Huawei Digital Power Technologies Co., Ltd.

ENVIRONMENTAL PRODUCT DECLARATION

PRODUCT NAME :

SUN2000-330KTL-H2

PLANTS:

Office 01, 39th Floor, Block A, Antuoshan Headquarters Towers, 33 Antuoshan 6th Road, Futian District, Shenzhen, P.R.C

in compliance with ISO 14025

Program Operator	UL
Publisher	EPDItaly

Declaration Number	4790938996.102.1
Registration Number	MR-EPDITALY0074

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Valid to	2028/ 09 / 21

Registered under the mutual recognition between EPDItaly and UL.
www.epditaly.it

Environmental Product Declaration

SUN2000-330KTL-H2

SOLAR INVERTER
HUAWEI DIGITAL POWER TECHNOLOGIES CO., LTD.

A three-phase grid-tied photovoltaic string inverter that converts the direct current (DC) power generated by PV strings into alternating current.

HUAWEI

Huawei Digital Power has been pursuing the vision of "integrate digital and power electronics technologies, develop clean power, and enable energy digitization to drive energy revolution for a better, greener future". We will continue to pursue the UN SDGs and implement the Corporate Sustainable Development (CSD) for digital power, "ZERO", under the guidance of Huawei's CSD strategy which consists of the four key areas of zero-carbon enablement, empower with digitalization, responsible operation and one-mind growth.

The basic LCA and EPD are developed based on ISO14025 and scientific LCA method. By the Quantitative evaluation of the environmental impacts of product entire life cycle, hotspots of impacts can be identified, and product improvement can be promoted. In addition, EPD must undergo strict third-party review and approval, and the release of validated and effective information can assist us in conducting supply chain communication, reflecting our sustainable development concept.

UL
CERTIFIED
ENVIRONMENTAL PRODUCT DECLARATION
UL.COM/EPD

ENVIRONMENTAL PRODUCT DECLARATION

HUAWEI

SUN2000-330KTL-H2
Solar Inverter

According to ISO 14025, EN 15804:2012+A2:2019/AC:2021

EPD PROGRAM AND PROGRAM OPERATOR NAME, ADDRESS, LOGO, AND WEBSITE	UL ENVIRONMENT 333 PFINGSTEN ROAD NORTHBROOK, IL 60611 HTTPS://WWW.UL.COM/ HTTPS://SPOT.UL.COM/
GENERAL PROGRAM INSTRUCTIONS AND VERSION NUMBER	PROGRAM OPERATOR RULES V2.7 2022
MANUFACTURER NAME AND ADDRESS	Huawei Digital Power Technologies Co., Ltd. Office 01, 39th Floor, Block A, Antuoshan Headquarters Towers, 33 Antuoshan 6th Road, Futian District, Shenzhen, P.R.C
DECLARATION NUMBER	4790938996.102.1
DECLARED PRODUCT & FUNCTIONAL UNIT OR DECLARED UNIT	SUN2000-330KTL-H2 The usage of one SUN2000-330KTL-H2 for 25 years
REFERENCE PCR AND VERSION NUMBER	ISO 14067:2018 Greenhouse gases — Carbon footprint of products — Requirements and guidelines for quantification EN 15804:2012+A2:2019+AC:2021, Sustainability of construction works – Environmental product declarations - Core rules for the product category of construction products EN 50693:2019, Product category rules for life cycle assessments of electronic and electrical products and systems PCR EPDItaly007 Electronic and electrical Products and systems PCR EPDItaly032 Electronic and electrical products and systems power inverters
DESCRIPTION OF PRODUCT APPLICATION/USE	SUN2000-330KTL-H2 is a three-phase grid-tied photovoltaic (PV) string inverter that converts the direct current (DC) power generated by PV strings into alternating current (AC) power and feeds the power into the power grid.
PRODUCT RSL DESCRIPTION (IF APPL.)	25 Years
MARKETS OF APPLICABILITY	Europe
DATE OF ISSUE	September 21, 2023
PERIOD OF VALIDITY	5 years
EPD TYPE	Product-specific
RANGE OF DATASET VARIABILITY	N/A
EPD SCOPE	Cradle to grave
YEAR(S) OF REPORTED PRIMARY DATA	2022.7-2023.7
LCA SOFTWARE & VERSION NUMBER	SimaPro 9.4
LCI DATABASE(S) & VERSION NUMBER	Ecoinvent 3.8
LCIA METHODOLOGY & VERSION NUMBER	EN 15804+A2 Method V1.03

The PCR review was conducted by:	EPDItaly Program PCR Moderator & PCR Committee info@epditaly.it
This declaration was independently verified in accordance with ISO 14025: 2006. ☐ INTERNAL ☒ EXTERNAL	Shan shan Zhao Shanshan Zhao, UL Environment
This life cycle assessment was conducted in accordance with ISO 14044 and the reference PCR by:	Huawei
This life cycle assessment was independently verified in accordance with ISO 14044 and the reference PCR by:	Thomas P. Gloria

LIMITATIONS

Exclusions: EPDs do not indicate that any environmental or social performance benchmarks are met, and there may be impacts that they do not encompass. LCAs do not typically address the site-specific environmental impacts of raw material extraction, nor are they meant to assess human health toxicity. EPDs can complement but cannot replace tools and certifications that are designed to address these impacts and/or set performance thresholds – e.g. Type 1 certifications, health assessments and declarations, environmental impact assessments, etc.

Accuracy of Results: EPDs regularly rely on estimations of impacts; the level of accuracy in estimation of effect differs for any particular product line and reported impact.

Comparability: EPDs from different programs may not be comparable. Full conformance with a PCR allows EPD comparability only when all stages of a life cycle have been considered. However, variations and deviations are possible”. Example of variations: Different LCA software and background LCI datasets may lead to differences results for upstream or downstream of the life cycle stages declared.

1. Product Definition and Information

1.1. Description of Company/Organization

Founded in June 2021, Huawei Digital Power Technology Co., Ltd. is a wholly-owned subsidiary of Huawei Technology Co. Ltd.and the world's leading provider of digital power products and solutions. We are committed to integrating digital and power electronics technologies, developing clean power, and enable energy digitalization to drive energy revolution for a better, greener future. At present, we have about 6,000 employees, conducting business in more than 170 countries and regions worldwide, serving one third of the global population.

1.2. Product Description

Product Identification

SUN2000-330KTL-H2 is a three-phase grid-tied photovoltaic (PV) string inverter that converts the direct current (DC) power generated by PV strings into alternating current (AC) power and feeds the power into the power grid.

Product Specification

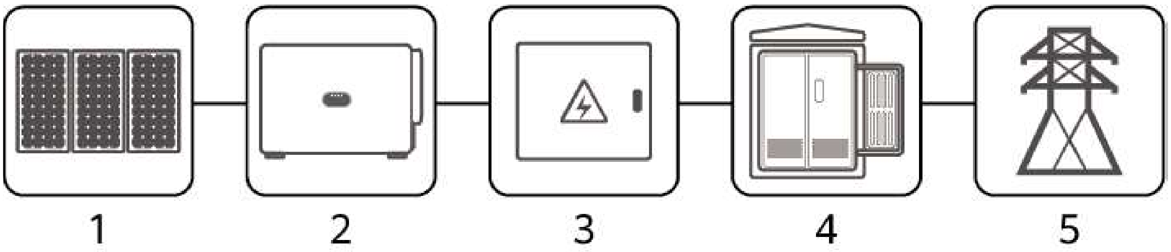
Huawei Digital Power' SUN2000 is a three-phase grid-tied photovoltaic (PV) string inverter. The product model covered in this EPD is SUN2000-330KTL-H2, with max active power of 330kW. The critical information of product is shown as follow, complete product specifications can be found in the user manual

Table 1. The critical information of product

NAME		VALUE
General Parameters	Topology	Triphase
	Dimensions (W x H x D)	1048 mm×732 mm×395 mm
	Weight (Including delivery accessories and mounting kits)	118.7 kg/pcs
	Packaging Weight	29.9 kg/pcs
	Nighttime self-consumption (sleep mode)	4.8 W
Efficiency	European Effect	98.8%
Input	Nominal PV input voltage	1080 V
	Number of input channels	28
	Number of MPP Trackers	6
Output	Max output current	238.2 A
	Nominal AC voltage	800 V
	Max active power	330 kW
	Output rated active power	275 kW

1.3. Application

The product applies to commercial rooftop grid-tied systems and large-scale power plant grid-tied systems. The system consists of PV strings, SUN2000s, AC PDUs, and step-up transformers.



Remarks:
(1) PV strings
(2) SUN2000
(3) Alternating current distribution unit (AC PDU)
(4) Step-up transformer
(5) Power grid

Figure 1. The networking application of SUN2000-330KTL-H2

1.4. Declaration of Methodological Framework

EN 15804+A2:2019, EN 50693:2019 and the PCR for Power Inverter, EPDItaly007 and EPDItaly032 were applied to quantify the environmental impact of the product lifecycle. In addition, ISO 14067:2018 was employed for the environmental impact assessment of climate change (Product Carbon Footprint, PCF). Life Cycle Inventory Assessment Model are selected according to EN15804:2012+A2:2019+AC:2021, the characterization factors from EC-JRC is applied.

1.5. Technical Requirements

Some technical requirements of the products represented in this EPD are listed in the following table:

Table 2. Standards required for SUN2000-330KTL-H2

Product	Categories	Standards
SUN2000-330KTL-H2	Safety	EN 62109-1:2010 EN 62109-2:2011
	EMC	EN 62920:2017+ A1:2021 EN 55011:2016+A2:2021 EN 61000-3-12:2011

1.6. Material Composition

SUN2000-330KTL-H2 physically consists of general building blocks such as: box body, metal support, semi-finished board (PCBA), connector, fan and cable, etc. Table 3 shows the peracentage material composition of SUN2000-330KTL-H2.

Table 3. Material composition of SUN2000-330KTL-H2

Raw Materials	Weight of Declared Product	Percentage of Declared Product
Steel	10.8 kg	7.2%
Copper	2.2 kg	1.5%
Aluminium	47.6 kg	32.0%

Plastic	1.1 kg	0.7%
Electronic part	55.3 kg	37.2%
Rubber	0.9 kg	0.6%
Battery	0.0 kg	0.0%
Packaging	29.9 kg	20.1%
Others	1.0 kg	0.6%

Note： "0.0" indicates that the percentage is less than "0.1". Others include delivery accessories, etc.

1.7. Manufacturing

The production process of inverters mainly includes the assembly of printed boards (PCBA) and the assembly of final products. The process flow can be simply summarized as PCB assembly, inverter assembly, testing, and packaging.

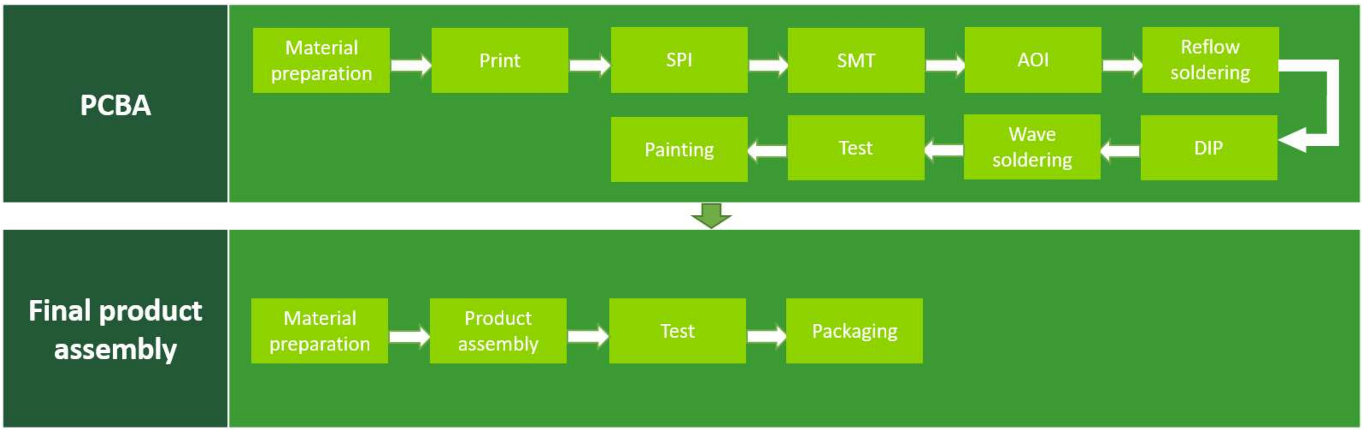


Figure 2. Production Process Flow Diagram

1.8. Packaging

The packaging of the product consists of corrugated cartons, binding belts, paper edge protectors and pallets,etc. Weight of Product packaging is allocated to individual products according to the number of packaged items. Package composition can be found in the Table 4.

Table 4. Packaging material composition of SUN2000-330KTL-H2

PACKAGING	WEIGHT OF DECLARED PRODUCT	PERCENTAGE OF DECLARED PRODUCT
Wood lining board	1.3 kg	4.4%
Paper edge protector	2.1 kg	7.0%
Single-carton package	9.9 kg	33.1%
Pallet	16.3 kg	54.3%
Others	0.3 kg	1.1%

Note: Others include binding straps, plastic bags, desiccant, labels, etc.

1.9. Transportation

The product is assumed to be used in Europe, the distribution stage is modeled from HUAWEI assembly location Dongguan to use location Europe. Assuming the product is supplied to customers through Huawei's European supply center (EGS).

1.10. Product Installation

It is assumed that the product is installed in Europe. SUN2000-330KTL-H2 is installed as part of the photovoltaic system. Assuming the product is sold in the following EU countries, the installation and usage is modeled based on the proportion of PV installed capacity in these countries. The PV installed capacity data is obtained from IEA-PVPS Trends report-Trends in PV Applications 2022.

Table 5. The PV cumulative capacity

COUNTRY	2021 CUMULATIVE CAPACITY (MW)	PERCENTAGE
Austria	2783	2.0%
Denmark	2344	1.7%
Finland	413	0.3%
France	16450	11.7%
Germany	59661	42.5%
Italy	22594	16.1%
Netherlands	14349	10.2%
Portugal	1647	1.2%
Spain	18503	13.2%
Sweden	1798	1.3%

For solar inverter, installation is carried out using manual tools such as screwdrivers, wrenches, etc. There is almost no electricity energy consumption during this installation process, energy consumption is assumed to be zero.

1.11. Use

The impacts related to the energy used by the power inverter to operate during its entire reference service life is considered for product usage. The electricity loss converted through the product is calculated refer to EPDItaly032 PCR.

$$E_{use} = \text{Output rated AC active power} * \text{average local annual sunshine} * (1 - \text{average energy efficiency}) * \text{RSL}$$
$$= 275\ \text{kW} * 1949.3\ \text{hr} * (1 - 98.8\%) * 25\ \text{Year} = 160817.3\ \text{kWh}$$

1.12. Reference Service Life and Estimated Building Service Life

Reference Service life is assumed to be 25 years based on EPDItaly032 PCR.

1.13. End-of-Life

The End-of-Life treatment stage includes De-construction and demolition (Model C1), the transport from use location to waste treatment site (Model C2), waste processing (Model C3) and disposal (Model C4).

Similar to the installation phase, the inverter is manually de-construction and demolition.

Considering that it was not possible to determine the specific collection and treatment location, it was assumed that the average distance of the product from the collection place to final treatment place was 100 km.

The end-of-life (EOL) model is established based on EN 50693:2019 Annex G, regulations, and industry reports based on actual recovery data.

2. Life Cycle Assessment Background Information

2.1. Functional or Declared Unit

According to EPDItaly032 PCR, the functional unit is defined as one solar inverter with the model of SUN2000-330KTL-H2 that converting the variable DC voltage generated by a photovoltaic (PV) solar panel into a commercial frequency alternating current (AC), during a reference service life of 25 years.

2.2. System Boundary

The system boundary of this evaluation is cradle-to-grave, i.e., from the acquisition of raw materials stage to equipment end-of-life treatment stage. including the following life cycle stages:

Module A1-A3: Production stage

The production stage includes the environmental impacts associated with raw materials extraction and processing, transport to, between and within the manufacturing site, and the manufacturing of product. Module A includes provision of all materials, products and energy, as well as waste processing up to the end-of waste state or disposal of final residues during the product stage.

Module A4-A5: Construction stage

The construction process stage includes the transportation from the production gate to construction site and energy consumption and waste generated during installation.

Module B6: Use stage

The use stage covering the period from the product operation to when it is deconstructed or demolished.

Module C1-C4: End-of-life stage

The end-of-life stage of the product starts when it is replaced, dismantled or deconstructed from the installation location to final disposal.

Module D: Benefits and avoided loads beyond the product system boundary

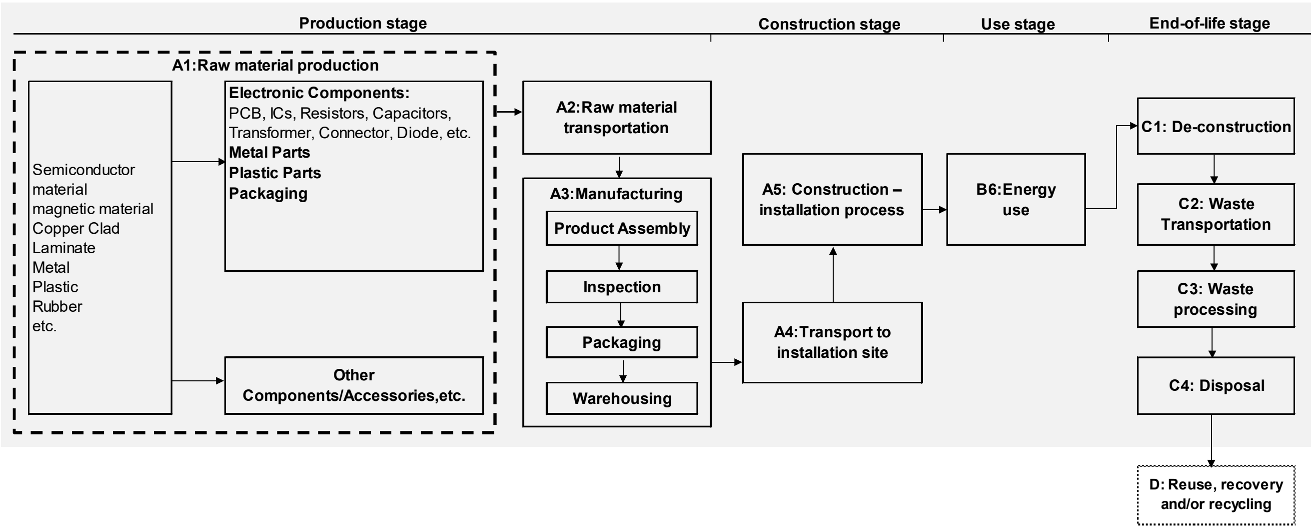


Figure 3. The Life Cycle Process Map of SUN2000-330KTL-H2

2.3. Estimates and Assumptions

In the absence of a matching lifecycle inventory to represent flow, proxy data is applied based on conservative assumptions about environmental impacts. The key assumptions of this LCA are summarized below.

- Assuming that the power consumption during uninstallation (module C1) and installation (module A5) is zero given their marginal relevance to the environmental impacts of the life cycle.

- Some processes and flows lacking activity data are hypothesized according to PCR and industry reports.

2.4. Cut-off Criteria

The cut off criteria used in this study: the material or energy flows which is insignificant for the environmental impact (<1%), at least 95% of the anticipated life cycle environmental impact associated with the functional unit.

2.5. Data Sources

Primary data were collected as far as possible for the manufacturing stage, including the amount of raw materials, material information, transportation distance, etc.The activity data comes from the Bill of Materials (BOM), Huawei Product Data Management (PDM), and Material Environmental Information Management System Insight. The emission factors come from the ecoinvent database, and the secondary data sources that do not use the software database are collected from other reliable sources, such as government reports, etc.

2.6. Data Quality

During data collection, primary data directly provided by suppliers are preferred, and secondary data that represent geographical and technical average level are selected as far as possible if primary data are not available. The secondary data mostly come from the latest applicable ecoinvent database, while industry data obtained from reliable sources are used if there is no applicable secondary data in the database. The ecoinvent database is one of the most widely used databases in the field of LCA research worldwide. It has been used in LCA models in industrial and scientific applications worldwide and has been used in many critically reviewed and published studies.

2.7. Period under Review

Most of the activity data were collected in the year 2022-2023. The Specific data manufacturing process of product collected from January 2023 to June 2023.

2.8. Allocation

Co-products and multi-output allocation

For those front-end processes used in the ecoinvent database, "Allocation, cut-off by classification" is used here to apply the assumptions to determine the supply and the distribution of impacts (allocation and substitution). The production process of the product is mainly assembly process, no other by-product are produced from the assembly process. Therefore, the distribution of energy and water is not involved. The power consumption is allocated to multi-output systems according to the production time in the same PCBA assembly, product assembly and testing processes.

EoL allocation

EOL allocation follows the requirements of EN15804:2012+A2:2019+AC:2021, the reuse, recovery, and/or recycling allocation follows the polluter pays principle and potentials are reported separately in module D.

2.9. Comparability (Optional)

Environmental declarations EPDs within the same product category but from different programmes may not be comparable, as such comparisons would require that the assumptions and context of each LCA are equivalent.

Comparing environmental performance using EPD information should consider all relevant information modules throughout the entire lifecycle. For two EPDs developed based on the same PCR comparable, at least: a) having the identical functions, technical characteristics, and uses; b) The purpose and scope definition of life cycle impact assessment are the same, including equivalent functional units, system boundaries, and cut-off criteria; c) The same data quality requirements and background database, including data collection methods, allocation methods; d) Equivalent impact assessment methods, including feature factors of the same version.

For more information about comparability, please refer to EN 15804 and ISO 14025.

3. Life Cycle Assessment Scenarios

Table 6. Transport to the building site (A4)

NAME	VALUE	UNIT
Truck transportation	90243.1	kgkm
Freight train transportation	25109.1	kgkm
Ship transportation	42095.6	kgkm

Table 7. Installation into the building (A5)

NAME	VALUE	UNIT
Biogenic carbon contained in packaging	27.15	kg CO_2

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

Table 8. Reference Service Life

NAME	VALUE	UNIT
RSL	25	years

Table 9. Operational energy use (B6)

NAME	VALUE	UNIT
Energy input, specified by activity, type and amount	175437.0	kWh

Table 10. End of life (C1-C4)

NAME		VALUE		UNIT
Assumptions for scenario development (description of deconstruction, collection, recovery, disposal method and transportation)		100		km
Materials recovery, energy recovery and disposal/landfill rate	Materials	Material recovery rate	Material recovery rate	Disposal/landfill rate
	Steel	80%	0%	20%
	Copper	60%	0%	40%
	Aluminium	70%	0%	30%
	PP	20%	40%	40%
	Other plastic	0%	50%	50%
	Rubber	0%	50%	50%
	Electronic part/Others	65%	10%	25%
	Battery	70%	0%	30%
	Packaging	64%	16%	20%

Table 11. Reuse, recovery and/or recycling potentials (D), relevant scenario information

NAME	VALUE
Further assumptions for scenario development (e.g. further processing technologies, assumptions on correction factors);	According to Printed Circuit Board Recycling Methods from EPA (United States Environmental Protection Agency), Tin/lead solder dross generated from hot air leveling and solder plating processes typically contains approximately 37% lead (Pb) and 63% tin (Sn) metals and oxides, assuming 64% of tin in waste tin slag is recyclable. Copper metal (copper foil, copper wire, etc.) can be recovered chemically from waste printed circuit boards, assuming that 40% of the copper in the recycled waste PCB can be recycled. According to the literature from

	Zackrisson M et al., it is assumed that the recovery coefficient for copper in recycled cables is 100%, and the recovery coefficient for plastic skins is 93%.

4. Life Cycle Assessment Results

Table 12. Description of the system boundary modules

	PRODUCT STAGE			CONSTRUCT-ION 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	Assembly/Install	Use	Maintenance	Repair	Replacement	Refurbishment	Building Operational Energy Use During Product Use	Building Operational Water Use During Product Use	Deconstruction	Transport	Waste processing	Disposal	Reuse, Recovery, Recycling Potential
EPD Type	X	X	X	X	X	ND	ND	ND	ND	ND	X	ND	X	X	X	X	X

4.1. Life Cycle Impact Assessment Results

Table 13. Core Environmental Impact Category Indicators Assessment Results

INDICATOR	UNIT	A1-A3	A4	A5	B6	C1	C2	C3	C4
GWP-total	kg $CO_{2\ eq}$	4.00E+03	3.22E+01	1.92E+01	1.40E+04	0.00E+00	1.07E+00	6.20E+00	2.40E+01
GWP-fossil	kg $CO_{2\ eq}$	3.99E+03	3.21E+01	1.15E+00	1.39E+04	0.00E+00	1.07E+00	6.18E+00	6.54E+00
GWP-biogenic	kg $CO_{2\ eq}$	-9.03E-02	1.06E-02	1.81E+01	7.37E+01	0.00E+00	1.10E-03	2.97E-03	1.75E+01
GWP-luluc	kg $CO_{2\ eq}$	7.80E+00	1.89E-02	1.65E-04	2.75E+01	0.00E+00	3.87E-04	1.29E-02	5.65E-04
ODP	Kg CFC 11 $_{eq}$	2.04E-04	6.88E-06	3.23E-08	1.56E-03	0.00E+00	2.57E-07	2.78E-07	1.15E-07
AP	mol H^{+}_{eq}	3.57E+01	7.06E-01	3.01E-03	9.25E+01	0.00E+00	5.43E-03	3.48E-02	5.72E-03
EP-freshwater	kg P eq	3.11E+00	1.43E-03	4.71E-05	7.03E+00	0.00E+00	6.71E-05	2.92E-03	4.60E-04
EP-marine	kg N eq	4.85E+00	1.80E-01	5.90E-03	1.62E+01	0.00E+00	1.86E-03	6.58E-03	2.96E-02
EP-terrestrial	mol N $_{eq}$	5.12E+01	1.99E+00	1.22E-02	1.65E+02	0.00E+00	2.04E-02	7.07E-02	2.03E-02
POCP	Kg NMVOC $_{eq}$	2.14E+01	5.26E-01	4.19E-03	5.54E+01	0.00E+00	6.09E-03	1.84E-02	8.69E-03
ADP-minerals & metals [2]	kg Sb $_{eq}$	6.20E-01	5.56E-05	9.47E-07	7.97E-01	0.00E+00	2.47E-06	9.13E-05	1.99E-06
ADP-fossil [2]	MJ, net calorific	4.90E+04	4.47E+02	2.85E+00	1.70E+05	0.00E+00	1.68E+01	8.02E+01	9.83E+00

	value								
WDP [2]	m^3 world $_{eq.}$ deprived	1.14E+03	1.11E+00	3.46E-01	1.30E+04	0.00E+00	5.78E-02	1.02E+00	5.65E-01

Acronyms: 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; EP-marine =Eutrophication potential, fraction of nutrients reaching marine end compartment; EP-terrestrial = Eutrophication potential, Accumulated Exceedance; POCP = Formation potential of tropospheric ozone; ADP-minerals & metals = Abiotic depletion potential for non-fossil resources ; ADP-fossil = Abiotic depletion potential for fossil resources; WDP = Water (user) deprivation potential, deprivation-weighted water consumption

Table 14. Additional Environmental Impact Category Indicators Assessment Results

INDICATOR	UNIT	A1-A3	A4	A5	B6	C1	C2	C3	C4
PM	Disease incidence	2.52E-04	2.10E-06	2.49E-08	9.88E-04	0.00E+00	1.29E-07	3.04E-07	6.82E-08
IRP [1]	kBq U235 $_{eq}$	3.80E+02	2.12E+00	1.21E-02	1.16E+03	0.00E+00	8.49E-02	8.48E-01	5.10E-02
ETP-fw [2]	CTUe	2.56E+05	3.07E+02	2.70E+01	4.99E+05	0.00E+00	1.31E+01	1.67E+02	9.82E+01
HTP-c [2]	CTUh	4.83E-06	1.61E-08	8.39E-10	2.13E-05	0.00E+00	3.62E-10	4.11E-09	1.46E-09
HTP-nc [2]	CTUh	2.04E-04	2.66E-07	4.04E-08	6.20E-04	0.00E+00	1.43E-08	2.17E-07	5.77E-08
SQP [2]	Dimensionless	1.66E+04	2.55E+02	2.20E+00	2.07E+06	0.00E+00	1.92E+01	2.81E+01	1.62E+01

Acronyms: PM = Potential incidence of disease due to PM emissions; IRP = Potential Human exposure efficiency relative to U235; Potential Comparative Toxic Unit for ecosystems; HTP-c = Potential Comparative Toxic Unit for humans; HTP-nc = Potential Comparative Toxic Unit for humans; SQP = Potential Soil quality index

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

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

4.2. Life Cycle Inventory Results

Table 15. Resource Use

INDICATOR	UNIT	A1-A3	A4	A5	B6	C1	C2	C3	C4
PENRE	MJ, LHV	4.89E+04	4.47E+02	2.85E+00	1.70E+05	0.00E+00	1.68E+01	8.02E+01	9.83E+00
PERE	MJ, LHV	5.22E+03	4.17E+00	1.22E-01	6.50E+05	0.00E+00	2.14E-01	9.66E+00	3.28E-01
PENRM	MJ, LHV	1.22E+02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PERM	MJ, LHV	4.08E+02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PENRT	MJ, LHV	4.90E+04	4.47E+02	2.85E+00	1.70E+05	0.00E+00	1.68E+01	8.02E+01	9.83E+00
PERT	MJ, LHV	5.63E+03	4.17E+00	1.22E-01	6.50E+05	0.00E+00	2.14E-01	9.66E+00	3.28E-01
FW	m^3	3.89E+01	3.79E-02	1.14E-02	4.38E+02	0.00E+00	2.00E-03	4.41E-02	1.70E-02
SM	kg	1.13E+01	1.34E-03	2.86E-05	3.94E+01	0.00E+00	6.76E-05	1.35E-03	5.63E-05
RSF	MJ, LHV	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, LHV	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Acronyms: LHV PENRE = Use of non-renewable primary energy excluding nonrenewable primary energy resources used as raw material; PERE = Use of renewable primary energy excluding renewable primary energy resources used as raw material; PENRM = Use of non-renewable primary energy resources used as raw material; PERM = Use of renewable primary energy resources used as raw material; PENRT = Total use of non-renewable primary energy resources (primary *energy and primary energy resources used as raw materials); PERT = Total use of renewable primary energy resources (primary energy and primary energy resources used as raw materials); FW = Net use of fresh water; SM = Use of secondary materials; SF = Use of renewable secondary fuels; NRSF = Use of non-renewable secondary fuels; LVH=Lower Heating value*

Table 16. Output Flows and Waste Categories

INDICATOR	UNIT	A1-A3	A4	A5	B6	C1	C2	C3	C4
HWD	kg	2.41E+01	2.04E-02	8.16E-02	2.55E+02	0.00E+00	9.25E-04	3.08E-02	1.18E+00
NHWD	kg	5.02E+02	1.87E+01	3.89E+00	2.54E+03	0.00E+00	1.57E+00	1.07E+00	1.11E+02
RWD	kg	1.24E-01	3.07E-03	9.09E-06	4.40E-01	0.00E+00	1.14E-04	2.66E-04	5.01E-05
MER	kg	0.00E+00	0.00E+00	8.65E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.00E+00
MFR	kg	1.37E+01	0.00E+00	1.22E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.72E+01
CRU	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
ETE	MJ	0.00E+00	0.00E+00	3.57E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.26E+00
EEE	MJ	0.00E+00	0.00E+00	1.79E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.71E+00

Acronyms: HWD = Hazardous waste disposed; NHWD = Non-hazardous waste disposed; RWD = Radioactive waste disposed; MER = Materials for energy recovery; MFR = Material for recycling; CRU = Components for reuse; ETE = Exported thermal energy; EEE = Exported electricity energy

Table 17. Carbon Emissions and Removals

INDICATOR	UNIT	A1-A3	A4	A5	B6	C1	C2	C3	C4
Biogenic Carbon Removal	kg $CO_{2\ eq}$	-2.55E+01	-1.81E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Biogenic Carbon Emission	kg $CO_{2\ eq}$	2.55E+01	1.24E-02	1.81E+01	7.37E+01	0.00E+00	1.10E-03	2.97E-03	1.75E+01

5. LCA Interpretation

The highest impact of SUN2000-330KTL-H2 emissions occurs from the use stage (Model A1). As a part of the photovoltaic system, the solar inverter basically does not need to consume other energy resources in the use stage. The environmental impact during this stage come from the energy loss of conversion process, and the amount of loss is related to sunshine duration, energy efficiency, and output power. Improving efficiency can effectively reduce energy loss. In addition, the environmental impact is also related to the photovoltaic system installed in the product.

Production stage (Module A) is another main contributor to environmental impact, especially the raw materials stage (A1). The configuration of inverter can have a high impact on the environmental results within its lifetime, the environmental impact may be reduced through a) increasing the data quality of components to extend the service life, b) reducing the amount of materials used and c) focus more on the on the supply chain of manufacturing of parts/components.

6. Supporting Documentation

More information about Huawei and Huawei's digital energy sustainability can be found on the website:
https://digitalpower.huawei.com/cn/sustainability.html

More information about SUN2000-330KTL-H2 can be found in the User maunal on the website:
https://support.huawei.com/enterprise/zh/doc/EDOC1100270192

7. References

1) ISO 14067:2018 Carbon footprint of products —Requirements and guidelines for quantification and communication
2) ISO 14040:2006 Environmental management — Life cycle assessment —Principles and Framework
3) ISO 14044:2006 Environmental management- Life cycle assessment Principles and guidelines
4) EN 15804:2012+A2:2019/AC:2021 Sustainability of construction works – Environmental product declarations - Core rules for the product category of construction products
5) EN 50693:2019 Product category rules for life cycle assessments of electronic and electrical products and systems
6) PCR for Electronic and electrical products and systems, EPDItaly007 Rev. 3
7) PCR for Power Inverter, EPDItaly032 Rev. 0
8) Zampori, L. and Pant,R., Suggestions for updating the Product Environmental Footprint (PEF) method, EUR 29682 EN, Publications Office of the European Union, Luxembourg, 2019,ISBN 978-92-76- 00654-1, doi:10.2760/424613, JRC115959.
9) Recommendation ITU-T L.1410 Methodology for environmental life cycle assessments of information and communication technology goods, networks and services, 2014
10) Product Environmental Footprint Category Rules Guidance, Version 6.3, May, 2018
11) Trends in photovoltaic applications 2022, IEA-PVPS Trends report
12) Printed Circuit Board Recycling Methods, Workshop Materials on WEEE Management in Taiwan, EPA
13) Zackrisson M, Christina J. Life cycle assessment and life cycle cost of waste management—plastic cable waste [J]. Advances in Chemical Engineering and Science, 2014.