Environmental Product Declaration

In accordance with ISO 14025 and EN 50693 for:

Lithium iron phosphate battery cell-280Ah *(FC-FV0-72H4L7-014L)*

from

Contemporary Amperex Technology Co., Limited

No.1, Shidai Street, High-tech Industrial Development Zone, Zhaoqing City, Guangdong Province

Programme:	EPDItaly, www.epditaly.it
Programme operator:	EPDItaly
EPD registration number:	EPDITALY0565
EPD declaration number:	EPDItaly-CATL-002
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1 General information

1.1 Programme information

Programme:	EPDItaly
Address	EPDItaly Via Gaetano De Castillia, 10 20124 – Milano Italy
Website	www.epditaly.it
E-mail	info@epditaly.it
EPD Owner	Contemporary Amperex Technology Co., Limited
Manufacturer address	No.1, Shidai Street, High-tech Industrial Development Zone, Zhaoqing City, Guangdong Province
Product code	FC-FV0-72H4L7-014L
Functional unit	Functional unit is defined as 1 kWh minimum guaranteed energy when the cell is installed provided over 20 years RSL with 365 days of operation per year and 1 full charge/discharge cycles per day by the Lithium iron phosphate battery cell-280Ah. The reference flow is defined as 1 kWh Lithium iron phosphate battery cell-280Ah (net weight 5.978 kg, gross weight 6.176 kg).
CPC code	46410
Independent verification	EXTERNAL, Third party verification carried out by: ICMQ ICMQ spa - Via Gaetano De Castillia 10, 20124 Milano (MI), Italia
Product category rules (PCR)	Core PCR: EPDItaly007 - PCR for Electronic and Electrical Products and Systems, (rev.3), January 2023
Other references	EN 50693:2019 - Product category rules for life cycle assessments of electronic and electrical products and systems Regulations of the EPDItaly Programme rev. 5.2 published on 2022/02/16
Product RSL description	20 years
LCA study	This EPD study is based on the LCA study described in the LCA report
EPD type	Product specific

EPD scope	Cradle to grave
Year of reported primary data	1 Aug 2022 to 31 July 2023
Technical support	Emily Zhao SGS China Co., Ltd A - 16/F, Century Yuhui Mansion, No. 73 Fucheng Road, Beijing, 100142, China

The EPD owner has the sole ownership, liability, and responsibility for the EPD.
EPDs within the same product category but registered in different EPD programmes, or not compliant with EN 50693, may not be comparable. For two EPDs to be comparable, they must be based on the same PCR (including the same version number) or be based on fully-aligned PCRs or versions of PCRs; cover products with identical functions, technical performances and use (e.g. identical declared/functional units); have equivalent system boundaries and descriptions of data; apply equivalent data quality requirements, methods of data collection, and allocation methods; apply identical cut-off rules and impact assessment methods (including the same version of characterization factors); have equivalent content declarations; and be valid at the time of comparison. For further information about comparability, see EN 50693 and ISO 14025.

1.2 Company information

Owner of the EPD: Contemporary Amperex Technology Co., Limited

Description of the organisation:
Contemporary Amperex Technology Co., Limited (CATL) is a global leader in new energy innovative technologies, committed to providing premier solutions and services for new energy applications worldwide. Adhering to the concept of circular economy, CATL is committed to producing carbon neutral battery products, reducing energy consumption and emissions.
CATL implements the quality standard as ISO9001, and environment standards as ISO14001&ISO50001. In the future, CATL will actively fulfil corporate social responsibilities and make outstanding contributions to the cause of global new energy development.

Name and location of production site:
Contemporary Amperex Technology Co., Limited (CATL)
No.1, Shidai Street, High-tech Industrial Development Zone, Zhaoqing City, Guangdong Province

1.3 Product information

Product name: Lithium iron phosphate battery cell-280Ah (FC-FV0-72H4L7-014L)

Product identification: Prismatic cell with 280Ah

Product description:

The cell using the LFP chemistry, has 280Ah capacity. It can be assembled in different type of product, such as module, cabinet, container, etc. The photos below illustrate the representative product, but not all of the product.




The product can be used for the energy storage system. The major application field include: voltage regulation, frequency regulation, backup power supply, new energy power generation, peak shifting & peak shaving & demand response, micro grid, etc.

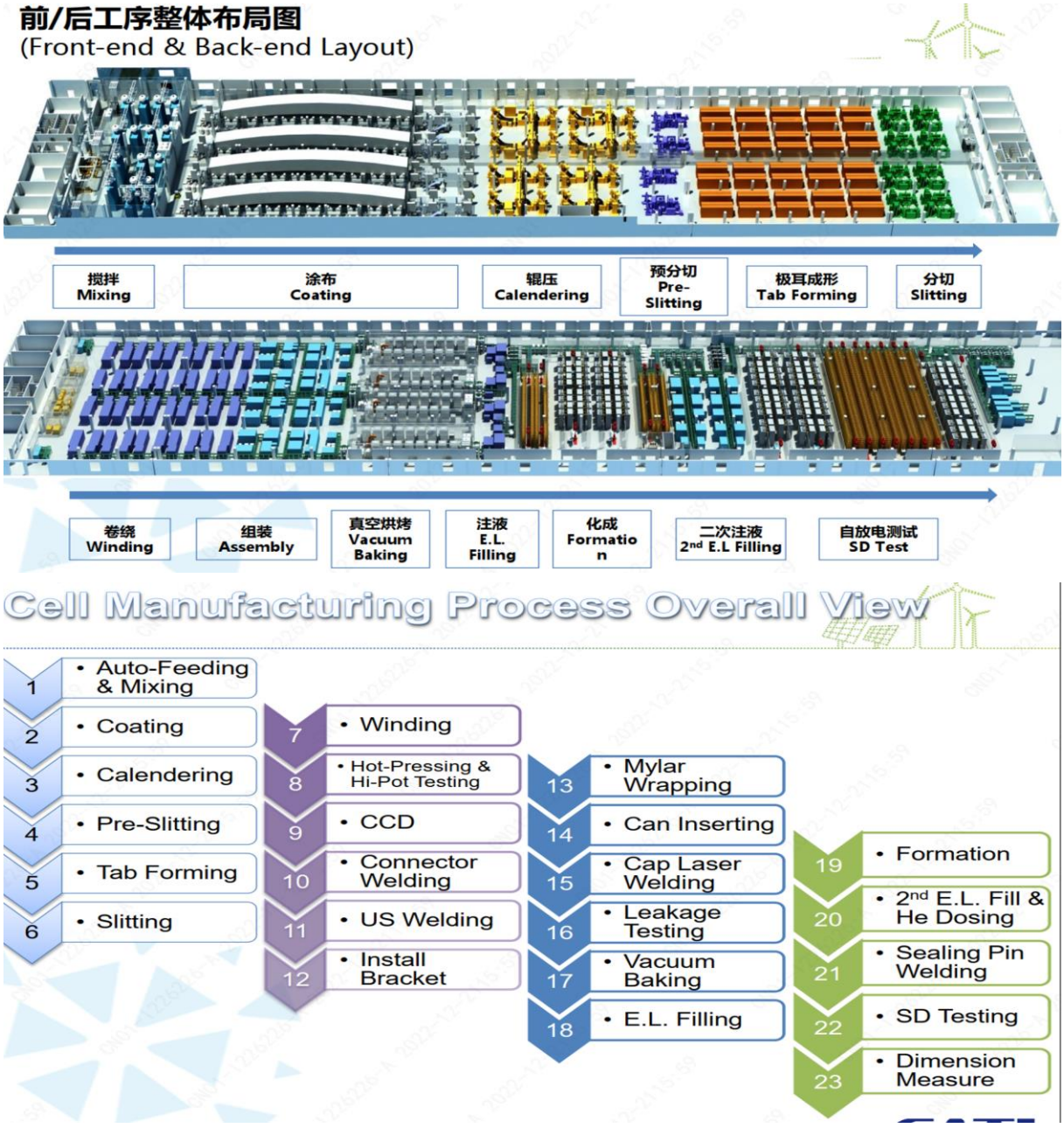
Technical data:

Parameter	Description	Value
Dimension	173.79*71.65*207.20	mm*mm*mm
Weight	5400±160	g
Capacity	280	Ah
Voltage	3.2	V
Minimum guaranteed Energy	896	Wh
RTE	94.5	%

Geography: The products are manufactured in China and sold to Europe.

UN CPC code: 46410

Manufacturing process: The pictures below show the flow-chart of manufacturing process.



2 Content information

Product components	Material classes	Share [in %]
LFP	M-199	35-47
Aluminum	M-120	3-15
Graphite	M-399	10-25
Copper	M-121	3-15
Separator	M-201	0-5
PP	M-202	0-5
PC	M-204	0-5
PET	M-209	0-5
N-Methylpyrrolidone	M-449	0-5
Electrolyte	M-449	10-30
Product components	**Material classes**	**Share [in %]**
Wood	M-340	2.50
Paper	M-341	0.29
EPO plastics	M-299	0.42

3 LCA information

3.1 Overview

Functional unit and reference flow: The functional unit (FU) is the product or system main function(s) quantified, to which the inputs and outputs are related to. For lithium iron phosphate energy storage batteries, the functional unit is defined as **1 kWh minimum guaranteed energy when the cell is installed provided over 20 years RSL with 365 days of operation per year and 1 full charge/discharge cycles per day by the Lithium iron phosphate battery cell-280Ah.**

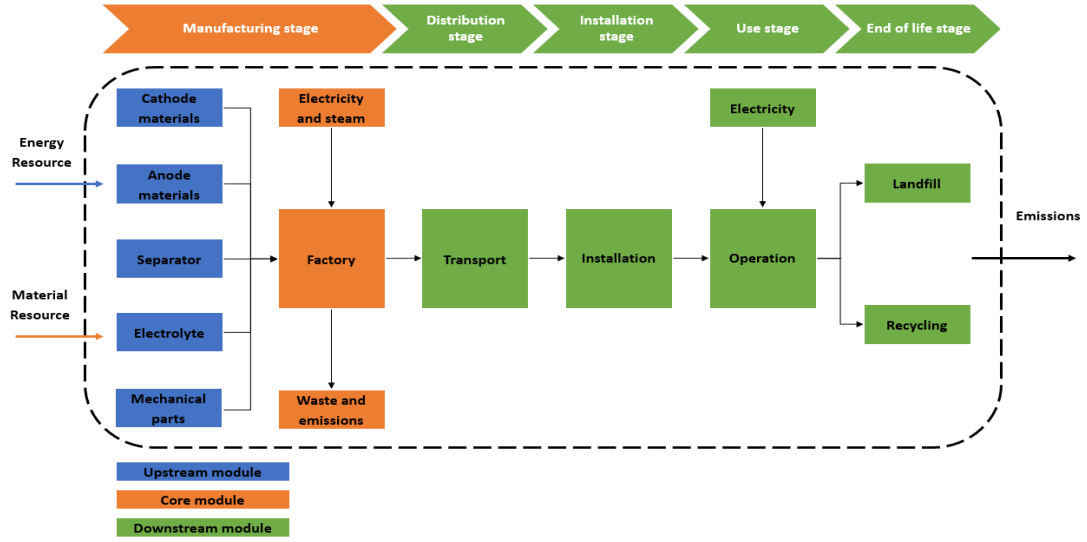
The reference flow describes all the needed flows to fulfil the functional unit, and is defined as **1 kWh Lithium iron phosphate battery cell-280Ah (net weight 5.978 kg, gross weight 6.176 kg).**

Reference service life: 20 years

Time representativeness: The primary data used has been obtained from the CATL plant in 1 Aug 2022 to 31 July 2023, being representative of the products and the production process.

Database(s) and LCA software used: SimaPro® software v.9.5 developed by PRé Consultants was used to create the product system model. The ecoinvent® database version 3.9.1 provided the life cycle background data for product system modelling.

System diagram: This EPD® is from cradle to grave with Upstream module, core module and Downstream module. System diagram is as follow:



Allocation processes: Many processes within the system boundary are associated with having multiple inputs and/or outputs. For delivering the functional unit, a procedure for partitioning impacts associated with these processes are required.

In this study, the systems which have been subject to the PCR EPDItaly 007, multi-output and recycling processes. Allocation for multi-input processes is based upon the physical composition of the inputs and outputs. Energy consumption (electricity, steam, and natural gas), solid waste and emissions of manufacturing stage are based on annual output 17925000 kWh cell from 1 Aug 2022 to 31 July 2023, and allocated to 1 kWh cell.

Cut-off rules and considerations: According to EN 50693 4.2.3.3, based on established LCA practice, the cut-off criteria are set to a maximum of 5% of the overall environmental impact of the analyzed product system given by its life cycle impact assessment (LCIA) results. In accordance with the cut-off rule, flows less than 1% of the total inventory were excluded, i.e.:

- construction of company plants and processing machinery (with a life of more than three years);
- staff travel and home-work transfers;
- research and development activities;
- some components of the kit of the products under study, such as: sensors, remote control and other operating tools; trays and other moving parts of the structures moved by the engines;
- the materials necessary for cleaning the machinery.

Calculation methodologies: In this study, EN 15804+A2:2019 method is selected as Impact assessment method. The EN 15804 standard covers Environmental Product Declarations

(EPDs) of Construction Products. The 2019 EN 15804+A2 revision of this standard has aligned their methodology with the EF 3.0 method, except for their approach on biogenic carbon. According to the EN 15804, biogenic carbon emissions cause the same amount of Climate Change as fossil carbon, but can be neutralized by removing this carbon from the atmosphere. Temporary and permanent carbon storage is not allowed therefore the 15804 standard provides a set of requirement to prevent its accounting.

3.2 Raw material acquisition stage (Upstream module)

At this stage, the materials and components are manufactured by supplies, and transported to the CATL plant.
The LFP cell product can be divided into 5 parts: Cathode materials, Anode materials, Separator, Electrolyte and Mechanical parts. Because CATL has no financial control or operational control over the supplies manufacturing materials above, Upstream production data for materials (eg., LFP, NCM, Al foil, Electrolyte) refer to Ecoinvent database.
The mode of transportation of materials is by lorry and assumed was EURO 4, 16-32 t.

3.3 Manufacturing and assembling stage (Core module)

The CATL is responsible for the processing semi-finished products, assembling cells, testing cells performance.
The consumed electricity in CATL plant comes from three electricity source during 1 Aug 2022 to 31 July 2023, and each mix source was used in terms of its proportion to the total kWh of electricity consumed. 4.2% comes from on-site electricity generation (photovoltaic) and 95.8% from the grid.
Waste is divided into ordinary solid waste and hazardous waste. Solid waste for recycling and hazardous waste for incineration in production process are entrusted to a third party, and trucked by EURO 4, 16-32t lorry. Water and air pollutants are discharged up to standard after being treated by factories, and pollutants were obtained from factory monitoring.

3.4 Distribution stage (Downstream module)

There are many places where products are sold, it is difficult to determine the distance and mode of transport. According to EN 50693 4.3.2, If no specific data are available, the following generic data shall be applied:

— International transport: 19 000 km by ship plus 1 000 km by lorry (85 % payload);
— Intracontinental transport: 3 500 km by lorry (85 % payload);
— Local transport: 1 000 km by lorry (85 % payload);

This report selects 19 000 km by ship plus 1 000 km by lorry as assumption scenario.

Name	Description	Value	Unit
Transport	Ship	6.176*19000	kg*km

Transport	Lorry, 16-32t	EURO4,	6.176*1000	kg*km

3.5 Installation stage (Downstream module)

The product does not consume any energy and auxiliary materials during installation. In this stage, the transport and End-of-life of packaging waste is taken into account. The transport distance of packaging materials to the treatment plant is assumed to be 50 km. The End-of-life scenario of packaging materials was used according to EN 50693.

Name	Description	Value	Unit
Transport	Lorry, EURO4, 16-32t	0.198*50	kg*km
Energy recovery	waste paper/wood	0.172*0.5	kg
Energy recovery	waste plastics	0.026*0.5	kg
Landfill	waste paper/wood	0.172*0.5	kg
Landfill	waste plastics	0.026*0.5	kg

3.6 Use and Maintenance stage (Downstream module)

The cell does not require maintenance during use and maintenance stage, while there is a loss of energy due to charge/discharge cycles. The energy loss calculation formula is as follows:

$$\mathrm{E_{loss}} = \sum_{i=0}^{RSL} \frac{E_{useful\ i} \times N_{cycles} \times 365 \times (1 - DC\ RTE\ i)}{DC\ RTE\ i \times 1000}$$

Where:

- E_{loss} = the energy dissipation occurring whenever the battery is charged and discharged.
- DC RTEi (DC Round Trip efficiency in the year i) = the battery efficiency during a complete discharge/charge cycle defined as energy discharged divided by energy charged measured on DC power terminal in the charging/discharging cycle at the maximum power that the battery system can keep constantly without rest time and at Nominal Operating Temperature.
- $E_{useful\ i}$= the max energy dischargeable from the battery system (DC side) during discharge at the maximum power that the battery system can keep constantly during discharging process without rest time and Nominal Operating Temperature.
- N_{cycles} = the number of full charge/discharge cycles per day.
- 365 = the number of days in one year.

Name	Value	Unit
DC RTEi	94.17	%
$\sum_{i=0}^{RSL} E_{useful\ i}$	17481.25	Wh
N_{cycles}	1	/
RSL	20	year
E_{loss}	395.02	kWh

3.7 End of life stage (Downstream module)

The material recovery rate, energy recovery rete and disposal rete of material in discard cell is in line with EN 50693 Annex G. The material recovery rate of LFP is assumed 80%. The remaining parts, based on mass balance, are sent to sanitary landfill. The transport distances from Installation Location into the disassembly facility is 100 km.

Process	Description	Value	Unit
Collection process	Discard cell	5.978	kg
	Transport, lorry, EURO4, 16-32t	5.978 *100	kg*km
Recovery system specified by type	Reuse	0	kg
	Recycling	2.510	kg
	Incineration for energy recovery	0.060	kg
Disposal specified by type	Landfill	3.408	kg
	Incineration	0	kg

All declared life cycle stages are marked with" X" in below. Modules not declared will be marked with MND.

	Manufacturing		Distribution	Installation	Use and maintenance	End-of-life
Module	**Upstream module**	**Core module**	**Downstream module**			
Supply chain processes	Extraction of raw materials and the production of semi-finished	Cell assembling; Transport of solid waste; Waste treatment;	Cell transport into the operation site; installation and packaging waste management; operating for 20 years (RSL);			

	products and auxiliary items; Electricity production; Transport of raw materials to CATL plant.	Emissions to air; Emissions to water.	EoL, including collecting, transport of waste, material/energy recycling and disposal of non-recyclable fractions at sanitary landfill.			
Modules declared	x	x	x	x	x	x
Geography	CN	CN	EU	EU	EU	EU

4 Environmental impacts

4.1 Potential environmental impact

			Manufacturing stage		Distribution stage	Installation stage	Use and maintenance stage	End of life stage
Impact category	**Unit**	**Total**	**Upstream**	**Core**	**Downstream**			
GWP-total	kg CO2 eq	2.221E+02	4.817E+01	1.598E+01	2.422E+00	1.624E-01	1.476E+02	7.715E+00
GWP-fossil	kg CO2 eq	2.131E+02	4.827E+01	1.603E+01	2.420E+00	5.673E-03	1.422E+02	4.233E+00
GWP-biogenic	kg CO2 eq	8.158E+00	-1.829E-01	-5.152E-02	2.460E-04	1.468E-01	4.987E+00	3.258E+00
GWP-luluc	kg CO2 eq	4.360E-01	7.432E-02	7.256E-03	1.548E-03	3.810E-06	3.489E-01	3.943E-03
ODP	kg CFC11 eq	4.804E-06	1.955E-06	1.202E-07	3.667E-08	6.421E-11	2.663E-06	2.836E-08
AP	mol H+ eq	1.561E+00	6.147E-01	7.623E-02	4.068E-02	2.940E-05	8.019E-01	2.772E-02
EP-freshwater	kg P eq	1.788E-01	4.257E-02	2.605E-03	1.354E-04	8.717E-07	1.324E-01	1.122E-03
EP-marine	kg N eq	2.580E-01	9.451E-02	1.364E-02	1.077E-02	2.403E-04	1.296E-01	9.239E-03
EP-terrestrial	mol N eq	2.208E+00	7.421E-01	1.443E-01	1.184E-01	8.672E-05	1.173E+00	3.026E-02
POCP	kg NMVOC eq	7.097E-01	2.437E-01	4.507E-02	3.347E-02	6.442E-05	3.766E-01	1.075E-02
ADP-minerals&metals	kg Sb eq	6.227E-03	4.405E-03	5.914E-05	4.941E-06	1.346E-08	1.695E-03	6.277E-05
ADP-fossil	MJ	4.026E+03	6.005E+02	1.855E+02	3.127E+01	6.423E-02	3.180E+03	2.845E+01

WDP	m3 depriv.	6.298E+01	2.158E+01	3.712E+00	1.084E-01	1.360E-03	3.629E+01	1.281E+00

Acronyms: GWP-total=Global Warming Potential total; GWP-biogenic=Global Warming Potential biogenic; GWP-fossil=Global Warming Potential fossil; GWP-luluc=Global Warming Potential land use and land use change; ODP=Ozone Depletion; AP=Acidification; E=Eutrophication; POCP=Photochemical ozone formation; ADPE=Depletion of abiotic resources-minerals and metals; ADPF=Depletion of abiotic resources-fossil fuels; WDP=Water resource deprivation.

4.2 Use of resources

			Manufacturing stage		Distribution stage	Installation stage	Use and maintenance stage	End of life stage
Parameter	**Unit**	**Total**	**Upstream**	**Core**	**Downstream**			
PERE	MJ, lower calorific value	8.036E+02	5.374E+01	2.589E+01	3.155E-01	2.450E-03	7.129E+02	1.072E+01
PERM	MJ, lower calorific value	2.962E+00	2.962E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
PERT	MJ, lower calorific value	8.066E+02	5.670E+01	2.589E+01	3.155E-01	2.450E-03	7.129E+02	1.072E+01
PENRE	MJ, lower calorific value	4.016E+03	5.916E+02	1.855E+02	3.127E+01	6.423E-02	3.179E+03	2.845E+01
PENRM	MJ, lower calorific value	8.965E+00	8.965E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
PENRT	MJ, lower calorific value	4.025E+03	6.005E+02	1.855E+02	3.127E+01	6.423E-02	3.179E+03	2.845E+01
FW	cubic metres	3.271E+00	5.666E-01	9.153E-02	3.550E-03	3.657E-05	2.574E+00	3.545E-02
MS	kg	0.000	0.000	0.000	0.000	0.000	0.000	0.000

RSF	MJ	0.000	0.000	0.000	0.000	0.000	0.000	0.000
NRSF	MJ	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Acronyms: 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; MS=Use of secondary materials; RSF= Use of renewable secondary fuels ; NRSF=Use of non-renewable secondary fuels

4.3 Waste production and output flows

			Manufacturing stage		Distribution stage	Installation stage	Use and maintenance stage	End of life stage
Parameter	**Unit**	**Total**	**Upstream**	**Core**	**Downstream**			
HWD	kg	0.022	0.022	0.000	0.000	0.000	0.000	0.000
NHWD	kg	3.507	0.000	0.000	0.000	0.099	0.000	3.408
RWD	kg	0.000	0.000	0.000	0.000	0.000	0.000	0.000
MFR	kg	4.748	2.238	0.000	0.000	0.000	0.000	2.510
MER	kg	0.159	0.000	0.000	0.000	0.099	0.000	0.060

CRU	kg	0.000	0.000	0.000	0.000	0.000	0.000	0.000
ETE	MJ	0.000	0.000	0.000	0.000	0.000	0.000	0.000
EEE	MJ	0.000	0.000	0.000	0.000	0.000	0.000	0.000

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

5 Reference

- ISO 14044:2006: Environmental management — Life cycle assessment — Requirements and guidelines
- ISO 14040:2006: Environmental management — Life cycle assessment — Principles and framework
- ISO 14025:2006: Environmental labels and declarations — Type III environmental declarations — Principles and procedures
- 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 EPDItaly 007: Electronic and Electrical Products and Systems, (rev.3), January 2023
- Regulations of the EPDItaly Programm Rev.5.2, 2022/02/16
- ISO 14040:2006/Amd 1:2020: Environmental management — Life cycle assessment — Principles and framework — Amendment 1
- ISO 14044:2006/Amd 2:2020: Environmental management — Life cycle assessment — Requirements and guidelines — Amendment 2
- ISO 14044:2006/Amd 1:2017: Environmental management — Life cycle assessment — Requirements and guidelines — Amendment
- LCA report of CATL Lithium iron phosphate battery cell-280Ah for Environmental Product Declaration, January 2024