Environmental Product Declaration

EPD Programme Information

The EPD is a certified declaration assessing JA products environmental impacts throughout its lifecycle, including carbon footprint/greenhouse gas emissions, land and water effects, mineral depletion, and end-of-life waste. It transparently communicates product or service environmental performance. Certified by The Norwegian EPD Foundation, this study follows ISO 14044, ISO 14040 and EN 15804 +A2 standards and is valid for 5 years

Scope

The study is based on a complete and total cradle-to-grave analysis of environmental impacts i.e., from raw material extraction, through production, transport, installation, end of life, disposal of waste and through to recycling.

	Product stage			Construction process stage		Use stage							End of life stage				Benefits and loads beyond the system boundary
	A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
	Raw material supply	Transport	Manufacturing	Transport from gate to site	Installation	Use	Maintenance	Repair	Replacement	Refurbishment	Building operational Energy use	Building operational water use	Deconstruction	Transport	Waste processing	Disposal	Reuse, recovery, recycling potential
Scope	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	Module not relevant

Products In the Study

The EPD study has been decomposed into 3 EPDs according to the specification of each module:

	EPD 1: Single glass P-type	EPD 2: Double glass P-type	EPD 3: Double glass N-type
JA SOLAR Module	JAM78S30/MR JAM72S30/MR JAM54S30/MR JAM54S31/MR JAM66S30/MR JAM72S30/LR JAM54S30/LR JAM54S31/LR JAM72S30/GR JAM54S30/GR JAM54S31/GR	JAM72D30/MB JAM72D30/LB JAM72D30/GB JAM78D30/MB	JAM78D40/MB JAM72D40/MB JAM54D40/MB JAM72D42/LB JAM66D45/LB JAM72D40/GB JAM54D40/GB JAM54D41/GB JAM72D40/LB JAM54D40/LB JAM54D41/LB

Manufacturing process, Based on existing Life Cycle Analysis (LCAs) and the supply chain identified is the following:

Supply chain to consider for EPD	
Production	**Site**
Virgin Polysi	Yongxiang, China
Ingot/brick	Qujing, China
Wafer	Qujing, China
Recycled Polysi	Qujing, China
Cells	Ningjin, China
Modules	Yiwu, China Yanghzou, China Hefei, China

Results

The Life Cycle Assessment (LCA) evaluates a product's environmental impacts and resource usage. It measures effects arising from producing a material unit. Outcomes are given per functional unit (1Wp) and declared unit (1 m^2) of a manufactured photovoltaic module.

Additionally, carbon emissions per kWh, represented as gCO2/kWh, are estimated. This value changes based on annual production and irradiance.

Examples: For a plant in Italy with an estimated irradiance of 1600 kWh/m^2/year:

- P-Type panel: 12.83 gCO2-eq/kWh
- P-Type Bifacial panel: 9.89 gCO2-eq/kWh
- N-Type Bifacial panel: 11.59 gCO2-eq/kWh

For a plant in Norway with an estimated irradiance of 1000 kWh/m^2/year:

- P-Type panel: 20.53 gCO2-eq/kWh
- P-Type Bifacial panel: 15.83 gCO2-eq/kWh
- N-Type Bifacial panel: 18.55 gCO2-eq/kWh

For a plant in UK with an estimated irradiance of 1100 kWh/m^2/year:

- P-Type panel: 18.66 gCO2-eq/kWh
- P-Type Bifacial panel: 14.39 gCO2-eq/kWh
- N-Type Bifacial panel: 16.86 gCO2-eq/kWh

Comparatively, the carbon emission of the electricity mix in the UK in 2022 was 193 gCO2/kWh. Based on these values, the Energy Payback Time (EPBT) is calculated for these installations for the module P-Type Bifacial panel:

- Energy payback time for an installation in Italy: ~ 1.5 years
- Energy payback time for an installation in Norway: ~ 2.4 years
- Energy payback time for and installation in UK ~ 2.2 years

KEY DATA SETS With examples from EPD 1

For more details please refer to JA Solar certificates EPD-4907-4258 (EPD 1), EPD-4909-4258 (EPD 2), and EPD-4908-4258 (EPD 3).

Global Warming Potential (GWP): GWP measures human-induced atmospheric warming caused by burning fossil fuels. It's expressed as equivalent CO2 emissions.

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

Ozone Depletion Potential (ODP): ODP gauges ozone layer reduction due to man-made emissions like CFCs, resulting in harmful UVB light increase.

ODP	kg CFC11 eq.	5.60E-08	4.80E.09	5.42E-09	1.30E-10	0.00E+00	2.36E-09

Acidification Potential (AP): AP assesses the harm caused by acidifying substances, leading to issues such as acid rain and reduced biodiversity.

AP	mol H' eq.	9.12E-01	6.76E-01	1.85E-01	1.31E-03	0.00E+00	5.05E-02

Eutrophication Potential (EP): EP examines excessive aquatic vegetation growth from nutrient additions, harming oxygen levels, ecosystems, and species. EP is quantified using phosphate equivalents.

EP-freshwater	kg P eq.	3.70E-03	3.46E-03	7.11E-05	6.45E-06	0.00E+00	1.65E-04
EP-marine	kg N eq.	1.71E-01	1.10E-01	4.95E-02	1.47E-03	0.00E+00	1.04E-02
EP-terrestial	mol N eq.	1.92E+00	1.25E+00	5.49E-01	5.08E-03	0.00E+00	1.17E-01

Formation Potential of Tropospheric Ozone (POCP) : POCP is the formation of reactive substances (mainly ozone) which are injurious to human health and ecosystems and which also may damage crops.

POCP	kg NMVOC eq.	6.93E-01	5.13E-01	1.46E-01	1.61E-03	0.00E+00	3.26E-02

Abiotic Depletion Potential (ADP-M&M, ADP-fossil) : Resource depletion is one of the impact categories expressing how much of the world's natural resources (petroleum, iron ore, etc.) are used up. It has global, regional and local aspects of impact and expresses the amount of mineral/ fossil fuel used. In LCA, fossil and non-fossil resource depletion are expressed in terms of the MJ and Sb eq. respectively.

ADP-M&M	kg Sb eq.	6.59E-03	6.00E-03	2.90E-05	7.16E-07	0.00E+00	5.57E-04
ADP-fossil	MJ	1.18E+03	9.35E+02	1.61E+02	3.20E+00	0.00E+00	8.46E+01

Water Deprivation Potential (WDP) : WPD Deprivation weighted water consumption.

WDP	m^3	5.14E+01	4.89E+01	4.43E-01	4.97E-02	0.00E+00	2.05E+00

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