

Chint New Energy Technology Co., Ltd



ENVIRONMENTAL PRODUCT DECLARATION

**ASTRONERGY
MONOCRYSTALLINE PV
MODULE**

**Zhejiang & Jiangsu Province,
P.R.China**

in compliance with ISO 14025 and EN15804

Program Operator	The Norwegian EPD Foundation
Publisher	EPDItaly

Declaration Number	NEPD-15724-19659
Registration Number	MR-EPDITALY0165

Issue Date	28/ 05/ 2026
Valid to	28/ 05 / 2031

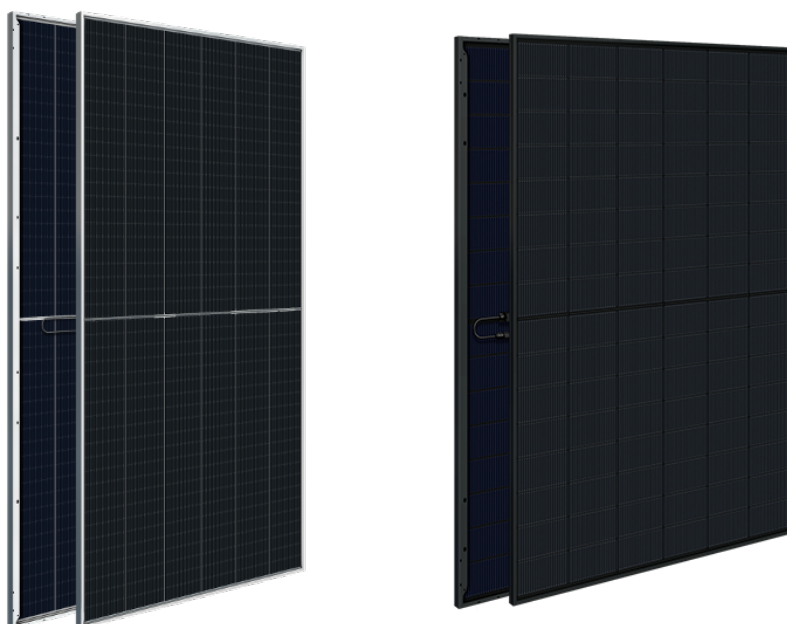


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Environmental Product Declaration

In accordance with ISO14025:2006 and EN15804:2012+A2:2019/AC: 2021

ASTRONERGY MONOCRYSTALLINE PV MODULE



ASTRONERGY

Owner of the declaration:
Chint New Energy Technology Co., Ltd.

Product name:
CHSM66RN(DG)/F-BQ

CHSM54RN(DG)(BLH)/F-BH

Functional unit:
1 Wp

Product category /PCR:
NPCR 029 Version 1.2

Program holder and publisher:
The Norwegian EPD foundation

Declaration number:
NEPD-15724-19659

Registration number:
NEPD-15724-19659

Issue date: 28.05.2026

Valid to: 28.05.2031
ver-290526

General information

Product:

CHSM66RN(DG)/F-BQ (620-670 Wp)

CHSM54RN(DG)(BLH)/F-BH (495-525 Wp)

Program holder:

EPD-Global

Post Box 5250 Majorstuen, 0303 Oslo, Norway

Phone: +47 23 08 80 00

E-mail: post@epd-norge.no

Declaration Number:

NEPD-15724-19659

This declaration is based on Product Category Rules:

NPCR 029 version 1.2

This EPD follows additional requirements for construction products considered as Electronic or Electric Equipment.

Statements:

The owner of the declaration shall be liable for the underlying information and evidence.

EPD-Global shall not be liable with respect to manufacturer, life cycle assessment data and evidences.

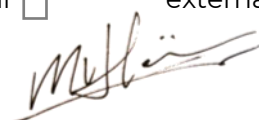
Functional unit:

1 Wp

Verification:

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

internal ☐ external ☒


Martijn van Hövell

Independent verifier approved by EPD-Global

Owner of the declaration:

Chint New Energy Technology Co., Ltd.

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Manufacturer:

1、Chint Solar (Haining) Co., Ltd.

NO.2 Jisheng Road, Jianshan New Zone, Huangwan Town, Haining City, Jiaxing

City, Zhejiang Province

2、Chint Solar Technology (Yiwu) Co., Ltd.

No. 1, Qingcheng West Road, Fotang Town, Yiwu City, Jinhua City, Zhejiang

Province

3、Chint Solar Technology (Yancheng) Co., Ltd.

No. 8, Fengyang Road, Shanghai-Suzhou -Dafeng Industry Linkage Cluster, Dafeng District, Yancheng City, Jiangsu Province, China

4、Chint New Energy Technology (Fuyang) Co., Ltd.

No.177, TongDeng Road, Lingqiao Town, Fuyang District, Hangzhou, Zhejiang Province

Place of production:

Zhejiang & Jiangsu Province, P.R.China

Management system:

ISO 9001, ISO 14001, ISO 45001

Organisation no:

913304813502083466

Issue date:

28.05.2026

Valid to:

28.05.2031

Year of study:

2025.01-2025.12

Comparability:

EPDs from other programmes than EPD-Global may not be comparable.

The EPD has been worked out by:

Star Talers EnviroTech Ltd.



Approved



Manager of EPD-Global

Product

Product description:

Astronergy strengthens technological innovation and R&D investment, and continues to launch the ASTRO series of modules, covering ASTRO monocrystalline bifacial series and ASTRO monocrystalline mono-facial series. The products assessed in this LCA report are two Astronergy bifacial photovoltaic modules: CHSM66RN(DG)/F-BQ, with a rated power range of 620–670 Wp, and CHSM54RN(DG)(BLH)/F-BH, with a rated power range of 495–525 Wp. Both products are bifacial, n-type mono-crystalline photovoltaic modules. CHSM66RN(DG)/F-BQ adopts n-type TOPCon 5.0+ cell technology and is designed with features such as low open-circuit voltage design, bifacial power generation, and an improved temperature coefficient. Its maximum module efficiency reaches 24.8%. CHSM54RN(DG)(BLH)/F-BH adopts n-type TOPCon 5.0 cell technology and ZBB (Zero Busbar) integrated interconnection design. It is also designed with moderate module dimensions and all-black technology for distributed PV and rooftop applications. Its maximum module efficiency reaches 23.6%.

Product specification:

Material compositions and technical data are shown below.

Materials	CHSM66RN(DG)/F-BQ KG/FU	%	CHSM54RN(DG)(BLH)/F-BH KG/FU	%
Solar Cell	1.07E-03	2.14%	1.10E-03	2.11%
Glass	3.90E-02	77.87%	4.10E-02	78.66%
Gap Film	8.94E-06	0.02%	-	-
Encapsulant Film (EVA)	3.26E-03	6.51%	2.84E-03	5.45%
Ribbon (Sn ₆₃ Pb ₃₇)	2.00E-04	0.40%	2.95E-04	0.57%
Busbar	1.55E-04	0.31%	7.53E-05	0.14%
Isolation Strip	7.52E-06	0.02%	-	-
Aluminium Frame	3.58E-03	7.15%	3.97E-03	7.61%
Junction Box	1.32E-04	0.26%	1.78E-04	0.34%
Silicone Sealant	5.13E-04	1.02%	5.58E-04	1.07%
Fixing Tape	8.78E-07	0.0018%	8.00E-07	0.0015%
Edge Sealing Tape	2.39E-05	0.0477%	3.67E-05	0.0705%
Self-adhesive Label	1.11E-06	0.0022%	1.42E-06	0.0027%
Anti-overflow Tape	4.37E-07	0.0009%	5.57E-07	0.0011%
Carbon Ribbon	3.04E-08	0.0001%	3.87E-08	0.0001%
Soldering Flux	-	-	4.46E-07	0.0009%
Corrugated Box	2.24E-04	0.45%	2.65E-04	0.51%
Pallet	1.69E-03	3.38%	1.51E-03	2.91%
Top Cover	4.98E-05	0.10%	9.52E-05	0.18%
Cardboard	4.98E-05	0.10%	4.23E-05	0.08%
Frame Corner Protector	1.97E-05	0.04%	2.52E-05	0.05%
Packing Strap	7.84E-05	0.16%	8.66E-05	0.17%
Corner Protector (PP)	3.65E-06	0.01%	4.66E-06	0.01%
Stretch Film (PE)	1.27E-05	0.03%	3.47E-05	0.07%

Technical data:

Series	CHSM66RN(DG)/F-BQ	CHSM54RN(DG)(BLH)/F-BH
Power output range (W)	620~670	495~525
Dimensions (mm)	2382×1134×30	1961×1134×30



Area (m ²)	2.7	2.22
Module efficiency (%)	23.8~24.8	22.9~23.6
Weight (kg)	32.1	26.3
Weight (incl. package)	33.5	27.4
First year degradation (%)	1	1
Annual degradation (%)	0.4	0.4

*Values are tested under STC conditions, defined as irradiance of 1000 W/m², cell temperature of 25°C, AM 1.5.

Market:

The product is manufactured in China for a global market. However, this EPD is evaluated based on the European market.

Reference service life:

25 years (based on ≥80% of the labelled power output). The product has a 30-year power warranty as specified in the product specification.

Type of EPD

This declaration is a specific EPD using a representative power output for each product. LCA Results of various power output ranges could be obtained using the conversion factors presented in the Chapter "additional requirements".

LCA: Calculation rules

Functional unit:

Functional unit is 1 Wp of manufactured photovoltaic module, with activities needed for a study period for a defined reference service life (≥80% of the labelled power output).

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 have been applied based on conservative assumptions regarding environmental impacts. The following steps/stages are not included in the system boundary due to the reason that the elements below are considered irrelevant or not within the boundary:

- Impacts related to the production, transportation and installation of capital goods (buildings, infrastructure, machinery, internal transport packaging) and general operations (staff travel, marketing and communication actions) that cannot be directly allocated to products are excluded from the LCA study.
- The packaging for silicon wafer and solar cells is reused internally and its impact was excluded from the system;
- Emissions during the PV module installation and operation due to no obvious emission observable.



- Storage phases and sales of PV products due to no observable impact. Product losses due to abnormal damage such as natural disasters or fire accidents would occur at a rather low frequency.
- Handling operations at the distribution center and retail outlet due to small contribution and negligible impact.
- Research and development activities.
- Long-term emissions.

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 background datasets, the ecoinvent system model “allocation, cut-off by classification” is applied. 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.

Data quality:

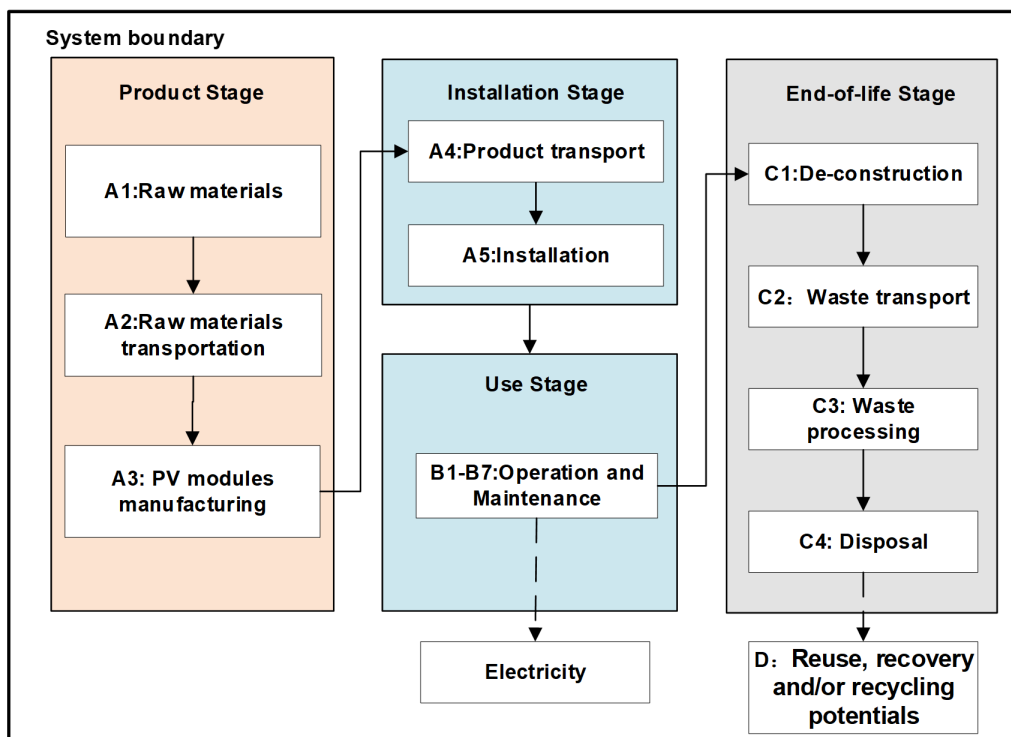
The data quality assessment was performed with reference to EN 15804+A2, Annex E, Table E.1 “Data quality level and criteria of the UN Environment Global Guidance on LCA database development”. The assessment considers geographical, technical and time representativeness of the relevant data.

Primary data, including material and energy flows entering and leaving the production system, were collected from Astronergy’s manufacturing facilities for the period from January 2025 to December 2025 as annual average data. Generic background data related to the life-cycle impacts of material and energy flows were sourced from the ecoinvent 3.11 database using the “allocation, cut-off by classification - unit” system model.

Overall, the foreground production data are considered geographically, technically and temporally representative of the assessed products and manufacturing processes. Some background datasets and downstream end-of-life datasets may not fully represent the reference year; these temporal limitations are acknowledged in the LCA study. In particular, silicon-related background datasets are older than five years but are considered the best available and technically representative data for current monocrystalline silicon PV production.

System boundary:

The system boundary for this LCA study of PV modules encompasses product stage, installation stage, use stage, and end-of-life stage, from cradle to grave and module D.



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)

Transport from production place to assembly/user (A4)	Capacity utilisation (incl. return) %	Distance (km)	Fuel/Energy consumption	Unit	Value
Truck (domestic)	36.7	230	Diesel	kg/tkm	0.0366
Ship	70	18000	Heavy oil	kg/tkm	0.0025
Truck (overboard)	36.7	300	Diesel	kg/tkm	0.0366

The product distribution involves a scenario for transporting the product to Europe

Assembly (A5)

	Unit	CHSM66RN(DG)/F-BQ	CHSM54RN(DG)(BLH)/F-BH
Water consumption	m ³ /FU	-	-
Electricity consumption	kWh/FU	6.32E-05	6.32E-05
Other energy carriers	MJ/FU	Diesel: 1.35E-2	Diesel: 1.35E-2
Material loss	kg/FU	-	-
Output materials from waste treatment	kg/FU	2.54E-04	1.78E-04

According to PCR, mounting structures and electrical components will not be included in this stage, only energy consumption, 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.

Use (B1)

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

Maintenance (B2)/Repair (B3)

	Unit	CHSM66RN(DG)/F-BQ	CHSM54RN(DG)(BLH)/F-BH
Water consumption	m ³ /FU	1.72E-05	2.19E-05

As for the maintenance stage (B2), water used for cleaning to maintain the performance is considered, 0.23L water used per module each time, and 2 times in a year are assumed. During the operation of PV module, no repair (B3) is required.

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, m².

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/m², 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:

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

Operational energy (B6) and water consumption (B7)

No inputs and outputs during operation stage.

End of Life (C1, C3, C4)

	Unit	CHSM66RN(DG)/F-BQ	CHSM54RN(DG)(BLH)/F-BH
Hazardous waste disposed	kg/FU	-	
Collected as mixed construction waste	kg/FU	4.79E-02	5.01E-02
Reuse	kg/FU	-	
Recycling	kg/FU	3.75E-02	3.97E-02
Energy recovery	kg/FU	3.44E-03	3.05E-03
To landfill	kg/FU	6.93E-03	7.25E-03

Assumptions are made for C1, C3 and C4 stage. Decommissioning stage (C1) of PV modules is assumed to be taken with same energy and fuel consumption as for installation stage. Waste processing (C3) stage is assumed to be mechanically treated to yield the bulk materials. Modelling of disposal stage (C4) refers to legal requirements issued by Waste Electrical and Electronic Equipment (WEEE) under the EU scenario.

Transport to waste processing (C2)

Transport from production place to assembly/user (C2)	Capacity utilisation (incl. return) %	Distance (km)	Fuel/Energy consumption	Unit	Value
Truck	36.7	50	Diesel	kg·km	0.036

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

Benefits and loads beyond the system boundaries (D)

Benefits and loads beyond the system boundaries (D)	Unit	CHSM66RN(DG)/F-BQ	CHSM54RN(DG)(BLH)/F-BH
Substitution of electricity	MJ/FU	2.59E-02	3.14E-02
Substitution of thermal energy, district heating	MJ/FU	4.67E-02	5.65E-02
Substitution of aluminum with net scrap	kg/FU	1.07E-03	1.19E-03



Substitution of primary silver with net scrap	kg/FU	6.63E-06	6.80E-06
Substitution of primary copper with net scrap	kg/FU	2.70E-04	2.81E-04
Substitution of primary glass with glass gullets	kg/FU	2.82E-02	2.96E-02
Substitution of primary wood pallet with recycled wood	kg/FU	1.44E-03	1.29E-03

LCA: Results

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	

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 10.2, EF v3.1 characterization factors are used for impact assessment.

Environmental impact

CHSM66RN(DG)/F-BQ (670Wp)

Indicator	Unit	A1-A3	A4	A5	B1	B2	B3-B7	C1	C2	C3	C4	D
GWP - total	kg CO ₂ eq	3.12E-01	1.44E-02	4.62E-03	0	5.14E-06	0	1.36E-03	4.56E-04	1.08E-03	8.12E-03	-7.57E-02
GWP - fossil	kg CO ₂ eq	3.14E-01	1.44E-02	1.68E-03	0	5.13E-06	0	1.36E-03	4.56E-04	1.06E-03	8.12E-03	-7.56E-02
GWP - biogenic	kg CO ₂ eq	-2.93E-03	0.00E+00	2.93E-03	0	0.00E+00	0	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
GWP - luluc	kg CO ₂ eq	2.53E-04	6.93E-06	2.50E-07	0	1.01E-08	0	2.40E-07	1.51E-07	2.14E-05	3.97E-08	-1.40E-04
ODP	kg CFC11 eq	4.19E-08	2.22E-10	2.10E-11	0	7.62E-14	0	2.03E-11	9.94E-12	4.40E-11	3.83E-12	-1.46E-09
AP	molc H ⁺ eq	1.96E-03	2.88E-04	1.24E-05	0	2.74E-08	0	1.21E-05	1.46E-06	5.93E-06	2.06E-06	-5.41E-04



EP- freshwater	kg P eq	8.33E-06	8.55E-08	5.22E-09	0	3.54E-10	0	4.84E-09	3.34E-09	2.15E-08	2.28E-09	-3.13E-06
EP -marine	kg N eq	3.99E-04	7.28E-05	5.75E-06	0	4.54E-09	0	5.64E-06	4.87E-07	1.53E-06	9.66E-07	-8.80E-05
EP - terrestrial	molc N eq	4.29E-03	8.09E-04	6.30E-05	0	5.10E-08	0	6.18E-05	5.36E-06	2.20E-05	9.98E-06	-1.07E-03
POCP	kg NMVOC eq	1.23E-03	2.28E-04	1.88E-05	0	1.66E-08	0	1.85E-05	2.22E-06	4.73E-06	2.64E-06	-3.13E-04
ADP-fossil	MJ	3.79E+00	1.85E-01	1.85E-02	0	9.23E-05	0	1.81E-02	6.46E-03	8.93E-02	2.31E-03	-1.01E+00
ADP-M&M	kg Sb-Eq	1.31E-05	2.65E-08	6.20E-10	0	2.82E-11	0	5.20E-10	1.54E-09	7.64E-09	3.76E-10	-4.38E-06
WDP ²	m ³	3.84E-01	5.63E-04	4.65E-05	0	7.36E-04	0	4.23E-05	2.51E-05	9.67E-04	-9.90E-05	-1.22E-02

CHSM54RN(DG)(BLH)/F-BH (525Wp)

Indicator	Unit	A1-A3	A4	A5	B1	B2	B3-B7	C1	C2	C3	C4	D
GWP - total	kg CO ₂ eq	3.24E-01	1.50E-02	4.57E-03	0	6.56E-06	0	1.36E-03	4.77E-04	1.13E-03	7.18E-03	-8.12E-02
GWP - fossil	kg CO ₂ eq	3.26E-01	1.50E-02	1.77E-03	0	6.54E-06	0	1.36E-03	4.76E-04	1.10E-03	7.18E-03	-8.11E-02
GWP - biogenic	kg CO ₂ eq	-2.80E-03	0.00E+00	2.80E-03	0	0.00E+00	0	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
GWP - luluc	kg CO ₂ eq	2.68E-04	7.24E-06	2.51E-07	0	1.29E-08	0	2.40E-07	1.58E-07	2.23E-05	3.65E-08	-1.50E-04
ODP	kg CFC11 eq	4.52E-08	2.32E-10	2.10E-11	0	9.72E-14	0	2.03E-11	1.04E-11	4.60E-11	3.63E-12	-1.68E-09
AP	molc H ⁺ eq	2.04E-03	3.00E-04	1.24E-05	0	3.50E-08	0	1.21E-05	1.53E-06	6.20E-06	1.87E-06	-5.38E-04
EP- freshwater	kg P eq	8.68E-06	8.92E-08	5.24E-09	0	4.52E-10	0	4.84E-09	3.49E-09	2.24E-08	2.09E-09	-3.14E-06
EP -marine	kg N eq	4.15E-04	7.60E-05	5.76E-06	0	5.79E-09	0	5.64E-06	5.09E-07	1.60E-06	8.73E-07	-9.23E-05
EP - terrestrial	molc N eq	4.46E-03	8.44E-04	6.31E-05	0	6.51E-08	0	6.18E-05	5.60E-06	2.30E-05	9.04E-06	-1.11E-03
POCP	kg NMVOC eq	1.28E-03	2.38E-04	1.88E-05	0	2.12E-08	0	1.85E-05	2.32E-06	4.95E-06	2.41E-06	-3.27E-04
ADP-fossil	MJ	3.91E+00	1.94E-01	1.85E-02	0	1.18E-04	0	1.81E-02	6.76E-03	9.34E-02	2.22E-03	-1.08E+00
ADP-M&M	kg Sb-Eq	1.36E-05	2.76E-08	6.22E-10	0	3.59E-11	0	5.20E-10	1.61E-09	7.99E-09	3.41E-10	-4.02E-06
WDP ²	m ³	3.95E-01	5.87E-04	4.69E-05	0	9.40E-04	0	4.23E-05	2.62E-05	1.01E-03	-1.06E-04	-1.25E-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

Reading example: 9.0 E-03 = 9.0*10⁻³ = 0.009

Additional environmental impact indicators

CHSM66RN(DG)/F-BQ (670Wp)

Indicator	Unit	A1-A3	A4	A5	B1	B2	B3-B7	C1	C2	C3	C4	D
PM	Disease incidence	2.68E-08	6.77E-10	3.49E-10	0	3.05E-13	0	3.46E-10	3.63E-11	6.52E-11	1.47E-11	-4.23E-09
IRP ¹	kBq U235 eq.	5.07E-03	4.68E-05	1.75E-05	0	6.03E-07	0	1.72E-05	2.79E-06	3.00E-03	2.05E-06	-2.27E-03
ETP-fw ²	CTUe	2.16E+00	1.93E-02	1.75E-03	0	1.67E-05	0	9.68E-04	8.57E-04	2.33E-03	1.73E-02	-3.70E-01
HTP-c ²	CTUh	1.10E-10	2.82E-12	1.77E-13	0	6.20E-15	0	1.40E-13	7.73E-14	4.43E-13	4.61E-13	-3.59E-11
HTP-nc ²	CTUh	2.44E-09	7.23E-11	4.16E-12	0	2.85E-13	0	2.25E-12	4.03E-12	1.76E-11	1.88E-11	-2.05E-09
SQP ²	Dimensionless	1.28E+00	5.10E-02	1.65E-03	0	1.99E-05	0	1.45E-03	3.82E-03	5.88E-02	2.63E-03	-4.63E-01

CHSM54RN(DG)(BLH)/F-BH (525Wp)

Indicator	Unit	A1-A3	A4	A5	B1	B2	B3-B7	C1	C2	C3	C4	D
PM	Disease incidence	2.80E-08	7.07E-10	3.49E-10	0	3.90E-13	0	3.46E-10	3.79E-11	6.82E-11	1.42E-11	-4.46E-09
IRP ¹	kBq U235 eq.	5.24E-03	4.88E-05	1.75E-05	0	7.70E-07	0	1.72E-05	2.92E-06	3.14E-03	1.88E-06	-2.37E-03
ETP-fw ²	CTUe	2.24E+00	2.01E-02	1.92E-03	0	2.14E-05	0	9.68E-04	8.96E-04	2.44E-03	1.53E-02	-3.43E-01
HTP-c ²	CTUh	1.15E-10	2.94E-12	1.82E-13	0	7.91E-15	0	1.40E-13	8.09E-14	4.63E-13	4.09E-13	-3.47E-11
HTP-nc ²	CTUh	2.54E-09	7.54E-11	4.35E-12	0	3.64E-13	0	2.25E-12	4.21E-12	1.84E-11	1.67E-11	-1.77E-09
SQP ²	Dimensionless	1.29E+00	5.32E-02	1.65E-03	0	2.54E-05	0	1.45E-03	3.99E-03	6.14E-02	2.70E-03	-5.02E-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

¹ This impact category deals mainly with the eventual impact of low dose ionizing radiation on human health of the nuclear fuel cycle. It does not consider effects due to possible nuclear accidents, occupational exposure nor due to radioactive waste disposal in underground facilities. Potential ionizing radiation from the soil, from radon and from some construction materials is also not measured by this indicator.

² The results of this environmental impact indicator shall be used with care as the uncertainties on these results are high or as there is limited experienced with the indicator

Resource use

CHSM66RN(DG)/F-BQ (670Wp)

Parameter	Unit	A1-A3	A4	A5	B1	B2	B3-B7	C1	C2	C3	C4	D
RPEE	MJ	3.28E-01	1.97E-03	2.64E-04	0	1.58E-05	0	2.53E-04	1.05E-04	2.97E-02	2.74E-02	-1.40E-01
RPEM	MJ	2.73E-02	0.00E+00	0.00E+00	0	0.00E+00	0	0.00E+00	0.00E+00	0.00E+00	-2.73E-02	0.00E+00
TPE	MJ	3.55E-01	1.97E-03	2.64E-04	0	1.58E-05	0	2.53E-04	1.05E-04	2.97E-02	9.58E-05	-1.40E-01
NRPE	MJ	2.91E+00	1.60E-02	1.25E-01	0	3.43E-05	0	8.87E-04	5.74E-04	2.79E-03	2.35E-04	-5.32E-01
NRPM	MJ	1.24E-01	0.00E+00	-1.24E-01	0	0.00E+00	0	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
TRPE	MJ	3.03E+00	1.60E-02	9.42E-04	0	3.43E-05	0	8.87E-04	5.74E-04	2.79E-03	2.35E-04	-5.32E-01
SM	kg	0.00E+00	0.00E+00	0.00E+00	0	0.00E+00	0	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	0.00E+00	0	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	0.00E+00	0	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
W	m3	9.26E-03	1.75E-05	1.98E-06	0	1.72E-05	0	1.41E-06	8.01E-07	3.71E-05	7.20E-06	-4.13E-04

CHSM54RN(DG)(BLH)/F-BH (525Wp)

Parameter	Unit	A1-A3	A4	A5	B1	B2	B3-B7	C1	C2	C3	C4	D
RPEE	MJ	3.38E-01	2.06E-03	2.65E-04	0	2.02E-05	0	2.53E-04	1.10E-04	3.11E-02	2.61E-02	-1.53E-01
RPEM	MJ	2.60E-02	0.00E+00	0.00E+00	0	0.00E+00	0	0.00E+00	0.00E+00	0.00E+00	-2.60E-02	0.00E+00
TPE	MJ	3.64E-01	2.06E-03	2.65E-04	0	2.02E-05	0	2.53E-04	1.10E-04	3.11E-02	8.82E-05	-1.53E-01
NRPE	MJ	3.03E+00	1.67E-02	1.12E-01	0	4.37E-05	0	8.87E-04	6.00E-04	2.91E-03	2.15E-04	-5.67E-01
NRPM	MJ	1.11E-01	0.00E+00	-1.11E-01	0	0.00E+00	0	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
TRPE	MJ	3.14E+00	1.67E-02	9.45E-04	0	4.37E-05	0	8.87E-04	6.00E-04	2.91E-03	2.15E-04	-5.67E-01
SM	kg	0.00E+00	0.00E+00	0.00E+00	0	0.00E+00	0	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	0.00E+00	0	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	0.00E+00	0	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
W	m3	9.53E-03	1.83E-05	2.09E-06	0	2.20E-05	0	1.41E-06	8.38E-07	3.88E-05	6.10E-06	-4.27E-04

RPEE Renewable primary energy resources used as energy carrier; **RPEM** Renewable primary energy resources used as raw materials; **TPE** Total use of renewable primary energy resources; **NRPE** Nonrenewable primary energy resources used as energy carrier; **NRPM** Nonrenewable primary energy resources used as materials; **TRPE** Total use of non-renewable primary energy resources; **SM** Use of secondary materials; **RSF** Use of renewable secondary fuels; **NRSF** Use of non-renewable secondary fuels; **W** Use of net fresh water.

End of life – Waste

CHSM66RN(DG)/F-BQ (670Wp)

Parameter	Unit	A1-A3	A4	A5	B1	B2	B3-B7	C1	C2	C3	C4	D
HW	kg	6.83E-04	1.08E-06	1.28E-07	0	4.40E-10	0	1.23E-07	4.41E-08	1.03E-07	3.99E-08	-2.85E-06
NHW	kg	2.03E-02	3.52E-03	3.19E-05	0	7.84E-07	0	1.26E-05	3.10E-04	3.75E-02	1.05E-02	-4.20E-03
RW	kg	3.63E-06	3.01E-08	8.29E-09	0	4.90E-10	0	8.10E-09	1.90E-09	1.31E-06	1.46E-09	-1.37E-06

CHSM54RN(DG)(BLH)/F-BH (525Wp)

Parameter	Unit	A1-A3	A4	A5	B1	B2	B3-B7	C1	C2	C3	C4	D
HW	kg	7.00E-04	1.12E-06	1.28E-07	0	5.61E-10	0	1.23E-07	4.61E-08	1.07E-07	3.64E-08	-3.02E-06
NHW	kg	2.13E-02	3.67E-03	3.22E-05	0	1.00E-06	0	1.26E-05	3.24E-04	3.97E-02	1.04E-02	-4.35E-03
RW	kg	3.75E-06	3.15E-08	8.30E-09	0	6.26E-10	0	8.10E-09	1.99E-09	1.37E-06	1.33E-09	-1.43E-06

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

End of life – output flow

CHSM66RN(DG)/F-BQ (670Wp)

Parameter	Unit	A1-A3	A4	A5	B1	B2	B3-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	0.00E+00	0.00E+00
MR	kg	7.66E-04	0.00E+00	1.27E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.75E-02	0.00E+00	0.00E+00
MER	kg	1.36E-05	0.00E+00	7.65E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.44E-03	0.00E+00
EEE	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.59E-02
ETE	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.67E-02

CHSM54RN(DG)(BLH)/F-BH (525Wp)

Parameter	Unit	A1-A3	A4	A5	B1	B2	B3-B7	C1	C2	C3	C4	D
CR	kg	0.00E+00	0.00E+00	0.00E+00	0	0.00E+00	0	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
MR	kg	7.66E-04	0.00E+00	1.13E-03	0	0.00E+00	0	0.00E+00	0.00E+00	3.97E-02	0.00E+00	0.00E+00
MER	kg	1.36E-05	0.00E+00	8.05E-04	0	0.00E+00	0	0.00E+00	0.00E+00	0.00E+00	3.05E-03	0.00E+00
EEE	MJ	0.00E+00	0.00E+00	0.00E+00	0	0.00E+00	0	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.14E-02
ETE	MJ	0.00E+00	0.00E+00	0.00E+00	0	0.00E+00	0	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.65E-02

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	CHSM66RN(DG)/F-BQ	CHSM54RN(DG)(BLH)/F-BH
Biogenic carbon content in product	kg C/FU	0	
Biogenic carbon content in the accompanying packaging	kg C/FU	8.00E-04	7.63E-04

Note: 1 kg biogenic carbon is equivalent to 44/12 kg CO₂

Additional requirements

Location based electricity mix from the use of electricity in manufacturing

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

Regional electricity grid	Data source	GWP _{total} [kg CO ₂ -eq/kWh]
<i>Electricity, medium voltage {CN-ECGC} market for electricity, medium voltage Cut-off, U</i>	ecoinvent 3.11	0.764
<i>Electricity, low voltage {CN-SH} electricity production, photovoltaic, 3kWp slanted-roof installation, single-Si, panel, mounted Cut-off, U</i>	ecoinvent 3.11	0.0879

Additional environmental impact indicators required for construction products

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

Series	Unit	A1-A3	A4	A5	B1	B2	B3 - B7	C1	C2	C3	C4	D
CHSM66 RN(DG)/F-BQ (670 Wp)	kg CO ₂ eq	3.15E-01	1.44E-02	1.68E-03	0	5.14E-06	0	1.36E-03	4.56E-04	1.08E-03	8.12E-03	-7.57E-02
CHSM54 RN(DG)(BLH)/F-BH (525Wp)	kg CO ₂ eq	3.26E-01	1.50E-02	1.77E-03	0	6.56E-06	0	1.36E-03	4.77E-04	1.13E-03	7.18E-03	-8.12E-02

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

Dangerous 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.
- ✓ The product contains substances given by the REACH Candidate list that are less than 0,1 % by weight.
- ☐ The product contains dangerous substances, more than 0,1% by weight, given by the REACH Candidate List, see table.
- ☐ The product contains no substances given by the REACH Candidate list.
- ☐ The product is classified as hazardous waste, see table.

Indoor environment

This is not relevant to the product under study.

EPD results conversion factors of various power output ranges

CHSM66RN(DG)/F-BQ

Rated power output range (Wp)	620	625	630	635	640	645	650	655	660	665
Conversion factor*	1.081	1.072	1.063	1.055	1.047	1.039	1.031	1.023	1.015	1.008

*Note: Environmental impacts of other power outputs are determined by multiplying the results for 670 Wp by relevant conversion factors.

CHSM54RN(DG)(BLH)/F-BH

Rated power output range (Wp)	495	500	505	510	515	520
Conversion factor*	1.051	1.040	1.030	1.029	1.019	1.010

*Note: Environmental impacts of other power outputs are determined by multiplying the results for 525 Wp by relevant conversion factors.

Bibliography

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