

# Environmental Product Declaration

In accordance with 14025 and EN15804 +A2

Mono-crystalline Double glass, N-Type, solar photovoltaic modules



The Norwegian  
EPD Foundation

**Owner of the declaration:**  
Zhejiang Aiko Solar Technology Co., Ltd

**Product name:**  
Mono-crystalline Double glass, N-Type, solar photovoltaic modules

**Declared unit:**  
1m<sup>2</sup> of manufactured photovoltaic module

**Product category /PCR:**  
NPCR 029:2022 Part B for photovoltaic modules 1.2

**Program holder and publisher:**  
The Norwegian EPD foundation

**Declaration number:**  
NEPD-6586-5846-EN

**Registration number:**  
NEPD-6586-5846-EN

**Issue date:** 13.05.2024

**Valid to:** 13.05.2029

ver-291024

# General information

## Product:

Mono-crystalline Double glass, N-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-6586-5846-EN

## This declaration is based on Product Category Rules:

NPCR 029:2022 Part B for photovoltaic modules 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 evidence. EPD of construction products may not be comparable if they do not comply with EN 15804. This is a an average EPD.

## Declared unit:

1m<sup>2</sup> of manufactured photovoltaic module

## Functional unit:

1 Wp of manufactured 555Wp photovoltaic module, from cradle-to-grave and module D, 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

Sign



Julie Lyslo Skullestad

Independent verifier approved by EPD Norway

## Owner of the declaration:

**Zhejiang Aiko Solar Technology Co., Ltd.**

Contact: Li Fenggao  
Phone: 400-0099-366  
e-mail: lifenggao@aikosolar.com

## Manufacturer:

**Zhuhai Fushan Aiko Solar Technology Co., Ltd**

e-mail: lifenggao@aikosolar.com

## Place of production:

China

## Management system:

ISO 14001, ISO 9001, IEC 62941,  
OHSAS 18001:2007, ISO 45001

## Organisation no:

91330782MA28EYNM36

## Issue date:

13.05.2024

## Valid to:

13.05.2029

## Year of study:

2024

## Comparability:

EPDs from other programs than The Norwegian EPD Foundation may not be comparable.

## The EPD has been worked out by:

Laurène MEJEAN  
Kapstan

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Approved



Manager of EPD Norway

# Product

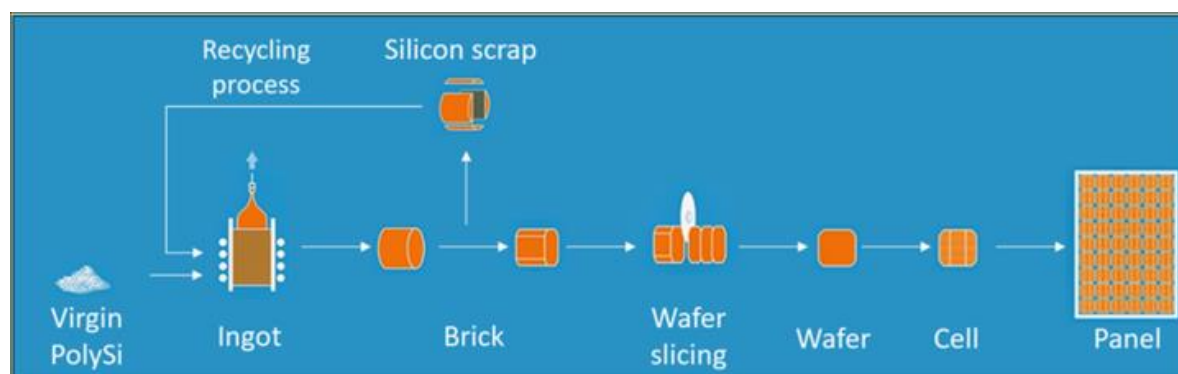
## Product description:

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 double glass and the solar cells are produced with ABC process. Solar cells are assembled with the EVA, glass, frame and electrical connections to produce the finished solar module in the production factory in Zhuhai 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 average inventory amongst the modules. The variation between each module results is lower than 10 %.

## Production process:

The solar module production from silicon is explained in the figure below:



Step 1 - **PolySi**: The raw material used to produce the cells is a high purity silicon called “Solar grade silicon” or “PolySi”.

Step 2 - **Ingot**: The PolySi is transformed into a monocrystalline ingot by heating up the silicon with a process called “Czochralski process”.

Step 3 - **Wafer**: the ingot is then cut into bricks and sliced into wafers by diamond wire slicing.

Step 4 - **Solar cell**: the wafer is transformed into a cell through chemical treatments and screen-printing wiring.

Step 5 - **Solar module**: Solar cells are interconnected to form a complete solar module. This process involves soldering the cells together and encapsulating them between a front sheet (usually made of glass), EVA and a back sheet (here made of glass). Aluminium frame is used for reinforcement. A junction box is included for electrical connection.

## Product specification:

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

| Materials        | KG/DU          | %   |
|------------------|----------------|-----|
| Cells            | <b>2.9E-01</b> | 3%  |
| Glass            | <b>9.9E+01</b> | 85% |
| EVA              | <b>8.7E+00</b> | 7%  |
| Aluminium frame  | <b>9.9E-01</b> | 9%  |
| Junction box     | <b>6.0E-02</b> | 0%  |
| String connector | <b>1.8E-02</b> | 0%  |
| Cell connector   | <b>1.2E-01</b> | 1%  |
| Silicone         | <b>1.6E-01</b> | 1%  |
| Packaging        | KG/DU          | %   |
| Wooden pallet    | <b>5.6E-01</b> | 5%  |
| Cardboard        | <b>1.6E-01</b> | 1%  |
| Low density PE   | <b>1.2E-03</b> | 0%  |
| PP band          | <b>1.8E-02</b> | 0%  |
| Paper corner     | <b>1.4E-02</b> | 0%  |

## Technical data:

The modules are produced according to IEC 61215 / 61730, IEC 61701, IEC 61215, IEC 62782, IEC 62716, ISO 11925-2, IEC 62938, IEC 62804, AS 40404.2

This EPD is valid for the following module types:

- AIKO-Axxx-MAH72Dw (2 types with different cell sizes)
- AIKO-Axxx-MAH54Dw/Db (2 types with different cell sizes)
- AIKO-Gxxx-MCH72Dw
- AIKO-Axxx-GRH66Dw
- AIKO-Axxx-GCH66Dw
- AIKO-Axxx-MAH60Dw/Db
- AIKO-Axxx-MCE54Dw/Db
- AIKO-Axxx-MAE78Dw
- AIKO-Axxx-MAH78Dw
- AIKO-Axxx-GTE66Dw
- AIKO-Axxx-MDE72Dw

| AIKO-Axxx-MAH72Dw | AIKO-Axxx-MAH54Dw | AIKO-Axxx-MAH54Db | AIKO-Axxx-MAH72Dw. | AIKO-Axxx-MAH54Dw. | AIKO-Axxx-MAH54Db. | AIKO-Gxxx-MCH72Dw | AIKO-Axxx-GRH66Dw | AIKO-Axxx-GCH66Dw |
|-------------------|-------------------|-------------------|--------------------|--------------------|--------------------|-------------------|-------------------|-------------------|
|-------------------|-------------------|-------------------|--------------------|--------------------|--------------------|-------------------|-------------------|-------------------|

|                        |          |          |          |              |              |              |               |           |          |
|------------------------|----------|----------|----------|--------------|--------------|--------------|---------------|-----------|----------|
| Area (m <sup>2</sup> ) | 2.58     | 1.95     | 1.95     | 2.63         | 1.99         | 1.99         | 2.70          | 2.70      | 3.11     |
| Weight (kg)            | 32.50    | 24.20    | 24.20    | 31.80        | 24.50        | 24.50        | 33.50         | 33.50     | 33.50    |
| Number of cells        | 72 cells | 54 cells | 54 cells | 72 cells     | 54 cells     | 54 cells     | 72 cells      | 66 cells  | 66 cells |
| Size of cells          | 182x184  | 182x184  | 182x184  | 182.2x187.75 | 182.2x187.75 | 182.2x187.75 | 182.2 x 192.5 | 182.2x210 | 210x210  |
| Power min              | 550 W    | 415 W    | 415 W    | 610 W        | 450 W        | 450 W        | 645 W         | 635 W     | 745 W    |
| Power max              | 625 W    | 465 W    | 465 W    | 630 W        | 470 W        | 470 W        | 670 W         | 655 W     | 725 W    |

| AIKO-Axxx-MAH60DW | AIKO-Axxx-MAH60Db | AIKO-Axxx-MCE54Dw | AIKO-Axxx-MCE54Db | AIKO-Axxx-MAE78DW | AIKO-Axxx-MAH78DW | AIKO-Axxx-GTE66DW | AIKO-Axxx-MDE72DW |
|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|
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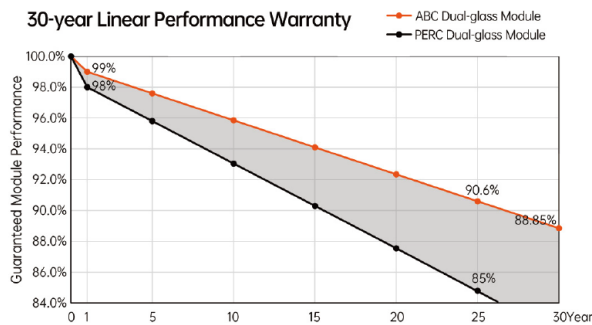
|                        |              |              |               |               |              |          |           |             |
|------------------------|--------------|--------------|---------------|---------------|--------------|----------|-----------|-------------|
| Area (m <sup>2</sup> ) | 2.22         | 2.22         | 2.00          | 2.00          | 2.80         | 2.80     | 2.70      | 2.70        |
| Weight (kg)            | 27.20        | 27.20        | 24.50         | 24.50         | 34.50        | 34.50    | 33.50     | 33.00       |
| Number of cells        | 60 cells     | 60 cells     | 54 cells      | 54 cells      | 78 cells     | 78 cells | 66 cells  | 72 cells    |
| Size of cells          | 182.2x187.75 | 182.2x187.75 | 182.2 x 192.5 | 182.2 x 192.5 | 182.2x187.75 | 182x184  | 214x182.7 | 196.2x182.7 |
| Power min              | 525 W        | 525 W        | 485 W         | 485 W         | 675 W        | 680 W    | 655 W     | 675 W       |
| Power max              | 505 W        | 505 W        | 460 W         | 460 W         | 650 W        | 655 W    | 635 W     | 650 W       |

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:  
30 years



# LCA: Calculation rules

## Declared unit:

1m<sup>2</sup> of manufactured photovoltaic module

## Data quality:

Specific data comes from actual consumption of the module assembly factory (May 2023 – February 2024). This data has been collected by the manufacturer and checked by the LCA practitioner.

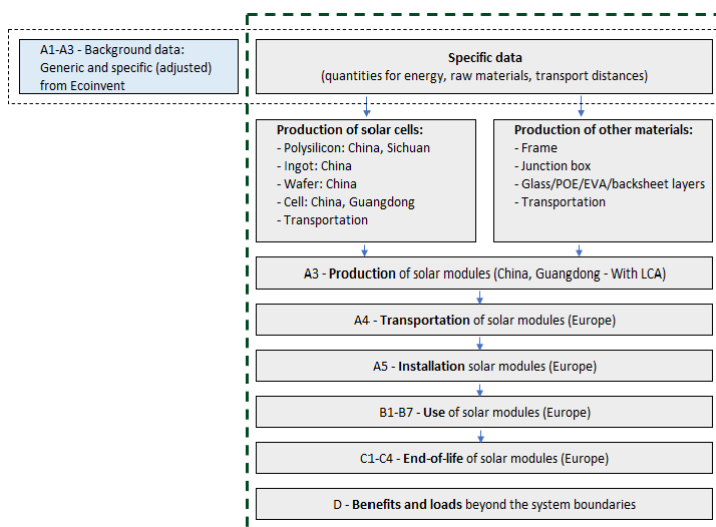
Generic data is from Ecoinvent v3.10 and Simapro v9. Characterization factors from EN15804:2012 + A2: 2019. Generic data <10 years old. Ecoinvent system model used: cut-off.

## 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 surface 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   | China, Sichuan |
| Ingot/brick     | China          |
| Wafer           | China          |
| Recycled Polysi | China          |

|            |                 |
|------------|-----------------|
| Cells, ABC | China, Guandong |
| Modules    | China, Guandong |

**Cut-off criteria:**

No known significant flows have been excluded from the study.

## LCA: Scenarios and additional technical information

The following information describes the scenarios in the different modules of the EPD. All data is provided per functional unit.

### Transport from production place to assembly/user (A4)

The transport step A4 covers the transport from the factory in China to the installation site in Europe by sea and road. The delivery port used for calculations in Europe is Rotterdam.

| Transport from production place to assembly/user (A4) | Capacity utilisation (incl. return) % | Distance (km) | Fuel/Energy consumption    | Unit | Value  |
|---|---------------------------------------|---------------|----------------------------|------|--------|
| Truck   | 50%                                   | 200           | Diesel (4.44E-2 L/tkm)     | tkm  | 2.53   |
| Railway   | 50%                                   | 19000         | Heavy fuel (2.63E-3 L/tkm) | tkm  | 240.25 |
| Truck   | 50%                                   | 1000          | Diesel (4.44E-2 L/tkm)     | tkm  | 12.64  |

The calculation of fuel consumption is based on the weight of the product and packaging. It includes return freight.

### Assembly (A5)

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:

| Packaging  | Unit | Value    |
|--|------|----------|
| Wooden pallet  | Kg   | 5.58E-01 |
| Cardboard  | Kg   | 1.55E-01 |
| Low density PE   | Kg   | 1.22E-03 |
| PP band  | Kg   | 1.78E-02 |
| Paper corner   | Kg   | 1.44E-02 |
| Transportation in lorry (Capacity utilisation incl. return: 50%) | Tkm  | 7.47E-01 |

### Use (B1)

Photovoltaic modules harness solar energy throughout their entire lifecycle via the photovoltaic effect. The amount of electricity they produce is directly influenced by solar irradiance. The electricity production is calculated as below:

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

Where:

- $I_{sun}$  is the sun irradiation received by the module in kWh. m<sup>-2</sup>.year<sup>-1</sup>, which depends on the site location.
- 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 (cables, inverter, etc.).
- $Eff_{panel}$ , or panel efficiency, is the ratio between the energy produced and the solar radiation received.



- $b$  is the bifacial gain (5% if bifacial and 0% if monofacial)
- $S_{1kWp}$  is the surface area to get 1 kWp.
- $D_{panel}$  corresponds to the degradation of the panel in year  $i$ . This degradation is 1% the first year and then 0.35% per year.  $D_{panel} = 0.99 \times (1 - 0.35\%)^{i-1}$

As a result, the following chart illustrates the electricity produced:

| Solar irradiance for electricity production | Unit                          | Value |
|---|-------------------------------|-------|
| 1000 kWh/m <sup>2</sup> /year               | kWh/m <sup>2</sup> (30 years) | 5 504 |
| 1100 kWh/m <sup>2</sup> /year               | kWh/m <sup>2</sup> (30 years) | 6 054 |
| 1200 kWh/m <sup>2</sup> /year               | kWh/m <sup>2</sup> (30 years) | 6 605 |
| 1300 kWh/m <sup>2</sup> /year               | kWh/m <sup>2</sup> (30 years) | 7 155 |
| 1400 kWh/m <sup>2</sup> /year               | kWh/m <sup>2</sup> (30 years) | 7 706 |
| 1500 kWh/m <sup>2</sup> /year               | kWh/m <sup>2</sup> (30 years) | 8 256 |
| 1600 kWh/m <sup>2</sup> /year               | kWh/m <sup>2</sup> (30 years) | 8 806 |
| 1700 kWh/m <sup>2</sup> /year               | kWh/m <sup>2</sup> (30 years) | 9 357 |

### Maintenance (B2)/Repair (B3)/Replacement (B4)/Refurbishment (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 products do not require any energy or water consumption.

### End of Life (C1, C3, C4)

The modules are considered as removed by hand. Different parts are either recycled or incinerated with energy recovery, according to scenarios in PCR Part B for each product type.

For the recycled parts, the following recycling rates are used:

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

| Waste process                    | Unit | Value    |
|----------------------------------|------|----------|
| Recycling                        | Kg   | 1.08E+01 |
| Incineration and energy recovery | Kg   | 1.04E+00 |

### Transport to waste processing (C2)

It has been assumed that the modules are collected by truck and sent for recycling. 50 km is considered from the site to the recycling factory as proposed in PCR part B.

| Type  | Capacity utilisation (incl. return) % | Type of vehicle               | Distance (km) | Fuel/Energy consumption | Value (tkm) |
|-------|---------------------------------------|-------------------------------|---------------|-------------------------|-------------|
| Truck | 50%                                   | 16-32 metric ton lorry, EURO5 | 50            | Diesel (4.44E-2 l/tkm)  | 5.94E-01    |

### Benefits and loads beyond the system boundaries (D)

Benefits and loads have been based on glass and aluminium frame recycling only. Energy recovery from A4-A5 and C1-C4 modules is included.

The benefits of exported energy from energy recovery in a treatment facility is calculated with substitution of Norwegian electricity market mix and heat production from wood chip burning plants in Norway. Conversion factors for efficiencies and losses from waste to delivered energy are included.

| Item                              | Unit | Value     |
|-----------------------------------|------|-----------|
| Glass                             | Kg   | -9.43E+00 |
| Aluminium                         | Kg   | -2.56E-01 |
| Substitution of electrical energy | MJ   | 8.70E-01  |
| Substitution of thermal energy    | MJ   | 3.11E+01  |

## 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 m<sup>2</sup>. 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        | X                                  |   |

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

| ILCD classification | Indicator   | Disclaimer |
|---------------------|---|------------|
| ILCD type / level 1 | Global warming potential (GWP)  | None       |
|                     | Depletion potential of the stratospheric ozone layer (ODP)                                  | None       |
|                     | Potential incidence of disease due to PM emissions (PM)                                     | None       |
| ILCD type / level 2 | Acidification potential, Accumulated Exceedance (AP)  | None       |
|                     | Eutrophication potential, Fraction of nutrients reaching marine end compartment (EP-marine) | None       |
|                     | Eutrophication potential, Accumulated Exceedance (EP-terrestrial)                           | None       |

|   |  |      |
|---|--|------|
|   | Formation potential of tropospheric ozone (POCP)                                 | None |
|   | Potential Human exposure efficiency relative to U235 (IRP)                       | 1    |
| ILCD type / level<br>3  | Abiotic depletion potential for non-fossil resources (ADP-minerals&metals)       | 2    |
|   | Abiotic depletion potential for fossil resources (ADP-fossil)                    | 2    |
|   | Water (user) deprivation potential, deprivation-weighted water consumption (WDP) | 2    |
|   | Potential Comparative Toxic Unit for ecosystems (ETP-fw)                         | 2    |
|   | Potential Comparative Toxic Unit for humans (HTP-c)                              | 2    |
|   | Potential Comparative Toxic Unit for humans (HTP-nc)                             | 2    |
|   | Potential Soil quality index (SQP)   | 2    |
| <p><b>Disclaimer 1</b> – 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><b>Disclaimer 2</b> – 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)

| Parameter               | Unit        | A1-A3     | A4       | A5       | B1 - B7  | C1       | C2       | C3       | C4       | D         |
|-------------------------|-------------|-----------|----------|----------|----------|----------|----------|----------|----------|-----------|
| GWP-total               | kg CO2 eq   | 5.06E-01  | 2.18E-02 | 6.16E-03 | 0.00E+00 | 0.00E+00 | 3.67E-04 | 1.07E-02 | 4.54E-04 | -2.18E-02 |
| GWP-fossil              | kg CO2 eq   | 5.08E-01  | 2.18E-02 | 2.03E-03 | 0.00E+00 | 0.00E+00 | 3.66E-04 | 1.07E-02 | 4.53E-04 | -2.15E-02 |
| GWP-biogenic            | kg CO2 eq   | -2.54E-03 | 3.58E-06 | 4.13E-03 | 0.00E+00 | 0.00E+00 | 6.77E-08 | 1.76E-05 | 3.76E-07 | -2.25E-04 |
| GWP-luluc               | kg CO2 eq   | 4.08E-04  | 9.24E-06 | 1.55E-06 | 0.00E+00 | 0.00E+00 | 1.25E-07 | 3.95E-06 | 1.75E-07 | -6.12E-05 |
| ODP                     | kg CFC11 eq | 5.41E-09  | 3.66E-10 | 9.73E-12 | 0.00E+00 | 0.00E+00 | 7.36E-12 | 2.35E-11 | 2.08E-12 | -3.19E-10 |
| AP                      | mol H+ eq   | 3.16E-03  | 3.29E-04 | 2.99E-06 | 0.00E+00 | 0.00E+00 | 1.65E-06 | 5.69E-06 | 1.44E-06 | -1.47E-04 |
| EP-freshwater           | kg P eq     | 3.49E-05  | 1.32E-07 | 6.16E-09 | 0.00E+00 | 0.00E+00 | 2.89E-09 | 2.42E-08 | 7.81E-09 | -7.65E-07 |
| EP-marine               | kg N eq     | 8.14E-04  | 8.49E-05 | 1.20E-06 | 0.00E+00 | 0.00E+00 | 6.42E-07 | 1.63E-06 | 4.22E-07 | -2.49E-05 |
| EP-terrestrial          | mol N eq    | 6.54E-03  | 9.42E-04 | 1.28E-05 | 0.00E+00 | 0.00E+00 | 7.05E-06 | 1.81E-05 | 4.80E-06 | -2.97E-04 |
| POCP                    | kg NMVOC eq | 1.94E-03  | 2.76E-04 | 4.09E-06 | 0.00E+00 | 0.00E+00 | 2.53E-06 | 4.87E-06 | 1.38E-06 | -8.85E-05 |
| ADP-M&M <sup>2</sup>    | kg Sb eq    | 1.73E-05  | 4.87E-08 | 1.81E-09 | 0.00E+00 | 0.00E+00 | 1.17E-09 | 2.08E-08 | 1.94E-09 | 8.21E-08  |
| ADP-fossil <sup>2</sup> | MJ          | 3.44E+00  | 1.96E-02 | 8.26E-04 | 0.00E+00 | 0.00E+00 | 4.35E-04 | 6.78E-03 | 9.78E-04 | -1.29E-01 |
| WDP <sup>2</sup>        | m3          | 2.62E-01  | 9.91E-04 | 2.26E-04 | 0.00E+00 | 0.00E+00 | 2.32E-05 | 1.16E-03 | 4.73E-05 | -2.81E-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 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)

| Parameter | Unit              | A1-A3    | A4       | A5       | B1 - B7  | C1       | C2       | C3       | C4       | D         |
|-----------|-------------------|----------|----------|----------|----------|----------|----------|----------|----------|-----------|
| PM        | Disease incidence | 3.90E-08 | 1.22E-09 | 5.33E-11 | 0.00E+00 | 0.00E+00 | 3.54E-11 | 5.46E-11 | 1.49E-11 | -1.78E-09 |
| IRP       | kBq U235 eq.      | 6.13E-03 | 9.39E-05 | 3.19E-06 | 0.00E+00 | 0.00E+00 | 2.47E-06 | 1.57E-04 | 1.87E-06 | -2.53E-04 |
| ETP-fw    | CTUe              | 3.64E+00 | 4.76E-02 | 7.93E-03 | 0.00E+00 | 0.00E+00 | 1.03E-03 | 2.78E-02 | 2.86E-03 | -1.85E-02 |
| HTP-c     | CTUh              | 2.84E-09 | 1.19E-10 | 3.32E-12 | 0.00E+00 | 0.00E+00 | 2.45E-12 | 1.11E-11 | 5.31E-13 | -6.05E-11 |
| HTP-nc    | CTUh              | 4.30E-09 | 6.37E-11 | 3.66E-12 | 0.00E+00 | 0.00E+00 | 1.61E-12 | 1.10E-11 | 1.25E-12 | -1.49E-10 |
| SQP       | Dimensionless     | 2.52E+00 | 1.08E-01 | 5.74E-03 | 0.00E+00 | 0.00E+00 | 3.92E-03 | 3.84E-03 | 2.50E-03 | -3.24E-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 functional unit - Wp)

| Parameter | Unit           | A1-A3     | A4       | A5        | B1 - B7  | C1       | C2        | C3       | C4        | D         |
|-----------|----------------|-----------|----------|-----------|----------|----------|-----------|----------|-----------|-----------|
| RPEE      | MJ             | 1.14E+00  | 3.62E-03 | 1.33E-04  | 0.00E+00 | 0.00E+00 | 9.05E-05  | 1.55E-01 | 1.17E-04  | -9.05E-02 |
| RPEM      | 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  |
| TPE       | MJ             | 1.14E+00  | 3.62E-03 | 1.33E-04  | 0.00E+00 | 0.00E+00 | 9.05E-05  | 1.55E-01 | 1.17E-04  | -9.05E-02 |
| NRPE      | MJ             | 3.44E+00  | 1.96E-02 | 8.36E-04  | 0.00E+00 | 0.00E+00 | 4.35E-04  | 6.78E-03 | 9.79E-04  | -1.29E-01 |
| NRPM      | 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  |
| TRPE      | MJ             | 3.44E+00  | 1.96E-02 | 8.36E-04  | 0.00E+00 | 0.00E+00 | 4.35E-04  | 6.78E-03 | 9.79E-04  | -1.29E-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 <sup>3</sup> | -3.54E-02 | -1.44E-4 | -1.22E-05 | 0.00E+00 | 0.00E+00 | -3.41E-06 | 1.07E-03 | -4.96E-06 | 1.63E-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 | A1-A3    | A4       | A5       | B1 - B7  | C1       | C2       | C3       | C4       | D         |
|-----------|------|----------|----------|----------|----------|----------|----------|----------|----------|-----------|
| HW        | KG   | 1.74E-03 | 7.12E-06 | 7.53E-04 | 0.00E+00 | 0.00E+00 | 1.65E-07 | 1.53E-04 | 6.55E-08 | 3.00E-04  |
| NHW       | KG   | 6.31E-01 | 1.08E-02 | 6.30E-04 | 0.00E+00 | 0.00E+00 | 3.78E-04 | 2.25E-03 | 3.04E-03 | -1.91E-02 |
| RW        | KG   | 4.04E-06 | 6.32E-08 | 2.13E-09 | 0.00E+00 | 0.00E+00 | 1.72E-09 | 7.24E-08 | 1.20E-09 | -1.89E-07 |

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

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

| Parameter | Unit | A1-A3    | A4       | A5       | B1 - B7  | C1       | 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 | 0.00E+00 | 0.00E+00 |
| MR        | kg   | 4.40E-02 | 4.84E-04 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 4.35E-02 | 0.00E+00 |
| MER       | kg   | 4.19E-03 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 4.19E-03 | 0.00E+00 |
| EE        | MJ   | 1.01E-01 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 1.01E-01 | 0.00E+00 |
| TPE       | MJ   | 4.77E+00 | 4.58E+00 | 2.32E-02 | 9.69E-04 | 0.00E+00 | 0.00E+00 | 5.26E-04 | 1.62E-01 | 1.10E-03 |

*CR* Components for reuse; *MR* Materials for recycling; *MER* Materials for energy recovery; *EE* Exported energy; *TPE* Total primary energy

Reading example:  $9,0 \text{ E-}03 = 9,0 \cdot 10^{-3} = 0,009$

### 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 | 1.13E-03 |

## Results presented per declared unit

### Core environmental impact indicators (per declared unit – m<sup>2</sup>)

| Parameter      | Unit                   | A1-A3     | A4       | A5       | B1 - B7  | C1       | C2       | C3       | C4       | D         |
|----------------|------------------------|-----------|----------|----------|----------|----------|----------|----------|----------|-----------|
| GWP-total      | kg CO2 eq              | 1.26E+02  | 5.41E+00 | 1.53E+00 | 0.00E+00 | 0.00E+00 | 9.09E-02 | 2.67E+00 | 1.13E-01 | -5.40E+00 |
| GWP-fossil     | kg CO2 eq              | 1.26E+02  | 5.40E+00 | 5.03E-01 | 0.00E+00 | 0.00E+00 | 9.09E-02 | 2.66E+00 | 1.12E-01 | -5.33E+00 |
| GWP-biogenic   | kg CO2 eq              | -6.31E-01 | 8.87E-04 | 1.02E+00 | 0.00E+00 | 0.00E+00 | 1.68E-05 | 4.36E-03 | 9.32E-05 | -5.59E-02 |
| GWP-LULUC      | kg CO2 eq              | 1.01E-01  | 2.29E-03 | 3.85E-04 | 0.00E+00 | 0.00E+00 | 3.09E-05 | 9.81E-04 | 4.35E-05 | -1.52E-02 |
| ODP            | kg CFC11 eq            | 1.34E-06  | 9.08E-08 | 2.41E-09 | 0.00E+00 | 0.00E+00 | 1.83E-09 | 5.83E-09 | 5.16E-10 | -7.91E-08 |
| AP             | mol H+ eq              | 7.83E-01  | 8.16E-02 | 7.41E-04 | 0.00E+00 | 0.00E+00 | 4.09E-04 | 1.41E-03 | 3.57E-04 | -3.65E-02 |
| EP-freshwater  | kg P eq                | 8.66E-03  | 3.28E-05 | 1.53E-06 | 0.00E+00 | 0.00E+00 | 7.17E-07 | 6.00E-06 | 1.94E-06 | -1.90E-04 |
| EP-marine      | kg N eq                | 2.02E-01  | 2.11E-02 | 2.98E-04 | 0.00E+00 | 0.00E+00 | 1.59E-04 | 4.05E-04 | 1.05E-04 | -6.18E-03 |
| EP-terrestrial | mol N eq               | 1.62E+00  | 2.34E-01 | 3.17E-03 | 0.00E+00 | 0.00E+00 | 1.75E-03 | 4.49E-03 | 1.19E-03 | -7.37E-02 |
| POCP           | kg NMVOC eq            | 4.81E-01  | 6.84E-02 | 1.01E-03 | 0.00E+00 | 0.00E+00 | 6.27E-04 | 1.21E-03 | 3.42E-04 | -2.20E-02 |
| ADP-M&M        | kg Sb eq               | 4.29E-03  | 1.21E-05 | 4.48E-07 | 0.00E+00 | 0.00E+00 | 2.90E-07 | 5.16E-06 | 4.81E-07 | 2.04E-05  |
| ADP-fossil     | MJ                     | 8.52E+02  | 4.85E+00 | 2.05E-01 | 0.00E+00 | 0.00E+00 | 1.08E-01 | 1.68E+00 | 2.43E-01 | -3.19E+01 |
| WDP            | m <sup>3</sup> depriv. | 6.51E+01  | 2.46E-01 | 5.60E-02 | 0.00E+00 | 0.00E+00 | 5.76E-03 | 2.88E-01 | 1.17E-02 | -6.97E-01 |

**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 (per declared unit – m<sup>2</sup>)

| Parameter | Unit              | A1-A3    | A4       | A5       | B1 - B7  | C1       | C2       | C3       | C4       | D         |
|-----------|-------------------|----------|----------|----------|----------|----------|----------|----------|----------|-----------|
| PM        | Disease incidence | 9.67E-06 | 3.03E-07 | 1.32E-08 | 0.00E+00 | 0.00E+00 | 8.78E-09 | 1.35E-08 | 3.70E-09 | -4.43E-07 |
| IRP       | kBq U235 eq.      | 1.52E+00 | 2.33E-02 | 7.92E-04 | 0.00E+00 | 0.00E+00 | 6.13E-04 | 3.90E-02 | 4.63E-04 | -6.27E-02 |
| ETP-fw    | CTUe              | 9.03E+02 | 1.18E+01 | 1.97E+00 | 0.00E+00 | 0.00E+00 | 2.56E-01 | 6.91E+00 | 7.09E-01 | -4.58E+00 |
| HTP-c     | CTUh              | 7.05E-07 | 2.94E-08 | 8.24E-10 | 0.00E+00 | 0.00E+00 | 6.07E-10 | 2.74E-09 | 1.32E-10 | -1.50E-08 |
| HTP-nc    | CTUh              | 1.07E-06 | 1.58E-08 | 9.08E-10 | 0.00E+00 | 0.00E+00 | 3.99E-10 | 2.72E-09 | 3.10E-10 | -3.71E-08 |
| SQP       | Dimensionless     | 6.26E+02 | 2.69E+01 | 1.42E+00 | 0.00E+00 | 0.00E+00 | 9.72E-01 | 9.53E-01 | 6.19E-01 | -8.03E+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 – m<sup>2</sup>)

| Parameter | Unit           | A1-A3     | A4       | A5        | B1 - B7  | C1       | C2        | C3       | C4        | D         |
|-----------|----------------|-----------|----------|-----------|----------|----------|-----------|----------|-----------|-----------|
| RPEE      | MJ             | 2.84E+02  | 8.97E-01 | 3.31E-02  | 0.00E+00 | 0.00E+00 | 2.24E-02  | 3.84E+01 | 2.89E-02  | -2.24E+01 |
| RPEM      | 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  |
| TPE       | MJ             | 2.84E+02  | 8.97E-01 | 3.31E-02  | 0.00E+00 | 0.00E+00 | 2.24E-02  | 3.84E+01 | 2.89E-02  | -2.24E+01 |
| NRPE      | MJ             | 8.52E+02  | 4.86E+00 | 2.07E-01  | 0.00E+00 | 0.00E+00 | 1.08E-01  | 1.68E+00 | 2.43E-01  | -3.19E+01 |
| NRPM      | 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  |
| TRPE      | MJ             | 8.52E+02  | 4.86E+00 | 2.07E-01  | 0.00E+00 | 0.00E+00 | 1.08E-01  | 1.68E+00 | 2.43E-01  | -3.19E+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 <sup>3</sup> | -8.77E+00 | -3.56E-2 | -3.02E-03 | 0.00E+00 | 0.00E+00 | -8.45E-04 | 2.65E-01 | -1.23E-03 | 4.04E-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 – m<sup>2</sup>)

| Parameter | Unit | A1-A3    | A4       | A5       | B1 - B7  | C1       | C2       | C3       | C4       | D         |
|-----------|------|----------|----------|----------|----------|----------|----------|----------|----------|-----------|
| HW        | KG   | 4.31E-01 | 1.77E-03 | 1.87E-01 | 0.00E+00 | 0.00E+00 | 4.09E-05 | 3.80E-02 | 1.62E-05 | 7.44E-02  |
| NHW       | KG   | 1.56E+02 | 2.67E+00 | 1.56E-01 | 0.00E+00 | 0.00E+00 | 9.39E-02 | 5.57E-01 | 7.54E-01 | -4.73E+00 |
| RW        | KG   | 1.00E-03 | 1.57E-05 | 5.28E-07 | 0.00E+00 | 0.00E+00 | 4.27E-07 | 1.80E-05 | 2.97E-07 | -4.69E-05 |

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

### End of life – output flow (per declared unit – m<sup>2</sup>)

| Parameter | Unit | A1-A3    | A4       | A5       | B1 - B7  | C1       | 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 | 0.00E+00 | 0.00E+00  |
| MR        | kg   | 1.20E-01 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 1.08E+01 | 0.00E+00 | 0.00E+00  |
| MER       | kg   | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 1.04E+00 | 0.00E+00 | 0.00E+00  |
| EEE       | MJ   | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 2.49E+01 | 0.00E+00 | 0.00E+00  |
| ETE       | MJ   | 1.14E+03 | 5.75E+00 | 2.40E-01 | 0.00E+00 | 0.00E+00 | 1.30E-01 | 4.01E+01 | 2.72E-01 | -5.44E+01 |

**CR** Components for reuse; **MR** Materials for recycling; **MER** Materials for energy recovery; **EE** Exported energy; **TPE** Total primary energy

Reading example: 9,0 E-03 = 9,0\*10<sup>-3</sup> = 0,009

Information describing the biogenic carbon content at the factory gate (per declared unit – m<sup>2</sup>)

| Biogenic carbon content                               | Unit | Value    |
|---|------|----------|
| Biogenic carbon content in product                    | kg C | 0.00E+00 |
| Biogenic carbon content in the accompanying packaging | kg C | 2.79E-01 |



## Additional requirements

### Location based electricity mix from the use of electricity in manufacturing

Regional production mix from import, medium or high voltage (production of transmission lines, in addition to direct emissions and losses in grid) of applied electricity for the PolySi, cells and module processes since the supply chain for these products is specific and known. National production mix from import, medium voltage (production of transmission lines, in addition to direct emissions and losses in grid) of applied electricity for Ingot and Wafer processes.

| National electricity grid   | Process      | Electricity consumption (kWh/m <sup>2</sup> ) | Value (kgCO <sub>2</sub> eq/kWh) |
|---|--------------|---|----------------------------------|
| Electricity, high voltage {CN-CSG} electricity, high voltage, production mix   Cut-off, U | Cell, Module | 3.6E+01                                       | 0.882                            |
| Electricity, high voltage {CN-SWG} electricity, high voltage, production mix   Cut-off, S | PolySi       | 4.9E+01                                       | 0,337                            |
| Electricity, medium voltage {CN } market group for   Cut-off, U                           | Ingot, Wafer | 3.2E+01<br>4.8E+00                            | 0.948                            |

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

In the context of China, a market-based approach is not applicable due to the absence of a Guarantee of Origin system. Therefore, a location-based approach is employed to assess the environmental impact of electricity in this EPD.

### Additional environmental impact indicators required for construction products (Wp)

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.

| Parameter | Unit | A1-A3    | A4       | A5       | B1 - B7  | C1       | C2       | C3       | C4       | D         |
|-----------|------|----------|----------|----------|----------|----------|----------|----------|----------|-----------|
| GWP-IOBC  | KG   | 4.94E-01 | 1.98E-02 | 1.91E-03 | 0.00E+00 | 0.00E+00 | 3.13E-04 | 1.08E-02 | 4.14E-04 | -2.62E-02 |

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

### 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 substances given by the REACH Candidate list that are less than 0,1 % by weight.

### Indoor environment

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

### Carbon footprint

The carbon footprint GWP total per kWh with a production in Norway ( $I_{rad}=1000 \text{ kWh} \cdot \text{m}^{-2} \cdot \text{year}^{-1}$ ) is 25.36 gCO<sub>2</sub>-eq / kWh. It includes life cycle stages A1-C3 as calculated in this EPD, in addition to the avoided energy production from the energy production during the use phase. Hence the

carbon footprint shows the net carbon footprint when avoided emissions in the use phase is subtracted.

Similarly, the carbon footprint GWP total per kWh with a production in Italy ( $I_{\text{rad}}=1600 \text{ kWh} \cdot \text{m}^{-2} \cdot \text{year}^{-1}$ ) is  $15.85 \text{ gCO}_2\text{-eq} / \text{kWh}$ .

## Extrapolation rules

### Power peak

The environmental impacts are given for a specific module power peak. The ratio for this EPD is  $Wp/area_{EPD} = 248 Wp/m^2$  based on module **AIKO-Gxxx-MCH72Dw**.

| Specific Wp / area |       |
|--------------------|-------|
| EPD 2              | Unit  |
| 248                | Wp/m2 |

For a different Wp (for example  $Wp_{project} = 236 Wp/m^2$  for module AIKO-Axxx-MAH54Db), the impacts can be re-calculated by applying to each impact the following ratio:  $Wp/area_{EPD} / Wp/area_{Project} = 248 Wp/m^2 / 236 Wp/m^2$ .

Indeed, the 670 Wp and 470 Wp modules have the same impact per  $m^2$  (Impact<sub>per m<sup>2</sup></sub>).

Therefore:






$$Impacts_{project} (per Wp) = \frac{impact_{per m^2}}{236} = \frac{Impact_{per m^2}}{248} \times \frac{248}{236} = Impacts_{EPD} (per Wp) \times \frac{248}{236}$$

|             |                | EPD 2             | EPD 2             | EPD 2             | EPD 2              | EPD 2              | EPD 2              | EPD 2             | EPD 2             | EPD 2             |
|-------------|----------------|-------------------|-------------------|-------------------|--------------------|--------------------|--------------------|-------------------|-------------------|-------------------|
|             |                | AIKO-Axxx-MAH72Dw | AIKO-Axxx-MAH54Dw | AIKO-Axxx-MAH54Db | AIKO-Axxx-MAH72Dw. | AIKO-Axxx-MAH54Dw. | AIKO-Axxx-MAH54Db. | AIKO-Gxxx-MCH72Dw | AIKO-Axxx-GRH66Dw | AIKO-Axxx-GCH66Dw |
| Module area | m <sup>2</sup> | 2.583             | 1.953             | 1.953             | 2.634              | 1.992              | 1.992              | 2.701             | 2.701             | 3.106             |
| Power       | Wp             | 625               | 465               | 465               | 630                | 470                | 470                | 670               | 655               | 725               |
| Power/Area  | Wp/m2          | 242               | 238               | 238               | 239                | 236                | 236                | 248               | 242               | 233               |

|             |                | EPD 2             | EPD 2             | EPD 2             | EPD 2             | EPD 2             | EPD 2             | EPD 2             | EPD 2             |
|-------------|----------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|
|             |                | AIKO-Axxx-MAH60DW | AIKO-Axxx-MAH60Db | AIKO-Axxx-MCE54Dw | AIKO-Axxx-MCE54Db | AIKO-Axxx-MAE78DW | AIKO-Axxx-MAH78DW | AIKO-Axxx-GTE66DW | AIKO-Axxx-MDE72DW |
| Module area | m <sup>2</sup> | 2.216             | 2.216             | 1.998             | 1.998             | 2.795             | 2.795             | 2.701             | 2.701             |
| Power       | Wp             | 505               | 505               | 460               | 460               | 650               | 655               | 635               | 650               |
| Power/Area  | Wp/m2          | 228               | 228               | 230               | 230               | 233               | 234               | 235               | 241               |

## Bibliography

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