Hefei Gotion High-tech Power Energy Co.,Ltd.

ENVIRONMENTAL PRODUCT DECLARATION

2.7MWh Air-cooled Cabin Energy Storage System

No.599, Daihe Road, Xinzhan District,230012 Hefei City, Anhui ProvinceP.R. China

In accordance with ISO 14025 and EN 15804:2012+A1:2013/A2:2019

Program Operator	EPDItaly
Publisher	EPDItaly

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GENERAL INFORMATION

EPD OWNER	
Name of the company	Hefei Gotion High-tech Power Energy Co.,Ltd.
Registered office	Hefei Gotion High-tech Power Energy Co.,Ltd.
The address of the registered office	No.599, Daihe Road, Xinzhan District,230012 Hefei City, Anhui ProvinceP.R. China
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PROGRAM OPERATOR	
EPDItaly	Via Gaetano De Castillia n° 10 - 20124 Milano, Italy

INFORMATION ON THE EPD	
EPD Tpye	Specific Product EPD
Product name (s)	2.7MWh Air-cooled Cabin Energy Storage System
Site (s)	Nantong Guoxuan New Energy Technology Co., Ltd No. 1168, New CenturyAvenue, Tongzhou District, Nantong City, Jiangsu Province, China
Short description and technical information of the product (s)	2.7MWh Air-cooled Cabin Energy Storage System, with Lithium iron phosphate energy type lithium-ion battery
Field of application of the product (s)	Electronic and electrical products and systems
Product (s) reference standards (if any)	
CPC Code (number) https://unstats.un.org/unsd/classifications/Econ	4641
LCA Consultant	The LCA report is written by: TÜV Rheinland (China) Ltd. www.tuv.com Contact person: Sharon Ye (sharon.ye@tuv.com)

VERIFICATION INFORMATION	
PCR (title, version, date of publication or update)	• Core PCR: EPDItaly007 – PCR for Electronic and Electrical Products and Systems, Rev. 3. 13/01/2023 • Sub-category PCR: EPDItaly021:2021 — for Energy Storage, Electronic and electrical products and systems – Charging Stations 29/03/2021
EPDItaly Regulation (version, date of publication or update)	REGULATIONS OF THE EPDItaly PROGRAMME VER. 6.0, ISSUED ON 2023/10/30
Project Report LCA	This EPD study is based on the LCA study described in the LCA report <LCA Report_Hefei Gotion High-tech Power Energy Co.,Ltd, v2, 2024/04/22 >
Independent Verification Statement	The PCR review was performed by Ing. Daniele Pace, Arch. Michele Paleari, Ing. Sara Toniolo - info@epditaly.it. Independent verification of the declaration and data, carried out according to ISO 14025: 2010. Internal ☑ External

	Third party verification carried out by: ICMQ S.p.A., via Gaetano De Castillia n ° 10 - 20124 Milan, Italy. Accredited by Accredia.
Comparability Statement	Environmental statements published within the same product category, but from different programs, may not be comparable. In particular, EPDs of construction products may not be comparable if they do not comply with EN 15804: 2012 + A2: 2019.
Liability Statement	The EPD Owner releases EPDItaly from any non-compliance with environmental legislation. The holder of the declaration will be responsible for the information and supporting evidence. EPDItaly disclaims any responsibility for the information, data and results provided by the EPD Owner for life cycle assessment.

OTHER INFORMATION

CONTENTS

Hefei Gotion High-tech Power Energy Co.,Ltd (The abbreviation is Gotion High-tech) is in the process of seeking their own survival and sustainable development. Gotion High-tech considers to achieve the goal of enterprise management and improve enterprise market position, and to keep the enterprise in the leading field of competition and the future expansion of the business environment always maintain sustained earnings growth and improvement of ability, ensure longevity enterprise for a long time.

Gotion High-tech establishes CSR management manual to ensure compliance with laws, regulations and customer requirements and continuous improvement.

1. The CSR policy

People-oriented, green operation, to promote the harmonious and sustainable development of economy, society and environment

2. CSR vision

To build a sustainable social responsibility system and become a first-class enterprise in the global relay field respected by the society and loved by employees

3. The CSR strategy

Develop employee value, promote green environmental protection, pursue win-win ecology and create a better life.

4. CSR practice path

For employees, people-oriented, growth together

For the environment, green environmental protection, clean production

For partners, development together, to achieve win-win

For shareholders, stable operation, create value

For the government, honest and honest, legitimate business

For community, being selfless contribution

GENERAL INFORMATION

Gotion High-tech Co., Ltd., as the earliest private enterprise in power battery industry to enter the capital market, was listed in May 2015 (stock code:002074), specializing in power battery for new energy vehicles, energy storage application, power transmission and distribution equipment, etc.

Gotion High-Tech is a technology-based company, which focus on power battery technology research and development and innovation. It is a national torch program project unit, a national enterprise technology center, a high-tech enterprise, a winner of Anhui Provincial Government Quality Award, and a unit undertaking three national "863" major projects. The related patented technologies have covered the whole battery industry chain technology, including four main materials of cell, cell structural design, BMS, PACK, testing and evaluation, dismantling and recycling, and energy storage, etc.

Gotion High-Tech is a dedicated company. It is one of the earliest enterprises engaged in the independent research and development, production and sales of new energy vehicle power lithium-ion batteries in China. Its main products are lithium iron phosphate materials and batteries, ternary batteries, power battery packs, battery management systems and energy storage batteries. The products are widely used in new energy vehicles such as pure electric passenger cars, commercial vehicles, special vehicles and hybrid electric vehicles, providing system solutions for energy storage power plant, communication base stations, etc.

Gotion High-Tech is an international company. Global R&D centers were established in Hefei, Shanghai, Silicon Valley, Cleveland, Tsukuba, Singapore, Europe, Germany and other places. Volkswagen (China) invested about 1.1 billion euros to become a shareholder of Gotion Hi-Tech on May 28, 2020. The two sides will jointly carry out battery technology innovation and R&D, making Hefei City, even Anhui Province an important base of China's electric vehicle industry, and welcome the arrival of the global electric era.

Gotion High-tech is committed to providing customers with satisfactory products and solutions through continuous innovation and unremitting pursuit of high quality to bring people a more comfortable and convenient life.

As a responsible company to society and environment, Gotion High-tech applied EPD Italy, conducted LCA study from 2023.01.01 to 2023.06.30, and is willing to disclosure the actual environmental impact to the public and customers for low voltage products.

Declared in this EPD includes the following products and for the product the characteristics and composition were listed from table 2-table 3.

Table 1 LCA study related types

Type for LCA Study	Related Types
Energy Storage System	2.7MWh Air-cooled Cabin Energy Storage System

However, the processes of the product in Nantong Guoxuan New Energy Technology Co., Ltd. are shown in figure1.

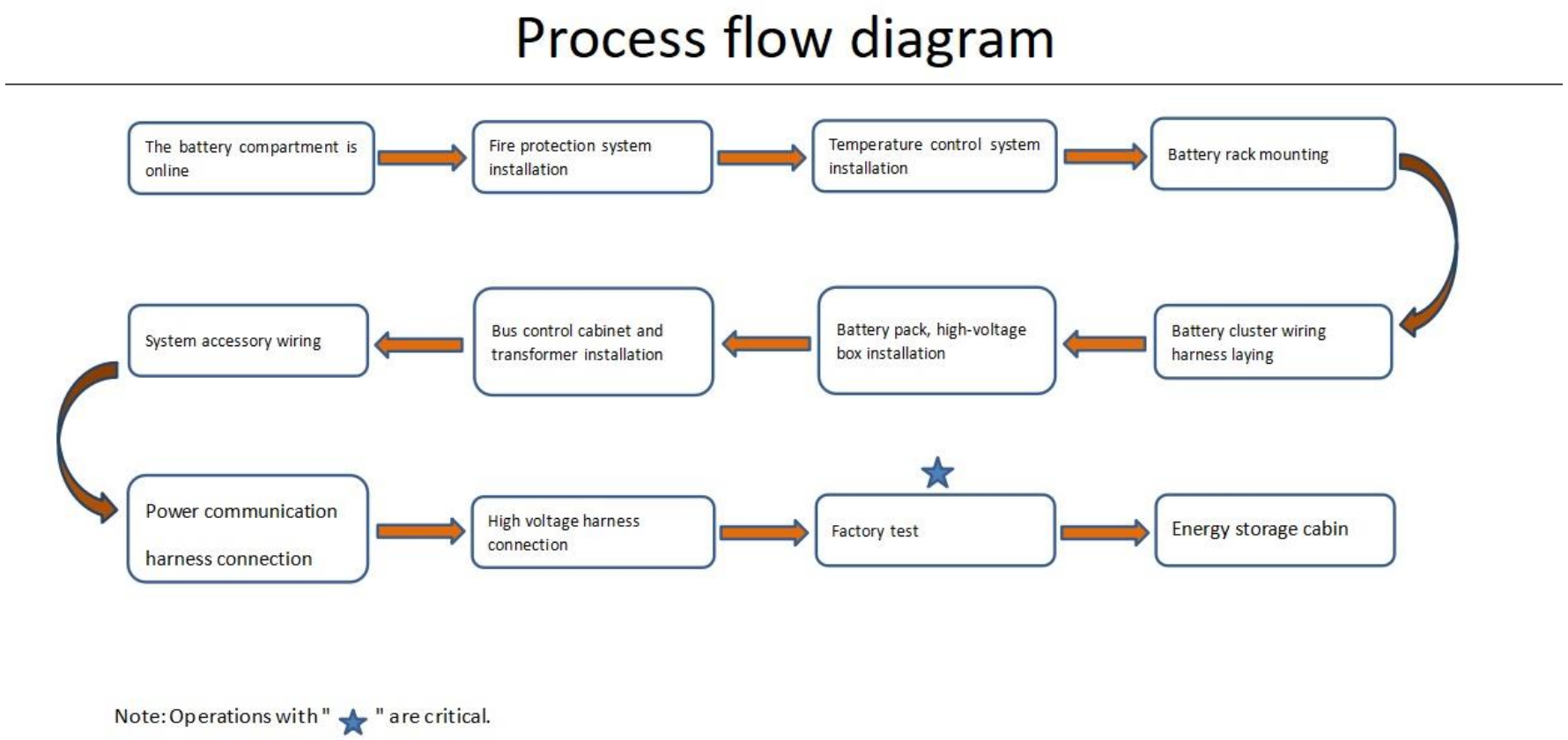

Figure 1 Processe of the product in Nantong Guoxuan New Energy Technology Co., Ltd

Table 2 Product characteristics

Item	Information
Name	2.7MWh Air-cooled Cabin Energy Storage System
Cell Type	Lithium Iron Phosphate, LFP
Capacity/Ah	2400.00
Energy/kwh	2703.36
Weight/ton	32.44
Allowed C-Rate/C	0.5
Recommended C-Rate/C	0.5

The 2.7MWh air-cooled cabin energy storage system adopts the lithium iron phosphate battery cell independently developed by Guoxuan Hi-Tech with high cycle, high energy density and high safety chemical material system, and integrates the design of integrated control cabinet, energy storage battery cluster, fire exhaust system, air conditioning temperature control system and transformer to meet the needs of rapid installation, safety and effectiveness and stable operation of medium and large power stations.

Table 3 2.7MWh Air-cooled Cabin Energy Storage System material composition

Item	Amount	Unit
Raw material		
Main materials		
Q235	6585298.00	g/pcs
Fire protection system+exhaust system	201050.00	g/pcs
5kw air conditioner	780000.00	g/pcs
Copper wire	182400.00	g/pcs
91%Steel、7%Copper、2%Plastic	220500.00	g/pcs
pack		g/pcs
87Steel、10%Copper、3%Plastic	207000.00	g/pcs
Adapter/Charger	285.96	g/pcs
By truck		
0.75t	351.24	t·km/pcs
20t	928.57	t·km/pcs
1.5t	0.08	t·km/pcs
Auxiliary materials		
PE	50.52	g/pcs
coated paper	0.76	g/pcs
By truck	0.03	t km/pcs

DECLARED UNIT (FUNCTIONAL UNIT)

The declared unit is specified in kWh stored by a single energy storage module. The functional unit is per kWh of 2.7MWh Air-cooled Cabin Energy Storage System, with a RSL of 10 years.

As for the type of cell technology, the Battery Energy Storage System is Lithium Iron Phosphate for industrial use.

SYSTEM BOUNDARIES

The life cycle of 2.7MWh Air-cooled Cabin Energy Storage System, is a "from cradle to grave" analysis and covers the following main life cycle stages.

The following table shows the stages of the product life cycle and the information stages according to EN 50693 and PCR021 for the evaluation of electronic and electrical products and systems.

Table 4 System boundaries

<table>
<tr><th colspan="2">MANUFACTURING STAGE</th><th>DISTRIBUTION STAGE</th><th>INSTALLATION STAGE</th><th>USE & Maintenance STAGE</th><th>END-OF-LIFE STAGE

De-installation</th></tr>
<tr><th>UPSTREAM MODULE</th><th>CORE MODULE</th><th colspan="4">DOWNSTREAM MODULE</th></tr>
<tr><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="4" rowspan="4">IN ACCORDANCE WITH EN 50693</td></tr>
<tr><td>transportation of raw materials to the manufacturing company</td><td>product assembly</td></tr>
<tr><td></td><td>packaging</td></tr>
<tr><td></td><td>waste handling processes</td></tr>
</table>

The stages of the product life cycle and the information considered for the evaluation of the cluster are:

- Manufacturing upstream includes raw materials, and production activities of Gotion High-tech suppliers, including transport of semi-finished items and subassemblies to Gotion High-tech. This includes also the packaging production.
- Manufacturing core includes local consumptions due tomanufacturing of the product, the relevant assembling and wastedue tomanufacturing.
- The distribution stage includes the impacts related to the distribution of the product from manufacture to the logistic center of the receiver.
- The installation stage includes the impact related to the transportation of packaging waste to recycling place.
- The use stages include the impact related to energy consumption during the service life of the product.
- End of life includes the transportation and operations for the disposal of the product at the end of its service life.

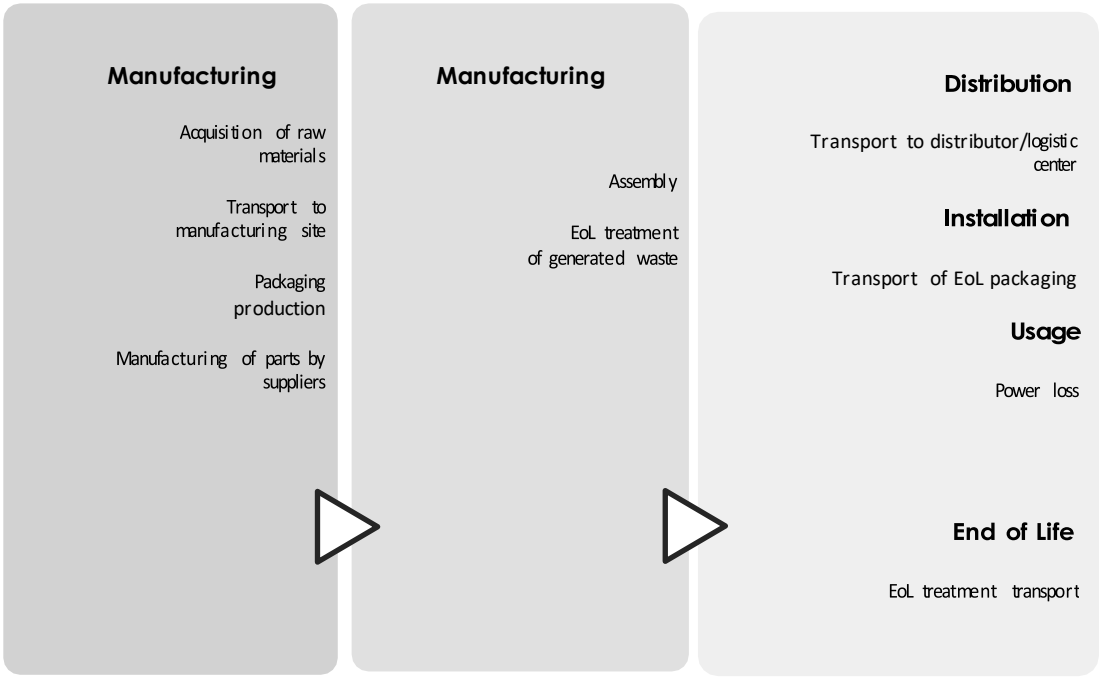

Figure 2 System boundary

TEMPORAL AND GEOGRAPHICAL BOUNDARIES

The Gotion High-tech component suppliers are sourced: China. All primary data collected from Gotion High-tech factory are from January to June 2023, which is a representative production period. And with stronger effectiveness for a given period of time, the latest statistics can provide more representative results. Secondary data are also representative for this year, as provided by Ecoinvent v3.9.1.

The selected Ecoinvent processes in the LCA model have a global representativeness, due to the unclear origin of each component. In this way, the conservative approach is adopted.

BOUNDARIES IN THE LIFE CYCLE

As indicated in the PCR EPDItaly021, capital goods, such as buildings, machinery, tools and infrastructure, the packaging for internal transport which cannot be allocated directly to the production of the reference product, may be excluded from the system boundary.

DATA QUALITY

In this EPD, both primary and secondary data are used. Site specific foreground data have been provided by Gotion High-tech. Main data sources are the bill of materials or weighting photos available on the enterprise resource planning. For all processes for which primary are not available, generic data originating from the Ecoinvent v3.91 database, allocation cut-off by classification, are used. The Ecoinvent database is available in the SimaPro 9.5 software used for the calculations.

ENVIRONMENTAL IMPACT INDICATORS

The information obtained from the inventory analysis is aggregated according to the effects related to the various environmental issues. According to PCR EPDItaly012 PCR, EPDItaly021 and EN 50693 the environmental impact indicators must be determined using the characterization factors and impact assessment methods specified in EN 15804 + A2 Method V1.02.

PCR EPDItaly021 and the EN 50693 standard establish four indicators for climate impact (GWP-GHG): GWP (total) which includes all greenhouse gases; GWP (fossil fuels); GWP (biogenic carbon) which includes the emissions and absorption of biogenic carbon dioxide and biogenic carbon stored in the product; GWP (land use).

ALLOCATION RULES

The energy demand for product line for products is allocated by yield based on total production amount from 2023.01.01 till 2023.06.30.

In the system studied, there is no co-product which is defined as "Partitioning the input or output flows of a process or a product system between the product system under study and one or more other product systems." [Source: ISO 14044:2006]. Therefore, there is no co-product allocation.

LIMITATIONS AND SIMPLIFICATIONS

The data of energy consumption and pollutants emission in the raw material acquisition stage are from the Ecoinvent 3.9.1 database published by the European Ecoinvent Center.

The emission factor of China electricity is from the Ecoinvent 3.9.1 database.

The emission factor of the Italy electricity is also from the Ecoinvent 3.9.1 database. The emission factor of China electricity is from the Ecoinvent 3.9.1 database. This dataset has been extrapolated from year 2015 to the year of the calculation (2020). China state grid launched the green electricity program in late of 2021, however, the green electiricty selling information is not public available when creating this LCA report. Therefore, we selected the Ecoinvent data base data for China electricity [Electricity, low voltage {CN}| market group for | Cut-off, S] is deemed conservative as this value is higher than the reality.

The uncertainty has been adjusted accordingly. This dataset describes the electricity available on the low voltage level in China and Italy. This is done by showing the distribution of 1kWh electricity at low voltage.

The transportation distance is assumed 200km at EOL stage.

The transportation distance of the waste during the production is assumed 10 km near the factory.

The material of container of the product is assumed as a single material steel, because the weight of container is extremely huge and with a very small amount plastic.

INVENTORY ANALYSIS

The Ecoinvent v3.9.1 by classification system processes are used to model the background system of the processes.

Due to the large amounts of components in the module, raw material inputs are modelled with data from Ecoinvent representing a global market coverage. These datasets are assumed to be representative.

MANUFACTURING STAGE

Cell is the most frequently used material, followed by steel.

The packaging (Plywood, Paper etc.) are also included in the analysis in the manufacturing stage-core. Gotion High-tech receives packaging components from outside suppliers and packages the product before shipping them.

The transport distances and weight from raw materials suppliers to the manufacturing are assumed as below:

- 2.7MWh Energy Storage System: Transport, freight, 0.75 ton lorry: 321.62 tkm/pcs;
- 2.7MWh Energy Storage System: Transport, freight, 1.5 ton lorry: 0.01 tkm/pcs;
- 2.7MWh Energy Storage System: Transport, freight, 20 ton lorry: 557.21 tkm/pcs;

"Transport, freight, lorry 3.5-7.5 metric ton, EURO6 {RoW}| market for transport, freight, lorry 3.5-7.5 metric ton, EURO6 | Cut-off, S"

"Transport, freight, lorry 16-32 metric ton, EURO6 {RoW}| market for transport, freight, lorry 16-32 metric ton, EURO6 | Cut-off, S"

"Transport, freight, lorry, unspecified {GLO}| market for | Cut-off, S;" are used

The manufacturer of the product is locatedNo. 1168, New CenturyAvenue, Tongzhou District, Nantong City, Jiangsu Province, China. In the factory, the different components and subassemblies are assembled to abroad.

For the manufacturing phase, the general China low voltage electricity mix from Ecoinvent v3.91 is used.

DISTRIBUTION

The transport distances from Gotion High-tech plant to the place of use are shown as below: However, the data source is from https://sea-distances.orf/

Table 5 Transportation activity data

Way of transportation	Amount	Unit
By ship	110803.24	t km/pcs
By truck	1640.19	t km/pcs

USE

Use and maintenance are modelled according to the PCR EPDItaly021.

During the use phase, the modules dissipates some electricity due to Euse and Eloss. The total energy consumed by the battery is the result of two parameters: the former describes the energy required by the battery to operate, while the latter considers the energy loss due to charge/discharge cycles.

They are calculated according to the own internal resistance of the Switch and the following PCR rules:

- RSL of 10 years;
- 8760 is the number of hours in a year;
- 365 is the number of days in one year;
- Nominal Operation Temperature equal to 25°C ±5°C shall be assumed.

The formula for the calculation of the electricity consumed is shown in sub-PCR EPDItaly021 and it is described as follows, where Euse and Eloss are the power consumed by the module at a given value of current:

$$E_{use}\ [kWh] = \frac{P_{use} * 8760 * RSL}{1000} \qquad E_{loss}\ [kWh] = \sum_{i=0}^{RSL} \frac{E_{useful\ i} * N_{cycles} * 365}{DC\ RTEi} * (1 - DC\ RTEi)$$

Equation 1 E_{use} and E_{loss}

Table 6 Data list of Euse and Eloss

Item	Amount	Unit
Puse	4,480.00	w
hours in a year	8,760.00	hours
RSL	10.00	years
conversion factor	1,000.00	/
Euse	392,448.00	Kwh
Item	Amount	Unit
DC RTEi	96.00	%
Euseful	2,700.00	Kwh
Nominal Operating Temperature	25.00	℃
N cycles	1.00	Time
Days	365.00	Days
conversion factor	1000.00	/
Eloss	409.3	Kwh/10 year

Since no maintenance happens during the use phase, the environmental impacts linked this procedure have been omitted from the analysis.

END OF LIFE

The end-of-life stage is modelled according to PCR EPDItaly021 and WEEE Directive(2012/19/EU). The percentages for end-of-life treatments of switches are taken from WEEE Directive(2012/19/EU).

ENVIRONMENTAL INDICATORS

The following tables show the environmental impact indicators of the life cycle of a single module, as indicated by PCR EPDItaly007, sub-PCR EPDItaly021 and EN 15804.

The indicators are divided into the contribution of the processes to the different modules (upstream, core and downstream) and stages (manufacturing, distribution, use and end-of-life).

Table 7 Environmental impacts of per kWh 2.7MWh Air-cooled Cabin Energy Storage System

Item	Unit	Total	MANUFACTURING STAGE		DISTRIBUTION	INSTALLATION	USE STAGE	END-OF-LIFE
			UPSTREAM MODULE	CORE MODULE	DOWNSTREAM MODULE			
Acidification	mol H+ eq	2.12E+00	1.83E+00	4.84E-03	4.44E-02	1.28E-06	2.36E-01	5.22E-03
Climate change	kg CO2 eq	1.45E+02	7.87E+01	8.72E-01	1.86E+00	2.69E-04	5.98E+01	3.66E+00
Climate change - Biogenic	kg CO2 eq	5.37E+00	5.53E-01	-5.04E-03	-1.61E-04	4.18E-07	4.82E+00	5.99E-04
Climate change - Fossil	kg CO2 eq	1.39E+02	7.80E+01	8.77E-01	1.86E+00	2.68E-04	5.49E+01	3.66E+00
Climate change - Land use and LU change	kg CO2 eq	1.30E-01	1.14E-01	3.61E-04	1.33E-03	9.55E-07	1.22E-02	2.29E-03
Eutrophication, marine	kg N eq	1.85E-01	1.38E-01	9.63E-04	1.11E-02	4.88E-07	3.41E-02	1.49E-03
Eutrophication, freshwater	kg P eq	8.73E-03	7.43E-03	1.95E-05	9.56E-06	2.67E-09	1.24E-03	3.03E-05
Eutrophication, terrestrial	mol N eq	4.78E+00	4.22E+00	1.06E-02	1.22E-01	5.20E-06	4.14E-01	1.62E-02
Ozone depletion	kg CFC11 eq	4.27E-06	2.92E-06	1.86E-09	2.83E-08	4.77E-12	1.31E-06	1.14E-08
Photochemical ozone formation	kg NMVOC eq	6.20E-01	4.06E-01	2.81E-03	3.37E-02	1.78E-06	1.73E-01	4.86E-03
Resource use, fossils	MJ	1.91E+03	1.01E+03	8.55E+00	2.35E+01	3.84E-03	8.57E+02	1.20E+01
Resource use, minerals and metals	kg Sb eq	1.09E-02	1.03E-02	3.58E-06	2.71E-06	8.39E-10	6.33E-04	5.82E-06
Water consumption	m3	6.21E+01	2.66E+01	1.01E-01	6.52E-02	2.10E-05	3.52E+01	1.64E-01
Use of non-renewable primary energy excluding nonrenewable primary energy resources used as raw material (PENRE)	MJ	1.66E+03	7.60E+02	3.20E+01	3.84E-03	0.00E+00	8.57E+02	1.20E+01
Use of renewable primary energy excluding renewable primary energy resources used as raw material (PERE)	MJ	2.89E+02	9.52E+01	2.80E+01	5.43E-05	0.00E+00	2.85E+02	9.50E-01
Use of non-renewable primary energy resources used as raw material (PENRM)	MJ	2.45E+02	2.45E+02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Use of renewable primary energy resources used as raw material (PERM)	MJ	9.38E+01	0.00E+00	9.38E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Total use of non-renewable primary energy resources (primary energy and primary energy resources used as raw materials) (PENRT)	MJ	1.91E+03	1.01E+03	3.20E+01	3.84E-03	0.00E+00	8.57E+02	1.20E+01
Total use of renewable primary energy resources (primary energy and primary energy resources used as raw materials) (PERT)	MJ	3.82E+02	9.52E+01	1.23E+00	5.43E-05	0.00E+00	2.85E+02	9.50E-01
Net use of fresh water (FW)	m3	1.73E+00	7.58E-01	4.71E-03	9.28E-07	0.00E+00	9.57E-01	6.35E-03

Use of secondary materials (MS)	kg	0.00E+00	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	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	0.00E+00
Hazardous waste disposed (HWD)	HWD (kg)	3.26E-01	8.48E-02	7.34E-04	1.03E-07	0.00E+00	4.47E-02	1.95E-01
Non-hazardous waste disposed (NHWD)	NHWD (kg)	2.77E+01	2.27E+01	3.97E-01	2.54E-04	0.00E+00	4.12E+00	4.45E-01
Radioactive waste disposed (RWD)	RWD (kg)	3.20E-03	1.33E-03	1.23E-05	8.78E-10	0.00E+00	1.84E-03	1.81E-05
Materials for energy recovery (MER)	MER (kg)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Material for recycling (MFR)	MFR (kg)	2.44E+01	0.00E+00	0.00E+00	0.00E+00	2.44E+01	0.00E+00	0.00E+00
Components for reuse (CRU)	CRU (kg)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Exported thermal energy (ETE)	ETE (MJ)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Exported electricity energy (EEE)	EEE (MJ)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

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- EPDItaly regulations rev. 6.0
- WEEE Directive(2012/19/EU)