epd-norge

Environmental Product Declaration

In accordance with ISO 14025 and EN 15804 +A2

The Norwegian
EPD Foundation

Owner of the declaration:
ROCKWOOL Nordics

Program holder and publisher:
The Norwegian EPD foundation

Declaration number:
NEPD-3414-2027-EN

Registration Number:
NEPD-3414-2027-EN

Issue date: 24.03.2022
Valid to: 24.03.2027

ROCKWOOL® stone wool thermal insulation

Product name:
General Building Insulation products for the Swedish market

SE: Byggisolering

Manufacturer ROCKWOOL Nordics

General information

Product:
ROCKWOOL® stone wool thermal insulation, General Building Insulation for the Swedish market

Program Operator:
The Norwegian EPD Foundation
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Declaration Number:
NEPD-3414-2027-EN

This declaration is based on Product Category Rules:
CEN Standard EN 15804+A2 serves as core PCR
NPCR Part A Construction products and services
NPCR 012:2018 version 2. Part B for Thermal insulation products

Statements:
The owner of the declaration shall be liable for the underlying information and evidence. EPD Norway shall not be liable with respect to manufacturer, life cycle assessment data and evidences.

Declared unit:
1 m^2 of stone wool thermal insulation with a thermal resistance (R) of 1,0 m^2K/W.

Functional unit:
1 m2 of stone wool thermal insulation with a thermal resistance (R) of 1,0 m^2K/W with a reference service life of minimum 60 years.

Verification:
Independent verification of the declaration and data, according to ISO14025:2010

internal ☐ external ☒

Jane Anderson
Independent verifier approved by EPD Norway

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Manufacturer:
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Place of production:
Moss factory (electrical melter), Norway
Trondheim factory (conventional melter), Norway

Management system:
ISO 14001, ISO 9001

Organisation no:
CVR. nr. 42391719

Issue date:
24.03.2022

Valid to:
24.03.2027

Year of study:
2021

Comparability:
EPDs of construction products may not be comparable if they are not compliant with EN 15804:A2:2019 and not seen in a building context.

The EPD has been worked out by:
Larisa Xanthopoulou, ROCKWOOL Int. A/S

Approved (Manager of EPD Norway)

Product

Description of the product and use of the EPD:

This EPD documents the potential environmental impacts of 1m² of ROCKWOOL® stone wool insulation with a thermal resistance (R-value) equal to 1 m²K/W. The intended use of the EPD is to communicate quantified environmental impacts of construction products for application in the assessment of the environmental performance of buildings.

ROCKWOOL® stone wool thermal insulation is a durable and firesafe insulation material that can be used to insulate against against heat, cold, fire, vibrations and noise.

ROCKWOOL® stone wool is made primarily from abundantly available volcanic rock, an increasing proportion of recycled ROCKWOOL® stone wool and a cured resin binder. Other materials utilised in the production of ROCKWOOL® stone wool are by-products sourced from other industries. Since 2012, ROCKWOOL® has been offering a take back system for closed loop recycling – Rockcycle.

The products covered by this declaration are General Building Insulation (GBI) products produced for the Swedish market. The unfaced and uncoated synthetic resin-bonded stone wool materials described in this declaration are produced in the form of batts, slabs or granulates for use in building applications in the density range from 27 up to 175 kg/m^3.

ROCKWOOL® stone wool is a non-combustible material that does not react to fire. Stone wool's built-in fire protection is natural and not dependent on flame retardants. Stone wool withstands temperatures exceeding 1,000 degrees Celsius, and retains its fire performance throughout its lifetime.

The insulation properties of stone wool is primarily achieved by the immobile air within in the open structure of the product. Therefore, the declared insulation property will remain constant for the declared lifetime of the product. This also allows the product to absorb noise and sounds and contribute to a better indoor acoustic climate.

ROCKWOOL® stone wool fibers are proven to be safe to manufacture, install and live with. Health and safety installation instructions shall always be followed. ROCKWOOL® stone wool fibers comply with the European REACH regulation and do not have any health-related classifications or negative impact on the indoor environment.

The packaging is included in the assessment.

Information on the environmental impacts facings, e.g. glass fleece or aluminium can be found in the relevant Appendix. Where applicable, environmental indicators values from facings should be added.

Product specification:

The average composition used for this EPD is calculated based on average factory consumption figures for raw materials. The raw materials are mainly non-scarce stones, and resin binder.

Materials	%
Mineral Wool	> 95%
De-duster and water repellence oil	<1%
Binder	<5%

Technical data:

For the products covered by this EPD, the performance data are in accordance with the declaration of performance with respect to its essential characteristics according to EN 13162:2012+A1:2015, "Thermal insulation products for buildings – Factory made mineral wool (MW) products – Specification".

A full overview of the technical specifications can be found on www.rockwool.com/no

Declared	Performance	Norms
Thermal conductivity	0,033-0,042 W/mK	EN 12939 and EN 12667
Fire class	A1, A2-s1,d0 or NPD (NPD=No performance declared)	EN 13501-1:2007+ A1:2009

Market:

This EPD is intended for the Swedish market that receives general building insulation (GBI) products from the factories in Moss (electrical melter) and Trondheim (conventional melter), Norway.

Reference service life, product:

ROCKWOOL® stone wool thermal insulation products are extremely durable and provide effective performance for the lifetime of a building or host structure, with no need to be replaced. The thermal, fire-resistance, and acoustic performance of ROCKWOOL® stone wool products, when correctly installed, remains the same during 60 years reference service life or as long as the insulation is part of the building.

Reference service life, building:

In this EPD, the reference service life of a building is set to 60 years.

LCA: Calculation rules

Declared unit	1m² of a ROCKWOOL® stone wool batt with a thermal resistance RD=1m²K/W.
Density of reference product	29 kg/m³
Thickness of reference product	37 mm
Scope	Cradle to Grave
Reference service life	60 years
Energy used for manufacturing process - Electricity	Renewable electricity mix GO's from Norwegian hydropower, to be prolonged to be valid at least equal to the validity of this EPD.
- Fossil fuels	Natural gas, coke, oil

Declared unit:

The specific product, referred to in the declared unit is 1m² of an average FLEXIBATTS with a thermal resistance R=1m²K/W. The reference product is a 37mm thick ROCKWOOL® stone wool batt with a density of 29 kg/m³. The weight of the reference product corresponding to the declared unit is 1,1 kg.

The impact indicators for another specific product can be calculated by multiplying the results of the EPD with the respective scaling factor from a range of products covered by this EPD. A table with the different products available in the portfolio and their respective scaling factors is provided within the 'Additional technical information' section.

Data quality:

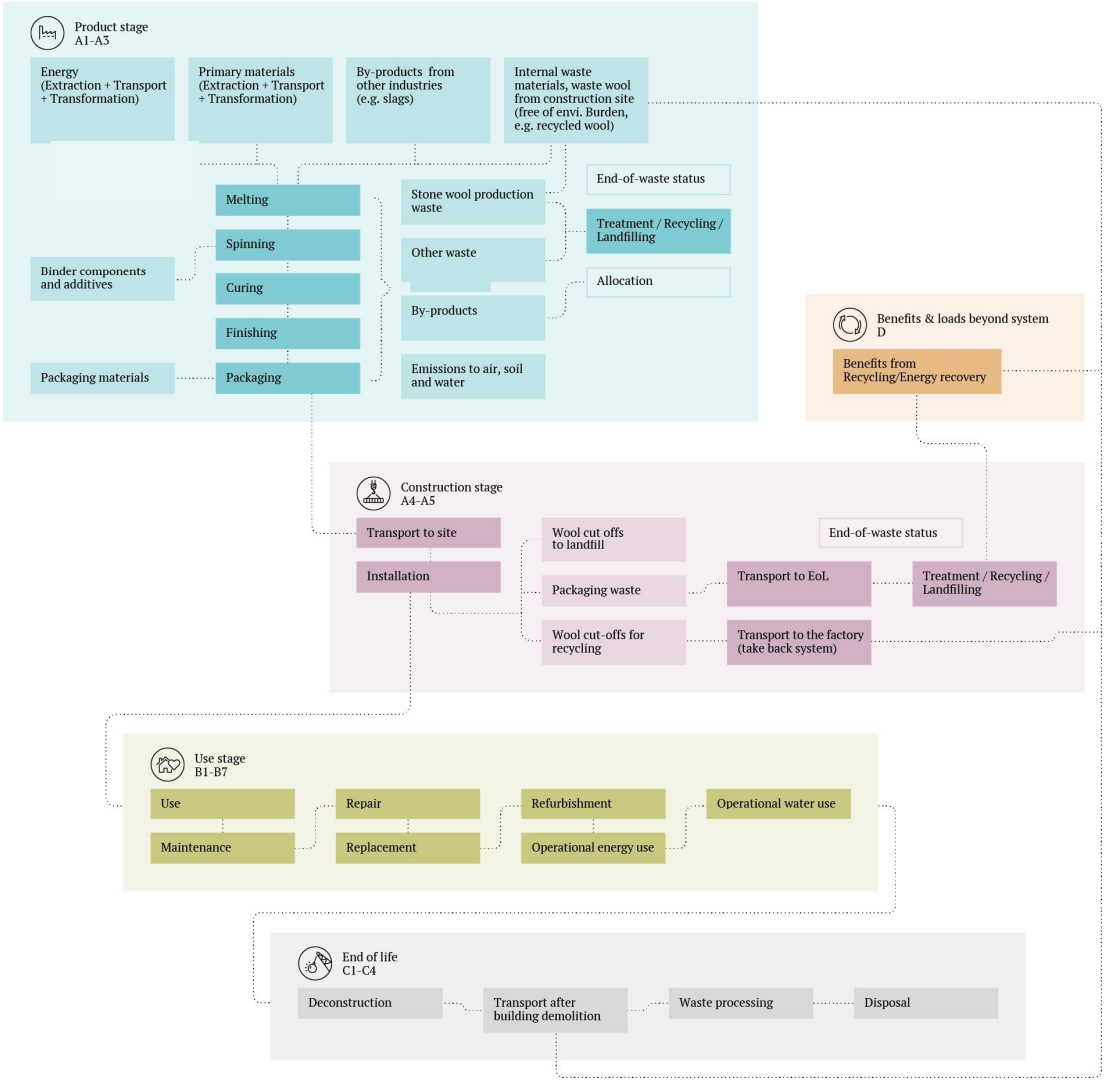
All data represents the applicable geography, time and technology for the specific and generic data, generally assessed as good and very good. Primary data are collected from respective production sites in Moss and Trondheim, Norway, in the reference year 2021 and represent stabilized production. Generic data is from GaBi database (version 2021) with GaBi Software version 10.0.1.92.

Allocation:

The allocation is made in accordance with the provisions of EN 15804+A2. Production activities, electricity and energy consumption and waste generation are allocated equally among all products from the production site through mass allocation.

System boundary:

The LCA is performed as a 'cradle-to-grave ' study, addressing all life cycle stages identified in the EN 15804+A2. All major raw materials, energy, electricity use and waste are included for all life cycle modules, see flowchart below. Use stage B1-7 modules are considered but are not relevant, as there are no activities and no significant environmental impact in the use stage.



Cut-off criteria:

All major raw materials and all the essential energy are included. All hazardous materials and substances are considered in the inventory. Data sets within the system boundary are complete and fulfil criteria for the exclusion of inputs and output criteria. All data, materials and energy consumptions , have been specified according to the production data and have been considered within the inventory analysis

LCA: Scenarios and additional technical information

The following information describe the scenarios in the different modules of the EPD. The EPD is based on LCA inventory data from the 2 factories. The reference flow is a weighted average based on the distribution of production capacity between the 2 factories.

Transport from production place to assembly/user (A4)

Type	Capacity utilisation (incl. return) %	Type of vehicle	Distance	Fuel/Energy consumption	value (l/t)
Truck	30 %	Euro 6, with a 27t payload	398	Diesel: 0,019 l/tkm	7,56 l/t

The A4 distance is calculated as weighted average distance for the Swedish market.

Assembly (A5)

	Unit	Value
Auxiliary	kg	0
Water consumption	m3	0
Electricity consumption	kWh	0
Other energy carriers	MJ	0
Material loss	%	2
Cardboard and paper packaging	kg	0,00015
Plastic packaging	kg	0,015
Wood packaging	kg	0,044

In A5 the default installation is assumed to be manual, therefore no energy consumption or ancillary equipment is needed. The product waste from installation is assumed to be 2% and according to the modularity principle of EN 15804+A2 its impacts are fully allocated to A5, following same EoL scenario as in C (100% landfill). The A5 module includes also the corresponding end-of-life considerations for packaging (10% landfill). The credits from heat and electricity recovery from incineration or material recycling of packaging from module A5 (90% recycling/energy recovery) are attributed to module D.

Use stage (B1, B2, B3, B4, B5, B6, B7)

There are no consumables and no maintenance (B2), repair (B3), replacements (B4) or refurbishments (B5) required during the use of ROCKWOOL® thermal insulation products in standard conditions. They do not use energy (B6) or water (B7) during their operational life. No significant emissions to the indoor environment occur in module (B1). Therefore, modules B1-B7 are not relevant for this EPD.

End of Life (C1, C3, C4)

	Unit	Value
Hazardous waste disposed	kg	0
Collected as mixed construction waste	kg	1
Reuse	kg	0
Recycling	kg	0
Energy recovery	kg	0
To landfill	kg	1

In Sweden, a RockCycle take back system is available for stone wool waste and recycling of stone wool in Norwegian factories is expected to increase in the following years.

Transport to waste processing (C2)

Type	Capacity utilisation (incl. Return) %	Type of vehicle	Distance KM	Fuel/Energy consumption	value (l/t)
Truck, Euro 6	50%	Truck, with 17,3 t payload	100 km	Diesel: 0,025 l/tkm	2,5 l/t

The distance represents an average distance to waste treatment facility or landfill.

Benefits and loads beyond the system boundaries (D)

	Unit	Value
Packaging recycled	kg	0,05
Energy recovered	MJ	0,31

Benefits in module D are created from packaging materials treatment after installation. Quantities of packaging materials include both recycled materials and materials sent for energy recovery.

Additional technical information

Below a list of products covered by this EPD and their scaling factors. The scaling factor can be used to estimate the environmental performance indicators for the specific products.

Product Name	Scaling factor, 1 m2 R=1	Scaling factor, 1 m3
FLEXIBATTS, 45 mm	1,2	33
FLEXIBATTS, ≥ 70 mm (reference product)	**1**	**27**
FLEXIBATTS 35, ≤ 145 mm	1	30
FLEXIBATTS 35, ≥ 170 mm	1,2	34
Markskiva	4,7	126
Nivell-/Subfloor-skiva (nonwoven glass fleece facing)*	1,4	37
Regelskiva med Vindskydd (kraft paper facing)*	1	27
RockOrbit Systemskiva, 50 mm (nonwoven glass fleece facing)*	2,5	75
RockOrbit Systemskiva, ≥ 95 mm (nonwoven glass fleece facing)*	1,9	56
ROCKWOOL® Vindsull	1,8	42
Skalmursskiva	1,7	51

Product Name	Scaling factor, 1 m2 R=1	Scaling factor, 1 m3
Stegljudsskiva	6	163
Stålregelskiva 37, 35 mm	1,6	42
Stålregelskiva 37, 45 mm	1,2	33
Stålregelskiva 37, ≥ 70 mm	1	27
Stålregelskiva 40, 45 mm	1,3	33
Stålregelskiva 41, ≥ 70 mm	1	25
Väggboard (kraft paper facing)*	5,3	144
Västkustskiva, 30 mm	3,6	103
Västkustskiva, 50 mm (nonwoven glass fleece facing)*	2,5	75
Västkustskiva, 80 mm (nonwoven glass fleece facing)*	2,2	65

*Environmental impacts from respective facings can be found in the Facings annex and shall be added for these products.

LCA: Results

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

Product stage			Construction stage		Use stage							End of life stage				Benefits & loads beyond system boundary
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	X	X	X	X	X

How to read scientific notation

Scientific notation	Decimal form
1,00E-01	0,1
1,00E-02	0,01
1,00E-03	0,001
1,00E-04	0,0001
1,00E-05	0,00001

Core environmental impact indicators

Indicator	Unit	A1-3	A4	A5	B1-B7	C1	C2	C3	C4	D
GWP-total	kg CO2 eq.	5,31E-01	5,62E-02	9,11E-02	MNR	0	3,43E-03	0	1,67E-02	-3,83E-02
		***G**lobal **W**arming **P**otential-total is the sum of GWP-fossil, GWP-biogenic and GWP luluc. GWP measures the Carbon Dioxide (CO_2) and other greenhouse gas emissions associated with the product.*								
GWP-fossil	kg CO2 eq.	5,97E-01	5,57E-02	2,26E-02	MNR	0	3,40E-03	0	1,66E-02	-4,21E-02
		GWP-fossil takes into account the GWP of greenhouse gas emissions from fossil fuels or fossil carbon containing substances (e.g. combustion, landfilling, etc.).								
GWP-biogenic	kg CO2 eq.	-6,72E-02	0	6,84E-02	MNR	0	0	0	0	3,75E-03
		GWP-biogenic represents the atmospheric CO_2 absorbed from biomass growth and emitted during e.g. incineration or natural decay.								
GWP-LULUC	kg CO2 eq.	2,68E-04	4,58E-04	1,84E-05	MNR	0	2,79E-05	0	4,88E-05	-3,11E-06
		GWP-land use and land use change (luluc) takes into account greenhouse gas emissions from changes in carbon stock as a result of land use and land use change, e.g. deforestation								
ODP	kg CFC11 eq.	3,55E-09	7,14E-18	1,50E-10	MNR	0	4,37E-19	0	6,46E-17	-1,17E-15
		*The **O**zone **D**epletion **P**otential, describes the potential for degradation of the ozone layer. High ODP substances are forbidden today.*								
AP	mol H^+ eq.	5,73E-03	4,96E-05	1,40E-04	MNR	0	3,59E-06	0	1,19E-04	-1,17E-04
		*The Acidification **P**otential reflects the potential to cause the acid deposition or "acid rain"*								
EP-freshwater	kg P eq.	9,41E-06	1,66E-07	2,76E-07	MNR	0	1,01E-08	0	2,79E-08	-1,13E-08
		***E**utrophication **P**otential-freshwater represents potential excessive growth of algae and damage of the ecosystems from nutrients emissions reaching the fresh water end compartment.*								
EP-marine	kg N eq.	6,93E-04	1,46E-05	2,30E-05	MNR	0	1,18E-06	0	3,08E-05	-2,16E-05
		As above, but emitted to the marine end compartment.								
EP-terrestrial	mol N eq.	1,94E-02	1,77E-04	4,76E-04	MNR	0	1,41E-05	0	3,38E-04	-2,36E-04
		***E**utrophication **P**otential-terrestrial. indicator for enrichment of terrestrial ecosystems w. nitrogen based nutrients, e.g. ammonia.*								
POCP	kg NMVOC eq.	1,54E-03	4,22E-05	5,27E-05	MNR	0	3,14E-06	0	9,32E-05	-7,11E-05
		***P**hotochemical **O**zone **C**reation **P**otential, most commonly manifested as smog.*								
ADP-M&M	kg Sb eq.	2,10E-07	3,21E-09	4,26E-09	MNR	0	2,60E-10	0	1,57E-09	-3,65E-09
		***A**biotic **D**epletion **P**otential for non-fossil resources (minerals and metals); relates to the consumption and scarcity of minerals and metals.*								
ADP-fossil	MJ	7,10E+00	5,61E-01	7,45E-01	MNR	0	4,54E-02	0	2,21E-01	-1,09E+00
		***A**biotic **D**epletion **P**otential for fossil resources (oil, gas, coal). Indicator for the depletion of fossil resources for energy use or as feedstock for the petrochemical industry.*								
WDP	m^3	1,53E-01	4,76E-04	1,07E-02	MNR	0	2,97E-05	0	1,78E-03	-1,63E-02
		***W**ater **D**eprivation **P**otential, a "water scarcity footprint" indicator for the potential impact of water use , linked to water deficiency to downstream human users and ecosystems.*								

GWP-total: *Global Warming Potential;* ***GWP-fossil:*** *Global Warming Potential fossil fuels;* ***GWP-biogenic:*** *Global Warming Potential biogenic;* ***GWP-LULUC:*** *Global Warming Potential land use and land use change;* ***ODP:*** *Depletion potential of the stratospheric ozone layer;* ***AP:*** *Acidification potential, Accumulated Exceedance;* ***EP-freshwater:*** *Eutrophication potential, fraction of nutrients reaching freshwater end compartment; See "additional Norwegian requirements" for indicator given as PO4 eq.* ***EP-marine:*** *Eutrophication potential, fraction of nutrients reaching freshwater end compartment;* ***EP-terrestrial:*** *Eutrophication potential, Accumulated Exceedance;* ***POCP****: Formation potential of tropospheric ozone;* ***ADP-M&M****: Abiotic depletion potential for non-fossil resources (minerals and metals);* ***ADP-fossil:*** *Abiotic depletion potential for fossil resources;* ***WDP:*** *Water deprivation potential, deprivation weighted water consumption*

Reading example: 9,0 E-03 = 9,0*10-3 = 0,009

Additional environmental impact indicators

Indicator	Unit	A1-3	A4	A5	B1-B7	C1	C2	C3	C4	D
PM	Disease incidence	5,28E-08	3,08E-10	1,25E-09	MNR	0	2,07E-11	0	1,47E-09	-1,51E-09
		***P**articulate **M**atter. An indicator for potential disease incidences (occurrences) linked to emissions of particulate matter from, e.g. diesel engines.*								
IRP	kBq U235 eq.	6,68E-03	1,26E-04	1,38E-03	MNR	0	7,89E-06	0	2,43E-04	-1,84E-04
		***I**onising **r**adiation **P**otential, relates to the possible damage to human health from exposure to low level radiation linked to generation of nuclear energy only.*								
ETP-fw	CTUe	2,40E+00	5,27E-01	1,01E-01	MNR	0	3,29E-02	0	1,25E-01	-1,21E-02
		***E**co**t**oxicity **P**otential-freshwater. Potential toxic effects on freshwater species of emissions of substances/chemicals.*								
HTP-c	CTUh	8,58E-10	1,06E-11	1,98E-11	MNR	0	6,63E-13	0	1,86E-11	-4,46E-12
		***H**uman **t**oxicity **p**otential - cancer effects. Potential carcinogenic impacts on people from the emissions of substances and chemicals*								
HTP-nc	CTUh	2,78E-09	5,49E-10	2,60E-10	MNR	0	3,43E-11	0	2,05E-09	-1,30E-10
		***H**uman **t**oxicity **P**otential - non-cancer effects. Potential toxic effects on humans other than carcinogenic from the emission of substances and chemicals.*								
SQP	Dimension-less	1,33E+01	2,51E-01	2,89E-01	MNR	0	1,56E-02	0	4,46E-02	-6,69E-01
		***S**oil **Q**uality **P**otential. Indicator representing factors impacting soil quality, e.g. Erosion, filtration ability and groundwater regeneration.*								

***PM:** Particulate matter emissions; **IRP:** Ionising radiation, human health; **ETP-fw:** Ecotoxicity (freshwater); **ETP-c:** Human toxicity, cancer effects; **HTP-nc:** Human toxicity, non-cancer effects; **SQP:** Land use related impacts / soil quality*

Classification of disclaimers to the declaration of core and additional environmental impact indicators

ILCD classification	Indicator	Disclaimer
ILCD type / level 1	Global warming potential (GWP)	None
	Depletion potential of the stratospheric ozone layer (ODP)	None
	Potential incidence of disease due to PM emissions (PM)	None
	Acidification potential, Accumulated Exceedance (AP)	None
ILCD type / level 2	Eutrophication potential, Fraction of nutrients reaching freshwater end compartment (EP-freshwater)	None
	Eutrophication potential, Fraction of nutrients reaching marine end compartment (EP-marine)	None
	Eutrophication potential, Accumulated Exceedance (EP-terrestrial)	None
	Formation potential of tropospheric ozone (POCP)	None
	Potential Human exposure efficiency relative to U235 (IRP)	1
ILCD type / level 3	Abiotic depletion potential for non-fossil resources (ADP-minerals&metals)	2
	Abiotic depletion potential for fossil resources (ADP-fossil)	2
	Water (user) deprivation potential, deprivation-weighted water consumption (WDP)	2
	Potential Comparative Toxic Unit for ecosystems (ETP-fw)	2
	Potential Comparative Toxic Unit for humans (HTP-c)	2
	Potential Comparative Toxic Unit for humans (HTP-nc)	2
	Potential Soil quality index (SQP)	2

Disclaimer 1 – This impact category deals mainly with the eventual impact of low dose ionizing radiation on human health of the nuclear fuel cycle. It does not consider effects due to possible nuclear accidents, occupational exposure nor due to radioactive waste disposal in underground facilities. Potential ionizing radiation from the soil, from radon and from some construction materials is also not measured by this indicator.

Disclaimer 2 – The results of this environmental impact indicator shall be used with care as the uncertainties on these results are high or as there is limited experienced with the indicator

Resource use

Indicator	Unit	A1-3	A4	A5	B1-B7	C1	C2	C3	C4	D
RPEE	MJ	6,16E+00	4,08E-02	1,53E-01	MNR	0	2,54E-03	0	2,97E-02	-1,52E-01
		***R**enewable **P**rimary **E**nergy used as **E**nergy carrier only.* *Typically renewable energy from Biomethane, windmills or hydropower*								
RPEM	MJ	7,96E-02	0	-2,39E-03	MNR	0	0	0	0	0
		***R**enewable **p**rimary **e**nergy resources used as raw materials – indicates the consumption of energy resources as raw materials e.g. wood, or biomethane as feedstock for bio-plastics*								
TPE	MJ	6,24E+00	4,08E-02	1,51E-01	MNR	0	2,54E-03	0	2,97E-02	-1,52E-01
		***T**otal use of renewable **p**rimary **e**nergy resources (RPEE+RPEM)*								
NRPE	MJ	6,46E+00	7,30E-01	2,64E-01	MNR	0	4,55E-02	0	2,21E-01	-1,09E+00
		***N**on **r**enewable **p**rimary **e**nergy used as **E**nergy carrier, e.g. energy from fossil fuel power plants or transportation*								
NRPM	MJ	6,39E-01	0	-1,92E-02	MNR	0	0	0	0	0
		***N**on **r**enewable **p**rimary energy resources used as raw materials, e.g. oil derivatives used as feedstock material for the petrochemical industry / plastics*								
TRPE	MJ	7,10E+00	7,30E-01	2,45E-01	MNR	0	4,55E-02	0	2,21E-01	-1,09E+00
		***T**otal use of non **r**enewable **p**rimary **e**nergy resources (NRPE+NRPM)*								
SM	kg	0	0	0	MNR	0	0	0	0	0
		***S**econdary **m**aterials, Use of recycled material, e.g. return wool*								
RSF	MJ	0	0	0	MNR	0	0	0	0	0
		***R**enewable **s**econdary **f**uels. E.g. used frying oil. Renewable secondary fuels can represent a limited resource why increased consumption potentially can create shortages.*								
NRSF	MJ	0	0	0	MNR	0	0	0	0	0
		***N**on-**r**enewable **s**econdary **f**uels, e.g. waste oil*								
W	m^3	3,72E-03	4,66E-05	2,66E-04	MNR	0	2,90E-06	0	5,45E-05	-5,21E-04
		Net fresh water consumption. Fresh water is a limited resource why high consumption of fresh water can create local shortages								

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	A1-3	A4	A5	B1-B7	C1	C2	C3	C4	D
HW	kg	2,46E-07	3,68E-11	4,97E-09	MNR	0	2,30E-12	0	2,34E-11	-9,05E-11
		***H**azardous **w**aste, collected and sent special treatment*								
NHW	kg	9,96E-02	1,08E-04	2,96E-02	MNR	0	6,77E-06	0	1,10E+00	-1,13E-04
		***N**on **H**azardous **W**aste Disposed consists of inactive (inert) waste e.g. construction waste that typically is sent to landfill. An increased fraction is sent to reuse or recycling.*								
RW	kg	2,06E-05	8,84E-07	9,20E-06	MNR	0	5,51E-08	0	2,31E-06	-1,42E-06
		***R**adioactive **W**aste Disposed. Mainly represents waste from nuclear power plants.*								

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

End of life – output flow

Parameter	Unit	A1-3	A4	A5	B1-B7	C1	C2	C3	C4	D
CR	kg	0	0	0	MNR	0	0	0	0	0
		***C**omponents for **R**e-Use. Materials or components which are re-used outside the system boundary.*								
MR	kg	0	0	5,03E-02	MNR	0	0	0	0	0
		***M**aterials for **R**ecycling. Materials recycled outside the system boundary*								
MER	kg	0	0	2,96E-03	MNR	0	0	0	0	0
		***M**aterials for **E**nergy **R**ecovery. Materials utilised in power plants as secondary fuels outside the system boundary*								
EEE	kg	0	0	7,74E-02	MNR	0	0	0	0	0
		***E**xported **e**lectrical **e**nergy: Electrical energy from incineration of waste or landfill gas*								
ETE	kg	0	0	2,30E-01	MNR	0	0	0	0	0
		***E**xported **t**hermal energy. Thermal energy, e.g. steam from incineration of waste or landfill gas*								

CR Components for reuse; MR Materials for recycling; MER Materials for energy recovery; EEE Exported electric energy; ETE Exported thermal energy

Information describing the biogenic carbon content at the factory gate

Biogenic carbon content	Unit	Value
Biogenic carbon content in product	kg C	0
Biogenic carbon content in the accompanying packaging	kg C	1,95E-02

GWP-total interpretation

Global Warming Potential-total	Product stage A1-A3	Construction stage A4	Construction stage A5	Use stage B1-B7	End of life stage C1-C4	**Total A1-C4**	Benefits & Loads beyond system D
Kg CO2 eqv./FU	0,53	0,04	0,09		0,02	**0,70**	-0,04

The main GWP contribution from the product life cycle is linked to the Product stage (A1-A3). This is primarily related to the materials delivered to the factory gate and consumption of energy.

The CO_2 absorbed by the wood in the wooden pallets is represented by a negative GWP-biogenic. This reduces the GWP-total (A1-A3) by approximately 10%.

The GWP-Biogenic, e.g. the carbon stored in the wooden pallets, is released during the construction stage phase (A5) where the wood is presumed incinerated with energy recovery.

The benefits from energy recovery (a negative GWP) from incineration of packaging materials (wood pallets and plastic foils) is allocated to Benefits & Loads beyond system (D).

Impacts linked to end of life stages (C1-C4) are primarily linked to transportation of stone wool to recycling or to landfill.

Melting virgin materials or re-melting returned ROCKWOOL stone wool are both similarly energy intensive processes. Increasing the recycling rate for return wool, will therefore not lead to great variations in the overall GWP profile. However, increased recycling will be linked directly to reduction of waste sent to landfill.

Additional Norwegian requirements

Greenhouse gas emission from the use of electricity in the manufacturing phase

The calculations of applied electricity for the manufacturing process (A3) are made taking into account 100% renewable electricity from Norwegian Hydropower. The renewable sources of electricity are evidenced by Guarantee of Origin certificates (GOs).

National production mix from import, low voltage (production of transmission lines, in addition to direct emissions and losses in grid) for wind power electricity production.

National electricity grid (with GOs)	Unit	Value
Norway Hydropower, GaBi version 10.0.1 (2021)	kg CO2 -eq/kWh	0,014

Additional GWP results calculations using the physical national electricity grid mix and gas mix (energy sources without a guarantees of origins)

National electricity grid	Unit	Value
Norway, GaBi version 10.0.1 (2021)	kg CO2 -eq/kWh	0,030

Indicator	Unit	A1-3
GWP-total	kg CO2 eq.	5,60E-01
GWP-fossil	kg CO2 eq.	6,27E-01
GWP-biogenic	kg CO2 eq.	-6,70E-02
GWP-LULUC	kg CO2 eq.	2,86E-04

The complete additional results for all the impact categories representing the calculations without guarantees of origins, applying Norwegian national production mix for electricity are given in Appendix: Additional LCA Results without GOs.

Additional environmental impact indicators required in NPCR Part A for construction products

In order to increase the transparency of biogenic carbon contribution to climate impact, the indicator for GWP has been sub-divided into the following:

GWP-IOBC Climate impacts calculated according to the principle of instantaneous oxidation
GWP-BC Climate impacts from the net uptake and emission of biogenic carbon from each module.

In addition, EP-freshwater shall also declared as PO4 eq.

Indicator	Unit	A1-3	A4	A5	B	C1	C2	C3	C4	D
EP-freshwater*	kg PO4 eq.	6,19E-04	1,85E-05	2,19E-05	MNR	0	5,32E-07	0	1,07E-05	-7,36E-06
GWP-IOBC	kg CO2 eq.	5,98E-01	4,23E-02	2,26E-02	MNR	0	3,43E-03	0	1,67E-02	-4,21E-02
GWP-BC	kg CO2 eq.	-6,72E-02	0	6,84E-02	MNR	0	0	0	0	3,75E-03
GWP	kg CO2 eq.	5,31E-01	4,23E-02	9,11E-02	MNR	0	3,43E-03	0	1,67E-02	-3,83E-02

EP-freshwater* *Eutrophication potential, fraction of nutrients reaching freshwater end compartment. Declared as PO4 eq.* ***GWP-IOBC*** *Global warming potential calculated according to the principle of instantaneous oxidation.* ***GWP-BC*** *Global warming potential from net uptake and emissions of biogenic carbon from the materials in each module.* ***GWP*** *Global warming potential*

Hazardous substances

The declaration is based upon reference to threshold values and/or test results and/or material safety data sheets provided to EPD verifiers. Documentation available upon request to EPD owner.

- ■ 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.

Mineral wool fibers produced by ROCKWOOL are classified as non-hazardous under REACH (Regulation (EC) No 1272/2008 of the European Parliament and of the Council Cof 16 December 2008 on classification, labelling and packaging of substances and mixtures). ROCKWOOL® are registered with REACH under the following definition: “Man-made vitreous (silicate) fibers with random orientation with alkaline oxide and alkali earth oxide(Na2O+K2O+CaO+MgO+BaO) content greater than 18% by weight and fulfilling one of the Note Q conditions”. ROCKWOOL products produced in Europe fulfil the Note Q requirements. This is certified by the independent certification body EUCEB (European Certification Board for mineral wool products). More information on EUCEB can be found at www.euceb.org.

Indoor environment

There are no legal requirements for indoor emissions of stone wool thermal insulation products.

Carbon footprint

Carbon footprint of 1 m^2 of a 37mm thick ROCKWOOL® stone wool board with a density of 29kg/m^3 (R=1m^2K/W) is 0,7 kg CO2 eq (including Module A1-C4). This is elaborated per module in the results section.

APPENDIX: Facings

The LCA approach for the facings options follows the general methodology and assumptions as for the stone wool insulation products.

This appendix includes impact assessment results and life cycle indicators for all facing options relevant for the products covered by this EPD.

The results are given per m^2 facing applied.

The environmental impact of a product with facing is calculated as follows:

> Environmental Impact per m^2 $_{\text{product-with facing}}$ =
>
> Environmental Impact $_{\text{product without facing}}$ + Environmental Impact $_{\text{facing material}}$

The results for the facings can be added to the results using Guarantee of Origin and also to the results using the consumption mix.

The disposal scenario is assumed to be landfill for all the facing options.

The following facings are included in this appendix:

- Kraft paper
- Nonwoven glass fleece

The system boundaries are identical to those applied in the main document.

Product stage			Construction stage		Use stage							End of life stage				Benefits & loads beyond system boundary
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	X	X	X	X	X

Kraft paper facing

Core environmental impact indicators

Indicator	Unit	A1-3	A4	A5	B1-B7*	C1	C2	C3	C4	D
GWP-total	kg CO2 eq.	-1,01E-01	3,45E-03	0,00E+00	MNR	0,00E+00	2,74E-04	0,00E+00	1,45E-01	0,00E+00
		***G**lobal **W**arming **P**otential-total is the sum of GWP-fossil, GWP-biogenic and GWP luluc. GWP measures the Carbon Dioxide (CO2) and other greenhouse gas emissions associated with the product.*								
GWP-fossil	kg CO2 eq.	4,25E-02	3,42E-03	0,00E+00	MNR	0,00E+00	2,72E-04	0,00E+00	8,40E-03	0,00E+00
		GWP-fossil takes into account the GWP of greenhouse gas emissions from fossil fuels or fossil carbon containing substances (e.g. combustion, landfilling, etc.).								
GWP-biogenic	kg CO2 eq.	-1,44E-01	1,05E-05	0,00E+00	MNR	0,00E+00	-3,76E-07	0,00E+00	1,36E-01	0,00E+00
		GWP-biogenic represents the atmospheric CO_2 absorbed from biomass growth and emitted during e.g. incineration or natural decay.								
GWP-LULUC	kg CO2 eq.	1,08E-04	1,91E-05	0,00E+00	MNR	0,00E+00	1,51E-06	0,00E+00	7,20E-06	0,00E+00
		GWP-land use and land use change (luluc) takes into account greenhouse gas emissions from changes in carbon stock as a result of land use and land use change, e.g. deforestation.								
ODP	kg CFC11 eq.	1,00E-12	2,06E-16	0,00E+00	MNR	0,00E+00	1,63E-17	0,00E+00	9,12E-15	0,00E+00
		*The **O**zone **D**epletion **P**otential, describes the potential for degradation of the ozone layer. High ODP substances are forbidden today.*								
AP	mol H^+ eq.	2,31E-04	3,05E-06	0,00E+00	MNR	0,00E+00	2,88E-07	0,00E+00	4,30E-05	0,00E+00
		*The **A**cidification **P**otential reflects the potential to cause the acid deposition or "acid rain".*								
EP-freshwater	kg P eq.	1,60E-06	1,02E-08	0,00E+00	MNR	0,00E+00	8,12E-10	0,00E+00	7,66E-07	0,00E+00
		***E**utrophication **P**otential-freshwater represents potential excessive growth of algae and damage of the ecosystems from nutrients emissions reaching the fresh water end compartment.*								
EP-marine	kg N eq.	9,41E-05	9,06E-07	0,00E+00	MNR	0,00E+00	9,50E-08	0,00E+00	2,27E-05	0,00E+00
		As above, but emitted to the marine end compartment.								
EP-terrestrial	mol N eq.	8,68E-04	1,10E-05	0,00E+00	MNR	0,00E+00	1,14E-06	0,00E+00	1,49E-04	0,00E+00
		***E**utrophication **P**otential-terrestrial. Indicator for enrichment of terrestrial ecosystems w. nitrogen based nutrients, e.g. ammonia.*								
POCP	kg NMVOC eq.	2,57E-04	2,63E-06	0,00E+00	MNR	0,00E+00	2,54E-07	0,00E+00	8,03E-05	0,00E+00
		***P**hotochemical **O**zone **C**reation **P**otential, most commonly manifested as smog.*								
ADP-M&M	kg Sb eq.	1,46E-08	2,87E-10	0,00E+00	MNR	0,00E+00	2,27E-11	0,00E+00	5,90E-10	0,00E+00
		***A**biotic **D**epletion **P**otential for non-fossil resources (minerals and metals); relates to the consumption and scarcity of minerals and metals.*								
ADP-fossil	MJ	6,49E-01	4,58E-02	0,00E+00	MNR	0,00E+00	3,63E-03	0,00E+00	1,14E-01	0,00E+00
		***A**biotic **D**epletion **P**otential for fossil resources (oil, gas, coal). Indicator for the depletion of fossil resources for energy use or as feedstock for the petrochemical industry.*								
WDP	m^3	9,22E-03	3,08E-05	0,00E+00	MNR	0,00E+00	2,44E-06	0,00E+00	6,40E-04	0,00E+00
		***W**ater **D**eprivation **P**otential, a "water scarcity footprint" indicator for the potential impact of water use , linked to water deficiency to downstream human users and ecosystems.*								

***GWP-total:** Global Warming Potential; **GWP-fossil:** Global Warming Potential fossil fuels; **GWP-biogenic:** Global Warming Potential biogenic; **GWP-LULUC:** Global Warming Potential land use and land use change; **ODP:** Depletion potential of the stratospheric ozone layer; **AP:** Acidification potential, Accumulated Exceedance; **EP-freshwater:** Eutrophication potential, fraction of nutrients reaching freshwater end compartment; See "additional Norwegian requirements" for indicator given as PO4 eq. **EP-marine:** Eutrophication potential, fraction of nutrients reaching freshwater end compartment; **EP-terrestrial:** Eutrophication potential, Accumulated Exceedance; **POCP**: Formation potential of tropospheric ozone; **ADP-M&M**: Abiotic depletion potential for non-fossil resources (minerals and metals); **ADP-fossil:** Abiotic depletion potential for fossil resources; **WDP:** Water deprivation potential, deprivation weighted water consumption*

Additional environmental impact indicators

Indicator	Unit	A1-3	A4	A5	B1-B7*	C1	C2	C3	C4	D
PM	Disease incidence	3,85E-09	1,92E-11	0,00E+00	MNR	0,00E+00	1,64E-12	0,00E+00	4,40E-10	0,00E+00
		***P**articulate **M**atter. An indicator for potential disease incidences (occurrences) linked to emissions of particulate matter from, e.g. diesel engines.*								
IRP	kBq U235 eq.	4,36E-03	8,29E-06	0,00E+00	MNR	0,00E+00	6,57E-07	0,00E+00	1,94E-04	0,00E+00
		***I**onising **r**adiation **P**otential, relates to the possible damage to human health from exposure to low level radiation - linked to generation of nuclear energy only.*								
ETP-fw	CTUe	2,60E-01	3,19E-02	0,00E+00	MNR	0,00E+00	2,53E-03	0,00E+00	1,02E-01	0,00E+00
		***E**co**t**oxicity Potential-freshwater. Potential toxic effects on freshwater species of emissions of substances/chemicals.*								
HTP-c	CTUh	1,13E-11	6,42E-13	0,00E+00	MNR	0,00E+00	5,09E-14	0,00E+00	5,60E-12	0,00E+00
		***H**uman **t**oxicity **p**otential - cancer effects. Potential carcinogenic impacts on people from the emissions of substances and chemicals.*								
HTP-nc	CTUh	6,41E-10	3,31E-11	0,00E+00	MNR	0,00E+00	2,64E-12	0,00E+00	6,70E-10	0,00E+00
		***H**uman **t**oxicity **P**otential - non-cancer effects. Potential toxic effects on humans other than carcinogenic from the emission of substances and chemicals.*								
SQP	Dimension-less	1,90E+01	1,58E-02	0,00E+00	MNR	0,00E+00	1,25E-03	0,00E+00	1,05E-02	0,00E+00
		***S**oil **Q**uality **P**otential. Indicator representing factors impacting soil quality, e.g. Erosion, filtration ability and groundwater regeneration.*								

***PM:** Particulate matter emissions; **IRP:** Ionising radiation, human health; **ETP-fw:** Ecotoxicity (freshwater); **ETP-c:** Human toxicity, cancer effects; **HTP-nc:** Human toxicity, non-cancer effects; **SQP:** Land use related impacts / soil quality*

Classification of disclaimers to the declaration of core and additional environmental impact indicators

ILCD classification	Indicator	Disclaimer
ILCD type / level 1	Global warming potential (GWP)	None
	Depletion potential of the stratospheric ozone layer (ODP)	None
	Potential incidence of disease due to PM emissions (PM)	None
	Acidification potential, Accumulated Exceedance (AP)	None
	Eutrophication potential, Fraction of nutrients reaching freshwater end compartment (EP-freshwater)	None
ILCD type / level 2	Eutrophication potential, Fraction of nutrients reaching marine end compartment (EP-marine)	None
	Eutrophication potential, Accumulated Exceedance (EP-terrestrial)	None
	Formation potential of tropospheric ozone (POCP)	None
	Potential Human exposure efficiency relative to U235 (IRP)	1
ILCD type / level 3	Abiotic depletion potential for non-fossil resources (ADP-minerals&metals)	2
	Abiotic depletion potential for fossil resources (ADP-fossil)	2
	Water (user) deprivation potential, deprivation-weighted water consumption (WDP)	2
	Potential Comparative Toxic Unit for ecosystems (ETP-fw)	2
	Potential Comparative Toxic Unit for humans (HTP-c)	2
	Potential Comparative Toxic Unit for humans (HTP-nc)	2
	Potential Soil quality index (SQP)	2

Disclaimer 1 – This impact category deals mainly with the eventual impact of low dose ionizing radiation on human health of the nuclear fuel cycle. It does not consider effects due to possible nuclear accidents, occupational exposure nor due to radioactive waste disposal in underground facilities. Potential ionizing radiation from the soil, from radon and from some construction materials is also not measured by this indicator.

Disclaimer 2 – The results of this environmental impact indicator shall be used with care as the uncertainties on these results are high or as there is limited experienced with the indicator

Resource use

Indicator	Unit	A1-3	A4	A5	B1-B7*	C1	C2	C3	C4	D
RPEE	MJ	1,52E+00	2,60E-03	0,00E+00	MNR	0,00E+00	2,07E-04	0,00E+00	1,03E-02	0,00E+00
		***R**enewable **P**rimary **E**nergy used as **E**nergy carrier only.* *Typically renewable energy from Biomethane, windmills or hydropower.*								
RPEM	MJ	1,32E+00	0,00E+00	0,00E+00	MNR	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
		***R**enewable **p**rimary **e**nergy resources used as raw materials – indicates the consumption of energy resources as raw materials e.g. wood, or biomethane as feedstock for bio-plastics.*								
TPE	MJ	2,84E+00	2,60E-03	0,00E+00	MNR	0,00E+00	2,07E-04	0,00E+00	1,03E-02	0,00E+00
		***T**otal use of renewable **p**rimary **e**nergy resources (RPEE+RPEM).*								
NRPE	MJ	6,49E-01	4,59E-02	0,00E+00	MNR	0,00E+00	3,64E-03	0,00E+00	1,14E-01	0,00E+00
		***N**on **r**enewable **p**rimary **e**nergy used as **E**nergy carrier, , e.g. energy from fossil fuel power plants or transportation.*								
NRPM	MJ	0,00E+00	0,00E+00	0,00E+00	MNR	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
		***N**on **r**enewable **p**rimary energy resources used as raw materials, e.g. oil derivates used as feedstock material for the petrochemical industry / plastics.*								
TRPE	MJ	6,49E-01	4,59E-02	0,00E+00	MNR	0,00E+00	3,64E-03	0,00E+00	1,14E-01	0,00E+00
		***T**otal use of non **r**enewable **p**rimary **e**nergy resources (NRPE+NRPM).*								
SM	kg	0,00E+00	0,00E+00	0,00E+00	MNR	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
		***S**econdary **m**aterials, Use of recycled material, e.g. return wool.*								
RSF	MJ	0,00E+00	0,00E+00	0,00E+00	MNR	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
		***R**enewable **s**econdary **f**uels. E.g. used frying oil. Renewable secondary fuels can represent a limited resource why increased consumption potentially can create shortages.*								
NRSF	MJ	0,00E+00	0,00E+00	0,00E+00	MNR	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
		***N**on-**r**enewable **s**econdary **f**uels, e.g. waste oil.*								
W	m^3	4,15E-04	2,95E-06	0,00E+00	MNR	0,00E+00	2,34E-07	0,00E+00	1,87E-05	0,00E+00
		Net fresh water consumption. Fresh water is a limited resource why high consumption of fresh water can create local shortages.								

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	A1-3	A4	A5	B1-B7*	C1	C2	C3	C4	D
HW	kg	2,10E-08	2,20E-13	0,00E+00	MNR	0,00E+00	1,74E-14	0,00E+00	1,67E-11	0,00E+00
		***H**azardous **w**aste, collected and sent special treatment*								
NHW	kg	3,10E-03	6,58E-06	0,00E+00	MNR	0,00E+00	5,22E-07	0,00E+00	1,60E-01	0,00E+00
		***N**on **H**azardous **W**aste Disposed consists of inactive (inert) waste e.g. construction waste that typically is sent to landfill. An increased fraction is sent to reuse or recycling.*								
RW	kg	2,71E-05	5,66E-08	0,00E+00	MNR	0,00E+00	4,49E-09	0,00E+00	1,37E-06	0,00E+00
		***R**adioactive **W**aste Disposed. Mainly represents waste from nuclear power plants.*								

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

End of life – output flow

Parameter	Unit	A1-3	A4	A5	B1-B7*	C1	C2	C3	C4	D
CR	kg	0,00E+00	0,00E+00	0,00E+00	MNR	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
		***C**omponents for **R**e-Use. Materials or components which are re-used outside the system boundary.*								
MR	kg	0,00E+00	0,00E+00	0,00E+00	MNR	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
		***M**aterials for **R**ecycling. Materials recycled outside the system boundary.*								
MER	kg	0,00E+00	0,00E+00	0,00E+00	MNR	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
		***M**aterials for **E**nergy **R**ecovery. Materials utilised in power plants as secondary fuels outside the system boundary.*								
EEE	kg	0,00E+00	0,00E+00	0,00E+00	MNR	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
		***E**xported **e**lectrical **e**nergy: Electrical energy from incineration of waste or landfill gas.*								
ETE	kg	0,00E+00	0,00E+00	0,00E+00	MNR	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
		***E**xported **t**hermal energy. Thermal energy, e.g. steam from incineration of waste or landfill gas.*								

Information describing the biogenic carbon content at the factory gate

Biogenic carbon content	Unit	Value
Biogenic carbon content in product	kg C	3,78E-02
Biogenic carbon content in the accompanying packaging	kg C	0

Nonwoven glass fleece facing

Core environmental impact indicators

Indicator	Unit	A1-3	A4	A5	B1-B7*	C1	C2	C3	C4	D
GWP-total	kg CO2 eq.	2,09E-01	3,92E-03	0,00E+00	MNR	0,00E+00	3,11E-04	0,00E+00	3,10E-03	0,00E+00
		***G**lobal **W**arming **P**otential-total is the sum of GWP-fossil, GWP-biogenic and GWP luluc. GWP measures the Carbon Dioxide (CO2) and other greenhouse gas emissions associated with the product.*								
GWP-fossil	kg CO2 eq.	2,14E-01	3,89E-03	0,00E+00	MNR	0,00E+00	3,09E-04	0,00E+00	3,20E-03	0,00E+00
		GWP-fossil takes into account the GWP of greenhouse gas emissions from fossil fuels or fossil carbon containing substances (e.g. combustion, landfilling, etc.).								
GWP-biogenic	kg CO2 eq.	-5,56E-03	1,19E-05	0,00E+00	MNR	0,00E+00	-4,27E-07	0,00E+00	-9,30E-05	0,00E+00
		GWP-biogenic represents the atmospheric CO_2 absorbed from biomass growth and emitted during e.g. incineration or natural decay.								
GWP-LULUC	kg CO2 eq.	2,45E-04	2,17E-05	0,00E+00	MNR	0,00E+00	1,72E-06	0,00E+00	9,40E-06	0,00E+00
		GWP-land use and land use change (luluc) takes into account greenhouse gas emissions from changes in carbon stock as a result of land use and land use change, e.g. deforestation.								
ODP	kg CFC11 eq.	1,10E-12	2,34E-16	0,00E+00	MNR	0,00E+00	1,85E-17	0,00E+00	1,24E-17	0,00E+00
		*The **O**zone **D**epletion **P**otential, describes the potential for degradation of the ozone layer. High ODP substances are forbidden today.*								
AP	mol H^+ eq.	1,38E-03	3,47E-06	0,00E+00	MNR	0,00E+00	3,27E-07	0,00E+00	2,20E-05	0,00E+00
		*The **A**cidification **P**otential reflects the potential to cause the acid deposition or "acid rain".*								
EP-freshwater	kg P eq.	5,04E-07	1,16E-08	0,00E+00	MNR	0,00E+00	9,23E-10	0,00E+00	5,30E-09	0,00E+00
		***E**utrophication **P**otential-freshwater represents potential excessive growth of algae and damage of the ecosystems from nutrients emissions reaching the fresh water end compartment.*								
EP-marine	kg N eq.	1,97E-04	1,03E-06	0,00E+00	MNR	0,00E+00	1,08E-07	0,00E+00	5,80E-06	0,00E+00
		As above, but emitted to the marine end compartment.								
EP-terrestrial	mol N eq.	2,22E-03	1,25E-05	0,00E+00	MNR	0,00E+00	1,29E-06	0,00E+00	6,50E-05	0,00E+00
		***E**utrophication **P**otential-terrestrial. Indicator for enrichment of terrestrial ecosystems w. nitrogen based nutrients, e.g. ammonia.*								
POCP	kg NMVOC eq.	5,93E-04	2,99E-06	0,00E+00	MNR	0,00E+00	2,89E-07	0,00E+00	1,83E-05	0,00E+00
		***P**hotochemical **O**zone **C**reation **P**otential, most commonly manifested as smog.*								
ADP-M&M	kg Sb eq.	6,37E-08	3,26E-10	0,00E+00	MNR	0,00E+00	2,58E-11	0,00E+00	3,00E-10	0,00E+00
		***A**biotic **D**epletion **P**otential for non-fossil resources (minerals and metals); relates to the consumption and scarcity of minerals and metals.*								
ADP-fossil	MJ	3,64E+00	5,21E-02	0,00E+00	MNR	0,00E+00	4,13E-03	0,00E+00	4,20E-02	0,00E+00
		***A**biotic **D**epletion **P**otential for fossil resources (oil, gas, coal). Indicator for the depletion of fossil resources for energy use or as feedstock for the petrochemical industry.*								
WDP	m^3	2,15E-02	3,50E-05	0,00E+00	MNR	0,00E+00	2,77E-06	0,00E+00	3,40E-04	0,00E+00
		***W**ater **D**eprivation **P**otential, a "water scarcity footprint" indicator for the potential impact of water use , linked to water deficiency to downstream human users and ecosystems.*								

***GWP-total:** Global Warming Potential; **GWP-fossil:** Global Warming Potential fossil fuels; **GWP-biogenic:** Global Warming Potential biogenic; **GWP-LULUC:** Global Warming Potential land use and land use change; **ODP:** Depletion potential of the stratospheric ozone layer; **AP:** Acidification potential, Accumulated Exceedance; **EP-freshwater:** Eutrophication potential, fraction of nutrients reaching freshwater end compartment; See "additional Norwegian requirements" for indicator given as PO4 eq. **EP-marine:** Eutrophication potential, fraction of nutrients reaching freshwater end compartment; **EP-terrestrial:** Eutrophication potential, Accumulated Exceedance; **POCP**: Formation potential of tropospheric ozone; **ADP-M&M**: Abiotic depletion potential for non-fossil resources (minerals and metals); **ADP-fossil:** Abiotic depletion potential for fossil resources; **WDP:** Water deprivation potential, deprivation weighted water consumption*

Additional environmental impact indicators

Indicator	Unit	A1-3	A4	A5	B1-B7*	C1	C2	C3	C4	D
PM	Disease incidence	9,70E-09	2,18E-11	0,00E+00	MNR	0,00E+00	1,86E-12	0,00E+00	2,80E-10	0,00E+00
		***P**articulate **M**atter. An indicator for potential disease incidences (occurrences) linked to emissions of particulate matter from, e.g. diesel engines.*								
IRP	kBq U235 eq.	8,53E-03	9,42E-06	0,00E+00	MNR	0,00E+00	7,47E-07	0,00E+00	4,60E-05	0,00E+00
		***I**onising **r**adiation **P**otential, relates to the possible damage to human health from exposure to low level radiation - linked to generation of nuclear energy only.*								
ETP-fw	CTUe	8,22E-01	3,62E-02	0,00E+00	MNR	0,00E+00	2,87E-03	0,00E+00	2,40E-02	0,00E+00
		***E**co**t**oxicity Potential-freshwater. Potential toxic effects on freshwater species of emissions of substances/chemicals.*								
HTP-c	CTUh	4,26E-10	7,29E-13	0,00E+00	MNR	0,00E+00	5,78E-14	0,00E+00	3,50E-12	0,00E+00
		***H**uman **t**oxicity **p**otential - cancer effects. Potential carcinogenic impacts on people from the emissions of substances and chemicals.*								
HTP-nc	CTUh	2,89E-09	3,76E-11	0,00E+00	MNR	0,00E+00	3,00E-12	0,00E+00	3,90E-10	0,00E+00
		***H**uman **t**oxicity **P**otential - non-cancer effects. Potential toxic effects on humans other than carcinogenic from the emission of substances and chemicals.*								
SQP	Dimension-less	1,79E+00	1,79E-02	0,00E+00	MNR	0,00E+00	1,42E-03	0,00E+00	8,50E-03	0,00E+00
		***S**oil **Q**uality **P**otential. Indicator representing factors impacting soil quality, e.g. Erosion, filtration ability and groundwater regeneration.*								

***PM:** Particulate matter emissions; **IRP:** Ionising radiation, human health; **ETP-fw:** Ecotoxicity (freshwater); **ETP-c:** Human toxicity, cancer effects; **HTP-nc:** Human toxicity, non-cancer effects; **SQP:** Land use related impacts / soil quality*

Classification of disclaimers to the declaration of core and additional environmental impact indicators

ILCD classification	Indicator	Disclaimer
ILCD type / level 1	Global warming potential (GWP)	None
	Depletion potential of the stratospheric ozone layer (ODP)	None
	Potential incidence of disease due to PM emissions (PM)	None
	Acidification potential, Accumulated Exceedance (AP)	None
ILCD type / level 2	Eutrophication potential, Fraction of nutrients reaching freshwater end compartment (EP-freshwater)	None
	Eutrophication potential, Fraction of nutrients reaching marine end compartment (EP-marine)	None
	Eutrophication potential, Accumulated Exceedance (EP-terrestrial)	None
	Formation potential of tropospheric ozone (POCP)	None
	Potential Human exposure efficiency relative to U235 (IRP)	1
ILCD type / level 3	Abiotic depletion potential for non-fossil resources (ADP-minerals&metals)	2
	Abiotic depletion potential for fossil resources (ADP-fossil)	2
	Water (user) deprivation potential, deprivation-weighted water consumption (WDP)	2
	Potential Comparative Toxic Unit for ecosystems (ETP-fw)	2
	Potential Comparative Toxic Unit for humans (HTP-c)	2
	Potential Comparative Toxic Unit for humans (HTP-nc)	2
	Potential Soil quality index (SQP)	2

Disclaimer 1 – This impact category deals mainly with the eventual impact of low dose ionizing radiation on human health of the nuclear fuel cycle. It does not consider effects due to possible nuclear accidents, occupational exposure nor due to radioactive waste disposal in underground facilities. Potential ionizing radiation from the soil, from radon and from some construction materials is also not measured by this indicator.

Disclaimer 2 – The results of this environmental impact indicator shall be used with care as the uncertainties on these results are high or as there is limited experienced with the indicator

Resource use

Indicator	Unit	A1-3	A4	A5	B1-B7*	C1	C2	C3	C4	D
RPEE	MJ	7,86E-01	2,96E-03	0,00E+00	MNR	0	2,35E-04	0,00E+00	5,70E-03	0,00E+00
		***R**enewable **P**rimary **E**nergy used as **E**nergy carrier only.* *Typically renewable energy from Biomethane, windmills or hydropower.*								
RPEM	MJ	0,00E+00	0,00E+00	0,00E+00	MNR	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
		***R**enewable **p**rimary **e**nergy resources used as raw materials – indicates the consumption of energy resources as raw materials e.g. wood, or biomethane as feedstock for bio-plastics.*								
TPE	MJ	7,86E-01	2,96E-03	0,00E+00	MNR	0,00E+00	2,35E-04	0,00E+00	5,70E-03	0,00E+00
		***T**otal use of renewable **p**rimary **e**nergy resources (RPEE+RPEM).*								
NRPE	MJ	3,65E+00	5,22E-02	0,00E+00	MNR	0,00E+00	4,14E-03	0,00E+00	4,20E-02	0,00E+00
		***N**on **r**enewable **p**rimary **e**nergy used as **E**nergy carrier, , e.g. energy from fossil fuel power plants or transportation.*								
NRPM	MJ	0,00E+00	0,00E+00	0,00E+00	MNR	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
		***N**on **r**enewable **p**rimary energy resources used as raw materials, e.g. oil derivates used as feedstock material for the petrochemical industry / plastics.*								
TRPE	MJ	3,65E+00	5,22E-02	0,00E+00	MNR	0,00E+00	4,14E-03	0,00E+00	4,20E-02	0,00E+00
		***T**otal use of non **r**enewable **p**rimary **e**nergy resources (NRPE+NRPM).*								
SM	kg	0,00E+00	0,00E+00	0,00E+00	MNR	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
		***S**econdary **m**aterials, Use of recycled material, e.g. return wool.*								
RSF	MJ	0,00E+00	0,00E+00	0,00E+00	MNR	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
		***R**enewable **s**econdary **f**uels. E.g. used frying oil. Renewable secondary fuels can represent a limited resource why increased consumption potentially can create shortages.*								
NRSF	MJ	0,00E+00	0,00E+00	0,00E+00	MNR	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
		***N**on-**r**enewable **s**econdary **f**uels, e.g. waste oil.*								
W	m^3	8,12E-04	3,35E-06	0,00E+00	MNR	0,00E+00	2,66E-07	0,00E+00	1,04E-05	0,00E+00
		Net fresh water consumption. Fresh water is a limited resource why high consumption of fresh water can create local shortages.								

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	A1-3	A4	A5	B1-B7*	C1	C2	C3	C4	D
HW	kg	1,00E-09	2,50E-13	0,00E+00	MNR	0,00E+00	1,98E-14	0,00E+00	4,50E-12	0,00E+00
		***H**azardous **w**aste, collected and sent special treatment*								
NHW	kg	1,97E-02	7,48E-06	0,00E+00	MNR	0,00E+00	5,93E-07	0,00E+00	2,10E-01	0,00E+00
		***N**on **H**azardous **W**aste Disposed consists of inactive (inert) waste e.g. construction waste that typically is sent to landfill. An increased fraction is sent to reuse or recycling.*								
RW	kg	8,79E-05	6,43E-08	0,00E+00	MNR	0,00E+00	5,10E-09	0,00E+00	4,40E-07	0,00E+00
		***R**adioactive **W**aste Disposed. Mainly represents waste from nuclear power plants.*								

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

End of life – output flow

Parameter	Unit	A1-3	A4	A5	B1-B7*	C1	C2	C3	C4	D
CR	kg	0,00E+00	0,00E+00	0,00E+00	MNR	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
		***C**omponents for **R**e-Use. Materials or components which are re-used outside the system boundary.*								
MR	kg	0,00E+00	0,00E+00	0,00E+00	MNR	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
		***M**aterials for **R**ecycling. Materials recycled outside the system boundary.*								
MER	kg	0,00E+00	0,00E+00	0,00E+00	MNR	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
		***M**aterials for **E**nergy **R**ecovery. Materials utilised in power plants as secondary fuels outside the system boundary.*								
EEE	kg	0,00E+00	0,00E+00	0,00E+00	MNR	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
		***E**xported **e**lectrical **e**nergy: Electrical energy from incineration of waste or landfill gas.*								
ETE	kg	0,00E+00	0,00E+00	0,00E+00	MNR	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
		***E**xported **t**hermal energy. Thermal energy, e.g. steam from incineration of waste or landfill gas.*								

CR Components for reuse; MR Materials for recycling; MER Materials for energy recovery; EEE Exported electric energy; ETE Exported thermal energy

Information describing the biogenic carbon content at the factory gate

Biogenic carbon content	Unit	Value
Biogenic carbon content in product	kg C	0
Biogenic carbon content in the accompanying packaging	kg C	0

APPENDIX: Additional LCA Results without GOs

The LCA Results were calculated additionally without taking into account the purchase of guarantees of origin. Based on these results the contribution of green electricity to the reduction of environmental impacts can be observed. ROCKWOOL Nordics has committed to continious purchase of renewable energy certificates for at least the validity period of this declaration.

Calculations are done applying Norwegian national production mix for electricity and natural gas for gas in manufacturing processes (A3).

National electricity grid	Unit	Value
Norway, GaBi version 10.0.1 (2021)	kg CO2 -eq/kWh	0,030

Core environmental impact indicators

Indicator	Unit	A1-3	A4	A5	B	C1	C2	C3	C4	D
GWP-total	kg CO2 eq.	5,60E-01	5,50E-02	9,17E-02	MNR	0	3,43E-03	0	1,67E-02	-3,83E-02
GWP-fossil	kg CO2 eq.	6,27E-01	5,46E-02	2,32E-02	MNR	0	3,40E-03	0	1,66E-02	-4,21E-02
GWP-biogenic	kg CO2 eq.	-6,70E-02	0,00E+00	6,85E-02	MNR	0	0	0	0	3,75E-03
GWP-LULUC	kg CO2 eq.	2,86E-04	4,49E-04	1,89E-05	MNR	0	2,79E-05	0	4,88E-05	-3,11E-06
ODP	kg CFC11 eq.	3,55E-09	7,00E-18	1,50E-10	MNR	0	4,37E-19	0	6,46E-17	-1,17E-15
AP	mol H^+ eq.	5,75E-03	4,86E-05	1,40E-04	MNR	0	3,59E-06	0	1,19E-04	-1,17E-04
EP-freshwater	kg P eq.	9,47E-06	1,63E-07	2,78E-07	MNR	0	1,01E-08	0	2,79E-08	-1,13E-08
EP-marine	kg N eq.	6,99E-04	1,43E-05	2,32E-05	MNR	0	1,18E-06	0	3,08E-05	-2,16E-05
EP-terrestial	mol N eq.	1,95E-02	1,74E-04	4,77E-04	MNR	0	1,41E-05	0	3,38E-04	-2,36E-04
POCP	kg NMVOC eq.	1,55E-03	4,13E-05	5,30E-05	MNR	0	3,14E-06	0	9,32E-05	-7,11E-05
ADP-M&M	kg Sb eq.	2,08E-07	4,18E-09	5,20E-09	MNR	0	2,60E-10	0	1,57E-09	-3,65E-09
ADP-fossil	MJ	7,45E+00	7,30E-01	2,65E-01	MNR	0	4,54E-02	0	2,21E-01	-1,09E+00
WDP	m^3	1,21E-01	4,76E-04	1,00E-02	MNR	0	2,97E-05	0	1,78E-03	-1,63E-02

GWP-total: *Global Warming Potential;* ***GWP-fossil:*** *Global Warming Potential fossil fuels;* ***GWP-biogenic:*** *Global Warming Potential biogenic;* ***GWP-LULUC:*** *Global Warming Potential land use and land use change;* ***ODP:*** *Depletion potential of the stratospheric ozone layer;* ***AP:*** *Acidification potential, Accumulated Exceedance;* ***EP-freshwater:*** *Eutrophication potential, fraction of nutrients reaching freshwater end compartment; See "additional Norwegian requirements" for indicator given as PO4 eq.* ***EP-marine:*** *Eutrophication potential, fraction of nutrients reaching freshwater end compartment;* ***EP-terrestial:*** *Eutrophication potential, Accumulated Exceedance;* ***POCP****: Formation potential of tropospheric ozone;* ***ADP-M&M****: Abiotic depletion potential for non-fossil resources (minerals and metals);* ***ADP-fossil:*** *Abiotic depletion potential for fossil resources;* ***WDP:*** *Water deprivation potential, deprivation weighted water counsumption*

Reading example: 9,0 E-03 = 9,0*10-3 = 0,009

Additional environmental impact indicators

Indicator	Unit	A1-3	A4	A5	B	C1	C2	C3	C4	D
PM	Disease incid.	5,30E-08	3,08E-10	1,25E-09	MNR	0	2,07E-11	0	1,47E-09	-1,51E-09
IRP	kBq U235 eq.	1,23E-02	1,26E-04	1,50E-03	MNR	0	7,89E-06	0	2,43E-04	-1,84E-04
ETP-fw	CTUe	2,49E+00	5,27E-01	1,02E-01	MNR	0	3,29E-02	0	1,25E-01	-1,21E-02
HTP-c	CTUh	8,12E-10	1,06E-11	1,89E-11	MNR	0	6,63E-13	0	1,86E-11	-4,46E-12
HTP-nc	CTUh	2,90E-09	5,49E-10	2,63E-10	MNR	0	3,43E-11	0	2,05E-09	-1,30E-10
SQP	Dimensionless	1,35E+01	2,51E-01	2,92E-01	MNR	0	1,56E-02	0	4,46E-02	-6,69E-01

PM: *Particulate matter emissions;* ***IRP:*** *Ionising radiation, human health;* ***ETP-fw:*** *Ecotoxicity (freshwater);* ***ETP-c:*** *Human toxicity, cancer effects;* ***HTP-nc:*** *Human toxicity, non-cancer effects;* ***SQP:*** *Land use related impacts / soil quality*

Classification of disclaimers to the declaration of core and additional environmental impact indicators

ILCD classification	Indicator	Disclaimer
ILCD type / level 1	Global warming potential (GWP)	None
	Depletion potential of the stratospheric ozone layer (ODP)	None
	Potential incidence of disease due to PM emissions (PM)	None
ILCD type / level 2	Acidification potential, Accumulated Exceedance (AP)	None
	Eutrophication potential, Fraction of nutrients reaching freshwater end compartment (EP-freshwater)	None
	Eutrophication potential, Fraction of nutrients reaching marine end compartment (EP-marine)	None
	Eutrophication potential, Accumulated Exceedance (EP-terrestrial)	None
	Formation potential of tropospheric ozone (POCP)	None
	Potential Human exposure efficiency relative to U235 (IRP)	1
ILCD type / level 3	Abiotic depletion potential for non-fossil resources (ADP-minerals&metals)	2
	Abiotic depletion potential for fossil resources (ADP-fossil)	2
	Water (user) deprivation potential, deprivation-weighted water consumption (WDP)	2
	Potential Comparative Toxic Unit for ecosystems (ETP-fw)	2
	Potential Comparative Toxic Unit for humans (HTP-c)	2
	Potential Comparative Toxic Unit for humans (HTP-nc)	2
	Potential Soil quality index (SQP)	2

Disclaimer 1 – This impact category deals mainly with the eventual impact of low dose ionizing radiation on human health of the nuclear fuel cycle. It does not consider effects due to possible nuclear accidents, occupational exposure nor due to radioactive waste disposal in underground facilities. Potential ionizing radiation from the soil, from radon and from some construction materials is also not measured by this indicator.

Disclaimer 2 – The results of this environmental impact indicator shall be used with care as the uncertainties on these results are high or as there is limited experienced with the indicator

Resource use

Indicator	Unit	A1-3	A4	A5	B	C1	C2	C3	C4	D
RPEE	MJ	6,29E+00	4,08E-02	2,84E-02	MNR	0	2,54E-03	0	2,97E-02	-1,52E-01
RPEM	MJ	7,96E-02	0	-2,39E-03	MNR	0	0	0	0	0
TPE	MJ	6,37E+00	4,08E-02	2,60E-02	MNR	0	2,54E-03	0	2,97E-02	-1,52E-01
NRPE	MJ	6,87E+00	7,30E-01	1,17E-01	MNR	0	4,55E-02	0	2,21E-01	-1,09E+00
NRPM	MJ	6,39E-01	0	-1,92E-02	MNR	0	0	0	0	0
TRPE	MJ	7,45E+00	7,30E-01	9,95E-02	MNR	0	4,55E-02	0	2,21E-01	-1,09E+00
SM	kg	0	0	0	MNR	0	0	0	0	0
RSF	MJ	0	0	0	MNR	0	0	0	0	0
NRSF	MJ	0	0	0	MNR	0	0	0	0	0
W	m^3	1,10E-02	4,66E-05	1,90E-04	MNR	0	2,90E-06	0	5,45E-05	-5,21E-04

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

Indicator	Unit	A1-3	A4	A5	B	C1	C2	C3	C4	D
HW	kg	2,47E-07	3,68E-11	4,20E-09	MNR	0	2,30E-12	0	2,34E-11	-9,05E-11
NHW	kg	1,01E-01	1,08E-04	5,61E-03	MNR	0	6,77E-06	0	1,10E+00	-1,13E-04
RW	kg	7,01E-05	8,84E-07	8,73E-06	MNR	0	5,51E-08	0	2,31E-06	-1,42E-06

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

End of life – output flow

Indicator	Unit	A1-3	A4	A5	B	C1	C2	C3	C4	D
CR	kg	0	0	0	MNR	0	0	0	0	0
MR	kg	0	0	1,56E-02	MNR	0	0	0	0	0
MER	kg	0	0	0	MNR	0	0	0	0	0
EEE	MJ	0	0	7,74E-02	MNR	0	0	0	0	0
ETE	MJ	0	0	2,30E-01	MNR	0	0	0	0	0

CR Components for reuse; MR Materials for recycling; MER Materials for energy recovery; EEE Exported electric energy; ETE Exported thermal energy

Bibliography

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