Risen Energy Co., Ltd.

ENVIRONMENTAL PRODUCT DECLARATION

PRODUCT:

132 TOPCon BIFACIAL MODULE

PLANTS:

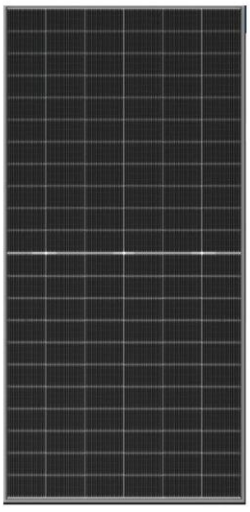
No.1, Middle Xingke Road, Ninghai County 315609 Ningbo City, Zhejiang Province PEOPLE'S REPUBLIC OF CHINA

in compliance with ISO 14025 and EN15804+A2

Program Operator	EPD-Global
Publisher	EPDItaly

Declaration Number	*NEPD-14343-14741*
Registration Number	MR-EPDITALY0147

Issue Date	05/12/2025
Valid to	05/12/2030



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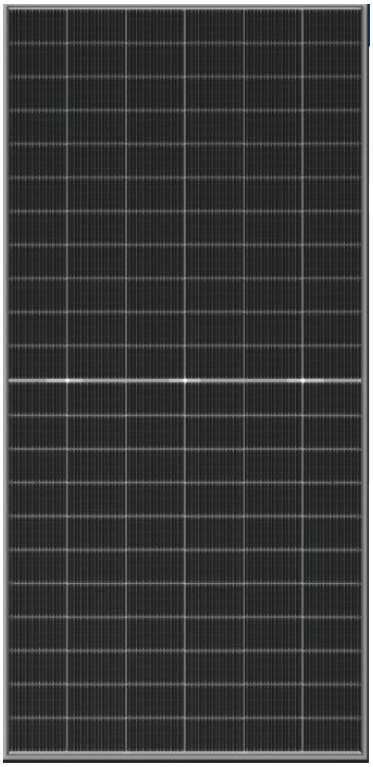
Powered by EPD-Norway

Environmental Product Declaration

In accordance with ISO14025:2006 and EN15804:2012+A2:2019

132 TOPCon BIFACIAL MODULE



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The Norwegian
EPD Foundation

Owner of the declaration:
Risen Energy Co., Ltd.

Product name:
Mono-Crystalline Photovoltaic Module

RSM132-11-xxxBNDG, xxx=600 to 650 in steps of 5

Functional unit:
1 Wp

Product category /PCR:
NPCR 029 Part B Version: 1.2

Program holder and publisher:
The Norwegian EPD foundation

Declaration number:
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Issue date: 05.12.2025

Valid to: 05.12.2030

General information

Product:
RSM132-11-xxxBNDG ,

xxx=600 to 650 in steps of 5

Program operator:
EPD-Global
Post Box 5250 Majorstuen, 0303 Oslo, Norway
Tlf: +47 23 08 80 00
web: www.epd-global.com/

Declaration number:
NEPD-14343-14741

This declaration is based on Product Category Rules:
NPCR PART A: Construction products and services Version 2.0

NPCR 029 Part B Version: 1.2 for photovoltaic modules used in the building and construction industry, including production of cell, wafer, ingot block, solar grade silicon, solar substrates, solar superstrates and other solar grade semiconductor materials.

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

Functional unit:
1 Wp of manufactured photovoltaic module, from cradle-to-grave and module D, with activities needed for a reference service life (RSL) of 30 years (⩾80% of the labelled power output)

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

internal ☐ external ■

Lucas Pedro Berman - Senda Environmental & Energy Consulting

Independent verifier approved by EPD Global

Owner of the declaration:
Risen Energy Co., Ltd.
Contact person: Hu Ziyun
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Manufacturer:
Risen Energy (Ningbo) Co., Ltd.
No.1, Middle Xingke Road, Ninghai County
315609 Ningbo City, Zhejiang Province
PEOPLE'S REPUBLIC OF CHINA

Place of production:
No.1, Middle Xingke Road, Ninghai County
315609 Ningbo City, Zhejiang Province
PEOPLE'S REPUBLIC OF CHINA

Management system:
ISO 9001, ISO 14001, ISO 45001

Organisation no:
913302001449739014

Issue date:
05.12.2025

Valid to:
05.12.2030

Year of study:
2024.07-2025.06

Comparability:
EPD of construction products may not be able to compare if they do not comply with EN 15804 and are seen in a building context.

The EPD has been worked out by:
Hongyu Tian, TÜV SÜD Certification and Testing (China) Co., Ltd. Shanghai Branch

Approved

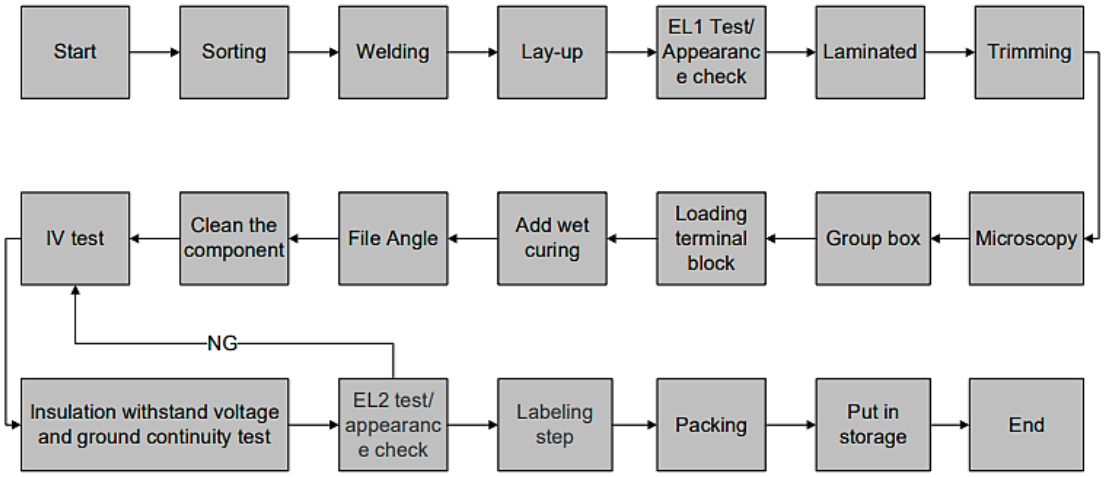
Manager of EPD Global

Product

Product description:

Risen Energy produces series of crystalline silicon photovoltaic (PV) modules. In this report, only one type of TOPCon bifacial module is included. This module has high power generation performance due to their stable power temperature coefficient and ultra-high bifacial technology. Function of PV module is to generate electricity. For Building-Integrated-PV (BIPV) applications there is an additional function of providing roofing to the building.

The manufacturing processes of PV modules production of Risen Energy (Ningbo) is presented as below.



Step 1: Sorting

Sort the cells which meet the requirements of the order and check whether they conform to the standards. Prepare for welding procedure.

Step 2: Welding

Solder the positive and negative electrodes of the single-welded cells together to form a cell string and prepare for the lamination process. Repair the nonconforming cell string.

Step 3: Lay-up

Connect the soldered cell strings with busbar, and play glass, EVA film, TPT or glass back plate to protect the cell.

Step 4: EL1 test/Appearance check

Conduct appearance and Electroluminescent imaging (EI) inspection on the PV modules before lamination.

Step 5: Lamination

Preliminary inspection on the appearance and EL of laminated components to improve yield and product quality. Rework the undesirable laminated components.

Step 6: Laminated

The lamination process is to melt EVA and solidify the laminate at a certain temperature. Laminating process is a key step of component production, which has a key influence on the quality of component products.

Step 7: Trimming

Trim the laminated components to prepare the frame.

Step 8: Microscopy

Re-check the laminated components, isolate the defective products timely and give feedback to improve the quality of components.

Step 9: Group box

The profile and junction box are mounted with sealed silicone on laminates to increase component strength, further seal the cell assembly, and extend the service life of the components. Put the automatic glue uneven secondary tonic. Install aluminum frame and junction box on the laminate with sealed silica gel, increase the strength of the component, further seal the cell component, and extend the service life of the component.

Step 10: Loading terminal block

The junction box is glued with silicone to the back of the assembly and the lead-out wire is welded to make the assembly and the wire box work. Then in the AB glue potting.

Step 11: Add wet curing

Solidify the assembled components and place the poor sealing of components to prepare for cleaning.

Step 12: File Angle

Fix and polish the four corners of the component.

Step 13: Clean the component

The silica gel and other dirt on the surface of the component shall be cleaned with alcohol to make the appearance of the component clean and beautiful, and check whether the appearance of the component meets the standards.

Step 14: IV test

Verify the output power of the cell component, test its output characteristics, and determine the power level of the component.

Step 15: Insulation withstand voltage and ground continuity test

Insulation test: test whether the current-carrying part of the component is well insulated with the frame or external; Voltage withstand test: the insulation material and insulation structure of the voltage withstand test; Grounding test: to determine whether the safety grounding wire can bear the current flow of the fault under the condition of the fault of the measured object.

Step 16: EL2 test/appearance check

Check whether there is any problem with cell cells in the component, such as hidden cracking, fragment, black plate, etc., and determine the level of component EL.

Step 17: Labeling step

Separate components in different gear positions to prepare for packaging.

Step 18: Packing

Packing finished components in specified quantity for easy transportation and sale.

Step 19: Put in storage

Put the packed components into the warehouse procedure.

Product specification:

Raw material and auxiliary material	Weight amount	
	kg/FU	%
Front Glass	2.06E-02	41.00
Back Glass	2.06E-02	41.00
EPE	1.64E-03	3.27
EVA	1.72E-03	3.43
Frame	3.43E-03	6.81
String Connector	7.82E-05	0.16
Cell Connector	2.80E-04	0.56
Cell	1.14E-03	2.27
Junction Box	1.54E-04	0.31
Silicone Adhesive	5.66E-04	1.12
Barcode	1.14E-07	0.00
Nameplate	3.43E-07	0.00
Fixing Tape	9.23E-07	0.00

Raw material and auxiliary material	Weight amount	
	kg/FU	%
Flux	4.02E-05	0.08
Net Product Weight	**5.03E-02**	**100.00**

Packaging material	Weight amount	
	kg/FU	%
Wooden Pallet	1.84E-03	80.89
Corrugated Paper Box	4.06E-04	17.89
Kraft Paper Corner Protector	5.86E-06	0.26
Kraft Paper Card	2.08E-05	0.91
Packing Tape	1.54E-08	0.00
Packing Belt	9.54E-07	0.04
Package Weight	**2.27E-03**	**100.00**

Technical data:

Technical parameters	RSM132-11-xxxBNDG
Power output (W)	600-650
Dimension (mm)	2382×1134×30
Weight (kg)	32.5
Area (m^2)	2.70
Converting factor (Wp/m^2)	240.74
Solar cells	TOPCon
Cell configuration	132 cells (6×11+6×11)
First year degradation rate (%)	1
Yearly degradation rate (%)	≤0.4

Market:

Global

Reference service life, product:

30 years (based on ≥80% of the labelled power output)

Additional technical information

None

LCA: Calculation rules

Functional unit:

1 Wp of manufactured photovoltaic module, from cradle-to-grave and module D, with activities needed for a reference service life (RSL) of 30 years (≥80% of the labelled power output).

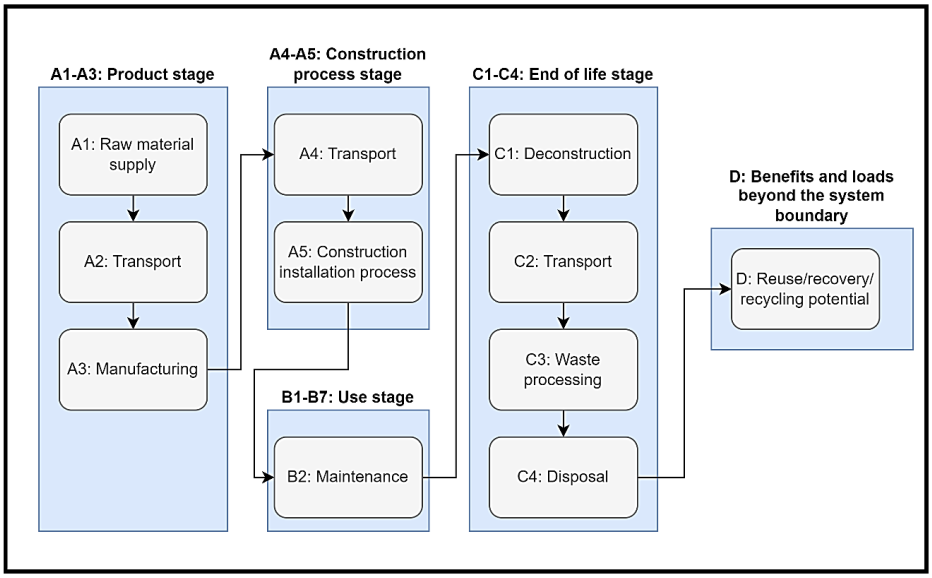
Cut-off criteria:

LCI data shall according to EN 15804 include a minimum of 95% of total inflows (mass and energy) per module. For the processes within the system boundary, all available energy and material flow data have been included in the model. In cases where no matching life cycle inventories are available to represent a flow, proxy data have been applied based on conservative assumptions regarding environmental impacts.

Allocation:

The allocation is made in accordance with the provisions of EN 15804 and the principles of "modularity" and "polluter pays" were followed. Incoming energy and water and waste production in-house is allocated equally among all products through power output allocation. For the end-of-life allocation of background data (energy and materials), the model "allocation cut-off by classification (ISO standard)" is used. As for the end-of-life stage of the solar PV modules, the load and benefit of reuse, recycling, and recovery processes is reported separately following the PCR's recommendation.

System boundary:



The following steps/stages are not included in the system boundary due to the reason that the elements below are considered irrelevant or not within the boundary to the LCA study：

- Production, transportation and installation of capital goods (buildings, infrastructure, machinery, internal transport packaging) and general operations (staff travel, marketing and communication actions).
- Emissions during the PV module installation and operation due to no obvious emission observable.
- Storage phases and sales of PV products due to no observable impact. Product losses due to abnormal damage such as natural disasters or fire accidents would occur at a rather low frequency.
- Handling operations at the distribution center and retail outlet due to small contribution and negligible impact.
- Research and development activities.
- Long-term emissions are excluded due to high modelling uncertainty and limited data availability.

Data quality:

The inventory is based on the collection of measured data in the manufacturer plant from 2024-07-01 to 2025-06-30. A high accuracy and quality are expected for specific data. Missing data are completed by data from secondary database, cell, wafer and ingot production are from IEA PVPS Task 12, 2020 report. Consistency checks are performed. Data quality of the main contributors are improved when possible. Generic data related to the life cycle impacts of the material or energy flows that enter and leave the production system is sourced from Ecoinvent 3.11 "allocation, cut-off by allocation-unit" database.

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

Product stage			Assembly 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	X	X	X	X	X	X	X	X	X	X	X	X

LCA: Scenarios and additional technical information

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

Transport from production place to assembly/user (A4)

For road transportation, lorry of EURO6, 16-32 metric ton is used for modelling, while container ship is used for sea transportaion. The inventory of Risen Energy (Ningbo) includes the transportation from the factory to departure port, departure port to arriving ports and arriving port to purchaser.

Transport from production place to assembly/user (A4)	Capacity utilisation (incl. return) %	Distance (km)	Fuel/Energy consumption	Unit	Value
Truck_domestic	36.7	EURO6, 16-32 metric ton	335	Diesel	0.037
Container ship	70	Container ship	12774	Heavy oil	0.0025
Truck_oversea	36.7	EURO6, 16-32 metric ton	510	Diesel	0.037

Assembly (A5)

According to NPCR 029 Part B, the waste treatment of packaging, energy use during installation shall be included. The electricity consumption and diesel consumption during installation stage is scaled up based on the data from Ecoinvent database value (36.03 kWh/570kWp and 7673 MJ/570kWp respectively) according to the power rating of PV modules. The compositions of the packing waste are mainly waste pallet, waste corrugated sheet, waste kraft paper, plastic film and other PET. The disposal is assumed 100% incineration for plastic film, corrugated sheet and kraft paper. 25% incineration for the wooden pallet. 75% recycling for the wooden pallet. The transportation distance to disposal site is assumed as 200km.

	Unit	RSM132-11-xxxBNDG
Water consumption	m^3	-
Electricity consumption	kWh	4.11E-02
Other energy carriers	MJ	8.75E+00
Material loss	Kg	-
Output materials from waste treatment	Kg	1.47E+00

Use (B1)

There are no material or energy inputs, no emissions during the use phase (B1) of the PV module.

Maintenance (B2)/Repair (B3)

In the maintenance stage (B2), it is assumed that each module is cleaned with 0.23L of water each time, and the cleaning frequency is twice a year. It is assumed that a small handheld device is used to spray water onto the panel, consuming no electricity during the cleaning process. And the PV modules do not require maintenance during RSL.

	Unit	RSM132-11-xxxBNDG
Water consumption	m^3	13.8
Electricity consumption	kWh	0

Replacement (B4)/Refurbishment (B5)

It is assumed that the PV module itself does not require replacement and refurbishment during its RSL.

Operational energy (B6) and water consumption (B7)

There is no operational energy and water consumption needed in life stage B6 and B7 respectively. The energy produced by a PV module depends on the installed power peak [Wp], degradation factor, geographic location, and direction/placement of the installation. The calculation formula of energy production are as follows:

- S_{rad}= Site specific annual average solar radiation on module (shadings not included), kWh/kWp/year. The annual radiation must take into consideration the specific inclination (slope, tilt) and orientation.
- A = Area of module, from functional unit (FU), m^2 (stated in the EPD).
- y = Module yield: electrical power, kWp for standard test conditions (STC) of the module divided by the area of the module (stated in the EPD).
- deg = yearly degradation rate (stated in the EPD).
- RSL = Reference service life for energy-producing unit, from functional unit (FU), stated in the EPD.
- PR = Performance ratio, coefficient for losses. Site specific performance ratio can be modelled with PV simulation software tools, such as PVSyst or similar.

Energy production in the first year of operation:

$E1=S_{rad}*A*y*PR*(1-deg)$

Energy production over reference service life of module：

$E_{RSL}=E1*(1+\sum_{n=1}^{RSL-1}(1-\mathrm{deg})^n)$

End of Life (C1, C3, C4)

For the end-of-life stage, default scenarios in section 6.3.8.4 of NPCR 029 version 1.2 of EPD Global are used. De-construction (C1) is assumed mainly energy use for onsite dismantling and the energy use is assumed to be the same as the construction stage (A5). The electricity consumption for demolition of PV modules and sorting of waste (C3) is assumed to be the same as the manufacture stage (A3) of PV modules. For the end-of-life disposal stage (C4), this study refers to legal requirements issued by Waste Electrical and Electronic Equipment (WEEE) under the EU scenario. The required recycling rate for waste PV modules is 85% according to 2012/19/EU-Article 11 & ANNEX V. The recycling rate for waste glass is assumed as 85%, while the refused parts are disposed of with landfilling. The silicon cell and solder are assumed as 100% landfill. And the waste aluminum and waste copper are assumed to be 100% recycled. Waste EVA, junction box, waste silicon adhesive and tape end up with 100% incineration.

	Unit	RSM132-11-xxxBNDG
Hazardous waste disposed	kg/FU	-
Collected as mixed construction waste	kg/FU	-
Reuse	kg/FU	-
Recycling	kg/FU	3.88E-02
Energy recovery	kg/FU	3.57E-03
To landfill	kg/FU	7.89E-03

Transport to waste processing (C2)

Transport distance of 50 km is assumed for transporting to waste processing site (C2).

Transport from production place to assembly/user	Capacity utilisation (incl. return) %	Distance (km)	Fuel/Energy consumption	Unit	Value
Truck	36.7	EURO6, 16-32 metric ton	50	Diesel	0.037

Benefits and loads beyond the system boundaries (D)

	Unit	RSM132-11-xxxBNDG
Substitution of secondary aluminum	kg	5.79E-01
Substitution of secondary tin	kg	1.98E-01
Substitution of glass cullet	kg	1.94E+01
Electrical energy recovery	MJ	4.03E+00
Thermal energy recovery	MJ	8.25E+00

LCA: Results

The core environmental impact results are calculated basing on the highest rating of the module type and expressed per functional unit (1 Wp). The hightest power of RSM132-11-xxxBNDG is 650Wp, which is served as representative. The LCA results been calculated by using SimaPro 10.2.0.0 LCA software.

Core environmental impact indicators

	Indicator	Unit	A1-A3	A4	A5	B2	C1	C2	C3	C4	D
RSM132-11-650BNDG	GWP-total	kg CO_2 eq.	3.20E-01	2.61E-02	2.85E-03	1.44E-05	1.39E-03	4.80E-04	7.09E-03	9.24E-03	-7.09E-02
	GWP-fossil	kg CO_2 eq.	3.23E-01	2.61E-02	1.50E-03	1.43E-05	1.39E-03	4.79E-04	6.98E-03	9.24E-03	-7.16E-02
	GWP-biogenic	kg CO_2 eq.	-2.54E-03	6.70E-06	1.35E-03	9.70E-08	6.96E-07	2.58E-07	9.29E-05	1.26E-06	8.93E-04
	GWP-LULUC	kg CO_2 eq.	3.31E-04	1.20E-05	2.44E-07	2.11E-08	2.04E-07	1.86E-07	1.43E-05	9.51E-08	-1.26E-04
	ODP	kg CFC11 eq.	4.55E-08	3.89E-10	2.23E-11	2.09E-12	2.05E-11	8.75E-12	7.46E-11	1.23E-11	-8.05E-10
	AP	mol H^+ eq.	1.95E-03	2.47E-04	1.27E-05	7.64E-08	1.23E-05	1.08E-06	3.95E-05	6.23E-06	-3.57E-04
	EP-freshwater	kg P eq.	5.82E-05	2.19E-06	7.86E-09	6.94E-10	6.77E-09	4.58E-09	4.47E-07	4.62E-09	-2.61E-06
	EP-marine	kg N eq.	5.10E-04	6.07E-05	5.79E-06	1.40E-08	5.66E-06	2.47E-07	6.31E-06	3.26E-06	-7.70E-05
	EP-terrestial	mol N eq.	4.34E-03	6.70E-04	6.34E-05	1.56E-07	6.20E-05	2.75E-06	7.08E-05	3.17E-05	-8.88E-04
	POCP	kg NMVOC eq.	1.32E-03	2.14E-04	1.91E-05	4.83E-08	1.86E-05	1.60E-06	2.08E-05	7.97E-06	-2.71E-04
	ADP-M&M	kg Sb eq.	1.66E-05	7.14E-08	1.09E-09	6.85E-11	7.56E-10	1.63E-09	6.02E-08	7.11E-10	-8.05E-06
	ADP-fossil	MJ	2.10E+00	3.53E-02	1.23E-03	1.27E-04	1.07E-03	6.75E-04	8.49E-02	5.03E-04	-4.30E-01
	WDP	m^3	1.46E-01	1.40E-03	6.60E-05	9.08E-04	4.33E-05	2.86E-05	1.25E-03	-4.46E-04	-9.66E-03

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-A3	A4	A5	B2	C1	C2	C3	C4	D
RSM132-11-650BNDG	PM	Disease incidence	2.48E-08	1.61E-09	3.55E-10	9.58E-13	3.47E-10	3.53E-11	3.04E-10	2.89E-11	-3.82E-09
	IRP	kBq U235 eq.	6.49E-03	2.75E-04	6.74E-06	7.93E-07	6.17E-06	2.60E-06	7.14E-04	2.80E-06	-1.89E-03
	ETP-fw	CTUe	9.36E+00	5.25E-02	4.08E-03	9.84E-05	2.10E-03	2.09E-03	4.22E-02	4.18E-02	-4.96E-01
	HTP-c	CTUh	2.63E-09	4.62E-12	4.14E-13	2.60E-14	2.88E-13	1.59E-13	2.80E-12	1.60E-12	-3.57E-11
	HTP-nc	CTUh	1.98E-07	1.87E-10	1.12E-11	1.06E-12	5.07E-12	8.44E-12	1.63E-10	5.65E-11	-4.56E-10
	SQP	Dimensionless	1.46E+00	1.66E-01	2.05E-03	4.10E-05	1.27E-03	4.04E-03	2.26E-02	4.14E-03	-3.46E-01

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

[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.

[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-A3	A4	A5	B2	C1	C2	C3	C4	D
RSM132-11-650BNDG	RPEE	MJ	7.53E-01	4.73E-03	2.47E-04	2.51E-05	2.23E-04	1.04E-04	2.46E-02	1.28E-04	-1.11E-01
	RPEM	MJ	3.03E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	TPE	MJ	7.83E-01	4.73E-03	2.47E-04	2.51E-05	2.23E-04	1.04E-04	2.46E-02	1.28E-04	-1.11E-01
	NRPE	MJ	2.02E+00	3.72E-02	1.23E-03	1.27E-04	1.07E-03	6.75E-04	8.49E-02	5.03E-04	-4.30E-01
	NRPM	MJ	7.67E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	TRPE	MJ	2.10E+00	3.72E-02	1.23E-03	1.27E-04	1.07E-03	6.75E-04	8.49E-02	5.03E-04	-4.30E-01
	SM	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	RSF	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	NRSF	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	W	m^3	5.09E-03	4.46E-05	2.27E-06	2.12E-05	1.51E-06	8.89E-07	6.16E-05	-5.70E-08	-3.66E-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*** *Nonrenewable primary energy resources used as energy carrier;* ***NRPM*** *Nonrenewable 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-A3	A4	A5	B2	C1	C2	C3	C4	D
RSM132-11-650BNDG	HW	KG	3.17E-04	2.31E-06	1.34E-07	9.70E-10	1.24E-07	4.58E-08	3.19E-07	4.66E-08	5.27E-06
	NHW	KG	2.03E-02	1.39E-02	8.33E-05	1.44E-06	1.37E-05	3.24E-04	4.03E-04	7.99E-03	-3.87E-03
	RW	KG	4.40E-06	7.06E-08	4.74E-09	5.73E-10	4.36E-09	1.73E-09	5.54E-07	2.02E-09	-1.22E-06

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

End of life – output flow

	Indicator	Unit	A1-A3	A4	A5	B2	C1	C2	C3	C4	D
RSM132-8-745BNDG	CR	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	MR	kg	1.35E-03	0.00E+00	1.38E-03	0.00E+00	0.00E+00	0.00E+00	3.88E-02	0.00E+00	0.00E+00
	MER	kg	2.15E-05	0.00E+00	8.93E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.56E-03	0.00E+00
	EEE	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.22E-03
	ETE	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.28E-02

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

Information describing the biogenic carbon content at the factory gate

Biogenic carbon content	Unit	RSM132-11-650BNDG
Biogenic carbon content in product	kg C / FU	0
Biogenic carbon content in the accompanying packaging	kg C / FU	1.03E-03

Additional requirements

Location based electricity mix from the use of electricity in manufacturing

National production mix from import, medium voltage (production of transmission lines, in addition to direct emissions and losses in grid) of applied electricity for the manufacturing process (A3) per FU. And there is no GoO used in A3.

National electricity grid	Data source	Foreground / core [kWh]	GWP_{total} [kg CO2 -eq/kWh]	SUM [kg CO2 -eq]
Electricity, medium voltage {CN-ECGC}| market for electricity, medium voltage| Cut-off, U	Ecoinvent 3.11	0.0108	0.763	8.24E-03
Electricity, low voltage {CN-ZJ}| electricity production, photovoltaic, 570kWp open ground installation, multi-Si | Cut-off, U	Ecoinvent 3.11	0.0015	0.0844	1.27E-04

Guarantees of origin from the use of electricity in the manufacturing phase

None

Additional environmental impact indicators required for construction products

In order to increase the transparency of biogenic carbon contribution to climate impact, the indicator GWP-IOBC is required as it declares climate impacts calculated according to the principle of instantaneous oxidation. GWP-IOBC is also referred to as GWP-GHG in context to Swedish public procurement legislation.

RSM132-11-650BNDG

Indicator	Unit	A1-A3	A4	A5	B1	B2	B3-B7	C1	C2	C3	C4
GWP-IOBC	kg CO_2 eq.	3.23E-01	2.61E-02	1.50E-03	1.43E-05	1.39E-03	4.79E-04	6.99E-03	9.24E-03	3.23E-01	2.40E-02

GWP-IOBC *Global warming potential calculated according to the principle of instantaneous oxidation.*

Hazardous substances

RSM132-11-xxxBNDG has been tested according to USEPA 200.8-1994 method (Determination of Trace Elements in Waters and Wastes by Inductively Coupled Plasma-Mass Spectrometry) and USEPA 7473-2007 method (Mercury in Solids and Solutions by Thermal Decomposition, Amalgamation, and Atomic Absorption Spectrophotometry). The PV modules passed the tests. Test reports are available on request to the EPD owner.

Indoor environment

Not relevant for outdoor products.

Carbon footprint (A1-C4)

Product name	Unit	Norway (Irad=1000 kWh-m^{-2}-year^{-1})	Italy (Irad=1600 kWh-m^{-2}-year^{-1})
RSM132-11-650BNDG	g CO_2 eq./ kWh	13.83	8.91

Note: the carbon footprint (per kWh) results do not include the impacts caused by electrical equipment and mounting structures, and the distribution losses.

EPD results in conversion factors of various power output ranges

RSM132-11-650BNDG

Rated power output range (Wp)	645	640	635	630	625	620	615	610	605	600
Conversion factor	1.008	1.016	1.024	1.032	1.040	1.048	1.057	1.066	1.074	1.083

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