-04	3,9E-04	0	1,7E-07	8,3E-05	0	1,3E-05

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

End of life - Output flow

Parameter	Unit	A1-A3 Broken	A1-A3 Sawn	A4	A5 Broken	A5 Sawn	B1-B7	C1	C2	C3	C4
CR	kg	INA	INA	INA	INA	INA	0	INA	INA	0	INA
MR	kg	0,27	0,60	INA	INA	INA	0	INA	INA	0	INA
MER	kg	0,42	0,93	INA	0,18	0,18	0	INA	INA	0	INA
EEE	MJ	INA	INA	INA	INA	INA	0	INA	INA	0	INA
ETE	MJ	INA	INA	INA	INA	INA	0	INA	INA	0	INA

INA = Indicator not assessed

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

Electricity

Norwegian consumption mix on medium voltage is used at the production site. Used Ecoinvent v2.2 process: Electricity, medium voltage, at grid/NO U. Import, production of transmission lines, in addition to direct emissions and loss in grid are included. Characterisation factors stated in EN 15804:2012+A1:2013 are used.

Greenhouse gas emissions: 0,0067 kg CO₂ - eqv/MJ
 0,0242 kg CO₂ - ekv/kWh

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 (of 13.02.2015) 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 Oppdal, Norway to construction site according to scenario A4: 400 km

Indoor environment

Concentration of radium in a schistose stone is in the range of 10 - 120 Bq/kg. There is nothing in the mineral content in the schist from Oppdal that should imply a high potential of radon.




Use of schist indoor (flooring, wall cladding, fire places etc.) should normally not imply increased radon concentrations exceeding the background level. This is related to the volume of schist compared to other building materials (gravel, sand) used in the building ground. It should also imply that the contribution of radon from the schist normally will have a small or no impact on the level of radon in a house. *Geological survey of Norway, NGU 06.12.04.*

Carbon footprint

Carbon footprint has not been worked out for the product.

Bibliography

ISO 14025:2006	<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	<i>Sustainability of construction works - Environmental product declaration - Core rules for the product category of construction products</i>
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www.bau-umwelt.com	<i>PCR Guidance-Texts for Building-Related Products and Services. From the range of Environmental Product Declarations of Institute Construction and Environment e.V. (IBU). Part B: Requirements on the EPD Dimension stone for roof, wall and floor applications, 30.07.2014.</i>
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EN 12407:2007	<i>Natural stone test methods. Petrographic examination</i>
EN 1936:2006	<i>Natural stone test methods. Determination of real density and apparent density, and of total and open porosity</i>
EN 13755:2008	<i>Natural stone test methods. Determination of water absorption at atmospheric pressure</i>
EN 12372:2006	<i>Natural stone test methods. Determination of flexural strength under concentrated load</i>
EN 1926:2006	<i>Natural stone test methods. Determination of uniaxial compressive strength</i>
EN 14231:2003	<i>Natural stone test methods. Determination of the slip resistance by means of the pendulum tester</i>
EN 13364:2001	<i>Natural stone test methods. Determination of the breaking load at dowel hole</i>
EN 12371:2010	<i>Natural stone test methods. Determination of frost resistance</i>

 epd-norge.no The Norwegian EPD Foundation	Program holder and publisher The Norwegian EPD Foundation Post Box 5250 Majorstuen, 0303 Oslo Norway	Phone: +47 23 08 8GJG e-mail: post@epd-norge.no web: www.epd-norge.no
	Owner of the declaration Minera Skifer AS Minera Skifer AS Engan, 7340 Oppdal, Norge	Phone: +47 72 40 04 00 e-mail: info@mineraskifer.no web: http://mineraskifer.no/
	Author of the Life Cycle Assessment Asplan Viak AS Oddbjørn Dahlstrøm Kjørboveien 20, 1337 Sandvika	Phone: +47 417 99 417 e-mail: oddbjorn.dahlstrom@asplanviak.no web: www.asplanviak.no