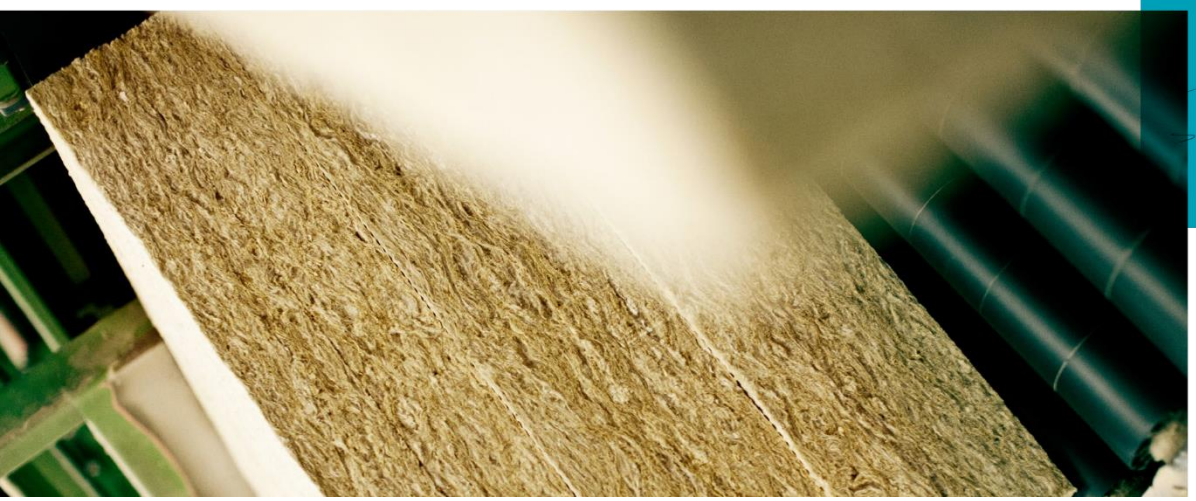
Environmental Product Declaration



ROCKWOOL®
Rockzero™ system

Self-declared EPD according to EN 15804 and ISO 14025 and 3rd party verification

Owner of the declaration:
ROCKWOOL International A/S
Hovedgaden 584
2640 Hedehusene
Denmark
www.rockwoolgroup.com/

Contact person: Larisa Xanthopoulou
(Larisa.xanthopoulou@rockwool.com)

Manufacturers on behalf of owner:

Contact person: Marina Mazin
(Marina.mazin@rockwool.com)

Based on the reviewed report and for publication of ROCKWOOL Rockzero with the Institut Bauen und Umwelt e. V. - the IBU EPD and EPD Norway program operators.

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Life Cycle Assessment study:
This environmental product declaration is based on a Life Cycle Assessment (LCA) background study according to EN15804:2012+A1:2013 carried out by:
Baijia Huang (Baijia.huang@rockwool.com) and
Larisa Xanthopoulou (Larisa.xanthopoulou@rockwool.com)
ROCKWOOL International A/S.

Verification:

External independent verification of the LCA background report and declaration.

Name and organization of the verifier	Frank Werner Werner Environment & Development
Date and location	2021
Signature:	

Environmental Product Declarations (EPD) may not be comparable if they do not comply with the EN15804:2012+A1: 2013 Clause 5.3

Product

Declared unit

1 square meter of Rockzero wall system for the lifetime of the building structure where this applied to. For the purpose of the EPD a conservative 50 year lifetime is assumed for the whole system.

The application is for a load carrying outer wall system. The Rockzero system includes columns and insulation. External and internal wall coverings and/or cladding and accessories are not provided by ROCKWOOL and therefore not part of this EPD.

The EPD is declared as an average for two types of cladding, a brick wall and a ventilated cladding. The total thickness of the construction is 297 mm (incl. 50 mm inner insulation, 100 mm core insulation and 120 mm outer wool insulation of different densities). The thermal transmittance of the system is U=0,12 W/m^{2}K.

Intended application of the Environmental Product Declaration

The EPD is for information supply to parties in Europe and customers of ROCKWOOL® interested in the environmental performance of the Rockzero system, such as architects, builders and also LCA experts and LCA database owners and other audiences that have an interest in EPDs.

The EPD is for business-to-business communication.

Product description

Rockzero is a product that consists of column made out of galvanised steel and pressed mineral wool components with the spaces between the columns filled with stone wool.

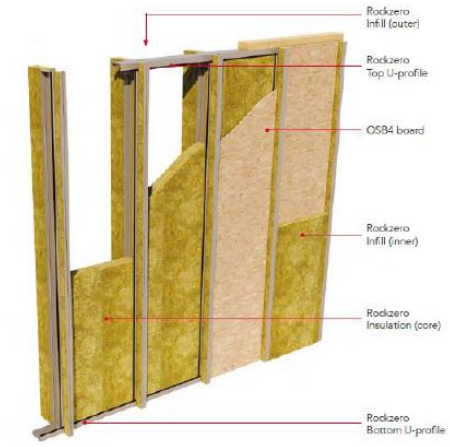


Figure 1: Rockzero system overview.

EPD values for the stone wool manufacturing come from the third party verified LCA model, operated by ROCKWOOL International.

Table 1: Components of the average Rockzero system per m^2

Material	Composition (% of total mass)
ROCKWOOL stone wool	48%
Steel	26%
Wood	23%
Screws	1%
Glue and bitumen	2%

Product specification

ROCKWOOL® stone wool is made from volcanic rock, typically basalt or dolomite, and an increasing proportion of recycled material. The stone wool fibres are bound by a binder with an average binder content of 4%. The binder is a water-based phenol-formaldehyde resin which is polymerized during production of the final stone wool product.

OSB is manufactured in Germany.

The metal for the screws and brackets starts as a steel coil. The coil is run through machines that pull, form, cut, roll and stamp into the raw screw, and then anodized.

The metal for the flanges, profiles and channels are made from cold-rolled coils that are galvanised. The coils are formed, cut and stamped to specs and supplied on length to ROCKWOOL.

The assembled columns are packed on single-use pallets with film.

Reference service life

The reference service life of Rockzero™ is 50 years in accordance with the Product Category Rules (PCR) for thermal insulation products EN 16783:2017. The components from the Rockzero system do not have to be replaced in the 50-year scenario[1].

[1] This scenario is based on simulated ageing tests for ROCKWOOL® stone wool, European Technical Approval (ETA) documents for the components and assumptions, as well as current practice where most often insulation material is not replaced during the lifetime of the building.

Product

Table 2: Reference Service Life (RSL) parameters

Parameter	Unit
Reference service life	50 years for the system
Declared product properties	EN13162-T3-DS(TH)-WS-MU1 Lambda 33-35, Fire rated A1 OSB insect and fungi treated Screws with corrosion class C3 or higher
Design application parameters	Installation to be conducted in accordance with manufacturers installation guide. Cladding to be applied in accordance to cladding manufacturers guide.
Quality of work assumption	It is assumed that the manufacturer's instructions are clear and followed. In case of doubt, the manufacturer should be contacted for instruction.
Outdoor environment	European climate or equivalent. During construction, fabric and materials of the system need to be protected from external impact.
Indoor environment	Hydro-thermal conditions equivalent to application purposes as, e.g., residential, educational or retail.
Usage conditions & maintenance	The installation is a one-time procedure. After mounting, the system shall be maintained by simple visual inspection – any movement of façade elements should be inspected and mitigated.

Life Cycle Assessment: Calculation rules

EPD type

Cradle-to-grave. Included are all relevant life cycle stages.

All use phase modules can be modelled as zero as there is no need for repair, refurbishment, replacement and there are no consumables

They do not use energy (B6) or water (B7) during use of the building.

Flow diagram system boundaries

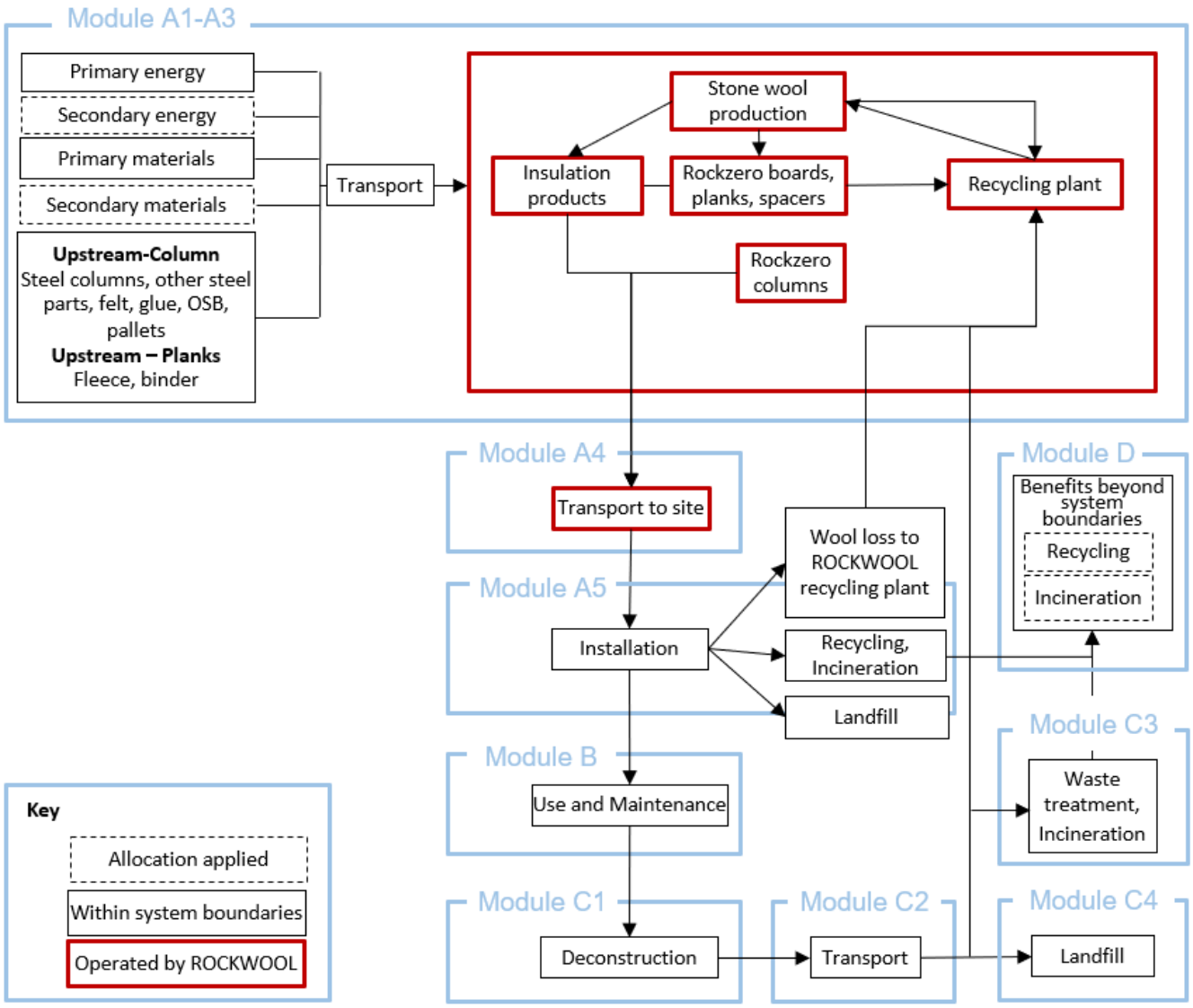


Figure 2: Rockzero system flow diagram and system boundaries

Description and modelling of scenarios

Modules A1–A3 Production stage
The manufacturing of the stone wool takes place in two locations. The spacers fixed to the column and outer and infill wool are produced in Doense, Denmark. The insulation parts included in the load carrying part of the column are manufactured at Rockwool plant in Flechtingen, Germany. Primary data was collected for the financial year 2019 (one-year average).

OSB is manufactured in Germany as described in the EPD[2]. Additionally, transport of OSB from manufacturing factory in Germany to the assembling of the final system in Hedehusene, Denmark is included in A2.

The metal for the screws and brackets starts as a steel coil. The coil is run through machines that pull, form, cut, roll and stamp into the raw screw, and then anodized. The metal for the flanges, profiles and channels are made from cold-rolled coils that are galvanised. The coils are formed, cut and stamped to specs and supplied on length to ROCKWOOL.

The assembled columns are packed on single-use pallets with a stretch film.

Module A4 transport to site
Orders of the columns are put together in Hedehusene, Denmark ready for transportation to the installation site. The spacers fixed to the column and outer and infill wool are coming from Doense, Denmark. The insulation parts included in the load carrying part of the column (wool planks) are delivered from factory in Flechtingen, Germany. The average distance for distribution in Denmark is 150 km. The relevant assumptions for transport are presented in the table below:

Table 3: A4 distance scenario

	Distance (km)
Distance (km)	Column from Hedehusene: 150 km Wool from Doense: 150 km Wool planks from Flechtingen: 730 km +150 km= 880 km
Fuel type and vehicle type	Insulation: Diesel, Truck, Euro 6 Column: Diesel, Truck, Euro 6 0,38 l per km
Vehicle type	Trailer, 88m3 volume
Capacity utilization	Insulation & columns: 85% Incl. empty returns
Bulk density of transported products	Insulation: 70 and 42kg/m3; hence transport by volume was applied Column: mixed product using steel, wood and mineral wool
Volume capacity utilization factor	1 (for insulation) <1 for columns

Module A5 Installation stage
Rockzero is an innovative, lightweight and flexible solution that is straightforward to install. It uses known construction techniques to make the on-site build quicker and easier, while also helping to create a safer and tidier working environment. This minimises risk, takes away the need for specialist skills and is flexible enough to provide complete design freedom. For guidelines on installation please be advised to refer to the installation guide found on www.rockwool.dk. The installation requires the use of hand-held tools, some of which are power tools and consume electricity. The power tool energy cost is calculated for an average square meter of the wall system. This is modelled using national grid mix data weighted for the market shares (see Table 4).

Table 4: EN15804 installation considerations

Parameter	Unit
Ancillary materials for installation (specified by material)	No other materials are needed in addition to the ones included in the Rockzero system
Water use	None
Other resource use	Power tools, cutting knives and drills. They are considered as capital goods.
Electricity consumption during the installation process	0.0426 kWh/m^2 DK electricity grid mix
Wastage of materials on the building site before waste processing, generated by the product's installation (specified by type)	2% stone wool, 6% OSB, < 1% for steel parts, felt, etc.
Output materials (specified by type) as result of waste processing at the building site	See Table 5 with building waste scenarios
Direct emissions to ambient air, soil and water	None

Module A5 installation includes processing of the installation waste from product packaging and product wastage during the construction up to the end-of-waste state or disposal of final residue. Benefits and loads for recycling and incineration are reported under Module D as specified in the table below.

Table 5: Building waste scenarios

Material	Landfill (%, distance)	Recycling (%, distance)	Energy recovery (%, distance)
Stone wool	3%, 150km	97%,150km	
OSB board			As in the respective EPD[2]
Plastic packaging		95%, 150km	5%,150km
Wood packaging pallets	15%,150km		85%,150km

[2] Institut Bauen und Umwelt e.V. (IBU) EPD of EGGER OSB-boards, No. ECO-0000074, valid until September 2023

Modules B1-B7
All use phase modules can be modelled as zero as there is no need for repair, refurbishment, replacement and there are no consumables. Emissions to the indoor environment are reported in module B1.

Module C1-C4 End-of life
The deconstruction is modelled similarly to the installation scenario as a conservative approach, even though less energy demand is expected for power tools compared to installation. The transport distances and waste processing and landfill scenarios are defined in Table 6. ROCKWOOL® stone wool can be disposed of as non-hazardous waste.

Table 6: End-of-life scenarios

Material	Landfill (%, distance)	Recycling (%, distance)	Energy recovery (%, distance)
Stone Wool	97%, 150km	3%,150km	
Soft Wood	10%,150km		90%,150km
OSB board			As in the respective EPD, 150km
Metal	1%, 150km	99%,150km	
Bituminous Felt	3%, 150km	97%,150km	5%,150km

Module D Benefits and loads beyond the system boundary
The generated energy such as heat and power from waste incineration the potential benefits from utilisation of such energy in the next product system are assigned to module D. The benefits are calculated using current average substitution processes. The heat is credited for with heat from natural gas. The electricity is credited for with the European grid mix. Recycling benefits are also included in module D.

Cut-off criteria

Data sets are complete according to cut-off rules of EN15804 (inclusion of all material and energy inputs >1%, inclusion of all materials with potential environmental impact and <5% of the total energy use and mass neglected). The most notable cut-off based on these criteria is the use of product labels and the packaging of screws and friction plate.

Data quality

The quality of the data of this specific EPD is assessed as good and appropriate. The data gathering approach for all EPDs is assessed as good and appropriate by the external verifier.

Suppliers have been contacted for process data, MSDS sheets and product composition. The LCI and background data that was not specified by the supplier, but that was part of the underlying model has been regionalised using GaBi professional database.

Capital goods and infrastructure processes are included from the GaBi database.

Data was collected consistently and based on the financial year 2019.

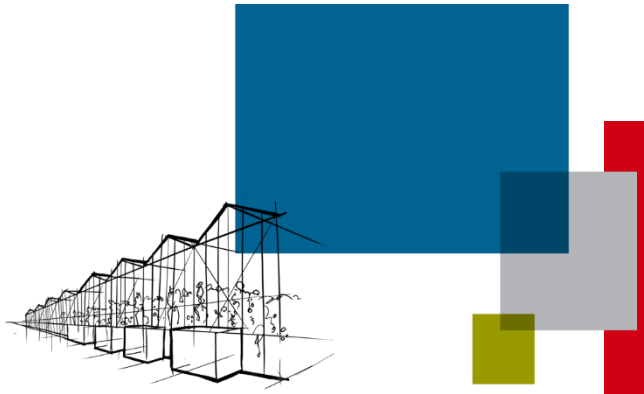
Life Cycle Assessment: Results

Limitations

Results provided are average results of systems for a brick wall and a ventilated cladding. Please contact ROCKWOOL® if you need figures for specific thicknesses.

Description of the system boundaries (x=included, MNR = Module not relevant)

Production stage			Construction stage		Use stage							End-of-life stage				Benefits and loads beyond the system boundaries
Raw materials	Transport	Manufacturing	Transport	Assembly	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	De-construction/ demolition	Transport	Waste processing	Disposal	Reuse- Recovery- Recycling - potential
A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
x	x	x	x	x	x	MNR	MNR	MNR	MNR	MNR	MNR	x	x	x	x	x



ROCKWOOL® Rockzero wall system

1 square meter (m^2) of Rockzero wall system for a period of 50 years. The results in this EPD are related to an average insulation system for a brick wall and a ventilated cladding. The R-value of the system, including the insulation and screws, is 8,33 m^2K/W.

Environmental impact

	Production stage	Construction stage		Use stage							End-of-life stage				
Parameter	A1-A3	A4 Transport	A5 Installation	B1 Use	B2 Maintenance	B3 Repair	B4 Replacement	B5 Refurbishment	B6 Operational energy use	B7 Operational water use	C1 De-construction/ demolition	C2 Transport	C3 Waste treatment	C4 Disposal	D Benefits and loads beyond the boundaries of the system
Global warming potential (GWP) kg CO2 eqv	2,74E+01*	7,57E-01	5,59E+00	0,00E+00	MNR	MNR	MNR	MNR	MNR	MNR	9,98E-03	2,94E-01	1,38E+01	2,33E-01	-2,12E+01
The global warming potential of a gas refers to the total contribution to global warming resulting from the emission of one unit of that gas relative to one unit of the reference gas, carbon dioxide, which is assigned a value of 1.															
Ozone depletion potential (ODP) kg CFC11 eqv	5,87E-08	1,45E-16	3,41E-09	0,00E+00	MNR	MNR	MNR	MNR	MNR	MNR	4,43E-16	5,12E-17	2,97E-13	1,28E-15	-1,83E-11
Destruction of the stratospheric ozone layer which shields the earth from ultraviolet radiation harmful to life. This destruction of ozone is caused by the breakdown of certain chlorine and/or bromine containing compounds (chlorofluorocarbons or halons), which break down when they reach the stratosphere and then catalytically destroy ozone molecules.															
Acidification potential (AP) kg SO^2 eqv	1,66E-01	5,50E-04	3,44E-03	0,00E+00	MNR	MNR	MNR	MNR	MNR	MNR	1,93E-05	2,22E-04	3,93E-04	1,41E-03	-2,36E-02
Acid depositions have negative impacts on natural ecosystems and the man-made environment incl, buildings. The main sources for emissions of acidifying substances are agriculture and fossil fuel combustion used for electricity production, heating and transport.															
Eutrophication potential (EP) kg PO4 3- eqv	2,75E-02	1,20E-04	8,13E-04	0,00E+00	MNR	MNR	MNR	MNR	MNR	MNR	2,98E-06	5,00E-05	1,69E-04	1,60E-04	-1,46E-03
Excessive enrichment of waters and continental surfaces with nutrients, and the associated adverse biological effects.															
Photochemical ozone creation (POCP) kg Ethene eqv	1,91E-02	-1,32E-06	5,87E-04	1,73E-09	MNR	MNR	MNR	MNR	MNR	MNR	1,38E-06	-5,82E-06	5,95E-05	1,07E-04	-5,26E-03
Chemical reactions brought about by the light energy of the sun. The reaction of nitrogen oxides with hydrocarbons in the presence of sunlight to form ozone is an example of a photochemical reaction															
Abiotic depletion potential for non-fossil resources (ADP-elements) kg Sb eqv	4,49E-05	6,79E-08	2,22E-07	0,00E+00	MNR	MNR	MNR	MNR	MNR	MNR	5,61E-09	2,56E-08	6,09E-08	8,58E-08	-2,84E-05
Abiotic depletion potential for fossil resources (ADP-fossils) MJ	5,36E+02	1,03E+01	1,04E+01	0,00E+00	MNR	MNR	MNR	MNR	MNR	MNR	9,63E-02	3,99E+00	1,15E+00	3,18E+00	-2,51E+02
Consumption of non-renewable resources, thereby lowering their availability for future generations.															

*Note on how to read the values in the tables: E in values stands for exponent of 10 followed by the value of the exponent, e.g. 2,74E+01=2,74 x 10^{+1}=27,4 and 7,57E-01= 7,57 x 10^{-1}=0,76 .

Resource use

	Production stage	Construction stage		Use stage							End-of-life stage				
Parameter	A1-A3	A4 Transport	A5 Installation	B1 Use	B2 Maintenance	B3 Repair	B4 Replacement	B5 Refurbishment	B6 Operational energy use	B7 Operational water use	C1 De-construction/ demolition	C2 Transport	C3 Waste treatment	C4 Disposal	D Benefits and loads beyond the boundaries of the system
Use of renewable primary energy excluding renewable primary energy resources used as raw materials - MJ/FU	1,42E+02	5,78E-01	2,65E+01	0,00E+00	MNR	MNR	MNR	MNR	MNR	MNR	2,48E-01	2,23E-01	1,36E+02	4,39E-01	-3,64E+01
Use of renewable primary energy resources used as raw materials - MJ/FU	1,54E+02	0,00E+00	-1,53E+01	0,00E+00	MNR	MNR	MNR	MNR	MNR	MNR	0,00E+00	0,00E+00	-1,35E+02	0,00E+00	0,00E+00
Total use of renewable primary energy resources - MJ/FU	2,96E+02	5,78E-01	1,12E+01	0,00E+00	MNR	MNR	MNR	MNR	MNR	MNR	2,48E-01	2,23E-01	5,52E-01	4,39E-01	-3,64E+01
Use of non-renewable primary energy excluding nonrenewable primary energy resources used as raw materials - MJ/FU	5,18E+02	1,03E+01	1,74E+01	0,00E+00	MNR	MNR	MNR	MNR	MNR	MNR	1,23E-01	4,01E+00	2,88E+01	3,27E+00	-2,91E+02
Use of non-renewable primary energy resources used as raw materials - MJ/FU	3,39E+01	0,00E+00	-6,78E+00	0,00E+00	MNR	MNR	MNR	MNR	MNR	MNR	0,00E+00	0,00E+00	-2,71E+01	0,00E+00	0,00E+00
Total use of non-renewable primary energy resources - MJ/FU	5,52E+02	1,03E+01	1,06E+01	0,00E+00	MNR	MNR	MNR	MNR	MNR	MNR	1,23E-01	4,01E+00	1,69E+00	3,27E+00	-2,91E+02
Use of secondary materials - kg/FU	1,74E+00	0,00E+00	0,00E+00	0,00E+00	MNR	MNR	MNR	MNR	MNR	MNR	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Use of renewable secondary fuels - MJ/FU	3,49E-01	0,00E+00	2,10E-02	0,00E+00	MNR	MNR	MNR	MNR	MNR	MNR	0,00E+00	0,00E+00	0,00E+00	0,00E+00	1,21E+02
Use of non-renewable secondary fuels - MJ/FU	0,00E+00	0,00E+00	0,00E+00	0,00E+00	MNR	MNR	MNR	MNR	MNR	MNR	0,00E+00	0,00E+00	0,00E+00	0,00E+00	1,15E+01
Net use of fresh water - m3/FU	1,26E-01	6,64E-04	1,45E-02	0,00E+00	MNR	MNR	MNR	MNR	MNR	MNR	1,02E-04	2,55E-04	4,30E-03	8,06E-04	-1,00E-01

Waste categories

	Production stage	Construction stage		Use stage							End-of-life stage				
Parameter	A1-A3	A4 Transport	A5 Installation	B1 Use	B2 Maintenance	B3 Repair	B4 Replacement	B5 Refurbishment	B6 Operational energy use	B7 Operational water use	C1 De-construction/ demolition	C2 Transport	C3 Waste treatment	C4 Disposal	D Benefits and loads beyond the boundaries of the system
Hazardous waste disposed - kg	6,76E-06	5,26E-10	2,33E-07	0,00E+00	MNR	MNR	MNR	MNR	MNR	MNR	2,49E-10	2,02E-10	6,72E-10	3,47E-10	-2,63E-08
Non-hazardous waste disposed - kg	8,73E-01	1,55E-03	4,67E-01	0,00E+00	MNR	MNR	MNR	MNR	MNR	MNR	4,86E-04	5,95E-04	7,29E-02	1,63E+01	1,31E+00
Radioactive waste disposed - kg	6,51E-02	1,36E-05	3,84E-03	0,00E+00	MNR	MNR	MNR	MNR	MNR	MNR	1,10E-05	4,85E-06	2,14E-04	3,43E-05	-1,44E-02

* There is never radioactive waste from a ROCKWOOL plant (A3), but potentially in its upstream chain (A1 & A2), which is not taken into account here.

Output flows

	Production stage	Construction stage		Use stage							End-of-life stage				
Parameter	A1-A3	A4 Transport	A5 Installation	B1 Use	B2 Maintenance	B3 Repair	B4 Replacement	B5 Refurbishment	B6 Operational energy use	B7 Operational water use	C1 De-construction/ demolition	C2 Transport	C3 Waste treatment	C4 Disposal	D Benefits and loads beyond the boundaries of the system
Component for re-use - kg	0,00E+00	0,00E+00	0,00E+00	0,00E+00	MNR	MNR	MNR	MNR	MNR	MNR	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Use of renewable primary Materials for recycling - kg	0,00E+00	0,00E+00	5,32E-01	0,00E+00	MNR	MNR	MNR	MNR	MNR	MNR	0,00E+00	0,00E+00	8,20E+00	0,00E+00	0,00E+00
Materials for energy recovery - kg	0,00E+00	0,00E+00	4,56E-01	0,00E+00	MNR	MNR	MNR	MNR	MNR	MNR	0,00E+00	0,00E+00	7,60E+00	0,00E+00	0,00E+00
Exported energy - MJ	0,00E+00	0,00E+00	2,09E+01	0,00E+00	MNR	MNR	MNR	MNR	MNR	MNR	0,00E+00	0,00E+00	6,48E+00	0,00E+00	0,00E+00

Other Information

Dangerous substances

Rockzero system insulation materials do not contain substances of very high concern (SVHC) according to the EU-REACH candidate list http://echa.europa.eu/candidate- list-table. For more information on the insulation a ROCKWOOL® Safe Use Instruction Sheet (SUIS) is available upon request.

The OSB boards used, according to the statement from the manufacturer, “pose no risk of water, air or ground contamination given currently available knowledge assuming intended use is observed. No known health hazards are expected from normal and intended use of OSB boards”.

For the steel profiles and screws no specific hazards are known to ROCKWOOL®.

Instruction for safe installation

Stone wool:
Due to the well-known mechanical effect of coarse fibres, mineral wool products may cause temporary skin itching. Mineral wool fibres cannot cause a chemical or allergic reaction.
To diminish the mechanical effect of coarse fibres and prevent unnecessary exposure to mineral wool dust, information on good practices is available on the packaging of all mineral wool products with pictograms and/or written tips (see below).

Cover exposed skin. When working in unventilated area wear disposable face mask.

Clean area using vacuum equipment.

Waste should be disposed of according to local regulations.

Rinse in cold water before washing.

Ventilate working area if possible.

Wear goggles when working overhead.

Safeguard against weather effects.

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