Huawei Technologies Co., Ltd.

ENVIRONMENTAL PRODUCT DECLARATION

Smart String Energy Storage System

Xiapu village group Dadong gang lot,
Yonghu Town, Huiyang District,
Huizhou City,

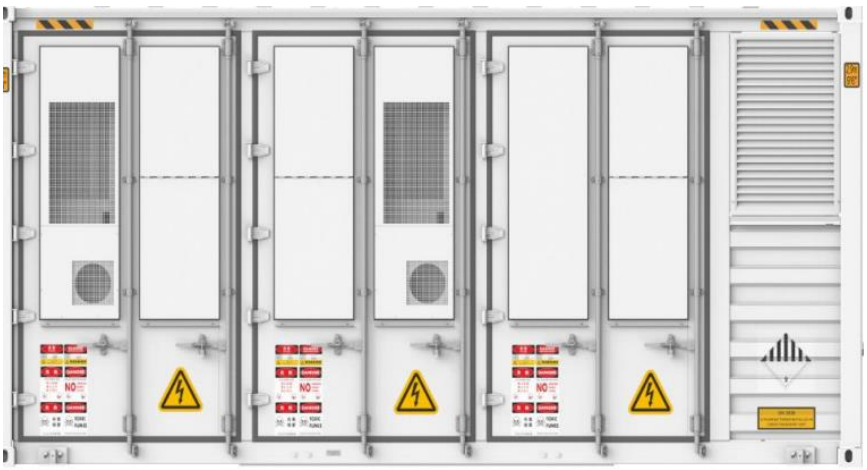
Guangdong Province, China.

in compliance with ISO 14025 and EN 50693:2019

Program Operator	EPD China
Publisher	EPDItaly

Declaration Number	*EPD-CN-00007*
Registration Number	MR-EPDITALY0091

Issue Date	_2024_ / _04_ / __29__
Valid to	_2029_ / _04_ / __29__



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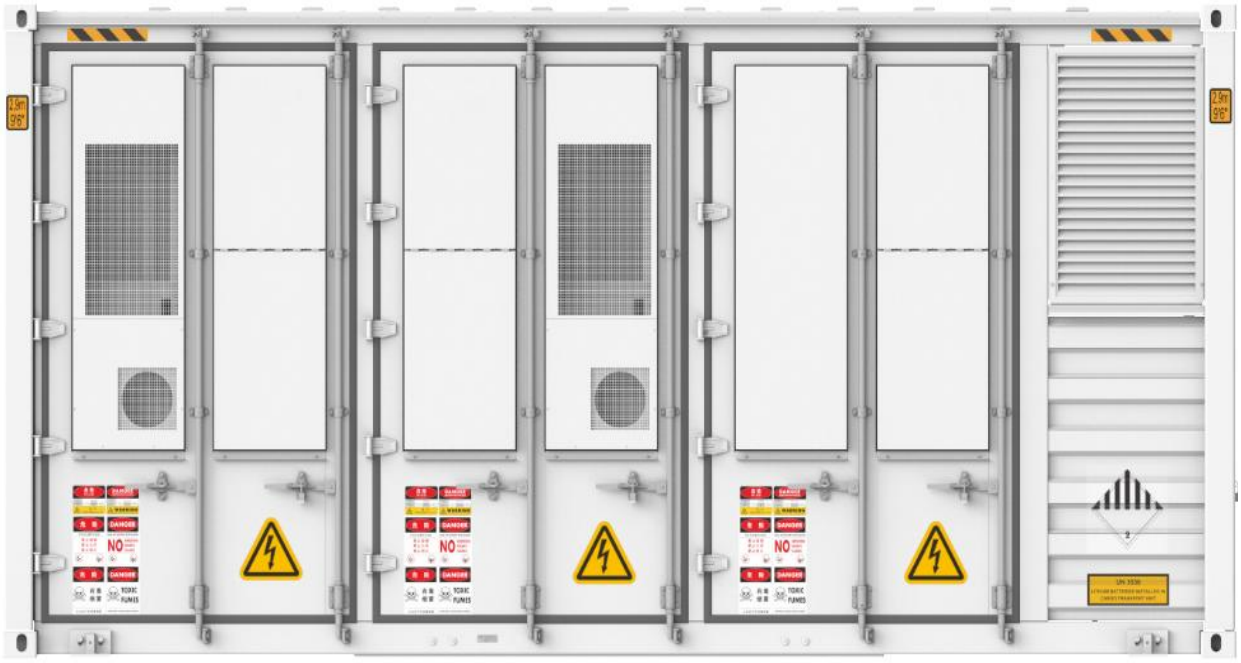
In accordance with ISO 14025 and EN 50693:2019 for:

Smart String Energy Storage System

From

Huawei Technologies Co., Ltd.

Declared product:



Programme operator:	EPD China
Registration number:	EPD-CN-00007
Issued date:	2024-04-29
Valid until:	2029-04-29

Programme Information

EPD Owner	Huawei Technologies Co., Ltd. Administration Building, Headquarters of Huawei Technologies Co., Ltd., Bantian, Longgang District, Shenzhen, 518129, P.R.C
Product Name	Smart String Energy Storage System
Production Site	Xiapu village group Dadong gang lot, Yonghu Town, Huiyang District, Huizhou City, Guangdong Province, China.
Identification of product	CPC code: 4642
Field of Application	Electronic and electrical products and systems
Programme Operator	EPD China Address of Headquarter: Tianping Road, Xuhui District, Shanghai Website: www.epdchina.cn Email: info@epdchina.cn | secretary@epdchina.cn
LCA Practitioner	TÜV SÜD Certification and Testing (China) Co., Ltd.
Responsibility	The EPD owner has the sole ownership, liability, and responsibility for the EPD
Comparability	EPDs within same category of product in different programme operator are not suggested to be compared. 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 even applying the same PCR.
Liability	The EPD owner has the sole ownership, liability, and responsibility for the EPD.
Validity	The EPD is published on 2024-04-29 and valid to2029-04-29
LCA Software (version)	SimaPro 9.5.0.0
LCI Dataset (version)	Ecoinvent 3.9.1
Year(s) of Primary Data	10/2023-12/2023
PCR	Core PCR: EPDItaly007 – PCR for Electronic and Electrical Products and System, Rev. 3-2023/01/13 Sub-category PCR: EPDItaly021 – PCR for Electronic and Electrical Products and Systems - Energy Storage, Rev. 4(23/06/2022)
Other Reference Document	Smart String Energy Storage System Life Cycle Assessment Report
Verification statement	
Independent verification of the declaration and data according to EN ISO 14025:2010 □ internal T external Third-party institution verification: Weifang Yao, WIT is an approved certification body accountable for third-party verification Approved by: EPD China	
Procedure for follow-up of data during EPD validity involves a third-party certification body: £ Yes T No	

General Information

1.1 Company information

Owner of the EPD

Huawei Technologies Co., Ltd.

Address：Administration Building, Headquarters of Huawei Technologies Co., Ltd., Bantian, Longgang District, Shenzhen, 518129, P.R.C

Description of the company

Founded in 1987, Huawei is a leading global provider of information and communications technology (ICT) infrastructure and smart devices. Huawei has 207,000 employees and operate in over 170 countries and regions, serving more than three billion people around the world. Huawei is committed to bringing digital to every person, home, and organization for a fully connected, intelligent world.

1.2 Production information

Product name: Smart String Energy Storage System

Product identification

This EPD represents Huawei's 4 models of Smart String Energy Storage System, LUNA2000-2.0MWH-1H0, LUNA2000-2.0MWH-1H1, LUNA2000-2.0MWH-2H0, LUNA2000-2.0MWH-2H1.

Production description

The declared products are mainly used in commercial energy storage scenarios. Storage of solar power, then connected to the grid, can also be used for frequency modulation. These products are mainly used in large photovoltaic power plants and has the function of storing electricity and regulating the frequency of the grid. The characteristics of the products are shown in following table.

Product model	Net weight (kg)	Dimensions (W×H×D)	Number of battery packs	Rated DC Voltage (Vd.c.)	Nominal Energy Capacity (kWh)
LUNA2000-2.0MWH-1H0	28400	6058mm×2896mm×2438mm	126	1200	2064
LUNA2000-2.0MWH-1H1	28300	6058mm×2896mm×2438mm	126	1250	2032
LUNA2000-2.0MWH-2H0	28000	6058mm×2896mm×2438mm	126	1200	2064
LUNA2000-2.0MWH-2H1	28000	6058mm×2896mm×2438mm	126	1250	2032

Material composition

The material composition of four models of per pc and per kWh stored of product is listed below. The material packaging of product is PVC and its weight per pc and per kWh stored of product is shown in table below.

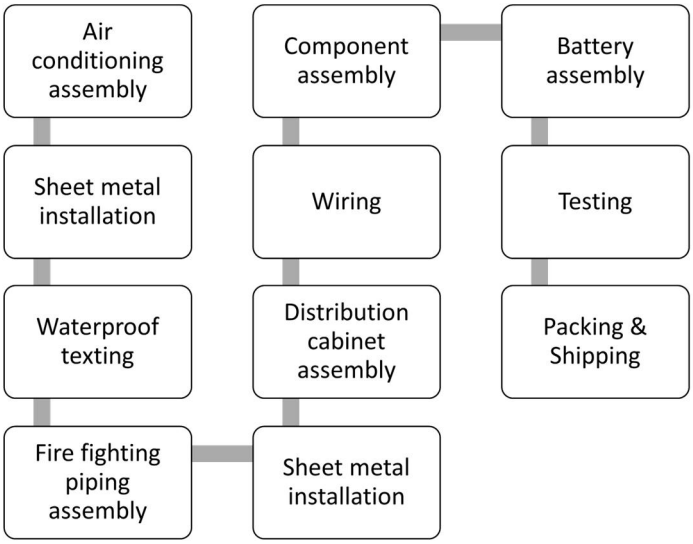
Raw materials	LUNA2000-2.0MWH-1H0		LUNA2000-2.0MWH-1H1		LUNA2000-2.0MWH-2H0		LUNA2000-2.0MWH-2H1	
	/pc	/kWh	/pc	/kWh	/pc	/kWh	/pc	/kWh
Printed Card Board (m^2)	11.4100	0.0055	11.4056	0.0056	10.2895	0.0050	10.2895	0.0051
Instruments and meters (kg)	8.8800	0.0043	8.8800	0.0044	8.8800	0.0043	8.8800	0.0044
Cable (kg)	336.0600	0.1628	338.7218	0.1667	266.1880	0.1290	156.2512	0.0769
Radio frequency components (kg)	0.0001	4.84E-08	0.0001	4.92E-08	0.0001	4.84E-08	0.0001	4.92E-08
Wire wound resistor (kg)	1.6420	0.0008	1.6420	0.0008	1.2647	0.0006	1.2647	0.0006
Integrated circuit – logic tyle (kg)	1.5927	0.0008	1.5891	0.0008	1.1605	0.0006	0.6962	0.0003
Connector (kg)	65.2144	0.0316	65.3891	0.0322	51.9785	0.0252	51.8891	0.0255
Controller (kg)	20.8890	0.0101	20.8890	0.0103	12.0924	0.0059	3.3526	0.0016
Switch (kg)	144.5191	0.0700	144.5187	0.0711	112.3485	0.0544	112.3490	0.0553
Resistor – metal film type (kg)	0.8119	0.0004	0.8119	0.0004	0.8088	0.0004	0.0297	1.46E-05
Fan (kg)	78.7657	0.0382	78.7657	0.0388	75.0457	0.0364	76.7293	0.0378
LED (kg)	0.0011	5.33E-07	0.0011	5.41E-07	0.0010	4.84E-07	0.0010	4.92E-07
Inductor – ring core choke type (kg)	87.3903	0.0423	87.3903	0.0430	45.8959	0.0222	45.8959	0.0226
Inductor, multilayer chip (kg)	0.1678	0.0001	0.1678	0.0001	0.1452	0.0001	0.1452	0.0001
Power supply (kg)	0.9000	0.0004	0.9000	0.0004	0.9000	0.0004	0.9000	0.0004
Buzzer (kg)	0.0020	9.69E-07	0.0020	9.84E-07	0.0020	9.69E-07	0.0020	9.84E-07
Capacitor – electrolyte type (kg)	8.2494	0.0040	8.2494	0.0041	7.9923	0.0039	7.9923	0.0039
Battery cell, Li-ion, LFP (kg)	12096.0000	5.8605	12476.2800	6.1399	12096.0000	5.8605	12476.2816	6.1399

Raw materials	LUNA2000-2.0MWH-1H0		LUNA2000-2.0MWH-1H1		LUNA2000-2.0MWH-2H0		LUNA2000-2.0MWH-2H1	
	/pc	/kWh	/pc	/kWh	/pc	/kWh	/pc	/kWh
Battery cell, manganese dioxide (kg)	0.0241	1.17E-05	0.0200	9.84E-06	0.0151	7.32E-06	0.0151	7.43E-06
Transformer (kg)	4.9762	0.0024	4.9762	0.0024	3.5267	0.0017	3.5258	0.0017
Integrated circuit – memory type (kg)	0.2199	0.0001	0.0000	0.0000	0.2173	0.0001	0.2150	0.0001
Magnetic (kg)	17.4636	0.0085	17.4636	0.0086	9.7077	0.0047	2.9877	0.0015
Plug (kg)	2.0951	0.0010	2.0951	0.0010	1.9243	0.0009	1.9267	0.0009
Capacitor – film type (kg)	3.1552	0.0015	3.1552	0.0016	1.7629	0.0009	1.7629	0.0009
Transistor – surface mounted (kg)	10.6883	0.0052	10.6883	0.0053	8.7097	0.0042	8.7097	0.0043
Diode - surface mounted (kg)	1.1935	0.0006	1.1935	0.0006	0.9970	0.0005	0.9970	0.0005
Resistor - surface mounted (kg)	62.5119	0.0303	64.9181	0.0319	60.0039	0.0291	51.6476	0.0254
Capacitor - surface mounted (kg)	7.1130	0.0034	7.1130	0.0035	6.7361	0.0033	6.7361	0.0033
Other electronic components - passive (kg)	0.1244	0.0001	0.1244	0.0001	0.1242	0.0001	0.1242	0.0001
LCD (kg)	0.0099	4.80E-06	0.0099	4.87E-06	0.0099	4.80E-06	0.0099	4.87E-06
Steel (kg)	13881.5000	6.7255	13464.3120	6.6261	13728.9030	6.6516	13311.7170	6.5510
Copper (kg)	294.5600	0.1427	444.2480	0.2186	259.5600	0.1258	409.2480	0.2014
Aluminum (kg)	734.4500	0.3558	918.4100	0.4520	600.8500	0.2911	784.8100	0.3862
Zinc (kg)	16.5000	0.0080	16.5000	0.0081	12.5000	0.0061	12.5000	0.0062
PA (kg)	16.1100	0.0078	16.1100	0.0079	15.7100	0.0076	15.7100	0.0077
PC (kg)	632.6300	0.3065	652.1600	0.3209	631.9100	0.3062	651.4400	0.3206
PET (kg)	0.0900	4.36E-05	0.0900	4.43E-05	0.0700	3.39E-05	0.0700	3.44E-05
PE (kg)	8.3000	0.0040	8.3000	0.0041	6.3000	0.0031	6.3000	0.0031
ABS (kg)	4.1000	0.0020	4.1000	0.0020	3.1000	0.0015	3.1000	0.0015
Rubber (kg)	60.5900	0.0294	60.5900	0.0298	50.5900	0.0245	50.5900	0.0249
Silicone (kg)	1.2000	0.0006	1.2000	0.0006	0.6000	0.0003	0.6000	0.0003

Raw materials	LUNA2000-2.0MWH-1H0		LUNA2000-2.0MWH-1H1		LUNA2000-2.0MWH-2H0		LUNA2000-2.0MWH-2H1	
	/pc	/kWh	/pc	/kWh	/pc	/kWh	/pc	/kWh
R134a (kg)	23.9000	0.0116	23.9000	0.0118	23.9000	0.0116	23.9000	0.0118
HFC-227e (kg)	28.5000	0.0138	28.5000	0.0140	28.5000	0.0138	28.5000	0.0140
PVC (packaging material) (kg)	40.0000	0.0194	40.0000	0.0197	40.0000	0.0194	40.0000	0.0197

Production process flow of product

The production process of product is shown below.



1.3 Type of EPD

The type of EPD is specific product EPD. The product declared in this EPD is Smart String Energy Storage System, including four models LUNA2000-2.0MWH-1H0, LUNA2000-2.0MWH-1H0, LUNA2000-2.0MWH-1H0 and LUNA2000-2.0MWH-1H0.

2 LCA information

Functional unit

The functional unit for the products assessed in this report is per kWh of smart string energy storage system with 10 years RSL. The environmental impacts are reported for 1 kWh stored by a smart string energy storage system.

The smart string energy storage system is for industrial use with the cell technology of lithium iron phosphate. The coupling type of the product is DC.

Time boundary

The plant had continuous production during 2023. Time boundary of data for product assessed in the report is 2023-10-01 to 2023-12-31. There is continuous production of the four models of product during this period. These latest statistics can provide more representative results with stronger effectiveness for a given period of time.

Description of system boundary

According to PCR EPDItaly021 and EN 50693, the product life cycle system boundary assessed in this report include following life cycle stages: manufacturing stage, distribution stage, installation stage, use & maintenance stage, and end-of-life stage.

Table: Process stages and EPD modules (X = including; MND = excluding)

<table>
<tr><td>Stage</td><td colspan="2">MANUFACTURING STAGE</td><td>DISTRIBUTION STAGE</td><td>INSTALLATION STAGE</td><td>USE & Maintenance STAGE</td><td>END-OF-LIFE STAGE</td></tr>
<tr><td>Stage declared</td><td colspan="2">X</td><td>X</td><td>X</td><td>X</td><td>X</td></tr>
<tr><td>Module</td><td>UPSTREAM MODULE</td><td>CORE MODULE</td><td colspan="3">DOWNSTREAM MODULE</td></tr>
<tr><td></td><td>Extraction of raw materials, including waste recycling processes and the production of semi-finished and ancillary products</td><td>Manufacturing of the product constituents, including all the stages</td><td colspan="3" rowspan="4">IN ACCORDANCE WITH EN 50693</td></tr>
<tr><td></td><td>Transportation of raw materials to the manufacturing company</td><td>Product assembly</td></tr>
<tr><td></td><td></td><td>Packaging</td></tr>
<tr><td></td><td></td><td>Waste handling processes</td></tr>
</table>

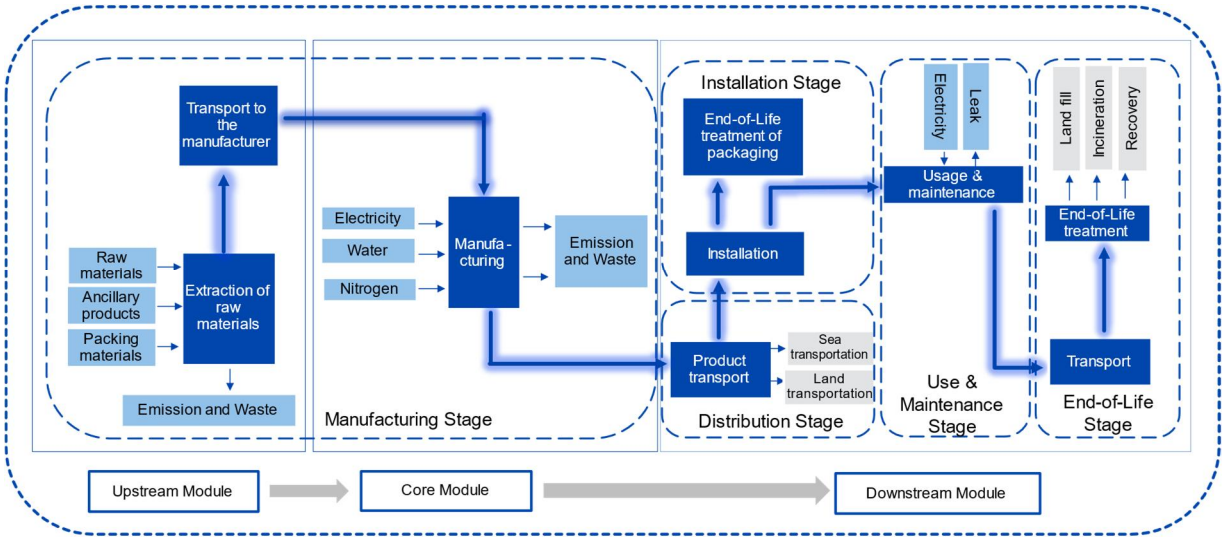


Figure: system diagram

- Manufacturing stage, including the production and processing of raw materials, ancillary products and packing materials, and transportation to the manufacturing company, and includes the resources and energy consumption during manufacturing process.
- Distribution stage, including the distribution of the product at the installation site.
- Installation stage, including the end-of-life process of the packaging.
- Use & maintenance stage, including the energy consumption, including E_{use} (maximum power was considered) and E_{loss}, within the RSL (10 years) associated to the product. The product has extraordinary maintenance during the RSL. The extraordinary maintenance rates are extreme low according to the past user data analysis that the relevant flows and operations are cut-off.

The following formula is used to calculate the electricity consumed during the RSL of 10 years.

$$E_{tot}[kWh] = E_{use} + E_{loss}$$

$$E_{use}[kWh] = P_{use} \times 8760 \times RSL$$

$$E_{loss}[kWh] = \sum_{i=0}^{RSL} \frac{E_{useful\ i} \times N_{cycles} \times 365}{DC\ RTEi} \times (1 - DC\ RTEi)$$

The Nominal Operating Temperature equal to 25 °C.

The $N_{cycles} = 1$ was considered per day according to the PCR.

The E_{use} and E_{loss} of per pc of declared product within RSL are showed in following tables.

Product model	P_{use} (maximum) (kWh)	E_{use} (kWh)	E_{loss} (kWh)
LUNA2000-2.0MWH-1H0	52.20	4572720.00	621599.13
LUNA2000-2.0MWH-1H1	52.20	4572720.00	671112.94
LUNA2000-2.0MWH-2H0	33.90	2969640.00	650258.93
LUNA2000-2.0MWH-2H1	33.90	2969640.00	576002.01

In this stage, the charge of battery system consumes photovoltaic electricity, and the storage equipment auxiliaries services that are not cycle related consume grid electricity. The electricity mix data is taken where the process takes place (Chile) based on grid mixes of the country from the Ecoinvent database. The electricity profiles are showed below.

Country	Production mix	Electricity mix technology reference
Chile	Electricity, low voltage {CL}| market for electricity, low voltage | Cut-off, U	2022
	Electricity, low voltage {RoW}| electricity production, photovoltaic, 570kWp open ground installation, multi-Si | Cut-off, U	2022

Ÿ End-of-life stage, including the transportation of product to the collection, recycling and disposal site, and the product separation operations, and the final disposal processes.

Cut-off criteria

According to the PCR EPDItaly021 and EN 50693:2019, the cut-off criteria are set to a maximum of 5% of the overall environmental impact of the analyzed product system.

Scenario assumptions

The scenario assumptions are as follows:

In distribution stage, the specific scenario is applied: the distributed market of the products assessed in this report is Chile. The transportation means and distance of product is manufacturing company (Huizhou City, Guangdong Province, China) - lorry transport (70km) - port of exporting country (Shekou Port, Shenzhen, Guangdong Province China) - sea transport (19468km) - port of importing country (Valparaiso Port, Chile) - lorry transport (119km) - installation site (Capital Santiago, Chile).

In the installation stage, the default recycling rate 50% are applied to the recycling rates of the waste packaging, The remain disposal part is assumed to be incineration and landfill.

In use & maintenance stage, the average annual refrigerant leakage is assumed to be 3g/a, the effusion coefficient of fire extinguisher is assumed to be 5%.

In end-of-life stage, the end-of-life transport distance of 100 km is assumed. The default ratios showed as followed table are applied to the recycling and disposal rates for each material and component of the disassembled product. The remain disposal part is assumed to be landfill or incineration without energy recovery.

Material or component	Recycling rate	Final disposal rate
Steel	80%	20%
Aluminum	70%	30%
Copper	60%	40%
Zinc	60%	40%
PP	60%	40%
ABS	60%	40%
Other plastics	50%	50%
Rubber	50%	50%
Cable	24%	76%
PCB	60%	40%
Battery	45%	55%

Date sources

The specific data within the time boundary and system boundary was submitted by Huawei. The generic data was chosen according to their time, technical and geographical representativeness. The database applied for generic data was the latest version as of the time of assessment, namely Ecoinvent (cut-off) 3.9.1 and represent a reference year within 10 years.

Database and LCA software used:

Ecoinvent 3.9.1 Database, Simapro 9.5.0.0 Software

Allocation principles

Allocation between co-products

The manufacturer produces more than one product, “Multi-Output” is applied as an allocation rule that based on a quantitative calculation of the resource consumption and the emissions in relation to the distribution of economic aspects.

Allocation for recovery operations

For the allocation of recycling and recovery, the polluter pays principle (PPP) is followed in this LCA study. This means that the entire environmental impacts of waste treatment procedures (from de-installation to the waste processing and disposal) to the producer. While the benefit, the load from waste treatment for recycling purposes is allocated to the next life cycle of substituted products, hence no burden or benefit will be allocated to the primary producer of the transformer products (cut-off approach).

3 LCA results

3.1 Environmental Impacts

The results of the underlying LCA are provided in this section as environmental impacts, resource use, and waste production. The life cycle assessment results are reported per kWh stored of each smart string energy storage system model.

Table: Environmental impacts

RESULTS OF THE LCA - ENVIRONMENTAL IMPACT of per kWh stored of LUNA2000-2.0MWH-1H0								
Impact Categories	Unit	Total	Manufacturing stage		Distribution stage	Installation stage	Use & maintenance stage	End-of-life stage
			Upstream module	Core module	Downstream module			
Global Warming Potential total (GWP-total)	[kg CO_2 eq.]	1.35E+03	1.11E+02		3.00E+00	4.62E-03	1.21E+03	1.90E+01
Global Warming Potential biogenic (GWP-biogenic)	[kg CO_2 eq.]	1.01E+00	1.03E+00		-4.64E-04	3.52E-06	-3.68E-01	3.49E-01
Global Warming Potential fossil fuels (GWP-fossil)	[kg CO_2 eq.]	1.35E+03	1.10E+02		3.00E+00	4.61E-03	1.21E+03	1.86E+01
Global Warming Potential land use and land use change (GWP-luluc)	[kg CO_2 eq.]	3.67E-01	1.26E-01		2.24E-03	3.02E-07	2.35E-01	3.61E-03
Depletion potential of the stratospheric ozone layer (ODP)	[kg CFC 11 eq.]	3.11E-05	1.35E-05		4.57E-08	4.38E-11	1.70E-05	5.30E-07
Acidification potential, Accumulated Exceedance (AP)	[mol H+ eq.]	1.19E+01	2.06E+00		8.24E-02	4.06E-06	9.75E+00	1.67E-02
Eutrophication potential, fraction of nutrients reaching freshwater end compartment (EP-freshwater)	[kg P eq.]	9.75E-01	1.05E-01		1.13E-04	9.90E-08	8.68E-01	2.59E-03
Eutrophication potential, fraction of nutrients reaching marine end compartment (EP-marine)	[kg N eq.]	2.41E+00	1.90E-01		2.07E-02	3.94E-06	2.20E+00	4.07E-03
Eutrophication potential, Accumulated Exceedence (EP-terrestrial)	[mol N eq.]	2.78E+01	4.48E+00		2.29E-01	1.55E-05	2.30E+01	4.05E-02
Formation potential of tropospheric ozone (POCP)	[kg NMVOC eq.]	6.81E+00	5.61E-01		6.23E-02	7.95E-06	6.17E+00	1.38E-02
Abiotic depletion potential for non-fossil resources (ADP-minerals&metals)	[kg Sb eq.]	2.36E-02	1.26E-02		3.37E-06	1.69E-09	1.09E-02	1.77E-05
Abiotic depletion potential for fossil resources (ADP-fossil)	MJ, net calorific value	1.60E+04	1.31E+03		3.74E+01	4.24E-03	1.46E+04	5.14E+01
Water deprivation potential, deprivation-weighted water consumption (WDP)	[m^3 world eq. Deprived]	1.28E+02	2.74E+01		9.53E-02	3.09E-03	9.97E+01	1.18E+00

RESULTS OF THE LCA - ENVIRONMENTAL IMPACT of per kWh stored by LUNA2000-2.0MWH-1H1							
Impact Categories	Unit	Total	Manufacturing stage		Distribution stage	Installation stage	Use & maintenance stage	End-of-life stage
			Upstream module	Core module	Downstream module			
Global Warming Potential total (GWP-total)	[kg CO_2 eq.]	1.37E+03	1.17E+02		3.03E+00	4.69E-03	1.24E+03	1.95E+01
Global Warming Potential biogenic (GWP-biogenic)	[kg CO_2 eq.]	9.72E-01	1.02E+00		-4.69E-04	3.58E-06	-3.66E-01	3.23E-01
Global Warming Potential fossil fuels (GWP-fossil)	[kg CO_2 eq.]	1.37E+03	1.16E+02		3.03E+00	4.69E-03	1.24E+03	1.92E+01
Global Warming Potential land use and land use change (GWP-luluc)	[kg CO_2 eq.]	3.80E-01	1.31E-01		2.27E-03	3.06E-07	2.43E-01	3.75E-03
Depletion potential of the stratospheric ozone layer (ODP)	[kg CFC 11 eq.]	3.18E-05	1.38E-05		4.63E-08	4.45E-11	1.74E-05	5.55E-07
Acidification potential, Accumulated Exceedance (AP)	[mol H+ eq.]	1.22E+01	2.18E+00		8.34E-02	4.12E-06	9.92E+00	1.73E-02
Eutrophication potential, fraction of nutrients reaching freshwater end compartment (EP-freshwater)	[kg P eq.]	1.00E+00	1.18E-01		1.14E-04	1.01E-07	8.83E-01	2.70E-03
Eutrophication potential, fraction of nutrients reaching marine end compartment (EP-marine)	[kg N eq.]	2.46E+00	2.03E-01		2.10E-02	4.00E-06	2.23E+00	4.23E-03
Eutrophication potential, Accumulated Exceedence (EP-terrestrial)	[mol N eq.]	2.84E+01	4.75E+00		2.32E-01	1.58E-05	2.34E+01	4.21E-02
Formation potential of tropospheric ozone (POCP)	[kg NMVOC eq.]	6.95E+00	5.97E-01		6.30E-02	8.07E-06	6.28E+00	1.43E-02
Abiotic depletion potential for non-fossil resources (ADP-minerals&metals)	[kg Sb eq.]	2.46E-02	1.33E-02		3.41E-06	1.72E-09	1.12E-02	1.83E-05
Abiotic depletion potential for fossil resources (ADP-fossil)	MJ, net calorific value	1.63E+04	1.37E+03		3.78E+01	4.30E-03	1.48E+04	5.35E+01
Water deprivation potential, deprivation-weighted water consumption (WDP)	[m^3 world eq. Deprived]	1.33E+02	2.89E+01		9.64E-02	3.14E-03	1.03E+02	1.23E+00

RESULTS OF THE LCA - ENVIRONMENTAL IMPACT of per kWh stored of LUNA2000-2.0MWH-2H0							
Impact Categories	Unit	Total	Manufacturing stage		Distribution stage	Installation stage	Use & maintenance stage	End-of-life stage
			Upstream module	Core module	Downstream module			
Global Warming Potential total (GWP-total)	[kg CO_2 eq.]	9.24E+02	1.03E+02		2.96E+00	4.62E-03	7.99E+02	1.88E+01
Global Warming Potential biogenic (GWP-biogenic)	[kg CO_2 eq.]	1.04E+00	9.63E-01		-4.57E-04	3.52E-06	-2.03E-01	2.81E-01
Global Warming Potential fossil fuels (GWP-fossil)	[kg CO_2 eq.]	9.23E+02	1.02E+02		2.95E+00	4.61E-03	7.99E+02	1.85E+01
Global Warming Potential land use and land use change (GWP-luluc)	[kg CO_2 eq.]	2.95E-01	1.17E-01		2.21E-03	3.02E-07	1.72E-01	3.58E-03
Depletion potential of the stratospheric ozone layer (ODP)	[kg CFC 11 eq.]	2.57E-05	1.34E-05		4.51E-08	4.38E-11	1.17E-05	5.29E-07
Acidification potential, Accumulated Exceedance (AP)	[mol H+ eq.]	8.47E+00	1.98E+00		8.12E-02	4.06E-06	6.40E+00	1.66E-02
Eutrophication potential, fraction of nutrients reaching freshwater end compartment (EP-freshwater)	[kg P eq.]	6.68E-01	9.65E-02		1.11E-04	9.90E-08	5.69E-01	2.58E-03
Eutrophication potential, fraction of nutrients reaching marine end compartment (EP-marine)	[kg N eq.]	1.64E+00	1.76E-01		2.04E-02	3.94E-06	1.44E+00	4.04E-03
Eutrophication potential, Accumulated Exceedence (EP-terrestrial)	[mol N eq.]	1.97E+01	4.36E+00		2.26E-01	1.55E-05	1.50E+01	4.01E-02
Formation potential of tropospheric ozone (POCP)	[kg NMVOC eq.]	4.65E+00	5.21E-01		6.14E-02	7.95E-06	4.05E+00	1.37E-02
Abiotic depletion potential for non-fossil resources (ADP-minerals&metals)	[kg Sb eq.]	1.91E-02	1.15E-02		3.33E-06	1.69E-09	7.50E-03	1.75E-05
Abiotic depletion potential for fossil resources (ADP-fossil)	MJ, net calorific value	1.09E+04	1.22E+03		3.68E+01	4.24E-03	9.58E+03	5.11E+01
Water deprivation potential, deprivation-weighted water consumption (WDP)	[m^3 world eq. Deprived]	1.01E+02	2.61E+01		9.39E-02	3.09E-03	7.37E+01	1.17E+00

RESULTS OF THE LCA - ENVIRONMENTAL IMPACT of per kWh stored of LUNA2000-2.0MWH-2H1							
Impact Categories	Unit	Total	Manufacturing stage		Distribution stage	Installation stage	Use & maintenance stage	End-of-life stage
			Upstream module	Core module	Downstream module			
Global Warming Potential total (GWP-total)	[kg CO_2 eq.]	9.41E+02	1.11E+02		3.00E+00	4.69E-03	8.09E+02	1.93E+01
Global Warming Potential biogenic (GWP-biogenic)	[kg CO_2 eq.]	9.87E-01	9.96E-01		-4.64E-04	3.58E-06	-2.17E-01	2.09E-01
Global Warming Potential fossil fuels (GWP-fossil)	[kg CO_2 eq.]	9.40E+02	1.09E+02		3.00E+00	4.69E-03	8.09E+02	1.91E+01
Global Warming Potential land use and land use change (GWP-luluc)	[kg CO_2 eq.]	2.98E-01	1.23E-01		2.24E-03	3.06E-07	1.69E-01	3.71E-03
Depletion potential of the stratospheric ozone layer (ODP)	[kg CFC 11 eq.]	2.60E-05	1.37E-05		4.58E-08	4.45E-11	1.17E-05	5.54E-07
Acidification potential, Accumulated Exceedance (AP)	[mol H+ eq.]	8.65E+00	2.07E+00		8.25E-02	4.12E-06	6.48E+00	1.72E-02
Eutrophication potential, fraction of nutrients reaching freshwater end compartment (EP-freshwater)	[kg P eq.]	6.87E-01	1.08E-01		1.13E-04	1.01E-07	5.76E-01	2.68E-03
Eutrophication potential, fraction of nutrients reaching marine end compartment (EP-marine)	[kg N eq.]	1.67E+00	1.87E-01		2.07E-02	4.00E-06	1.46E+00	4.17E-03
Eutrophication potential, Accumulated Exceedence (EP-terrestrial)	[mol N eq.]	2.02E+01	4.63E+00		2.29E-01	1.58E-05	1.53E+01	4.15E-02
Formation potential of tropospheric ozone (POCP)	[kg NMVOC eq.]	4.73E+00	5.57E-01		6.24E-02	8.07E-06	4.10E+00	1.42E-02
Abiotic depletion potential for non-fossil resources (ADP-minerals&metals)	[kg Sb eq.]	1.94E-02	1.18E-02		3.38E-06	1.72E-09	7.50E-03	1.82E-05
Abiotic depletion potential for fossil resources (ADP-fossil)	MJ, net calorific value	1.11E+04	1.30E+03		3.74E+01	4.30E-03	9.69E+03	5.31E+01
Water deprivation potential, deprivation-weighted water consumption (WDP)	[m^3 world eq. Deprived]	1.01E+02	2.73E+01		9.54E-02	3.14E-03	7.21E+01	1.22E+00

3.2 Resource use and waste production

RESULTS OF THE LCA - Resource use and waste production of per kWh stored of LUNA2000-2.0MWH-1H0							
Impact category	Unit	Total	Manufacturing stage	Distribution stage	Installation stage	Use & maintenance stage	End-of-life stage
			Upstream module	Core module	Downstream module		
Use of renewable primary energy excluding renewable primary energy resources used as raw materials (PERE)	MJ	5.74E+03	1.27E+02	2.88E-01	3.36E-04	5.61E+03	2.85E+00
Use of renewable primary energy resources used as raw materials (PERM)	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Total use of renewable primary energy resources (PERT) (primary energy and primary energy resources used as raw materials)	MJ	5.74E+03	1.27E+02	2.88E-01	3.36E-04	5.61E+03	2.85E+00
Use of non-renewable primary energy excluding non- renewable primary energy resources used as raw materials (PENRE)	MJ	1.60E+04	1.30E+03	3.74E+01	4.24E-03	1.46E+04	5.14E+01
Use of non-renewable primary energy resources used as raw materials (PENRM)	MJ	1.07E+01	1.07E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Total use of non-renewable primary energy resources (PENRT) (primary energy and primary energy resources used as raw materials)	MJ	1.60E+04	1.31E+03	3.74E+01	4.24E-03	1.46E+04	5.14E+01
Use of secondary material (SM)	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Use of renewable secondary fuels (RSF)	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Use of non-renewable secondary fuels (NRSF)	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Net use of fresh water (FW)	m^3	4.71E+00	8.09E-01	3.32E-03	9.44E-05	3.87E+00	3.29E-02
Hazardous waste disposed (HWD)	kg	1.43E+00	8.64E-02	5.40E-04	2.85E-05	1.09E+00	2.53E-01
Non-hazardous waste disposed (NHWD)	kg	1.40E+02	3.00E+01	4.32E-01	6.26E-04	1.06E+02	3.28E+00
Radioactive waste disposed (RWD)	kg	3.43E-03	1.60E-03	4.53E-06	4.08E-09	1.76E-03	5.64E-05
Components for re-use (CRU)	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Materials for recycling (MFR)	kg	8.59E+00	0.00E+00	0.00E+00	9.69E-03	0.00E+00	8.58E+00
Materials for energy recovery (MER)	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Exported electricity energy (EEE)	MJ	1.43E+00	8.64E-02	5.40E-04	2.85E-05	1.09E+00	2.53E-01
Exported thermal energy (ETE)	MJ	1.40E+02	3.00E+01	4.32E-01	6.26E-04	1.06E+02	3.28E+00

RESULTS OF THE LCA - Resource use and waste production of per kWh stored of LUNA2000-2.0MWH-1H1							
Impact category	Unit	Total	Manufacturing stage	Distribution stage	Installation stage	Use & maintenance stage	End-of-life stage
			Upstream module	Core module	Downstream module		
Use of renewable primary energy excluding renewable primary energy resources used as raw materials (PERE)	MJ	5.94E+03	1.34E+02	2.92E-01	3.42E-04	5.80E+03	2.95E+00
Use of renewable primary energy resources used as raw materials (PERM)	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Total use of renewable primary energy resources (PERT) (primary energy and primary energy resources used as raw materials)	MJ	5.94E+03	1.34E+02	2.92E-01	3.42E-04	5.80E+03	2.95E+00
Use of non-renewable primary energy excluding non- renewable primary energy resources used as raw materials (PENRE)	MJ	1.63E+04	1.36E+03	3.78E+01	4.30E-03	1.48E+04	5.35E+01
Use of non-renewable primary energy resources used as raw materials (PENRM)	MJ	1.12E+01	1.12E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Total use of non-renewable primary energy resources (PENRT) (primary energy and primary energy resources used as raw materials)	MJ	1.63E+04	1.37E+03	3.78E+01	4.30E-03	1.48E+04	5.35E+01
Use of secondary material (SM)	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Use of renewable secondary fuels (RSF)	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Use of non-renewable secondary fuels (NRSF)	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Net use of fresh water (FW)	m^3	4.88E+00	8.53E-01	3.36E-03	9.58E-05	3.99E+00	3.42E-02
Hazardous waste disposed (HWD)	kg	1.52E+00	9.01E-02	5.47E-04	2.89E-05	1.13E+00	2.95E-01
Non-hazardous waste disposed (NHWD)	kg	1.44E+02	3.15E+01	4.37E-01	6.36E-04	1.08E+02	3.34E+00
Radioactive waste disposed (RWD)	kg	3.55E-03	1.66E-03	4.58E-06	4.15E-09	1.83E-03	5.85E-05
Components for re-use (CRU)	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Materials for recycling (MFR)	kg	8.76E+00	0.00E+00	0.00E+00	9.69E-03	0.00E+00	8.75E+00
Materials for energy recovery (MER)	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Exported electricity energy (EEE)	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Exported thermal energy (ETE)	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

RESULTS OF THE LCA - Resource use and waste production of per kWh stored of LUNA2000-2.0MWH-2H0							
Impact category	Unit	Total	Manufacturing stage	Distribution stage	Installation stage	Use & maintenance stage	End-of-life stage
			Upstream module	Core module	Downstream module		
Use of renewable primary energy excluding renewable primary energy resources used as raw materials (PERE)	MJ	4.24E+03	1.10E+02	2.84E-01	3.36E-04	4.13E+03	2.82E+00
Use of renewable primary energy resources used as raw materials (PERM)	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Total use of renewable primary energy resources (PERT) (primary energy and primary energy resources used as raw materials)	MJ	4.24E+03	1.10E+02	2.84E-01	3.36E-04	4.13E+03	2.82E+00
Use of non-renewable primary energy excluding non- renewable primary energy resources used as raw materials (PENRE)	MJ	1.09E+04	1.21E+03	3.68E+01	4.24E-03	9.58E+03	5.11E+01
Use of non-renewable primary energy resources used as raw materials (PENRM)	MJ	1.05E+01	1.05E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Total use of non-renewable primary energy resources (PENRT) (primary energy and primary energy resources used as raw materials)	MJ	1.09E+04	1.22E+03	3.68E+01	4.24E-03	9.58E+03	5.11E+01
Use of secondary material (SM)	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Use of renewable secondary fuels (RSF)	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Use of non-renewable secondary fuels (NRSF)	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Net use of fresh water (FW)	m^3	3.63E+00	7.54E-01	3.27E-03	9.44E-05	2.84E+00	3.27E-02
Hazardous waste disposed (HWD)	kg	1.13E+00	8.16E-02	5.33E-04	2.85E-05	8.33E-01	2.10E-01
Non-hazardous waste disposed (NHWD)	kg	9.95E+01	2.51E+01	4.26E-01	6.26E-04	7.07E+01	3.25E+00
Radioactive waste disposed (RWD)	kg	2.78E-03	1.38E-03	4.46E-06	4.08E-09	1.33E-03	5.59E-05
Components for re-use (CRU)	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Materials for recycling (MFR)	kg	8.46E+00	0.00E+00	0.00E+00	9.69E-03	0.00E+00	8.45E+00
Materials for energy recovery (MER)	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Exported electricity energy (EEE)	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Exported thermal energy (ETE)	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

RESULTS OF THE LCA - Resource use and waste production of per kWh stored of LUNA2000-2.0MWH-2H1							
Impact category	Unit	Total	Manufacturing stage	Distribution stage	Installation stage	Use & maintenance stage	End-of-life stage
			Upstream module	Core module	Downstream module		
Use of renewable primary energy excluding renewable primary energy resources used as raw materials (PERE)	MJ	4.17E+03	1.26E+02	2.89E-01	3.42E-04	4.04E+03	2.92E+00
Use of renewable primary energy resources used as raw materials (PERM)	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Total use of renewable primary energy resources (PERT) (primary energy and primary energy resources used as raw materials)	MJ	4.17E+03	1.26E+02	2.89E-01	3.42E-04	4.04E+03	2.92E+00
Use of non-renewable primary energy excluding non- renewable primary energy resources used as raw materials (PENRE)	MJ	1.11E+04	1.29E+03	3.74E+01	4.30E-03	9.69E+03	5.31E+01
Use of non-renewable primary energy resources used as raw materials (PENRM)	MJ	1.10E+01	1.10E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Total use of non-renewable primary energy resources (PENRT) (primary energy and primary energy resources used as raw materials)	MJ	1.11E+04	1.30E+03	3.74E+01	4.30E-03	9.69E+03	5.31E+01
Use of secondary material (SM)	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Use of renewable secondary fuels (RSF)	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Use of non-renewable secondary fuels (NRSF)	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Net use of fresh water (FW)	m^3	3.62E+00	7.97E-01	3.32E-03	9.58E-05	2.78E+00	3.39E-02
Hazardous waste disposed (HWD)	kg	1.13E+00	8.50E-02	5.41E-04	2.89E-05	8.08E-01	2.38E-01
Non-hazardous waste disposed (NHWD)	kg	1.05E+02	3.04E+01	4.32E-01	6.36E-04	7.13E+01	3.30E+00
Radioactive waste disposed (RWD)	kg	2.72E-03	1.36E-03	4.53E-06	4.15E-09	1.30E-03	5.79E-05
Components for re-use (CRU)	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Materials for recycling (MFR)	kg	8.48E+00	0.00E+00	0.00E+00	9.69E-03	0.00E+00	8.47E+00
Materials for energy recovery (MER)	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Exported electricity energy (EEE)	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Exported thermal energy (ETE)	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

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