Risen Energy Co., Ltd.

ENVIRONMENTAL PRODUCT DECLARATION

PRODUCT:

132 HIGH PERFORMANCE MONOCRYSTALLINE PERC MODULE

PLANTS:

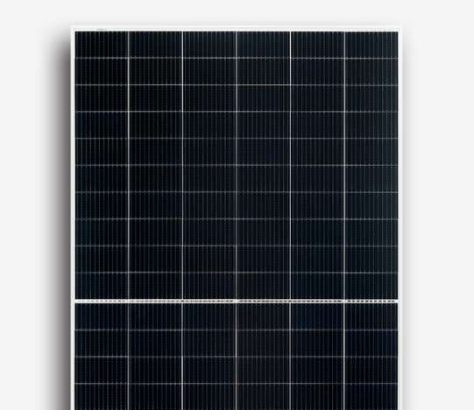
No.1, Middle Xingke Road Ninghai County, Ningbo City, Zhejiang Province, P.R.China

in compliance with ISO 14025 and EN15804

Program Operator	The Norwegian EPD Foundation
Publisher	EPDItaly

Declaration Number	*NEPD-4464-3725-EN*
Registration Number	MR-EPDITALY0068

Issue Date	19/05/2023
Valid to	19/05/2028



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Global Program Operator

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In accordance with 14025 and EN15804 +A2

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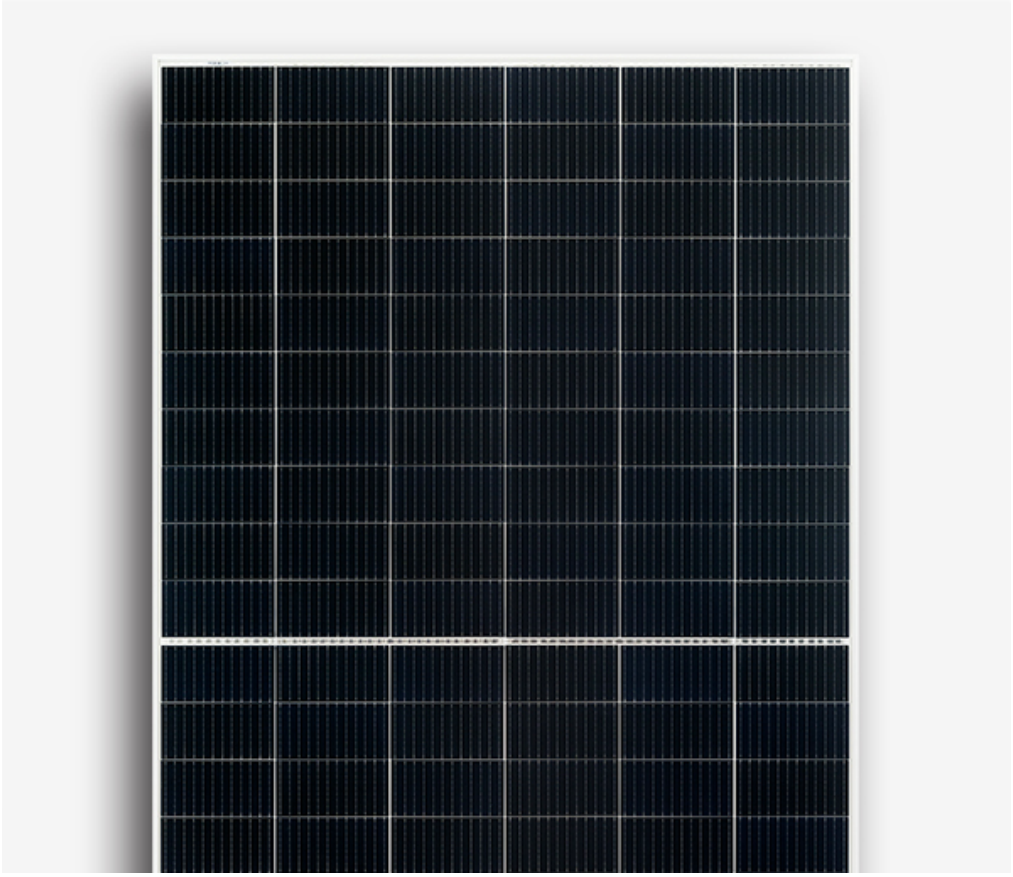

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Owner of the declaration:
Risen Energy Co., Ltd.

Product name:
Mono-crystalline Photovoltaic module

Functional unit:
1 Wp

Product category /PCR:
NPCR 029 version 1.2

Program holder and publisher:
The Norwegian EPD foundation

Declaration number:
NEPD-4464-3725-EN

Registration number:
NEPD-4464-3725-EN

Issue date: 19.05.2023

Valid to: 19.05.2028

GENERAL INFORMATION

PRODUCT:

RSM132-8-xxxM (Power range:635~675W)

RSM132-8-xxxBMDG (Power range:635~675W)

PROGRAM OPERATOR:

The Norwegian EPD Foundation
Post Box 5250 Majorstuen, 0303 Oslo, Norway
Tel: +47 23 08 80 00
e-mail: post@epd-norge.no

DECLARATION NUMBER:

NEPD-4464-3725-EN

THIS DECLARATION IS BASED ON PRODUCT CATEGORY RULES:

NPCR 029 version 1.2

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.

FUNCTIONAL UNIT:

1Wp

SYSTEM BOUNDARY:

Cradle-to-grave

VERIFICATION:

Independent verification of the declaration and data, according to ISO14025:2010	
Internal ☐	External ☒
Third Party Verifier: Martijn van Hövell (Independent verifier approved by EPD Norway)	

OWNER OF THE DECLARATION:

Risen Energy Co., Ltd.
Contact person: Mr. Yang shubo
Tel: 86-574-59953588
e-mail: yangsb@risenenergy.com

MANUFACTURER:

Risen Energy (Ningbo) Co., Ltd.

PLACE OF PRODUCTION:

Address: No.1, Middle Xingke Road Ninghai County, Ningbo City, Zhejiang Province, P.R.China

MANAGEMENT SYSTEM:

ISO 9001, ISO 14001, ISO 45001

ORGANISATION NO:

913302001449739014

ISSUE DATE:

19.05.2023

VALID TO:

19.05.2028

YEAR OF STUDY:

2023

COMPARABILITY:

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

THE EPD HAS BEEN WORKED OUT BY:

TÜV SÜD Certification and Testing (China) Co., Ltd. Shanghai Branch

Approved

Manager of EPD Norway

PRODUCT

PRODUCT DESCRIPTION:

Risen Energy produces more than a dozen series of mono-crystalline silicon PV modules. The PV module products integrate several technologies such as higher efficiency Mono Perc cell technology, low current density technology to decrease the internal power consumption effectively, and MBB and HC technology to reduce the negative affection to yield caused by microcrack and shadow. Besides, bifacial technology enables additional energy harvesting from the rear side (up to 30%). The module products have industry-leading lowest thermal co-efficient of power, excellent low irradiance performance, and excellent PID resistance. Risen Energy's modules have passed TÜV, CE, GS, ROHS, REACH, PAHS, and other international certifications, and have taken the lead in passing the ISO14001 environmental management system, ISO9001 quality management system, and GB/T28000 occupational health and safety management system certification. The certificates are available in the Risen Energy CSR report that can be downloaded from the Download Center on the official website (https://en.risenenergy.com/service/download).

PRODUCT SPECIFICATION:

Both PV modules considered in this LCA have a power ranging from 635W to 675W, and 675W is chosen as the peak power for the studied product. The products weigh 35.5 kg for RSM132-8-xxxM and 41 kg for RSM132-8-xxxBMDG respectively.

Materials	RSM132-8-xxxM		RSM132-8-xxxBMDG	
	KG/FU	%	KG/FU	%
Solar glass	3.65E-02	63.68%	4.57E-02	71.00%
Back sheet (PET/adhesive/PO)	2.00E-03	3.48%	-	-
Frame (Galvanized steel)	9.33E-03	16.26%	8.52E-03	13.24%
Solder	3.29E-04	0.57%	3.30E-04	0.51%
Solar cell	1.68E-03	2.93%	1.44E-03	2.23%
Junction box	1.69E-04	0.29%	1.69E-04	0.26%
Silicone gel	4.61E-04	0.80%	4.61E-04	0.72%
Flux	3.70E-05	0.06%	3.70E-05	0.06%
EVA	3.83E-03	6.68%	3.92E-03	6.09%
POE	-	-	1.96E-03	3.04%
Packaging: Pallet	2.23E-03	3.89%	1.32E-03	2.05%
Packaging: Corrugated board	6.31E-04	1.10%	4.07E-04	0.63%
Packaging: Bead	2.52E-05	0.04%	2.37E-05	0.04%
Packaging: LDPE Film	1.14E-04	0.20%	7.85E-05	0.12%

TECHNICAL DATA:

Series	RSM132-8-xxxM	RSM132-8-xxxBMDG
Power output range (W)	635~675	635~675
Dimensions (mm)	2384*1303*35	2384*1303*35
Area (m^2)	3.11	3.11
Converting factor (Wp/m^2)	217	217
Module efficiency (%)	20.4%~21.6%	20.4%~21.6%
Weight (kg)	35.5	41
Weight (incl. package)	37.526	42.236
Degradation (%)	0.55%	0.45%

MARKET:

Global

REFERENCE SERVICE LIFE, PRODUCT:

25 years

LCA: CALCULATION RULES

FUNCTIONAL UNIT:

1 Wp of manufactured photovoltaic module, from cradle to grave, with activities needed for a study period for a defined reference service life (≥80% of the labelled power output). The converting factor to convert the results related to the functional unit to 1 m^2 PV module is 217 Wp/m^2.

DATA QUALITY:

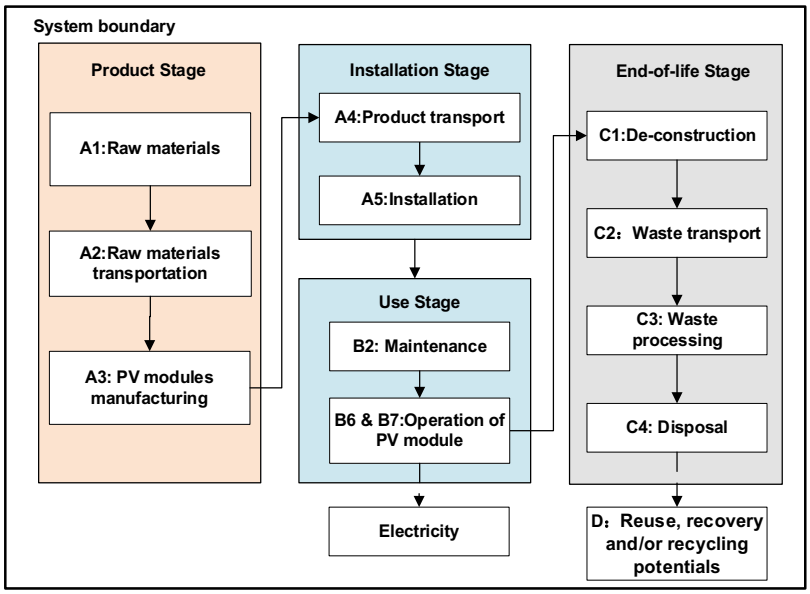
Primary data (such as materials or energy flows that enter and leave the production system) is from Risen Energy manufacturing facilities for year 2022 (annual average). Secondary data such as silicon ingot and silicon wafer production are taken from IEA PVPS Task 12, 2020 report. Generic data related to the life cycle impacts of the material or energy flows that enter and leave the production system is sourced from Ecoinvent 3.8 "allocation, cut-off by allocation - unit" database.

ALLOCATION:

The allocation is made in accordance with the provisions of EN 15804. 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. End-of-life approach with 100/0 allocation is adopted in this analysis.

SYSTEM BOUNDARY:

Cradle to grave (A1-D), Module D includes net benefits from recycled materials and exported energy.



CUT-OFF CRITERIA:

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 has been applied based on conservative assumptions regarding environmental impacts.

LCA: SCENARIOS AND ADDITIONAL TECHNICAL INFORMATION

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

TRANSPORT FROM PRODUCTION PLACE TO ASSEMBLY/USER (A4)

For domestic transportation, 16-32 metric ton, dataset for EURO6 type truck is used for modelling, while for overboard ocean transportation, dataset for container ship is used for modelling.

Type	Capacity utilization (incl. return) %	Type of vehicle	Fuel type	Fuel Consumption (kg/tkm)
Truck	36.7	EURO6 16-32 ton	Diesel	0.037
Ship	70	Container ship	Heavy oil	0.0025

ASSEMBLY (A5)

In the installation stage, there is negligible energy use during installation phase as the installation are mainly done manually. According to PCR, mounting structures and electrical components will not be included in this stage, only the waste generation and treatment of packaging materials will be considered. The waste from the products' packaging is considered in this stage, and waste treatment of wood pallet is modeled as 75% recycling and 25% incineration. Other packaging materials including paper and plastic film are modeled with 100% incineration.

A5 Assembly	Unit (per FU)	Value
Auxiliary	kg	-
Water consumption	m^3	-
Electricity consumption	kWh	-
Other energy carriers	MJ	-

Material loss	kg	-
Output materials from waste treatment	kg	1.67E-3 (RSM-132-8-xxxM) 1.32E-3 (RSM-132-8-xxxBMDG)
Dust in the air	kg	-

USE (B1)

There are no material or energy inputs, nor emissions during the use phase (B1) of the PV module.

MAINTENANCE (B2)/REPAIR (B3)

It is assumed that there are no material or energy inputs, nor emissions during the maintenance (B2), and the PV modules do not require repair during its RSL.

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)

It is assumed that there is no operational electricity (B6) or water consumption (B7). To calculate the expected energy production over the lifetime of the panels, the following formula may be used:

$$E_1 = S_{\text{rad}} * A * y * PR * (1 - \text{deg})$$

Where:

E_1= Energy produced in the first year of operation, kWh/year

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, m^2.

y = Module yield: electrical power, kWp for standard test conditions (STC) of the module divided by the area of the module.

STC: The ratio is given for standard test conditions: irradiance 1000 W/m^2, cell temperature 25 °C, wind speed 1 m/s, AM1.5.

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 second year of operation:

$$E_2 = E_1 * (1 - \text{deg})$$

Energy production n year of operation:

$$E_n = E_1 * (1 - \text{deg})^{n-1}$$

Energy production over reference service life of module, assuming linear annual degradation:

$$E_{RSL} = E_1 * (1 + \sum_{n=1}^{RSL-1} (1 - deg)^n)$$

End of Life (C1, C3, C4)

Assumptions are made for C1, C3 and C4 stage. De-construction stage (C1) of PV modules can be done manually. Waste processing (C3) stage is assumed to be mechanically treated to yield the bulk materials. The electricity consumption during this stage is 0.277kWh/kg module based on the data from IEA report. Modelling of disposal stage (C4) refers to legal requirements issued by Waste Electrical and Electronic Equipment (WEEE) under the EU scenario. Following the EU WEEE Directive, recycling of waste PV modules is mandatory in the EU countries. In 2012/19/EU-Article 11 & ANNEX V, the required recycling rate for waste PV module is 85%. It was assumed that 100% metal components and 85% glass would be recycled. 15% of the waste components (cells, glass, and waste plastics) end up to disposal stage (C4). The plastic components (junction box and back sheet) will be directed to incineration, while the cell and unrecovered glass will be treated as inert materials for landfilling.

End-of-Life	Unit (per FU)	RSM132-8-xxxM	RSM132-8-xxxBMDG
Hazardous waste disposed	kg	-	-
Collected as mixed construction waste	kg		
Reuse	kg	-	-
Recycling	kg	4.06E-02	4.78E-02
Energy recovery	kg	2.17E-03	1.69E-04
Landfill	kg	7.16E-03	8.54E-03

Transport to waste processing (C2)

50km transportation distance from the plant site to waste treatment site (C2) is assumed according to PCR.

Type	Capacity utilisation (incl. return) %	Type of vehicle	Distance KM	Fuel type	Fuel/Energy consumption
Truck	36	EURO6 16-32 ton	50	Diesel	0.037kg/tkm

Benefits and loads beyond the system boundaries (D)

100% metal scrap (steel, copper, and silver) and 85% of glass scrap will be recycled. The plastic components are incinerated with energy recovery. Efforts required by secondary production, loss of materials and quality are considered.

	Unit (per FU)	RSM132-8-xxxM	RSM132-8-xxxBMDG
Substitution of converter steel with net scrap	kg	7.37E-03	6.73E-03
Substitution of primary silver with net scrap	kg	4.74E-04	4.74E-04
Substitution of primary copper with net scrap	kg	8.89E-06	8.89E-06
Substitution of primary glass with glass gullets	kg	2.61E-02	3.30E-02
Electrical energy recovery	kWh	2.18E-03	1.60E-04
Thermal energy recovery	MJ	1.41E-02	1.04E-03

LCA: RESULTS

The LCA results show the environmental impacts and resource input and output flows calculated according to EN 15804:2012+A2. The results are shown per functional unit (1Wp). The LCA results have been calculated using the LCA software SimaPro 9.4.

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	MNR	MNR	MNR	MNR	MNR	MNR	MNR	X	X	X	X	X

CORE ENVIRONMENTAL IMPACT INDICATORS

RSM132-8-xxxM (per Wp)

Indicator	Unit	A1-A3	A4	A5	C2	C3	C4	D
GWP-total	kg CO_2 eq.	4.73E-01	1.46E-02	2.21E-03	4.29E-04	5.82E-03	4.51E-03	-6.89E-02
GWP-fossil	kg CO_2 eq.	4.72E-01	1.46E-02	3.67E-04	4.28E-04	5.62E-03	4.51E-03	-6.99E-02
GWP-biogenic	kg CO_2 eq.	2.09E-04	4.91E-06	1.85E-03	3.90E-07	1.88E-04	1.55E-06	1.08E-03
GWP-LULUC	kg CO_2 eq.	4.04E-04	7.81E-06	1.55E-08	1.71E-07	1.32E-05	5.93E-08	-8.65E-05
ODP	kg CFC11 eq.	3.95E-08	3.05E-09	5.42E-12	9.92E-11	2.79E-10	3.25E-11	-4.33E-09
AP	mol H^+ eq.	2.65E-03	2.05E-04	4.05E-07	1.22E-06	3.03E-05	1.36E-06	-5.56E-04
EP-freshwater	kg P eq.	1.39E-04	8.66E-07	7.18E-09	2.81E-08	5.62E-06	2.30E-08	-4.12E-05
EP-marine	kg N eq.	6.09E-04	4.93E-05	2.02E-07	2.47E-07	5.24E-06	7.20E-07	-8.97E-05
EP-terrestrial	mol N eq.	5.85E-03	5.47E-04	2.00E-06	2.69E-06	4.57E-05	6.22E-06	-1.06E-03
POCP	kg NMVOC eq.	1.64E-03	1.49E-04	5.05E-07	1.04E-06	1.25E-05	1.59E-06	-2.98E-04
ADP-M&M	kg Sb eq.	1.81E-05	3.90E-08	1.37E-10	1.52E-09	1.33E-08	5.17E-10	-9.04E-06
ADP-fossil	MJ	5.45E+00	2.04E-01	2.35E-04	6.49E-03	1.20E-01	2.07E-03	-9.20E-01
WDP	m^3	6.30E-01	5.90E-04	1.03E-05	1.98E-05	1.33E-03	6.35E-05	-1.42E-02

RSM132-8-BMDG (per Wp)

Indicator	Unit	A1-A3	A4	A5	C2	C3	C4	D
GWP-total	kg CO_2 eq.	4.77E-01	1.68E-02	1.41E-03	4.95E-04	6.72E-03	3.89E-04	-8.06E-02
GWP-fossil	kg CO_2 eq.	4.75E-01	1.68E-02	2.51E-04	4.95E-04	6.49E-03	3.88E-04	-8.17E-02
GWP-biogenic	kg CO_2 eq.	1.55E-03	5.67E-06	1.16E-03	4.51E-07	2.17E-04	1.29E-06	1.23E-03
GWP-LULUC	kg CO_2 eq.	3.96E-04	9.02E-06	1.01E-08	1.98E-07	1.53E-05	5.00E-08	-1.04E-04
ODP	kg CFC11 eq.	2.35E-08	3.52E-09	3.53E-12	1.15E-10	3.22E-10	3.03E-11	-5.03E-09
AP	mol H^+ eq.	2.72E-03	2.37E-04	2.62E-07	1.41E-06	3.50E-05	6.20E-07	-6.16E-04
EP-freshwater	kg P eq.	1.37E-04	1.00E-06	4.56E-09	3.24E-08	6.49E-06	1.83E-08	-4.53E-05
EP-marine	kg N eq.	6.18E-04	5.70E-05	1.31E-07	2.85E-07	6.05E-06	2.15E-07	-1.03E-04
EP-terrestial	mol N eq.	5.98E-03	6.32E-04	1.29E-06	3.11E-06	5.28E-05	2.22E-06	-1.20E-03
POCP	kg NMVOC eq.	1.67E-03	1.72E-04	3.26E-07	1.20E-06	1.44E-05	6.34E-07	-3.33E-04
ADP-M&M	kg Sb eq.	1.81E-05	4.51E-08	8.89E-11	1.75E-09	1.54E-08	4.07E-10	-9.11E-06
ADP-fossil	MJ	5.49E+00	2.36E-01	1.51E-04	7.50E-03	1.39E-01	1.77E-03	-1.09E+00
WDP	m^3	6.30E-01	6.82E-04	6.72E-06	2.28E-05	1.53E-03	5.17E-05	-1.66E-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 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

RSM132-8-xxxM (per Wp)

Indicator	Unit	A1-A3	A4	A5	C2	C3	C4	D
PM	Disease incidence	3.06E-08	8.93E-10	3.14E-12	3.45E-11	8.98E-11	1.36E-11	-3.86E-09
IRP	kBq U235 eq.	2.27E-02	9.33E-04	1.37E-06	3.35E-05	3.30E-03	1.09E-05	-6.50E-03
ETP-fw	CTUe	1.68E+01	1.59E-01	1.82E-03	5.10E-03	6.20E-02	2.33E-02	-5.82E+00
HTP-c	CTUh	3.89E-10	6.72E-12	2.55E-13	1.64E-13	1.58E-12	1.97E-13	9.44E-11
HTP-nc	CTUh	6.79E-09	1.36E-10	2.76E-12	5.15E-12	5.22E-11	1.30E-11	-3.43E-09
SQP	Dimensionless	1.98E+00	1.02E-01	6.98E-05	4.53E-03	1.75E-02	3.00E-03	-4.68E-01

RSM132-8-xxxBMDG (per Wp)

Indicator	Unit	A1-A3	A4	A5	C2	C3	C4	D
PM	Disease incidence	3.12E-08	1.03E-09	2.01E-12	3.99E-11	1.04E-10	1.04E-11	-4.43E-09
IRP	kBq U235 eq.	2.24E-02	1.08E-03	8.93E-07	3.86E-05	3.81E-03	1.05E-05	-7.93E-03
ETP-fw	CTUe	1.68E+01	1.83E-01	1.19E-03	5.89E-03	7.16E-02	2.22E-02	-6.08E+00
HTP-c	CTUh	3.70E-10	7.76E-12	1.67E-13	1.89E-13	1.83E-12	7.75E-14	7.43E-11
HTP-nc	CTUh	6.73E-09	1.57E-10	1.76E-12	5.95E-12	6.03E-11	5.83E-12	-3.53E-09
SQP	Dimensionless	1.82E+00	1.17E-01	4.49E-05	5.23E-03	2.02E-02	3.17E-03	-5.52E-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*

RESOURCE USE

RSM132-8-xxxM (per Wp)

Parameter	Unit	A1-A3	A4	A5	C2	C3	C4	D
RPEE	MJ	1.14E+00	2.05E-03	1.55E-05	9.31E-05	2.14E-02	9.41E-05	-1.06E-01
RPEM	MJ	1.93E-01	6.28E-04	3.17E-06	2.35E-05	3.14E-03	2.63E-05	-4.56E-02
TPE	MJ	1.33E+00	2.68E-03	1.87E-05	1.17E-04	2.45E-02	1.20E-04	-1.51E-01
NRPE	MJ	6.79E+00	2.00E-01	2.49E-04	6.22E-03	5.87E-02	2.03E-03	-8.95E-01
NRPM	MJ	8.26E-01	1.74E-01	4.24E-05	5.53E-03	3.90E-03	1.28E-03	-7.52E-02
TRPE	MJ	7.61E+00	3.75E-01	2.92E-04	1.17E-02	6.26E-02	3.30E-03	-9.70E-01
SM	kg	4.70E-03	2.32E-05	1.07E-05	9.17E-07	3.35E-05	1.99E-05	-4.33E-04
RSF	MJ	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
W	m^3	1.55E-02	1.96E-05	6.76E-07	7.35E-07	1.02E-04	1.28E-05	-4.52E-04

RSM132-8-xxxBMDG (per Wp)

Parameter	Unit	A1-A3	A4	A5	C2	C3	C4	D
RPEE	MJ	1.11E+00	2.37E-03	1.01E-05	1.08E-04	2.47E-02	8.67E-05	-1.40E-01
RPEM	MJ	1.69E-01	7.26E-04	2.06E-06	2.71E-05	3.62E-03	2.52E-05	-6.21E-02
TPE	MJ	1.28E+00	3.09E-03	1.21E-05	1.35E-04	2.83E-02	1.12E-04	-2.03E-01
NRPE	MJ	6.82E+00	2.32E-01	1.61E-04	7.18E-03	6.78E-02	1.76E-03	-1.18E+00
NRPM	MJ	8.59E-01	2.01E-01	2.72E-05	6.38E-03	4.50E-03	1.39E-03	-1.04E-01
TRPE	MJ	7.67E+00	4.33E-01	1.88E-04	1.36E-02	7.23E-02	3.15E-03	-1.28E+00
SM	kg	4.70E-03	2.69E-05	6.77E-06	1.06E-06	3.87E-05	3.91E-06	-6.08E-04
RSF	MJ	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
W	m^3	1.54E-02	2.27E-05	4.39E-07	8.49E-07	1.18E-04	1.23E-05	-5.40E-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

RSM132-8-xxxM (per Wp)

Parameter	Unit	A1-A3	A4	A5	C2	C3	C4	D
HW	kg	8.41E-04	4.20E-07	1.68E-09	1.69E-08	4.26E-08	6.32E-09	-1.85E-06
NHW	kg	5.42E-02	7.10E-03	1.35E-05	3.40E-04	3.98E-04	7.27E-03	-9.06E-03
RW	kg	9.07E-06	1.36E-06	6.53E-10	4.39E-08	8.87E-07	1.08E-08	-2.01E-06

RSM132-8-xxxBMDG (per Wp)

Parameter	Unit	A1-A3	A4	A5	C2	C3	C4	D
HW	kg	8.41E-04	4.85E-07	1.04E-09	1.96E-08	4.92E-08	3.16E-09	-1.87E-06
NHW	kg	5.32E-02	8.20E-03	8.73E-06	3.92E-04	4.60E-04	8.61E-03	-1.04E-02
RW	kg	9.12E-06	1.57E-06	4.22E-10	5.07E-08	1.02E-06	1.14E-08	-2.45E-06

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

END OF LIFE – OUTPUT FLOW

RSM132-8-xxxM (per Wp)

Parameter	Unit	A1-A3	A4	A5	C2	C3	C4	D
CR	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
MR	kg	1.72E-02	4.49E-04	1.96E-06	1.02E-05	4.80E-05	5.12E-06	1.65E-02
MER	kg	2.61E-04	7.43E-06	3.05E-09	1.36E-07	4.29E-07	7.38E-08	-6.90E-06
EEE	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.84E-03
ETE	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.41E-02

RSM132-8-xxxBMDG (per Wp)

Parameter	Unit	A1-A3	A4	A5	C2	C3	C4	D
CR	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
MR	kg	1.60E-02	5.19E-04	1.24E-06	1.18E-05	5.54E-05	2.17E-06	1.48E-02
MER	kg	2.43E-04	8.58E-06	1.96E-09	1.57E-07	4.96E-07	7.74E-08	-8.82E-06
EEE	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.76E-04
ETE	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.04E-03

***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 (per FU)	RSM132-8-xxxM	RSM132-8-xxxBMDG
Biogenic carbon content in product	kg C	0	0
Biogenic carbon content in the accompanying packaging	kg C	2.36E-04	1.49E-04

Note: 1 kg biogenic carbon is equivalent to 44/12 kg CO_2

ADDITIONAL REQUIREMENTS

GREENHOUS GAS EMISSION FROM THE USE OF ELECTRICITY IN THE MANUFACTURING PHASE

Dataset for national electricity grid mix in China is applied for the manufacturing process (A3).

National electricity grid	Unit	Value
China electricity grid mix (market for electricity, medium voltage, ecoinvent 3.8)	kg CO_2 -eq/kWh	1.02

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 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.

RSM132-8-xxxM (per Wp)

Indicator	Unit	A1-A3	A4	A5	C2	C3	C4	D
GWP-IOBC	kg CO2 eq.	4.73E-01	1.46E-02	3.67E-04	4.28E-04	5.63E-03	4.51E-03	-7.00E-02

RSM132-8-xxxBMDG (per Wp)

Indicator	Unit	A1-A3	A4	A5	C2	C3	C4	D
GWP-IOBC	kg CO2 eq.	4.76E-01	1.68E-02	2.51E-04	4.95E-04	6.51E-03	3.88E-04	-8.18E-02

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

HAZARDOUS SUBSTANCES

The samples of RSM132-8-xxxM and RSM132-8-xxxBMDG have 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 have passed the tests. Test reports are available upon request to EPD owner.

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