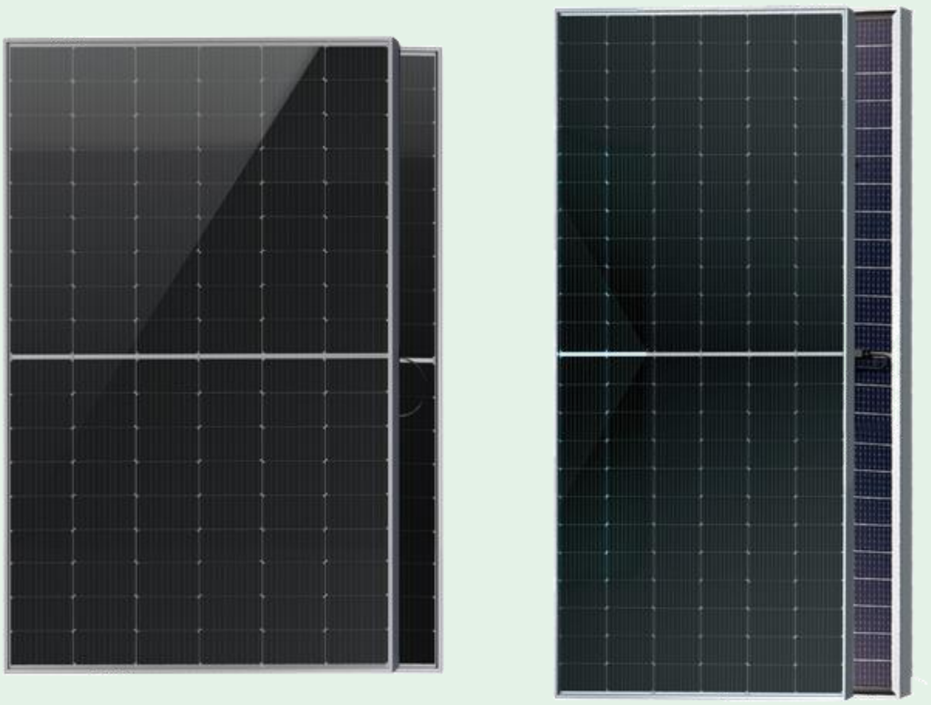
epd-norway
Global Program Operator

Environmental Product Declaration

In accordance with 14025 and EN15804 +A2

[182mm Mono-crystalline TOPCon Photovoltaic Module]



Owner of the declaration:
HONGYUAN GREEN ENERGY CO., LTD.

Product name:
Mono-crystalline Photovoltaic module

Functional unit:
1 Wp

Product category /PCR:
NPCR 029 Part B Version: 1.2

Program holder and publisher:
The Norwegian EPD foundation

Declaration number:
NEPD-7180-6581-EN

Registration number:
NEPD-7180-6581-EN

Issue date: 06.08.2024

Valid to: 06.08.2029

HY SOLAR

The Norwegian
EPD Foundation

General information

Product:
HY-NT10/54GDF (Power rating: 420-440W)
HY-NT10/72GDF (Power rating: 565-585W)

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-7180-6581-EN

This declaration is based on Product Category Rules:
NPCR 029 Part B Version: 1.2, 2022-03-31

Statements:
The owner of the declaration shall be liable for the underlying information and evidence. EPD Norway shall not be liable with respect to manufacturer, life cycle assessment data and evidences.

Functional unit:
1 Wp

System boundary:
Cradle to Grave + Module D

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

internal ☐ external ☒

Independent verifier approved by EPD Norway

Lucas Pedro Berman
Senda - Environmental & Energy consulting

Owner of the declaration:
HONGYUAN GREEN ENERGY CO., LTD.
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Manufacturer:
YuanTech Solar Co., Ltd.

Place of production:
No. 99, Jiuzi Road Dingcheng Town Economic Development Zone, Dingyuan County 233200 Chuzhou City, Anhui Province, PEOPLE'S REPUBLIC OF CHINA

Management system:
ISO 9001, ISO 14001, ISO 45001

Organisation no:
91320200743111173XT

Issue date:
06.08.2024

Valid to:
06.08.2029

Year of study:
2024

Comparability:
EPD of construction products may not be comparable if they do not comply with EN 15804.

The EPD has been worked out by:
TÜV SÜD Certification and Testing (China) Co., Ltd. Shanghai Branch, Tian Hongyu

Approved

Manager of EPD Norway

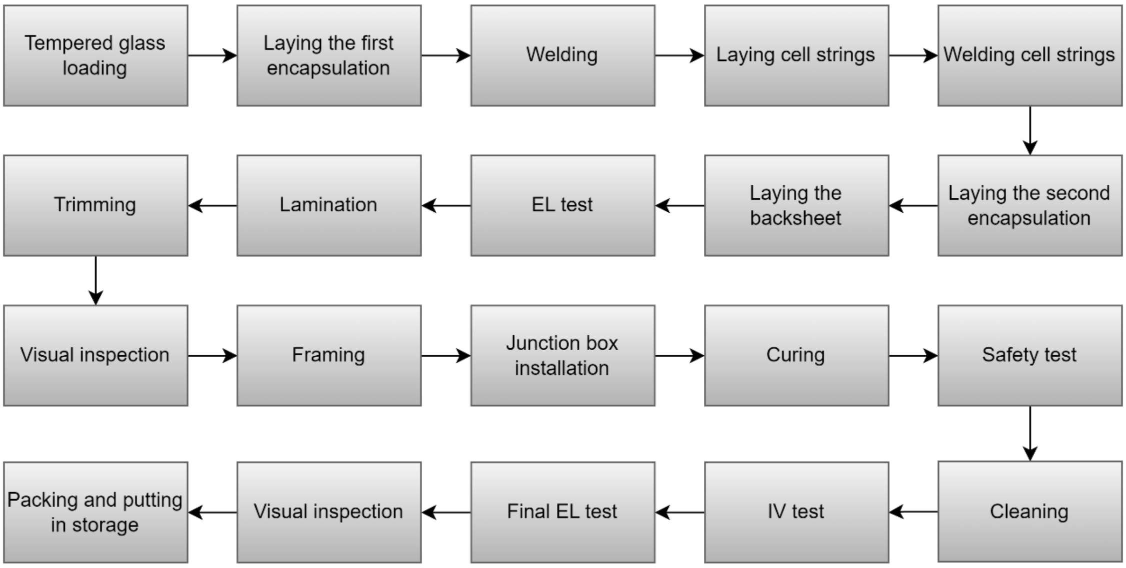
Product

Product description:

HY SOLAR TOPCon crystalline silicon photovoltaic (PV) modules have advantage in power generation, with module efficiency up to 22.6%. The application of SMBB and Half-cell technology brings HY SOLAR TOPCon crystalline silicon photovoltaic (PV) modules several characteristics, lower internal current loss, higher module efficiency, minimum micro-crack impacts, and higher reliability. Bifaciality rate of the PV modules are up to 80-85%, and brings a up to 30% power gain from back side (depending on albedo). Besides, lower temperature coefficient and excellent low irradiance performance lead to more energy yield, lower BOS and LCOE. The function of the PV module is to generate electricity. For Building-Integrated-PV (BIPV) applications, there is an additional function of providing roofing to the building.

The manufacturing processes of PV modules production of HY SOLAR are presented as following:

Processes of PV modules production



Step 1: Tempered glass loading

Placing tempered glass on the conveyor belt of the assembly line with the automatic loading device.

Step 2: Laying the first encapsulation

The encapsulation film was cut to specific size and laid on tempered glass.

Step 3: Welding

Soldering the positive and negative electrodes of the single cells together to form a cell string and prepare for the lamination process.

Step 4: Laying cell strings

Laying the cell strings precisely on the first encapsulation film according to the positioning requirements using automatic robot arm.

Step 5: Welding cell strings

The cell strings are welded together by copper-based tin-coated string connector.

Step 6: Laying the second encapsulation

The EVA encapsulation film was cut to specific size and laid on the cell strings.

Step 7: Laying the backsheet

Cutting the backsheet to specific size and laying it on the second encapsulation, ensuring each layer on the right position and keeping proper relative distance. This step is preparing for lamination process.

Step 8: EL test (before lamination)

Conducting electroluminescent imaging (EL) inspection on the PV modules before lamination.

Step 9: Lamination

The lamination process is to melt encapsulation and solidify the laminate at a certain temperature.

Step 10: Trimming

During lamination process, encapsulation film will extend outward and form a rough edge due to pressure after melting, so after lamination, the laminated PV module will be cut excess film along the edge of the tempered glass.

Step 11: Visual inspection after lamination

Under the conditions of light requirements of not less than 600Lux and visual acuity requirements of not less than 1.0 (including naked eye visual acuity and corrected visual acuity), the appearance of the laminated battery module is tested, and if there is any unqualified repair. Re-check the laminated PV modules, and send for repaired if any unqualified.

Step 12: Framing

With the framing and gluing machine, the silicone is automatically injected into the aluminum frame slot, and the frame is automatically assembled.

Step 13: Junction box installation

Installing the junction box on the required position of the back surface of PV modules and connect the outlet of the string connector to the junction box. Filling the junction box with potting adhesive.

Step 14: Curing

The battery module is placed in an independent space with adjustable humidity and temperature (temperature 23~25℃, humidity 50%) to cure the silicon adhesive, curing for more than 4h to meet the requirements.

Step 15: Safety test

Insulation test, dielectric withstand test and grounding continuity test.

Step 16: Cleaning

In order to ensure the cleanliness of the PV modules, the front and back sides of the PV modules are manually wiped with non-woven cloth (alcohol) in the cleaning room to remove surface impurities and excess colloids.

Step 17: IV test

The power rating is tested using a solar simulator (IV tester).

Step 18: Final EL test

Final EL inspection of the finished PV module products.

Step 19: Visual inspection

Final appearance inspection of the finished PV module products.

Step 20: Packing and putting in storage

The finished PV modules are classified according to the electrical performance, appearance and EL test results, and packed according to the classification results and stored in the warehouse.

Product specification:

HY-NT10/54GDF and HY-NT10/72GDF apply 108 and 144 pieces of N type mono-crystalline TOPCon solar cells respectively. The PV modules comply with the requirement of IEC 61215 :2016 series and IEC 61730:2016 series test standards.

Material	HY-NT10/54GDF		HY-NT10/72GDF	
	KG	%	KG	%
Glass	1.95E+01	79.385	2.56E+01	78.449
POE	1.82E+00	7.429	1.85E+00	5.665
Frame	1.96E+00	8.016	1.17E+00	3.578
Cell connector	1.48E-01	0.605	2.61E+00	7.988
String connector	4.44E-02	0.181	1.97E-01	0.604
Cell	5.05E-01	2.059	3.94E-02	0.121
Junction box	2.24E-01	0.916	6.72E-01	2.055
Flux agent	1.92E-02	0.078	1.02E-01	0.311
Silicone adhesive	3.10E-01	1.264	2.33E-02	0.071
Tape	1.51E-02	0.062	3.59E-01	1.100
Solder	1.10E-03	0.005	1.78E-02	0.055
Wooden pallet	7.36E-01	/	7.50E-01	/
Corrugated sheet	2.73E-01	/	6.45E-01	/
Kraft paper	1.03E-02	/	1.10E-02	/
Plastic film	8.79E-03	/	3.30E-02	/
PET	2.99E-02	/	6.01E-02	/

Technical data:

Technical parameters	HY-NT10/54GDF	HY-NT10/72GDF
Power output (W)	420-440	565-585
Dimension (mm)	1722 x 1134 x 30	2278 x 1134 x 30
Weight (kg)	23.7	32.1
Area (m^2)	1.95	2.58
Converting factor (Wp/m^2)	225.64	226.74
First year degradation rate (%)	1	1
Yearly degradation rate (%)	≤0.4	≤0.4

Market:
Norway

Reference service life, product:
A standard reference service life of 25 years for ≥80% of the labelled power output is used.

LCA: Calculation rules

Functional unit:
In this report, the functional unit is defined as 1 Wp of manufactured photovoltaic module, from cradle-to-grave + model D, with activities needed for a study period for a RSL of 25 years.

Data quality:
The inventory is based on the collection of measured data in the manufacturer plant from 2023-01-01 to 2023-12-31. A high accuracy and quality are expected for specific data. Missing data are completed by data from secondary database, cell, wafer and ingot production is from IEA PVPS Task 12, 2020 report. Consistency checks are performed. Data quality of the main contributors are improved as far as possible. Generic data related to the life cycle impacts of the material or energy flows that enter and leave the production system is sourced from Ecoinvent 3.9 "allocation, cut-off by allocation - unit" database.

Allocation:
When a factory produces different products, allocation of the inventory data to the different products is needed. The allocation is made in accordance with the provisions of EN 15804 and Core PCR. Allocation refers to the partitioning of input or output flows of a process or a product system between the product systems under study and one or more other product systems. In this study, there are three types of allocation procedures considered:

Multi-input allocation

For data sets in this study, the allocation of electricity and emissions during the manufacturing stage of PV module are allocated by power output ratio. The transportation of raw materials is allocated by mass ratio.

Multi-output allocation

No other by-products are produced from the production, hence there is no production of by-products that need to be used to allocate the situation.

End-of-life allocation

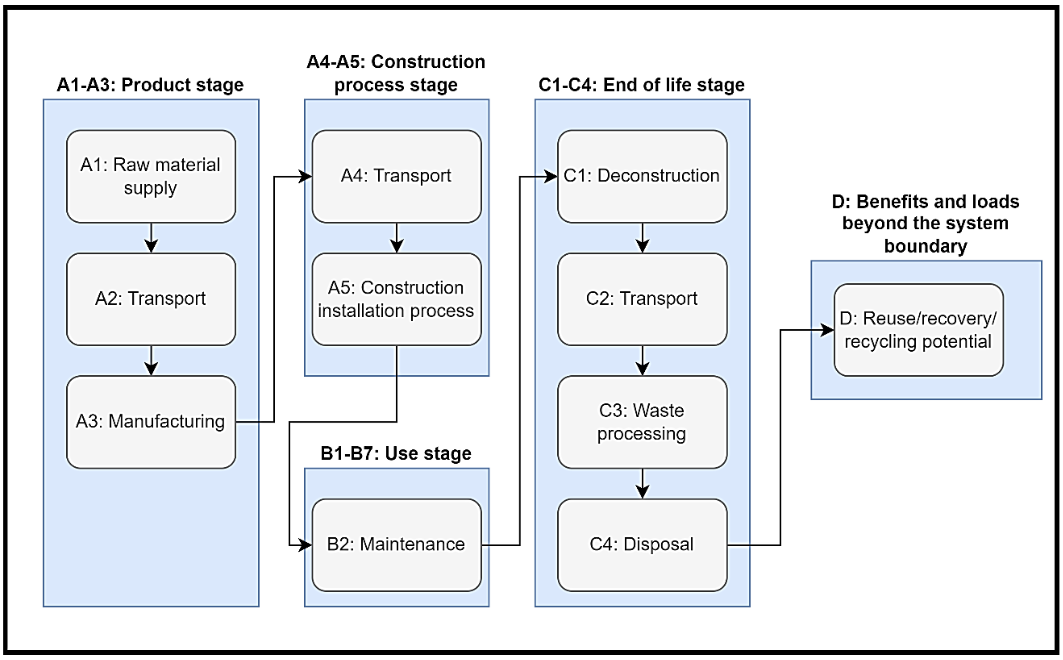
For end-of-life allocation of background data (energy and materials), the model "allocation cut-off by classification (ISO standard) is used. The underlying philosophy of this approach is that primary (first) production of materials is always allocated to the primary user of a material. If material is recycled, the primary producer does not receive any credit for the provision of any recyclable materials. Consequently, recyclable materials are available burden-free for recycling processes, and secondary (recycled) materials bear only the impacts of the recycling processes.

In this study, raw materials as well as packaging materials of different PV modules are based on the BOM from HY SOLAR, no allocation is used at the stage. For input and output flows during manufacturing processes such as electricity, auxiliary consumption, emissions and waste, the allocation is based on the amounts for power rating for PV modules.

In this report, the principles of modularity and the polluter pays have been followed.

System boundary:

The system boundary of this study is cradle-to-grave and module D, including raw materials acquisition, transportation, manufacturing, delivery, installation, maintenance, waste disposal for end-of-life and benefits and loads after end-of-life.



Cut-off criteria:

In case of insufficient input data or data gaps for a unit process, according to the PCR requirement, the cut-off criteria chosen is 2% of the total mass and energy of that unit process. (Respectively, of the photovoltaic module's unit weight and the energy needed to produce and assemble it).

The total of neglected input flows per module, e.g., per module A1-A3, A4-A5, B2, C1-C4 is maximum 2% of energy usage and mass.

In this study, no flows are cut off, all available energy and material flows have been included in the model. In the absence of a matching life cycle checklist to represent the process, proxy data was adopted based on conservative assumptions about environmental impact.

LCA: Scenarios and additional technical information

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

For road transportation, lorry of EURO6, 16-32 metric ton is used for modelling, while container ship is used for sea transportaion. The inventory of HY SOLAR includes the transportation from the factory to departure port, departure port to arriving ports and arriving port to purchaser.

Transport from production place to assembly/user (A4)

Type	Capacity utilisation (incl. return) %	Type of vehicle	Distance KM	Fuel/Energy consumption	value (kg/tkm)
Truck_domestic	36.7	EURO6, 16-32 metric ton	550	Diesel	0.037
Container ship	70	Container ship	21448	Heavy oil	0.0025
Truck_oversea	36.7	EURO6, 16-32 metric ton	500	Diesel	0.037

Assembly (A5)

According to NPCR 029 Part B, the waste treatment of packaging, energy use during installation shall be included. The electricity consumption and diesel consumption during installation stage is scaled up based on the data from Ecoinvent database value (36.03 kWh/570kWp and 7673 MJ/570kWp respectively) according to the power rating of PV modules. The compositions of the packing waste are mainly waste pallet, waste corrugated sheet, waste kraft paper, plastic film and other PET. The disposal is assumed 100% incineration for plastic film, corrugated sheet and kraft paper. 25% incineration for the wooden pallet. 75% recycling for the wooden pallet. The transportation distance to disposal site is assumed as 200km.

	Unit	HY-NT10/54GDF	HY-NT10/72GDF
Auxiliary	kg	-	-
Water consumption	m^3	-	-
Electricity consumption	kWh	2.78E-02	3.70E-02
Other energy carriers (diesel)	MJ	5.92E+00	7.87E+00
Material loss	kg	-	-
Output materials from waste treatment	kg	1.06E+00	1.50E+00
Dust in the air	kg	-	-

Use (B1)

There are no material or energy inputs, no emissions during the use phase (B1) of the PV module.

Maintenance (B2)/Repair (B3)

In the maintenance stage (B2), it is assumed that each module is cleaned with 0.3L of water each time, and the cleaning frequency is twice a year. It is assumed that a small handheld device is used to spray water onto the panel, consuming no electricity during the cleaning process. And the PV modules do not require maintenance during RSL.

	Unit	HY-NT10/54GDF	HY-NT10/72GDF
Maintenance cycle*	frequency/year	2	2
Auxiliary	kg	-	-
Other resources	kg	-	-
Water consumption	m^3/year	0.0006	0.0006

Electricity consumption	kWh	-	-
Other energy carriers	MJ	-	-
Material loss	kg	-	-

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)

There is no operational energy and water consumption needed in life stage B6 and B7 respectively. The energy produced by a PV module depends on the installed power peak [Wp], degradation factor, geographic location, and direction/placement of the installation. The calculation formula of energy production are as follows:

- 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, from functional unit (FU), m^2 (stated in the EPD).
- y = Module yield: electrical power, kWp for standard test conditions (STC) of the module divided by the area of the module (stated in the EPD).
- deg = yearly degradation rate (stated in the EPD).
- RSL = Reference service life for energy-producing unit, from functional unit (FU), stated in the EPD.
- 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 in the first year of operation:

$E1=S_{rad}*A*y*PR*(1-deg)$

Energy production over reference service life of module：

$E_{RSL}=E1*(1+\sum_{n=1}^{RSL-1}(1-\deg)^n)$

End of Life (C1, C3, C4)

For the end-of-life stage, default scenarios in section 6.3.8.4 of NPCR 029 version 1.2 of EPD Norway are used. De-construction (C1) is assumed mainly energy use for onsite dismantling and the energy use is assumed the same as the construction stage (A5). The electricity consumption for demolition of PV modules and sorting of waste (C3) is assumed the same as the manufacture stage (A3) of PV modules. For the end-of-life disposal stage (C4), this study refers to legal requirements issued by Waste Electrical and Electronic Equipment (WEEE) under the EU scenario. The required recycling rate for waste PV modules is 85% according to 2012/19/EU-Article 11 & ANNEX V. The recycling rate for waste glass is assumed as 85%, while the refused parts are disposed with landfilling. The silicon cell and solder are assumed as 100% landfill. And the waste aluminum and waste copper are assumed as 100% recycled. Waste EVA, EPE, POE, junction box, waste silicon adhesive and tape are end up with 100% incineration.

	Unit	HY-NT10/54GDF	HY-NT10/72GDF
Hazardous waste disposed	Kg	-	-

Collected as mixed construction waste	Kg	-	-
Reuse	Kg	-	-
Recycling	Kg	1.87E+01	2.46E+01
Energy recovery	Kg	-	-
To landfill	Kg	3.42E+00	4.52E+00

Transport to waste processing (C2)

Transport distance of 50 km is assumed for transporting to waste processing site (C2).

Type	Capacity utilisation (incl. return) %	Type of vehicle	Distance KM	Fuel/Energy consumption	value (kg/tkm)
Truck	36.7	EURO6, 16-32 metric ton	50	Diesel	0.037

Benefits and loads beyond the system boundaries (D)

In the disposal stage, 100% of metal scrap and 85% of glass scrap are recycled. Plastic components will be incinerated with energy recovery while recycled materials will be used as substitution of primary material.

	Unit	HY-NT10/54GDF	HY-NT10/72GDF
Substitution of glass cullet	kg	1.41E+01	1.85E+01
Substitution of secondary aluminum	kg	5.11E-01	6.79E-01
Substitution of secondary copper	kg	1.83E-01	2.25E-01
Electrical energy recovery	MJ	3.29E+00	4.86E+00
Thermal energy recovery	MJ	6.75E+00	9.97E+00

LCA: Results

The core environmental impact results are calculated basing on the highest rating of the module type and expressed per functional unit. The LCA results been calculated by using SimaPro 9.5 LCA software.

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 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 to the LCA study：

- 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 reusednternally 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

Core environmental impact indicators

	Indicator	Unit	A1-A3	A4	A5	B2	C1	C2	C3	C4	D
HY-NT10/54GDF	GWP-total	kg CO_2 eq.	3.61E-01	2.46E-02	2.93E-03	1.10E-05	1.37E-03	5.13E-04	4.99E-04	1.29E-02	-3.36E-02
	GWP-fossil	kg CO_2 eq.	3.63E-01	2.46E-02	2.06E-03	1.08E-05	1.37E-03	5.13E-04	4.76E-04	1.29E-02	-3.35E-02
	GWP-biogenic	kg CO_2 eq.	-2.02E-03	5.28E-06	8.65E-04	2.26E-07	4.03E-07	4.80E-07	1.88E-05	1.25E-06	-1.33E-04
	GWP-LULUC	kg CO_2 eq.	3.60E-04	1.57E-05	2.34E-07	1.83E-08	1.65E-07	2.49E-07	3.57E-06	1.15E-07	-9.52E-06
	ODP	kg CFC11 eq.	8.62E-09	4.03E-10	2.46E-11	2.96E-13	2.13E-11	1.09E-11	1.34E-11	1.48E-11	-2.99E-10
	AP	mol H^+ eq.	2.39E-03	4.04E-04	1.29E-05	5.73E-08	1.24E-05	1.09E-06	1.86E-06	3.23E-06	-4.13E-04
	EP-freshwater	kg P eq.	5.96E-05	1.51E-07	6.45E-09	7.55E-10	4.97E-09	4.06E-09	2.01E-08	4.02E-09	-1.60E-06
	EP-marine	kg N eq.	5.40E-04	1.01E-04	5.94E-06	9.48E-09	5.73E-06	2.69E-07	3.34E-07	1.51E-06	-4.20E-05
	EP-terrestial	mol N eq.	4.66E-03	1.11E-03	6.45E-05	1.07E-07	6.24E-05	2.80E-06	4.11E-06	1.56E-05	-5.01E-04
	POCP	kg NMVOC eq.	1.37E-03	3.19E-04	1.92E-05	3.92E-08	1.85E-05	1.69E-06	1.23E-06	4.11E-06	-1.47E-04
	ADP-M&M	kg Sb eq.	1.30E-05	4.94E-08	1.08E-09	5.50E-11	7.04E-10	1.63E-09	8.59E-09	6.75E-10	-3.00E-06
	ADP-fossil	MJ	4.16E+00	3.16E-01	1.91E-02	1.88E-04	1.75E-02	7.10E-03	9.75E-03	3.53E-03	-2.97E-01

	Indicator	Unit	A1-A3	A4	A5	B2	C1	C2	C3	C4	D
	WDP	m³	-5.53E-01	1.06E-03	9.14E-05	1.44E-03	4.04E-05	2.97E-05	4.13E-04	5.94E-04	-6.04E-03
HY-NT10/72GDF	GWP-total	kg CO_2 eq.	3.65E-01	2.47E-02	3.50E-03	8.27E-06	1.37E-03	5.22E-04	5.01E-04	1.43E-02	-3.36E-02
	GWP-fossil	kg CO_2 eq.	3.66E-01	2.47E-02	2.30E-03	8.09E-06	1.37E-03	5.22E-04	4.77E-04	1.43E-02	-3.34E-02
	GWP-biogenic	kg CO_2 eq.	-1.79E-03	5.29E-06	1.20E-03	1.70E-07	4.03E-07	4.89E-07	1.88E-05	1.37E-06	-1.30E-04
	GWP-LULUC	kg CO_2 eq.	3.72E-04	1.58E-05	2.46E-07	1.38E-08	1.65E-07	2.53E-07	3.57E-06	1.24E-07	-9.10E-06
	ODP	kg CFC11 eq.	9.01E-09	4.05E-10	2.53E-11	2.23E-13	2.13E-11	1.11E-11	1.34E-11	1.62E-11	-3.04E-10
	AP	mol H^+ eq.	2.37E-03	4.06E-04	1.31E-05	4.31E-08	1.24E-05	1.11E-06	1.86E-06	3.55E-06	-3.96E-04
	EP-freshwater	kg P eq.	5.98E-05	1.52E-07	6.79E-09	5.68E-10	4.97E-09	4.13E-09	2.01E-08	4.37E-09	-1.52E-06
	EP-marine	kg N eq.	5.42E-04	1.01E-04	6.00E-06	7.13E-09	5.73E-06	2.74E-07	3.35E-07	1.66E-06	-4.13E-05
	EP-terrestial	mol N eq.	4.68E-03	1.12E-03	6.51E-05	8.06E-08	6.24E-05	2.85E-06	4.11E-06	1.72E-05	-4.91E-04
	POCP	kg NMVOC eq.	1.39E-03	3.21E-04	1.94E-05	2.95E-08	1.85E-05	1.72E-06	1.23E-06	4.50E-06	-1.44E-04
	ADP-M&M	kg Sb eq.	1.27E-05	4.96E-08	1.13E-09	4.14E-11	7.04E-10	1.66E-09	8.61E-09	7.39E-10	-2.78E-06
	ADP-fossil	MJ	4.28E+00	3.18E-01	1.94E-02	1.41E-04	1.75E-02	7.22E-03	9.77E-03	3.77E-03	-2.96E-01
	WDP	m³	-5.43E-01	1.07E-03	1.10E-04	1.08E-03	4.04E-05	3.02E-05	4.14E-04	6.59E-04	-5.78E-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

	Indicator	Unit	A1-A3	A4	A5	B2	C1	C2	C3	C4	D
HY-NT10/54GDF	PM	Disease incidence	2.65E-08	1.22E-09	3.55E-10	5.70E-13	3.45E-10	3.71E-11	1.89E-11	2.19E-11	-3.10E-09
	IRP	kBq U235 eq.	7.17E-03	1.01E-04	5.29E-06	1.28E-06	4.41E-06	3.60E-06	2.13E-04	2.37E-06	-1.98E-04
	ETP-fw	CTUe	1.92E+00	1.40E-01	1.02E-02	3.85E-05	7.36E-03	3.03E-03	3.16E-03	2.47E-02	-1.83E-01
	HTP-c	CTUh	2.31E-10	4.72E-12	2.70E-13	1.37E-14	2.27E-13	1.19E-13	3.23E-13	3.74E-13	-1.73E-11
	HTP-nc	CTUh	1.10E-08	8.11E-11	7.63E-12	7.73E-14	6.69E-12	1.84E-12	3.33E-12	5.72E-12	-8.90E-10
	SQP	Dimensionless	1.54E+00	1.09E-01	2.19E-03	4.10E-05	1.19E-03	4.29E-03	3.49E-03	3.03E-03	-1.30E-01
HY-NT10/72GDF	PM	Disease incidence	2.66E-08	1.22E-09	3.57E-10	4.29E-13	3.45E-10	3.77E-11	1.90E-11	2.34E-11	-3.06E-09
	IRP	kBq U235 eq.	7.34E-03	1.02E-04	5.42E-06	9.60E-07	4.41E-06	3.66E-06	2.14E-04	2.52E-06	-1.88E-04
	ETP-fw	CTUe	1.94E+00	1.41E-01	1.12E-02	2.89E-05	7.36E-03	3.08E-03	3.16E-03	2.73E-02	-1.74E-01
	HTP-c	CTUh	2.30E-10	4.74E-12	2.80E-13	1.03E-14	2.27E-13	1.22E-13	3.23E-13	3.00E-13	-1.66E-11

	HTP-nc	CTUh	1.10E-08	8.14E-11	7.88E-12	5.81E-14	6.69E-12	1.87E-12	3.34E-12	6.22E-12	-8.35E-10
	SQP	Dimensionless	1.51E+00	1.09E-01	2.34E-03	3.08E-05	1.19E-03	4.36E-03	3.50E-03	3.09E-03	-1.24E-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

	Indicator	Unit	A1-A3	A4	A5	B2	C1	C2	C3	C4	D
HY-NT10/54GDF	RPEE	MJ	7.47E-01	3.39E-03	3.86E-04	2.77E-05	3.54E-04	1.12E-04	6.58E-02	1.22E-04	-2.14E-02
	RPEM	MJ	3.08E-02	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	7.77E-01	3.39E-03	3.86E-04	2.77E-05	3.54E-04	1.12E-04	6.58E-02	1.22E-04	-2.14E-02
	NRPE	MJ	3.98E+00	3.16E-01	1.91E-02	1.88E-04	1.75E-02	7.10E-03	9.75E-03	3.53E-03	-2.97E-01
	NRPM	MJ	1.87E-01	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	4.16E+00	3.16E-01	1.91E-02	1.88E-04	1.75E-02	7.10E-03	9.75E-03	3.53E-03	-2.97E-01
	SM	kg	1.29E-02	7.65E-04	2.68E-05	3.41E-06	2.32E-05	1.23E-05	3.64E-05	1.20E-05	-4.56E-04
	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^3	-1.17E-02	3.57E-05	4.63E-06	3.35E-05	3.17E-06	1.02E-06	4.65E-04	1.97E-05	-1.49E-04
HY-NT10/72GDF	RPEE	MJ	7.47E-01	3.41E-03	3.92E-04	2.09E-05	3.54E-04	1.14E-04	6.60E-02	1.31E-04	-2.07E-02
	RPEM	MJ	3.17E-02	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	7.78E-01	3.41E-03	3.92E-04	2.09E-05	3.54E-04	1.14E-04	6.60E-02	1.31E-04	-2.07E-02
	NRPE	MJ	4.24E+00	3.18E-01	1.94E-02	1.41E-04	1.75E-02	7.22E-03	9.77E-03	3.77E-03	-2.96E-01
	NRPM	MJ	3.71E-02	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	4.28E+00	3.18E-01	1.94E-02	1.41E-04	1.75E-02	7.22E-03	9.77E-03	3.77E-03	-2.96E-01
	SM	kg	1.30E-02	7.69E-04	2.77E-05	2.56E-06	2.31E-05	1.25E-05	3.66E-05	1.21E-05	-4.34E-04
	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^3	-1.14E-02	3.58E-05	5.15E-06	2.52E-05	3.17E-06	1.04E-06	4.66E-04	2.17E-05	-1.42E-04

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

End of life – Waste

	Indicator	Unit	A1-A3	A4	A5	B2	C1	C2	C3	C4	D
HY-NT10/54GDF	HW	KG	3.13E-04	1.80E-06	1.28E-07	5.46E-10	1.18E-07	4.51E-08	1.57E-08	1.99E-08	-4.69E-07
	NHW	KG	4.74E-02	8.38E-03	1.53E-04	2.18E-06	2.68E-05	3.53E-04	3.06E-04	8.01E-03	-6.92E-03

	RW	KG	4.81E-06	5.95E-08	2.87E-09	1.02E-09	2.30E-09	2.33E-09	9.74E-08	1.55E-09	-1.21E-07
HY-NT10/72GDF	HW	KG	3.13E-04	1.81E-06	1.29E-07	4.11E-10	1.18E-07	4.59E-08	1.58E-08	2.14E-08	-4.71E-07
	NHW	KG	4.81E-02	8.41E-03	1.82E-04	1.64E-06	2.68E-05	3.59E-04	3.07E-04	7.99E-03	-6.81E-03
	RW	KG	4.94E-06	5.98E-08	2.95E-09	7.67E-10	2.30E-09	2.37E-09	9.76E-08	1.64E-09	-1.15E-07

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

End of life – output flow

	Indicator	Unit	A1-A3	A4	A5	B2	C1	C2	C3	C4	D
HY-NT10/54GDF	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-04	0.00E+00	1.25E-03	0.00E+00	0.00E+00	0.00E+00	4.25E-02	0.00E+00	0.00E+00
	MER	kg	1.48E-05	0.00E+00	1.15E-03	0.00E+00	0.00E+00	0.00E+00	5.39E-03	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	0.00E+00	0.00E+00	7.48E-03
	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	1.53E-02
HY-NT10/72GDF	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-04	0.00E+00	9.62E-04	0.00E+00	0.00E+00	0.00E+00	4.21E-02	0.00E+00	0.00E+00
	MER	kg	1.49E-05	0.00E+00	1.60E-03	0.00E+00	0.00E+00	0.00E+00	5.98E-03	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	0.00E+00	0.00E+00	8.31E-03
	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	1.70E-02

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

Biogenic carbon content	Unit	HY-NT10/54GDF	HY-NT10/72GDF
Biogenic carbon content in product	kg C	0	0
Biogenic carbon content in the accompanying packaging	kg C	1.03E-03	9.92E-04

Additional requirements

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

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

National electricity grid	Unit	Value

Electricity, medium voltage {CN-ECGC}| market for electricity, medium voltage| Cut-off, U	kg CO_2 -eq/kWh	0.857

Additional environmental impact indicators required in NPCR Part A for construction products

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

	Indicator	Unit	A1-A3	A4	A5	B2	C1	C2	C3	C4	D
HY-NT10/54 GDF	GWP-IOBC	kg CO_2 eq.	3.63E-01	2.46E-02	2.06E-03	1.08E-05	1.37E-03	5.13E-04	4.76E-04	1.29E-02	-3.35E-02
HY-NT10/72 GDF	GWP-IOBC	kg CO_2 eq.	3.65E-01	2.47E-02	2.30E-03	8.09E-06	1.37E-03	5.22E-04	4.77E-04	1.43E-02	-3.34E-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 or the Norwegian priority list that are less than 0.1 % by weight.

Indoor environment

Not relevant for outdoor products.

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