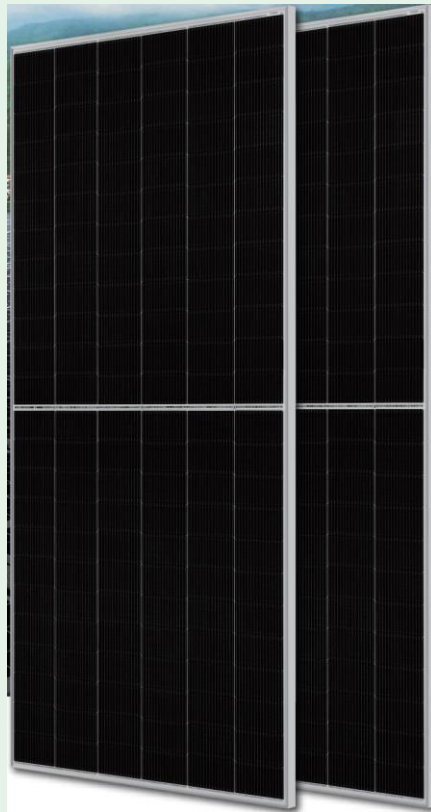


Environmental Product Declaration

In accordance with ISO 14025 and EN 15804 +A2



The Norwegian
EPD Foundation

Owner of the declaration:
JA Solar GmbH

Program holder and publisher:
The Norwegian EPD foundation

Declaration number:
NEPD-4907-4258-EN

Registration Number:
NEPD-4907-4258-EN

Issue date: 12.09.2023
Valid to: 12.09.2028

Product name

Mono-crystalline Single glass, P-Type, solar photovoltaic modules

Manufacturer

JA Solar GmbH

General information

Product:

Mono-crystalline Single glass, P-Type, solar photovoltaic modules

Program Operator:

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

Declaration Number:

NEPD-4907-4258-EN

This declaration is based on Product Category Rules:

NPCR 029 2020 Part B for PV modules 1.1

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 evidence.

Declared unit:

1m² of manufactured photovoltaic module

Declared unit with option:

1m² of manufactured photovoltaic module.

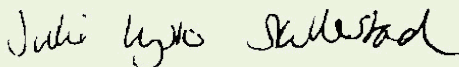
Functional unit:

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)

Verification:

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

internal external



Independent verifier approved by EPD Norway

Owner of the declaration:

JA Solar Technology Co., Ltd.

Contact person: Yanyan Yao
Phone: +86 15176256002
e-mail: bj.yaoyy@jasolar.com

Manufacturer:

Yiwu JA Solar Technology Co., Ltd.
Phone: +86 15176256002
e-mail: bj.yaoyy@jasolar.com

JA Solar New Energy Yangzhou Co., Ltd. / JA Solar New Energy Yangzhou Co., Ltd. (Jiangshan Park)

Phone: +86 15176256002
e-mail: bj.yaoyy@jasolar.com

Place of production:

China

Management system:

[ISO 14001 fill in]

Organisation no:

DE272082449

Issue date:

12.09.2023

Valid to:

12.09.2028

Year of study:

2023

Comparability:

EPDs from other programmes than [Name of Program operator] may not be comparable.

The EPD has been worked out by:

Laurène MEJEAN - Kasptan



Approved (Manager of EPD Norway)

Product

Product description:

Mono-crystalline solar photovoltaic modules are designed to be installed on roofs or as stand-alone systems for local power production. All the modules included in this EPD are single glass and the solar cells are produced with PERC process. Solar cells are assembled with the EVA, glass, frame and electrical connections to produce the finished solar module in the production factories Yiwu and Yangzhou in China.

This EPD represents multiples modules with small variations over the size, the number of cells, power... (see table of module characteristics in “Technical details”). The results are calculated based on the maximum inventory amongst the modules. The variation between each module results is lower than 10 %.

Product specification:

The packaging consists of LDPE, PP, paper and a cardboard box, and the panels are delivered on a wooden pallet.

Materials	KG/DU	%
Cells	3.3E-01	2%
Glass	8.0E+00	76%
EVA	1.0E+00	7%
Aluminium frame	1.2E+00	8%
Junction box	5.5E-02	0%
String connector	2.7E-02	0%
Cell connector	7.9E-02	1%
JB potting silicone	1.4E-01	1%
Soldering flux	7.1E-03	0%
Packaging	KG/DU	%
Wooden pallet	4.8E-01	4%
Cardboard	1.4E-01	1%
Low density PE	6.8E-03	0%
PP	1.7E-02	0%
Paper	6.2E-05	0%

Technical data:

This EPD is valid for the following module types:

- JAM78S30/MR
- JAM72S30/MR
- JAM54S30/MR
- JAM54S31/MR
- JAM66S30/MR

- JAM72S30/LR
- JAM54S30/LR
- JAM54S31/LR
- JAM72S30/GR
- JAM54S30/GR
- JAM54S31/GR

Characteristics	Unit	JAM78S30/MR	JAM72S30/MR	JAM54S30/MR	JAM66S30/MR	JAM72S30/LR	JAM54S30/LR	JAM72S30/GR	JAM54S30/GR	JAM54S31/MR	JAM54S31/LR	JAM54S31/GR
Height [m]	m	2.465	2.278	1.722	2.093	2.333	1.762	2.278	1.722	1.722	1.762	1.722
Width [m]	m	1.134	1.134	1.134	1.134	1.134	1.134	1.134	1.134	1.134	1.134	1.134
Area [m²]	m²	2.79531	2.583252	1.952748	2.373462	2.645622	1.998108	2.583252	1.952748	1.952748	1.998108	1.952748
Wafer size	mm	182*182	182*182	182	182*182	182*188	182*188	182*185.3	182*185.3	182	182*188	182*185.3
Power [Wp]	Wp	580-605	530-555	390-425	480-505	560-585	415-440	540-565	400-425	390-425	415-440	400-425
Bifacial	Y/N	Monofacial	Monofacial	Monofacial	Monofacial	Monofacial	Monofacial	Monofacial	Monofacial	Monofacial	Monofacial	Monofacial
Lifetime [year]	Year	25	25	25	25	25	25	25	25	25	25	25
Yearly degradation	%	0.0055	0.0055	0.0055	0.0055	0.0055	0.0055	0.0055	0.0045	0.0055	0.0055	0.0045
Nb. of cells [pcs]	pcs	78	72	54	66	72	54	72	54	54	54	54

This study has been conducted according to the requirements of:

- ISO 14044;
- ISO 14025;
- EN15804+A2:2019;
- NPCR part A “Construction products and services” version 2.0;
- NPCR part B “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” version 1.1.

Market:

World

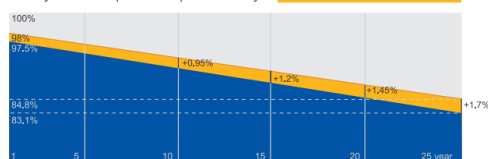
Reference service life, product:

25 years

Superior Warranty

- 12-year product warranty
- 25-year linear power output warranty

0.55% Annual Degradation Over 25 years



LCA: Calculation rules

Declared unit:

1m² of manufactured photovoltaic module

Data quality:

Specific data comes from actual consumption of the module assembly factory (July 2020 – June 2021). This data has been collected by the manufacturer and checked by the LCA practitioner.

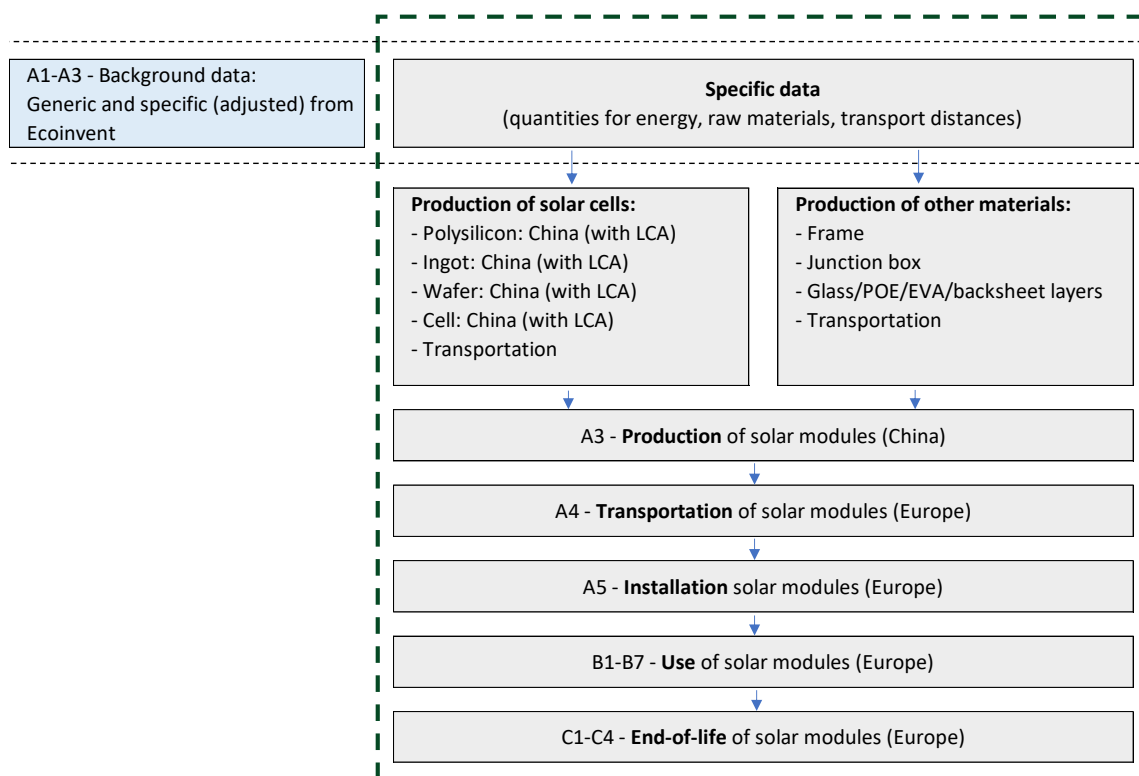
Generic data is from Ecoinvent v3.6 and SimaPro v9. Characterization factors from EN15804:2012 + A2: 2019. Generic data <10 years old.

Allocation:

The allocation is made in accordance with the provisions of ISO 14025. Incoming energy and water and waste production in-house is allocated equally among all products through mass allocation. Effects of primary production of recycled materials allocated to the main product in which the material was used. The recycling process and transportation of the material is allocated to this analysis.

System boundary:

The study is based on a cradle to grave analysis i.e., from raw material extraction to the disposal of waste. A summary of what is included and excluded is shown below:



The PolySi, ingots, wafers, cells and modules are manufactured in China. The supply chain is shown below:

Production	Site
Virgin Polysi	Yongxiang, China
Ingot/brick	Qujing, China
Wafer	Qujing, China
Recycled Polysi	Qujing, China
Cells	Ningjin, China
Modules	Yiwu, China Yangzhou, China

Cut-off criteria:

All major raw materials and all essential energy is included. The production process for raw materials and energy flows with very small amounts (<1%) are not included. This cut-off rule does not apply for hazardous materials and substances.

LCA: Scenarios and additional technical information

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

Transport from production place to assembly/user (A4) per declared unit

The transport step A4 covers the transport from the factories in China to the installation site in Europe by sea and road.

Type	Capacity utilisation (incl. return) %	Type of vehicle	Distance KM	value (tkm)
Truck	50%	Lorry, in China	1000	11.30
Boat	50%	Container ship	19000	214.62
Truck	50%	Lorry, Europe	1000	11.30

Assembly (A5) per declared unit

The modules are installed by hand. The screwdriver electricity consumption is neglected. As in PCR part B, the fasteners (screws) are not included in the LCA. The only impact is the packaging waste given in the table below:

	Unit	Value
Wooden pallet	Kg	4.80E-01
Cardboard	Kg	1.50E-01
Low density PE	Kg	6.79E-03
PP	Kg	1.7E-02
Paper	Kg	6.2E-05
Transportation in lorry (Capacity utilisation incl. return : 50%)	Tkm	6.46E-01

Use (B1-B5)

The modules are considered as self-cleaning materials. No maintenance, repair, replacement or refurbishment is required during the module lifetime.

Operational energy (B6) and water consumption (B7)

The modules are producing electricity from sunlight. The energy production during the buildings lifetime is not included in the results. However, the electricity production can be calculated as below:

$$E_{year\ i} = I_{sun} \times S_{1kWp} \times Eff_{panel} \times PR \times D_{panel}$$

Where:

- I_{sun} is the sun irradiation received by the module in kWh. m⁻².year⁻¹, which depends on the site location (Norway : 1000 kWh. m⁻².year⁻¹, source : Global Solar Atlas)

- PR, or Performance Ratio, is the ratio between the energy produced by the panel and the final energy at the output of the photovoltaic system in order to take into account the various losses (75%, source : Global Solar Atlas)
- Eff_{panel} , or panel efficiency, is the ratio between the energy produced and the solar radiation received.
- S_{1kWp} is the surface area to get 1 kWp.
- D_{panel} corresponds to the degradation of the panel in year i. This degradation is 2% the first year and then 0.25% per year. $D_{panel}=0.98 \times (1-0.25\%)^{i-1}$

Module production does not require water consumption.

End of Life (C1, C3, C4) per declared unit

The modules are considered as removed by hand. The recycling rates assumed for the LCA are:

- The cells and glass is shredded and recycled at 95%
- The frame is removed and recycled at 100%
- The cable and junction box are recycled at 100%

	Unit	Value
Solid waste, incinerated	Kg	1.58E+00
Recycling (sorting and shredding)	Kg	2.04E+01

Transport to waste processing (C2) per declared unit

It has been assumed that the modules are collected by truck.

Type	Capacity utilisation (incl. return) %	Type of vehicle	Distance KM	value (tkm)
Truck	50%	Lorry in Europe	1000	11.07

LCA: Results

The LCA results show the environmental impacts and resource input and output flows calculated according to ISO 14025 and EN 15804 +A2. The results are shown per functional unit, which for this declaration is 1Wp, as well as per declared unit, which for this declaration is 1 m². The LCA results have been calculated using the LCA software SimaPro 9.

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	MNR

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
ILCD type / level 3	Potential Human exposure efficiency relative to U235 (IRP)	1
	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
<p>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.</p> <p>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</p>		

Results presented per functional unit

Core environmental impact indicators (per functional unit - Wp)

Indicator	Unit	Total	A1-A3	A4- Distribution	A5 - Installation	B - Usage	C1-C4 End of life
GWP-total	kg CO2 eq.	4.20E-01	3.46E-01	2.51E-02	5.11E-03	0.00E+00	4.33E-02
GWP-fossil	kg CO2 eq.	4.15E-01	3.44E-01	2.51E-02	1.89E-03	0.00E+00	4.32E-02
GWP-biogenic	kg CO2 eq.	5.02E-03	1.71E-03	8.79E-06	3.21E-03	0.00E+00	8.87E-05
GWP-LULUC	kg CO2 eq.	2.96E-04	2.64E-04	1.36E-05	3.15E-07	0.00E+00	1.84E-05
ODP	kg CFC11 eq.	5.60E-08	4.80E-08	5.42E-09	1.30E-10	0.00E+00	2.36E-09
AP	mol H ⁺ eq.	3.15E-03	2.54E-03	4.09E-04	4.01E-06	0.00E+00	2.02E-04
EP-freshwater	kg P eq.	1.42E-05	1.33E-05	1.57E-07	2.82E-08	0.00E+00	7.56E-07
EP-marine	kg N eq.	5.65E-04	4.13E-04	1.10E-04	6.26E-06	0.00E+00	3.61E-05
EP-terrestrial	mol N eq.	6.33E-03	4.69E-03	1.22E-03	1.54E-05	0.00E+00	4.07E-04
POCP	kg NMVOC eq.	2.61E-03	2.17E-03	3.24E-04	5.18E-06	0.00E+00	1.12E-04
ADP-M&M	kg Sb eq.	2.78E-05	2.51E-05	6.42E-08	2.09E-09	0.00E+00	2.66E-06
ADP-fossil	MJ	4.34E+00	3.69E+00	3.57E-01	9.16E-03	0.00E+00	2.93E-01
WDP	m ³	1.83E-01	1.71E-01	9.81E-04	2.23E-04	0.00E+00	1.08E-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-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 (per functional unit - Wp)

Indicator	Unit	Total	A1-A3	A4- Distribution	A5 - Installation	B - Usage	C1-C4 End of life
PM	Disease incidence	3.36E-08	3.02E-08	1.63E-09	5.72E-11	0.00E+00	1.74E-09
IRP	kBq U235 eq.	9.12E-03	6.40E-03	1.52E-03	3.83E-05	0.00E+00	1.16E-03
ETP-fw	CTUe	1.70E+01	1.55E+01	2.69E-01	4.41E-02	0.00E+00	1.17E+00
HTP-c	CTUh	4.17E-10	3.69E-10	1.32E-11	7.79E-13	0.00E+00	3.37E-11
HTP-nc	CTUh	3.22E-08	3.01E-08	2.60E-10	2.55E-11	0.00E+00	1.81E-09
SQP	Dimensionless	3.19E+00	2.59E+00	3.00E-01	1.34E-02	0.00E+00	2.95E-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

Parameter	Unit	Total	A1-A3	A4- Distribution	A5 - Installation	B - Usage	C1-C4 End of life
RPEE	MJ	1.05E+00	8.71E-01	3.88E-03	4.76E-04	0.00E+00	1.72E-01
RPEM	MJ	4.88E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.88E-02
TPE	MJ	1.10E+00	8.71E-01	3.88E-03	4.76E-04	0.00E+00	2.20E-01
NRPE	MJ	4.09E+00	3.69E+00	3.57E-01	9.16E-03	0.00E+00	4.06E-02
NRPM	MJ	2.52E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.52E-01
TRPE	MJ	4.34E+00	3.68E+00	3.57E-01	9.16E-03	0.00E+00	2.92E-01
SM	kg	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
NRSF	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
W	m ³	5.50E-03	4.09E-03	2.94E-05	6.62E-06	0.00E+00	1.38E-03

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 (per functional unit - Wp)

Parameter	Unit	Total	A1-A3	A4- Distribution	A5 - Installation	B - Usage	C1-C4 End of life
HW	KG	2.77E-02	2.42E-02	3.26E-04	6.19E-04	0.00E+00	2.55E-03
NHW	KG	5.45E-01	4.68E-01	1.75E-02	4.46E-03	0.00E+00	5.48E-02
RW	KG	1.01E-05	6.44E-06	2.40E-06	5.71E-08	0.00E+00	1.22E-06

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

End of life – output flow (per functional unit - Wp)

Parameter	Unit	Total	A1-A3	A4- Distribution	A5 - Installation	B - Usage	C1-C4 End of life
CR	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
MR	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
MER	kg	2.48E-03	0.00E+00	0.00E+00	2.48E-03	0.00E+00	0.00E+00
EEE	MJ	7.36E+01	0.00E+00	0.00E+00	0.00E+00	7.36E+01	0.00E+00
ETE	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

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

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

Information describing the biogenic carbon content at the factory gate (per functional unit - Wp)

Biogenic carbon content	Unit	Value
Biogenic carbon content in product	kg C	0.00E+00
Biogenic carbon content in the accompanying packaging	kg C	1.19E-03

Results presented per declared unit

Core environmental impact indicators (per declared unit - m2)

Indicator	Unit	Total	A1-A3	A4- Distribution	A5 - Installation	B - Usage	C1-C4 End of life
GWP-total	kg CO2 eq.	8.48E+01	7.00E+01	5.07E+00	1.03E+00	0.00E+00	8.76E+00
GWP-fossil	kg CO2 eq.	8.38E+01	6.96E+01	5.06E+00	3.83E-01	0.00E+00	8.74E+00
GWP-biogenic	kg CO2 eq.	1.01E+00	3.46E-01	1.78E-03	6.50E-01	0.00E+00	1.79E-02
GWP-LULUC	kg CO2 eq.	5.99E-02	5.34E-02	2.74E-03	6.37E-05	0.00E+00	3.72E-03
ODP	kg CFC11 eq.	1.13E-05	9.71E-06	1.09E-06	2.64E-08	0.00E+00	4.77E-07
AP	mol H ⁺ eq.	6.37E-01	5.13E-01	8.27E-02	8.11E-04	0.00E+00	4.08E-02
EP-freshwater	kg P eq.	2.87E-03	2.68E-03	3.18E-05	5.70E-06	0.00E+00	1.53E-04
EP-marine	kg N eq.	1.14E-01	8.35E-02	2.21E-02	1.27E-03	0.00E+00	7.30E-03
EP-terrestrial	mol N eq.	1.28E+00	9.49E-01	2.46E-01	3.11E-03	0.00E+00	8.23E-02
POCP	kg NMVOC eq.	5.27E-01	4.38E-01	6.54E-02	1.05E-03	0.00E+00	2.26E-02
ADP-M&M	kg Sb eq.	5.62E-03	5.07E-03	1.30E-05	4.22E-07	0.00E+00	5.37E-04
ADP-fossil	MJ	8.78E+02	7.45E+02	7.21E+01	1.85E+00	0.00E+00	5.92E+01
WDP	m ³	3.71E+01	3.46E+01	1.98E-01	4.50E-02	0.00E+00	2.18E+00

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 (per declared unit - m2)

Indicator	Unit	Total	A1-A3	A4- Distribution	A5 - Installation	B - Usage	C1-C4 End of life
PM	Disease incidence	6.79E-06	6.10E-06	3.30E-07	1.16E-08	0.00E+00	3.51E-07
IRP	kBq U235 eq.	1.84E+00	1.29E+00	3.06E-01	7.75E-03	0.00E+00	2.35E-01
ETP-fw	CTUe	3.43E+03	3.13E+03	5.44E+01	8.91E+00	0.00E+00	2.36E+02
HTP-c	CTUh	8.42E-08	7.46E-08	2.67E-09	1.57E-10	0.00E+00	6.82E-09
HTP-nc	CTUh	6.51E-06	6.08E-06	5.26E-08	5.16E-09	0.00E+00	3.66E-07
SQP	Dimensionless	6.45E+02	5.23E+02	6.06E+01	2.71E+00	0.00E+00	5.96E+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 (per declared unit - m2)

Parameter	Unit	Total	A1-A3	A4- Distribution	A5 - Installation	B - Usage	C1-C4 End of life
RPEE	MJ	2.12E+02	1.76E+02	7.84E-01	9.62E-02	0.00E+00	3.47E+01
RPEM	MJ	9.86E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	9.86E+00
TPE	MJ	2.21E+02	1.76E+02	7.84E-01	9.62E-02	0.00E+00	4.46E+01
NRPE	MJ	8.27E+02	7.45E+02	7.21E+01	1.85E+00	0.00E+00	8.20E+00
NRPM	MJ	5.08E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.08E+01
TRPE	MJ	8.77E+02	7.44E+02	7.21E+01	1.85E+00	0.00E+00	5.90E+01
SM	kg	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
NRSF	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
W	m ³	1.11E+00	8.27E-01	5.95E-03	1.34E-03	0.00E+00	2.78E-01

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 (per declared unit - m2)

Parameter	Unit	Total	A1-A3	A4- Distribution	A5 - Installation	B - Usage	C1-C4 End of life
HW	KG	5.60E+00	4.89E+00	6.58E-02	1.25E-01	0.00E+00	5.15E-01
NHW	KG	1.10E+02	9.45E+01	3.54E+00	9.01E-01	0.00E+00	1.11E+01
RW	KG	2.05E-03	1.30E-03	4.86E-04	1.15E-05	0.00E+00	2.47E-04

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

End of life – output flow (per declared unit - m2)

Parameter	Unit	Total	A1-A3	A4- Distribution	A5 - Installation	B - Usage	C1-C4 End of life
CR	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
MR	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
MER	kg	5.01E-01	0.00E+00	0.00E+00	5.01E-01	0.00E+00	0.00E+00
EEE	MJ	1.49E+04	0.00E+00	0.00E+00	0.00E+00	1.49E+04	0.00E+00
ETE	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

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

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

Information describing the biogenic carbon content at the factory gate (per declared unit - m2)

Biogenic carbon content	Unit	Value
Biogenic carbon content in product	kg C	0.00E+00
Biogenic carbon content in the accompanying packaging	kg C	2.40E-01

Additional requirements

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

Regional production mix from import, high voltage (production of transmission lines, in addition to direct emissions and losses in grid) of applied electricity for the manufacturing proress(A3).

Regional electricity grid	Unit	Value
Electricity, high voltage {CN-SC} – China, Sichuan : Ecoinvent v3.8	kg CO2 -eq/kWh	0,297
Electricity, high voltage {CN-YN} – China, Yunnan : Ecoinvent v3.8	kg CO2 -eq/kWh	0,476
Electricity, high voltage {CN-HB} – China, Zhejiang: Ecoinvent v3.8	kg CO2 -eq/kWh	0,865
Electricity, high voltage {CN-JS} – China, Jiangu: Ecoinvent v3.8	kg CO2 -eq/kWh	1,06

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 be declared as PO4 eq.

Additional environmental impact indicators required in NPCR Part A (per functional unit - Wp)

Indicator	Unit	Total	A1-A3	A4- Distribution	A5 - Installation	B - Usage	C1-C4 End of life
EP-freshwater*	kg PO4 eq.	6.58E-06	6.15E-06	7.29E-08	1.31E-08	0.00E+00	3.50E-07
GWP-IOBC	kg CO2 eq.	4.15E-01	3.44E-01	2.51E-02	1.89E-03	0.00E+00	4.32E-02
GWP-BC	kg CO2 eq.	4.36E-03	4.36E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00
GWP	kg CO2 eq.	4.19E-01	3.49E-01	2.51E-02	1.89E-03	0.00E+00	4.32E-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.

Additional environmental impact indicators required in NPCR Part A (per declared unit - m2)

Indicator	Unit	Total	A1-A3	A4- Distribution	A5 - Installation	B - Usage	C1-C4 End of life
EP-freshwater*	kg PO4 eq.	1.33E-03	1.24E-03	1.47E-05	2.64E-06	0.00E+00	7.07E-05
GWP-IOBC	kg CO2 eq.	8.38E+01	6.96E+01	5.06E+00	3.83E-01	0.00E+00	8.74E+00
GWP-BC	kg CO2 eq.	8.81E-01	8.81E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00
GWP	kg CO2 eq.	8.47E+01	7.05E+01	5.06E+00	3.83E-01	0.00E+00	8.74E+00

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.

Indoor environment

No tests have been carried out on the product concerning indoor climate.

Carbon footprint (A1-C4)

The carbon footprint per kWh with a production in Norway ($I_{\text{rad}}=1000 \text{ kWh} \cdot \text{m}^{-2} \cdot \text{year}^{-1}$) is 20,53 gCO₂-eq / kWh.

The carbon footprint per kWh with a production in Italy ($I_{\text{rad}}=1600 \text{ kWh} \cdot \text{m}^{-2} \cdot \text{year}^{-1}$) is 12,83 gCO₂-eq / kWh.

Extrapolation rules

Solar Irradiation

The amount of electricity produced by the solar panels depends on the solar irradiation. The results are given with a default irradiation in Norway $I_{soleil} = 1000 \text{ kWh. m}^{-2}\cdot\text{year}^{-1}$. For a site with a different irradiation I_{site} the result can be extrapolated by multiplying “Exported energy - electricity” by the ratio $\frac{I_{site}}{I_{soleil}}$.

For example if $I_{site}=1600 \text{ kWh. m}^{-2}\cdot\text{year}^{-1}$ and for I_{soleil} , Exported energy -electricity = 7,36E+1

$$\text{Exported energy} - \text{electricity}_{I_{site}} = (7,36 \times 10^1) \times \frac{1600}{1000}$$

Bibliography

ISO 14025:2010	Environmental labels and declarations - Type III environmental declarations - Principles and procedures
ISO 14044:2006	Environmental management - Life cycle assessment - Requirements and guidelines
EN 15804:2012+A2:2019	Sustainability of construction works - Environmental product declaration - Core rules for the product category of construction products
ISO 21930:2007	Sustainability in building construction - Environmental declaration of building products

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