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
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Issue date	08.05.2015
Valid to	08.05.2020

Natural stone quartzite schist, even thickness, with broken or sawn edges

Product

Minera Skifer AS

Owner of the declaration

General information

Product
Natural stone quartzite schist, even thickness, with broken or sawn edges.

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Declaration number:
NEPD-316-192-EN

Place of production:
Engan at Oppdal, Norway

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).

Management system:
No

Declared unit:
Production of 1 ton of natural stone of quartzite schist, adjusted thickness, with broken or sawn edges.

Org. No:
NO 980 253 708 MVA

Declared unit with option:

Issue date
08.05.2015

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

Valid to
08.05.2020

The EPD has been worked out by:
Oddbjørn Dahlstrøm
Asplan Viak AS

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 preformed fall of 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 ☐

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

Approved

Dagfinn Malnes
Managing Director of EPD-Norway

Declared unit:
Production of 1 ton of natural stone of quartzite schist, adjusted thickness, with broken or sawn edges.

Key environmental indicators	Unit	Cradle to gate A1 - A3		Transport A4 - 400 km
		Broken edges	Sawn edges	
Global warming	kg CO_2 -eqv	83,7	177	25,2
Energy use	MJ	2504	4286	462
Dangerous substances	*	*	*	-
Share of renewable energy used	%	55,3 %	43,4 %	1,7 %

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

Scenario A4 – C4 is similar for all products with even thickness, 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.
Schist with even thickness: Wall cladding, flooring tiles, slabs, roofing and steps.

Product specification

Products with natural cleft surface, broken or sawn edges and even thickness includes all products mentioned above.
Surface: Natural cleft surface, antique brushed and silk brushed.
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	12 mm
1 ton schist with even thickness	30,9 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.

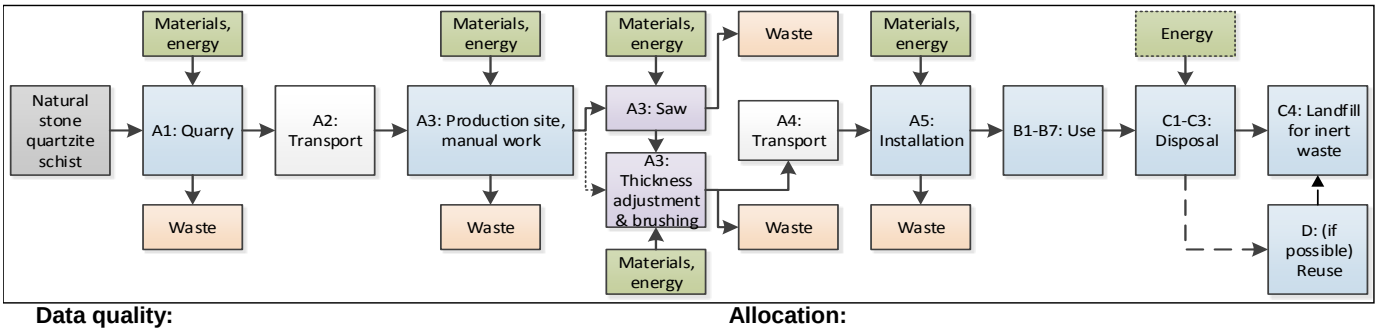
LCA: Calculation rules

Functional unit:

Production of 1 ton natural stone of quartzite schist, even thickness, 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. Most blocks are sawn before adjustment of thickness and brushing. Some part of the schist have adjusted thickness without sawing (broken edges). 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. 30,9 m², thickness 12 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 deposed on landfill intended for inert deposal.

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	154,5
Water consumption	m^3	0,031
Electricity consumption	kWh	0,958
Other energy carriers	MJ	0
Material loss	kg	100
Output materials from waste treatment	kg	0
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	1,02
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 12 mm. Example:83,7 kg CO2 e/ton * 0,012 m * 2,7 tonn/m3 = 2,71 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-eqv	83,7	177	25,2	39,9	49,2	0	2,5E-02	6,66	0	2,60
ODP	kg CFC11-eqv	1,0E-05	2,2E-05	4,4E-06	2,5E-06	3,8E-06	0	1,2E-09	1,1E-06	0	3,3E-07
POCP	kg C_2H_4-eqv	1,7E-02	3,7E-02	4,2E-03	4,0E-03	6,0E-03	0	7,5E-06	1,1E-03	0	5,0E-04
AP	kg SO_2-eqv	0,50	1,06	0,10	0,11	0,17	0	1,7E-04	3,6E-02	0	1,9E-02
EP	kg PO_4^{3-}-eqv	0,16	0,32	3,07E-02	3,1E-02	4,7E-02	0	1,4E-04	9,6E-03	0	4,5E-03
ADPM	kg Sb-eqv	3,3E-04	4,9E-04	1,3E-04	4,7E-05	6,3E-05	0	9,1E-07	1,9E-05	0	4,5E-07
ADPE	MJ	1106	2391	426	293	421	0	0,22	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	1386	1859	7,95	168	215	0	4,63	1,31	0	0,16
RPEM	MJ	11,1	24,7	INA	INA	INA	0	INA	INA	0	INA
TPE	MJ	1397	1883	7,95	169	217	0	4,63	1,31	0	0,16
NRPE	MJ	1118	2427	454	335	466	0	0,21	106	0	37,3
NRPM	MJ	18,6	26,8	INA	INA	INA	0	INA	INA	0	INA
TRPE	MJ	1137	2454	454	337	468	0	0,21	106	0	37,3
SM	kg	0,17	0,33	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	40,3	66,0	0,30	4,45	7,02	0	3,9E-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	8,3E-04	1,8E-03	6,9E-04	2,1E-04	3,0E-04	0	9,0E-07	1,1E-04	0	1,9E-05
NHW	kg	15705	36345	5,68	1671	3735	0	4,5E-02	0,76	0	1000
RW	kg	4,7E-04	9,9E-04	4,9E-04	8,4E-04	8,9E-04	0	4,2E-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	0,47	0,89	INA	INA	INA	0	INA	INA	0	INA
MER	kg	0,87	1,53	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 E-03 = $9,0*10^{-3}$ = 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 CO_2 -	eqv/MJ
	0,0242 kg CO_2 -	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 schistosious 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	*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	*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*
Dahlstrøm, Oddbjørn	*LCA-report for Minera Skifer AS. LCA-report nr. from Asplan Viak AS, Sandvika, Norway*
www.bau-umwelt.com	*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.*
Ulvan, E.M., Solem, Ø., Kvellestad, A. & Bongard, T	*Release of particles from the quartzite industry into the course of the Driva and its tributaries. Studies of the impact on fish end benthic. - NINA Report 1040.2014*
Geological survey of Norway, NGU	*Report-radioactivity in schist from Otta, Oppdal and Alta. 06.12.04*
EN 12407:2007	*Natural stone test methods. Petrographic examination*
EN 1936:2006	*Natural stone test methods. Determination of real density and apparent density, and of total and open porosity*
EN 13755:2008	*Natural stone test methods. Determination of water absorption at atmospheric pressure*
EN 12372:2006	*Natural stone test methods. Determination of flexural strength under concentrated load*
EN 1926:2006	*Natural stone test methods. Determination of uniaxial compressive strength*
EN 14231:2003	*Natural stone test methods. Determination of the slip resistance by means of the pendulum tester*
EN 13364:2001	*Natural stone test methods. Determination of the breaking load at dowel hole*
EN 12371:2010	*Natural stone test methods. Determination of frost resistance*

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