



EPD

ENVIRONMENTAL PRODUCT DECLARATION

Production site: Xiamen City, Fujian Province, China

Switches

HF P/N	UEM5-250L/180-430501C-111	UEM5-400L/350-430501C-P3-002	UEM5-400L/350-430501A-P3-002
Code	131114	131122	131123



DOCUMENT KIND	IN COMPLIANCE WITH		
Environmental Product Declaration	ISO 14025 and EN50693		
PROGRAM OPERATOR	PUBLISHER		
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Xiamen Hongfa Electrical Safety and Control Co.,Ltd.	HFESC 20220819	1.0	en

EPD Owner	Xiamen Hongfa Electrical Safety and Control Co,Ltd.
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Declared product & Functional unit or declared unit	DU: The declared unit is specified in terms of pcs. The declared unit is 1pc of manufactured product incl. packaging material with RSL of 20 years
Product description	3 switches in 1 synthesis EPD report: UEM5-250L/180-430501C-111, UEM5-400L/350-430501C-P3-002, UEM5-400L/350-430501A-P3-002
CPC code	46212
Independent verification	EXTERNAL, Third party verification carried out by: ICMQ accredited by: ACCREDIA. This declaration has been developed referring to EPDItaly, following the "REGULATIONS OF THE EPDItaly PROGRAMME" Revision 5.2; further information and the document itself are available at: www.epditaly.it . EPD document valid within the following geographical area: Italy. Independent verification of the declaration and data carried out according to ISO 14025: 2006.
Reference PCR and version number	Core PCR: EPDItaly007 – PCR for Electronic and Electrical Products and Systems, Rev. 2, 2020/10/21. Sub PCR: EPDItaly012 - Electronic and electrical products and systems –Switches, Rev. 0, 2020/03/16.
Other reference documents	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
Markets of applicability	B2B, Italy
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	2021/5~2022/4
Technical support	TÜV Rheinland (China) Ltd.
LCA software	SimaPro 9.3.0.2 (2021)
LCI database	Ecoinvent v3.8 (2021)
LCIA methodology	EN 15804 + A2 Method V1.02
Comparability	EPDs published within the same product category, though originating 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.
Liability	EPDItaly declines any responsibility regarding the manufacturer's information, data and results of the life cycle assessment.

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HONGFA PURPOSE & EMBEDDING SUSTAINABILITY

Xiamen Hongfa Electroacoustic Co., Ltd.(The abbreviation is Hongfa Group) is in the process of seeking their own survival and sustainable development. HONGFA 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.

Hongfa 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

Hongfa Group has more than 30 subsidiaries worldwide, and its business covers more than 120 countries and regions, including relays, medium and low voltage products, high and low voltage switchgears, connectors, capacitors, precision parts and automation equipment. Hongfa is the only enterprise that owns postdoctoral working station and academican working station of the industry in China.

Company development history

- 1) In 1984, Xiamen Hongfa Electroacoustic Co., Ltd (Hongfa Group for short) was established.
- 2) In 1987, product and company orientation aligned, committed to be an export-oriented enterprise with relays as the main product.
- 3) In 1999, enterprise reform implemented; Employee stock ownership started.
- 4) In 2008, Hongfa is nominated as “China’s Most Well-Known Trademark.”
- 5) In 2012, Hognfa Group was Listed on Shanghai Stock Exchange. accelerated its capital structure adjustment, and started its business again.
- 6) In 2013, Xiamen Hongfa Electrical Safety & Controls Co.,Ltd (called HFESC for short) became fully own by Hongfa Group. HFESC is a professional low voltage device manufacturer of Hongfa Group.

Hongfa 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, HFESC applied EPD Italy and conduct LCA study from May.1 2021 to April.30 2022 and are 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 each product the characteristics and composition were listed from table2-table5.

Table 1: LCA Study related types

Type for LCA Study	Related Types	code
UEM5-250L/180-430501C-111	UEM5-250L/180-430501C-111	131114
UEM5-400L/350-430501C-P3-002	UEM5-400L/350-430501C-P3-002	131122
UEM5-400L/350-430501A-P3-002	UEM5-400L/350-430501A-P3-002	131123

PRODUCT CHARACTERISTICS
Table 2: Product characteristics of Hongfa UEM5-250L/180-430501C- 111

Series	UEM5-250L/180-430501C -111
Frame maximum current I_{nm} (A)	250
Rated current I_n (A)	180
current setting I_r (A)	/
rated insulation voltage U_i (V)	800
Rated impulse withstand voltage $U_{imp}(kV)$	8
Rated operating voltage U_e (V)	400
Poles	4P
Rated ultimate short circuit breaking capacity $I_{cu}(kA)$	10
Mechanical life	7000 cycles
Electrical life	1000 cycles
mode of operation	local operations
additional function	Thermal magnetic + VDS

Table 3: Product characteristics of Hongfa UEM5-400L/350-430501C -002

Series	UEM5-400L/350-430501C-002
Frame maximum current I_{nm} (A)	400
Rated current I_n (A)	350
current setting I_r (A)	/
rated insulation voltage U_i (V)	800
Rated impulse withstand voltage $U_{imp}(kV)$	8
Rated operating voltage U_e (V)	400
Poles	4P
Rated ultimate short circuit breaking capacity $I_{cu}(kA)$	25
Mechanical life	4000 cycles
Electrical life	1000 cycles
mode of operation	local operations
additional function	Thermal magnetic + VDS

Table 4: Product characteristics of Hongfa UEM5-800L/630-430501C- 002

Series	UEM5-800L/630-430501C-002
Frame maximum current I_{nm} (A)	800
Rated current I_n (A)	630
current setting I_r (A)	/
rated insulation voltage U_i (V)	800
Rated impulse withstand voltage $U_{imp}(kV)$	8
Rated operating voltage U_e (V)	400
Poles	4P
Rated ultimate short circuit breaking capacity $I_{cu}(kA)$	25
Mechanical life	4000 cycles
Electrical life	1000 cycles
mode of operation	local operations
additional function	Thermal magnetic + VDS

MATERIALS COMPOSITION

Table 5: The Switches material composition

Class name, in grams	ID according to IEC62474	UEM5-250L/180-430501C-111	UEM5-400L/350-430501A-P3-002	UEM5-400L/350-430501C-P3-002
PolyAmide (PA)	M-258	580.3	1058.8	1058.8
Unsaturated polyester (UP)	M-301	960.9	3361.4	3415.6
PolyOxyMethylene (POM)	M-205	0.3	0.3	0.3
Polyphenylenesulfide (PPS)	M-263	16.5	3.5	3.5
PC-ABS	M-281	36.5	334.6	334.6
Epoxy resin (EP)	M-302	25.1	146.3	146.3
Polyphthalamide (PPA)	M-218		42.8	56.4
Other unfilled thermoplastics	M-249			
Other inorganic materials	M-199	8.26	92.9	123.86
PolyVinylChloride (PVC)	M-250	380.8	1915.7	1915.7
Other duromers	M-319			
Other organic materials	M-399	0.2	0.2	0.2
Other precious metals	M-159	5.9	5.9	7.9
Other non-ferrous metals and alloys	M-149	0.66	3	4
Other ferrous alloys, non-stainless steels	M-119	805.8	3665.6	3812.2
Copper and its alloys	M-121	1087.98	2842.1	2909.6
Stainless steel	M-100	8.4	21	21
Aluminium and its alloys	M-120	180	216.4	216.4
Cast and sintered irons	M-101		208	208
Other substances or mixtures for product operation	M-449	27.4	340	340
Paper	M-341	957.24	2377.1	2377.1
Other liquids	M-429	0.49		
Oils and greases	M-410	2	3.5	3.5
Liquid Silicone Rubber (LSR)	M-323	0.35	0.17	0.17
Wood	M-340	571.4	1666.7	1666.7
PolyEthylene (PE)	M-201	102	90	90
Total		5758.48	18395.97	18711.83
Total		5758.48	18395.97	18711.83

LCA BACKGROUND INFORMATION

DECLARED UNIT (FUNCTIONAL UNIT)

The declared unit is specified in terms of pcs. The declared unit is 1 pcs of manufactured product incl. packaging material in a reference service life 20 years.

SYSTEM BOUNDARIES

The life cycle of the Switch, an EEPs (Electronic and Electrical Products and Systems), 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 for the evaluation of electronic and electrical products and systems.

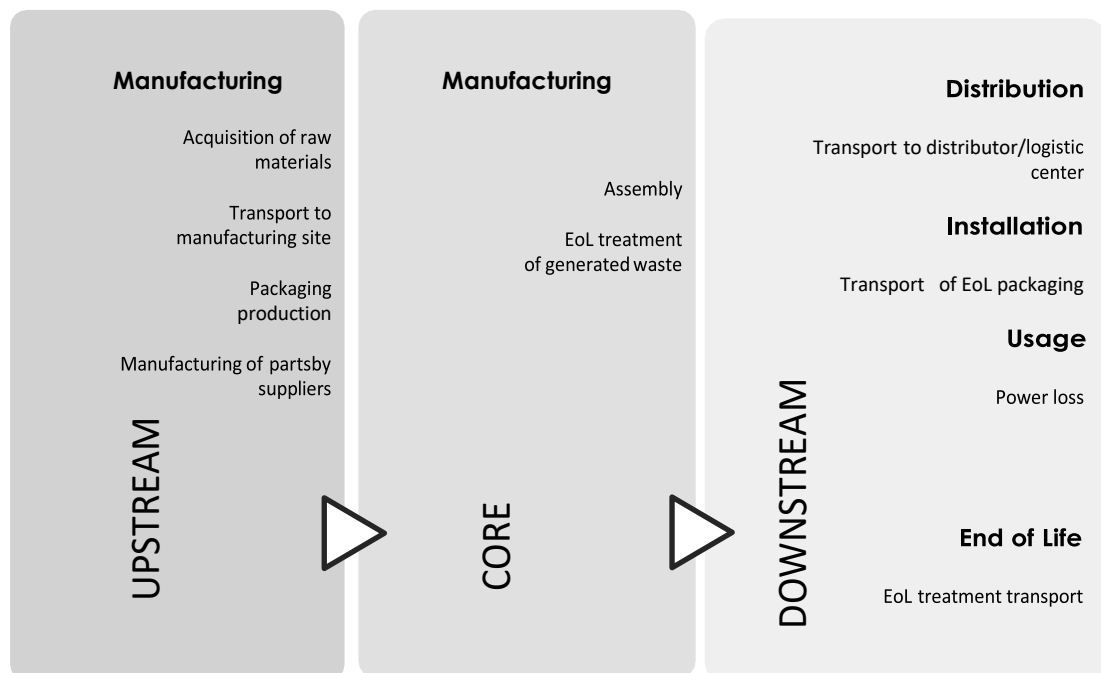
Table 6: System Boundaries

MANUFACTURING STAGE		DISTRIBUTION STAGE	INSTALLATION STAGE	USE & Maintenance STAGE	END-OF-LIFE STAGE De-installation	
UPSTREAM MODULE	CORE MODULE	DOWNSTREAM MODULE				
extraction of raw materials, including waste recycling processes and the production of semi-finished and ancillary products, as well as their packaging	Manufacturing of the product constituents, including all the stages	DISTRIBUTION	INSTALLATION	USE & Maintenance	De-installation	END-OF-LIFE
Transportation of raw materials to the manufacturing company	Product assembly					
	packaging					
	waste recycling processes					
X	X	X	X	X	X	X

X = module include in EPD

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 HONGFA suppliers, including transport of semifinished items and subassemblies to HONGFA. This includes also the packaging production.
- Manufacturing core includes local consumptions due to manufacturing of the products, the relevant assembling and waste due to manufacturing
- 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 deinstallation, transportation and operations for the disposal of the product at the end of its service life.



TEMPORAL AND GEOGRAPHICAL BOUNDARIES

The HONGFA component suppliers are sourced: China. All primary data collected from HONGFA are from 2021.5~2022.4, which is a representative production year. Secondary data are also representative for this year, as provided by ecoinvent v3.8.

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

BOUNDARIES IN THE LIFE CYCLE

As indicated in the PCR EPDItaly012, 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.

Infrastructures, when present, such as processes deriving from the ecoinvent database have not been excluded.

DATA QUALITY

In this EPD, both primary and secondary data are used. Site specific foreground data have been provided by HONGFA. Main data sources are the bill of materials available on the enterprise resource planning. For all processes for which primary are not available, generic data originating from the ecoinvent v3.8 database, allocation cut-off by classification, are used. The ecoinvent database is available in the SimaPro 9.3.0.2 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 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 EPDItaly012 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 and waste for products are allocated by mass on the basis of the total production amount from May 1, 2021 to April 30, 2022, considering the manufacture produce several types of circuit breakers with different weight and function, but the assembly process are similar, we choose to calculate 1kg of product power consumption and waste generation and then calculate the power and waste output data by product weight respectively.

LIMITATIONS AND SIMPLIFICATIONS

The data of energy consumption and pollutants emission in the raw material acquisition stage are from the Ecoinvent 3.8 database published by the European Ecoinvent Center.

The emission factor of China electricity is from the Ecoinvent 3.8 database.

The emission factor of Italy electricity is from the Ecoinvent 3.8 database.

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 transport of raw material use very different kinds of lorry. In total two types of lorries are applied in considering <7.5ton and >16ton levels

Switches contain more than numerous components. Thus, simplifications are made to categorize the components as steel, stainless steel, aluminium, copper and plastic based on its main constituents. The plastic components are assumed to be manufactured through injection moulding.

During the installation stage, since there is no primary data, an assumption is made by assuming that the switches are amounted through manual labor. The packaging materials are discarded after installation.

The de-installation is assumed to be the same as installation process, and the dismantling process of the waste processing is modelled by using generic data (Used industrial electronic device {GLO} treatment of, mechanical treatment | Cut-off, U) from Ecoinvent database;

During the end-of-life stage, the transportation of the waste to treatment facilities including recycling, landfill, or incineration center is assumed to be 200 km for simplification purposes.

INVENTORY ANALYSIS

The ecoinvent v3.8 by cut-off classification system processes are used to model the background system of the processes.

Due to the large amounts of components in the Switch, raw material inputs are modelled with data from ecoinvent representing a global market (GLO) and rest-of-world (ROW) coverage. These datasets are assumed to be representative.

MANUFACTURING STAGE

Nylon6 is the most frequently used material, followed by steel and copper and other plastics.

The single use packaging is also included in the analysis in the manufacturing stage- core. HONGFA receives packaging components from outside suppliers and packages the Switchs before shipping them.

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

In kgkm	UEM5-250L/180-430501C-111 /kgkm	UEM5-400L/350-430501A-P3-002 /kgkm	UEM5-400L/350-430501C-P3-002 /kgkm
<7.5t	78.4	216.7	220.6
>16t	1116.4	1132.7	1135.4

The manufacturing of the Switches is located in HONGFA facility of Xiamen, China. In the factory, the different components and subassemblies are assembled into the Switch.

For the manufacturing phase, the general China low voltage electricity mix from ecoinvent v3.8 is used.

The waste generated by the production and assembly processes is included in the calculation.

DISTRIBUTION

The transport distances and weight from HONGFA plant to the place of use are shown as below:

Table 7: Transportation activity data

ROUTE	TRANSPORT	DISTANCE (KM)
MANUFACTURER TO XIAMEN PORT	LORRY	19
XIAMEN PORT TO ITALY PORT	SHIP	14397
ITALY PORT TO DISTRIBUTION SITE	LORRY	200

USE

Use and maintenance are modelled according to the PCR EPDIItaly012 - Switches.

For the use phase, the general Italy low voltage electricity mix fromecoinvent v3.8 is used.

During the use phase, the Switches dissipates some electricity due to ohmic losses. They are calculated according to the own internal resistance of the Switch and the following PCR rules:

- nominal current reduced by a factor of 0.5;
- RSL of 20 years;
- functioning time of 30% of the RSL.

The formula for the calculation of the electricity consumed is shown in sub-PCR EPDIItaly012 and it is described as follows, where P_{use} is the power consumed by theSwitch at a given value of current:

$$E_{use} [kWh] = \frac{P_{use} * 8760 * RSL * \alpha}{1000}$$

Table 8: Power electricity losses of the switches

	UEM5-250L/180-430501C-111	UEM5-400L/350-430501A-P3-002	UEM5-400L/350-430501C-P3-002
P (W)	10.7	14.8	14.8
electricity (kWh)	563.4	776.9	776.9

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

END OF LIFE

For the end-of-life stage, De-installation of the electric products during the end-of-life stage is assumed to be same as in the installation stage. 200km transportation distance from plant site to waste treatment site is assumed, and waste processing stage is modeled by mechanical shredding and sorting based on the data from Ecoinvent database. Incineration is considered for the final disposal scenario. The recovery rate for metals is 95% according to IEC/TR 62635 guidelines. No energy and material credits are considered.

ENVIRONMENTAL INDICATORS

The following tables show the environmental impact indicators of the life cycle of a single Switch, as indicated by PCR EPDIItaly007, sub-PCR EPDIItaly012 and EN 50693:2019.

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).

UEM5-250L/180-430501C-111

Table 9: LCIA results for UEM5-250L/180-430501C-111

		Potential environmental impacts for 1 switch						
ITEMS	STAGE/ MODULE	Total	MANUFACTURING STAGE		DISTRIBUTION STAGE	INSTALLATION STAGE	USE STAGE	END-OF-LIFE STAGE
			UPSTREAM MODULE	CORE MODULE	DOWNSTREAM MODULE			
	GWP-total (kgCO ₂ eq)	3.07E+02	4.89E+01	4.51E+00	9.38E+00	1.04E-01	2.38E+02	6.33E+00
	GWP -fossil (kgCO ₂ eq)	2.83E+02	4.91E+01	4.55E+00	9.37E+00	1.04E-01	2.14E+02	6.32E+00
	GWP -biogenic (kgCO ₂ eq)	2.35E+01	-2.74E-01	-3.83E-02	3.24E-03	9.24E-05	2.38E+01	5.99E-03
	GWP -luluc (kgCO ₂ eq)	2.11E-01	1.65E-01	5.76E-04	6.12E-03	1.14E-05	3.80E-02	6.35E-04
	ODP(kgCFC11 eq)	3.48E-05	3.48E-06	2.42E-08	1.87E-06	2.26E-08	2.93E-05	6.73E-08
	AP(mol H+ eq.)	2.39E+00	1.02E+00	2.39E-02	3.00E-01	6.58E-04	1.05E+00	3.63E-03
	EP -freshwater (kg P eq.)	1.46E-01	8.94E-02	8.49E-04	2.97E-04	1.86E-06	5.50E-02	1.55E-04
	POCP (kg NMVOC eq.)	9.20E-01	2.68E-01	1.38E-02	2.02E-01	7.05E-04	4.32E-01	3.06E-03
	ADP –minerals and metals (kg Sb eq.)	2.96E-02	2.75E-02	1.37E-05	1.25E-05	9.07E-08	2.10E-03	4.48E-06
	ADP –fossil (MJ)	4.05E+03	6.20E+02	4.01E+01	1.21E+02	1.42E+00	3.26E+03	6.95E+00
	WDP(m ³ eq.)	1.69E+02	2.26E+01	5.80E-01	1.78E-01	1.23E-03	1.45E+02	3.74E-01

GWP total= Global Warming Potential total;
 GWP fossil=Global Warming Potential fossil;
 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;
 EP freshwater= Eutrophication potential freshwater compartment;
 POCP= Formation potential of tropospheric ozone;
 ADP minerals & metals= Abiotic Depletion for non fossil resources potential;
 ADP fossil=Abiotic Depletion for non fossil resources potential,
 WDP=Water deprivation potential.

Use of resources for 1 switch

ITEMS	STAGE/ MODULE	Total	MANUFACTURING STAGE		DISTRIBUTION STAGE	INSTALLATION STAGE	USE STAGE	END-OF-LIFE STAGE
			UPSTREAM MODULE	CORE MODULE	DOWNSTREAM MODULE			
PENRE (MJ)		4.01E+03	5.77E+02	4.01E+01	1.21E+02	1.42E+00	3.26E+03	6.95E+00
PERE (MJ)		1.17E+03	7.05E+01	4.12E+00	8.02E-01	5.52E-03	1.10E+03	4.28E-01
PENRM (MJ)		4.29E+01	4.29E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PERM (MJ)		2.11E+01	2.11E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PENRT (MJ)		4.05E+03	6.20E+02	4.01E+01	1.21E+02	1.42E+00	3.26E+03	6.95E+00
PERT (MJ)		1.20E+03	9.15E+01	4.12E+00	8.02E-01	5.52E-03	1.10E+03	4.28E-01
FW (m3)		4.29E+00	4.51E-01	8.33E-03	6.16E-03	4.95E-05	3.82E+00	1.12E-02
SM (kg)		0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
RSF (MJ)		0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NRSF (MJ)		0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

	<p>PENRE = Use of non-renewable primary energy excluding raw materials,</p> <p>PERE = Use of renewable primary energy excluding raw materials,</p> <p>PENRM = Use of non-renewable primary energy resources used as raw materials,</p> <p>PERM = Use of renewable primary energy resources used as raw materials,</p> <p>PENRT = Total use of non-renewable primary energy resources,</p> <p>PERT = Total use of renewable primary energy resources,</p> <p>FW = Use of net fresh water,</p> <p>SM = Use of secondary material,</p> <p>RSF = Use of renewable secondary fuels,</p> <p>NRSF = Use of non-renewable secondary fuels,</p> <p>INA = Indicator not accessed due to a limitation of the LCA tools and databases used to calculate the required resource flows. INA does not imply zero impact.</p>
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	Generation of waste for 1 switch
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ITEMS	STAGE/ MODULE	MANUFACTURING STAGE		DISTRIBUTION STAGE	INSTALLATION STAGE	USE STAGE	END-OF-LIFE STAGE
	Total	UPSTREAM MODULE	CORE MODULE	DOWNSTREAM MODULE			
HWD (kg)	1.25E-03	0.00E+00	1.25E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NHWD (kg)	2.15E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.15E+00
RWD (kg)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
MER (kg)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
MFR (kg)	3.65E+00	0.00E+00	3.61E-02	0.00E+00	1.63E+00	0.00E+00	1.98E+00
CRU (kg)	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	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
EEE (MJ)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

		<p>HWD = Hazardous waste disposed,</p> <p>NHWD = Non-hazardous waste disposed,</p> <p>RWD = Radioactive waste disposed,</p> <p>MER= Materials for energy recovery,</p> <p>MFR =Material for recycling,</p> <p>CRU =Components for reuse,</p> <p>ETE =Exported thermal energy,</p> <p>EEE= Exported electricity energy.</p> <p>INA = Indicator not accessed due to a limitation of the LCA tools and databases used to calculate the required resource flows. INA does not imply zero impact.</p>
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UEM5-400L/350-430501A-P3-002

Table 10: LCIA results for UEM5-400L/350-430501A-P3-002

Potential environmental impacts for 1 switch								
ITEMS	STAGE/ MODULE	Total	MANUFACTURING STAGE		DISTRIBUTION STAGE	INSTALLATION STAGE	USE STAGE	END-OF-LIFE STAGE
			UPSTREAM MODULE	CORE MODULE	DOWNSTREAM MODULE			
GWP-total (kgCO2 eq)		5.18E+02	1.22E+02	1.55E+01	3.00E+01	2.64E-01	3.28E+02	2.26E+01
GWP -fossil (kgCO2 eq)		4.87E+02	1.24E+02	1.56E+01	2.99E+01	2.64E-01	2.95E+02	2.26E+01
GWP -biogenic (kgCO2 eq)		3.08E+01	-1.95E+00	-1.31E-01	1.04E-02	2.34E-04	3.29E+01	1.71E-02
GWP -luluc (kgCO2 eq)		5.99E-01	5.23E-01	1.97E-03	1.95E-02	2.90E-05	5.24E-02	2.27E-03
ODP(kgCFC11 eq)		5.70E-05	1.02E-05	8.31E-08	5.98E-06	5.72E-08	4.04E-05	2.43E-07
AP(mol H+ eq.)		5.04E+00	2.54E+00	8.20E-02	9.57E-01	1.67E-03	1.45E+00	1.29E-02
EP -freshwater (kg P eq.)		3.06E-01	2.26E-01	2.91E-03	9.48E-04	4.72E-06	7.59E-02	5.66E-04
POCP (kg NMVOC eq.)		1.97E+00	6.67E-01	4.71E-02	6.46E-01	1.79E-03	5.96E-01	1.09E-02
ADP –minerals and metals (kg Sb eq.)		6.89E-02	6.59E-02	4.69E-05	4.00E-05	2.30E-07	2.90E-03	1.59E-05
ADP –fossil (MJ)		6.67E+03	1.62E+03	1.38E+02	3.85E+02	3.59E+00	4.50E+03	2.48E+01
WDP(m³ eq.)		2.65E+02	6.05E+01	1.99E+00	5.69E-01	3.11E-03	2.01E+02	1.44E+00

<p>GWP total= Global Warming Potential total;</p> <p>GWP fossil=Global Warming Potential fossil;</p> <p>GWP biogenic=Global Warming Potential biogenic;</p> <p>GWP luluc= Global Warming Potential land use and land use change;</p> <p>ODP= Depletion potential of the stratospheric ozone layer;</p> <p>AP=Acidification potential;</p> <p>EP freshwater= Eutrophication potential freshwater compartment;</p> <p>POCP= Formation potential of tropospheric ozone;</p> <p>ADP minerals & metals= Abiotic Depletion for non fossil resources potential;</p> <p>ADP fossil=Abiotic Depletion for non fossil resources potential,</p> <p>WDP=Water deprivation potential.</p>
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Use of resources for 1 switch

ITEMS	STAGE/ MODULE	Total	MANUFACTURING STAGE		DISTRIBUTION STAGE	INSTALLATION STAGE	USE STAGE	END-OF-LIFE STAGE
			UPSTREAM MODULE	CORE MODULE	DOWNSTREAM MODULE			
PENRE (MJ)		6.55E+03	1.50E+03	1.38E+02	3.85E+02	3.59E+00	4.50E+03	2.48E+01
PERE (MJ)		1.72E+03	1.87E+02	1.41E+01	2.56E+00	1.40E-02	1.51E+03	1.52E+00
PENRM (MJ)		1.26E+02	1.26E+02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PERM (MJ)		5.59E+01	5.59E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PENRT (MJ)		6.67E+03	1.62E+03	1.38E+02	3.85E+02	3.59E+00	4.50E+03	2.48E+01
PERT (MJ)		1.78E+03	2.43E+02	1.41E+01	2.56E+00	1.40E-02	1.51E+03	1.52E+00
FW (m3)		6.56E+00	1.21E+00	2.85E-02	1.97E-02	1.25E-04	5.26E+00	4.33E-02
SM (kg)		0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
RSF (MJ)		0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NRSF (MJ)		0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

	<p>PENRE = Use of non-renewable primary energy excluding raw materials,</p> <p>PERE = Use of renewable primary energy excluding raw materials,</p> <p>PENRM = Use of non-renewable primary energy resources used as raw materials,</p> <p>PERM = Use of renewable primary energy resources used as raw materials,</p> <p>PENRT = Total use of non-renewable primary energy resources,</p> <p>PERT = Total use of renewable primary energy resources,</p> <p>FW = Use of net fresh water,</p> <p>SM = Use of secondary material,</p> <p>RSF = Use of renewable secondary fuels,</p> <p>NRSF = Use of non-renewable secondary fuels,</p> <p>INA = Indicator not accessed due to a limitation of the LCA tools and databases used to calculate the required resource flows. INA does not imply zero impact.</p>
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	Generation of waste for 1 switch
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ITEMS	STAGE/ MODULE	MANUFACTURING STAGE		DISTRIBUTION STAGE	INSTALLATION STAGE	USE STAGE	END-OF-LIFE STAGE
	Total	UPSTREAM MODULE	CORE MODULE	DOWNSTREAM MODULE			
HWD (kg)	4.90E-03	0.00E+00	4.90E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NHWD (kg)	7.65E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.65E+00
RWD (kg)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
MER (kg)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
MFR (kg)	1.09E+01	0.00E+00	1.24E-01	0.00E+00	4.13E+00	0.00E+00	6.61E+00
CRU (kg)	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	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
EEE (MJ)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

		<p>HWD = Hazardous waste disposed,</p> <p>NHWD = Non-hazardous waste disposed,</p> <p>RWD = Radioactive waste disposed,</p> <p>MER= Materials for energy recovery,</p> <p>MFR =Material for recycling,</p> <p>CRU =Components for reuse,</p> <p>ETE =Exported thermal energy,</p> <p>EEE= Exported electricity energy.</p> <p>INA = Indicator not accessed due to a limitation of the LCA tools and databases used to calculate the required resource flows. INA does not imply zero impact.</p>
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UEM5-400L/350-430501C-P3-002

Table 11: LCIA results for UEM5-400L/350-430501C-P3-002

Potential environmental impacts for 1 switch								
ITEMS	STAGE/ MODULE	Total	MANUFACTURING STAGE		DISTRIBUTION STAGE	INSTALLATION STAGE	USE STAGE	END-OF-LIFE STAGE
			UPSTREAM MODULE	CORE MODULE	DOWNSTREAM MODULE			
	GWP-total (kgCO2 eq)			5.23E+02	1.25E+02	1.58E+01	3.05E+01	2.64E-01
GWP -fossil (kgCO2 eq)		4.91E+02	1.27E+02	1.59E+01	3.05E+01	2.64E-01	2.95E+02	2.29E+01
GWP -biogenic (kgCO2 eq)		3.09E+01	-1.87E+00	-1.34E-01	1.05E-02	2.34E-04	3.29E+01	1.74E-02
GWP -luluc (kgCO2 eq)		6.10E-01	5.33E-01	2.02E-03	1.99E-02	2.90E-05	5.24E-02	2.31E-03
ODP(kgCFC11 eq)		5.74E-05	1.05E-05	8.49E-08	6.09E-06	5.72E-08	4.04E-05	2.47E-07
AP(mol H+ eq.)		5.12E+00	2.60E+00	8.38E-02	9.73E-01	1.67E-03	1.45E+00	1.32E-02
EP -freshwater (kg P eq.)		3.13E-01	2.33E-01	2.97E-03	9.65E-04	4.72E-06	7.59E-02	5.76E-04
POCP (kg NMVOC eq.)		2.00E+00	6.87E-01	4.82E-02	6.57E-01	1.79E-03	5.96E-01	1.11E-02
ADP –minerals and metals (kg Sb eq.)		7.16E-02	6.86E-02	4.79E-05	4.07E-05	2.30E-07	2.90E-03	1.62E-05
ADP –fossil (MJ)		6.72E+03	1.66E+03	1.40E+02	3.92E+02	3.59E+00	4.50E+03	2.52E+01

WDP(m ³ eq.)	2.67E+02	6.22E+01	2.03E+00	5.79E-01	3.11E-03	2.01E+02	1.45E+00	
	GWP total= Global Warming Potential total; GWP fossil=Global Warming Potential fossil; 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; EP freshwater= Eutrophication potential freshwater compartment; POCP= Formation potential of tropospheric ozone; ADP minerals & metals= Abiotic Depletion for non fossil resources potential; ADP fossil=Abiotic Depletion for non fossil resources potential, WDP=Water deprivation potential.							
	Use of resources for 1 switch							
ITEMS	STAGE/ MODULE	Total	MANUFACTURING STAGE		DISTRIBUTION STAGE	INSTALLATION STAGE	USE STAGE	END-OF-LIFE STAGE
			UPSTREAM MODULE	CORE MODULE	DOWNSTREAM MODULE			
	PENRE (MJ)	6.60E+03	1.54E+03	1.40E+02	3.92E+02	3.59E+00	4.50E+03	2.52E+01
	PERE (MJ)	1.72E+03	1.92E+02	1.44E+01	2.60E+00	1.40E-02	1.51E+03	1.55E+00
	PENRM (MJ)	1.27E+02	1.27E+02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	PERM (MJ)	5.59E+01	5.59E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	PENRT (MJ)	6.72E+03	1.66E+03	1.40E+02	3.92E+02	3.59E+00	4.50E+03	2.52E+01
	PERT (MJ)	1.78E+03	2.48E+02	1.44E+01	2.60E+00	1.40E-02	1.51E+03	1.55E+00
	FW (m3)	6.60E+00	1.24E+00	2.92E-02	2.00E-02	1.25E-04	5.26E+00	4.37E-02
	SM (kg)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	RSF (MJ)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	NRSF (MJ)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

	<p>PENRE = Use of non-renewable primary energy excluding raw materials,</p> <p>PERE = Use of renewable primary energy excluding raw materials,</p> <p>PENRM = Use of non-renewable primary energy resources used as raw materials,</p> <p>PERM = Use of renewable primary energy resources used as raw materials,</p> <p>PENRT = Total use of non-renewable primary energy resources,</p> <p>PERT = Total use of renewable primary energy resources,</p> <p>FW = Use of net fresh water,</p> <p>SM = Use of secondary material,</p> <p>RSF = Use of renewable secondary fuels,</p> <p>NRSF = Use of non-renewable secondary fuels,</p> <p>INA = Indicator not accessed due to a limitation of the LCA tools and databases used to calculate the required resource flows. INA does not imply zero impact.</p>
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	Generation of waste for 1 switch
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STAGE/ MODULE ITEMS	Total	MANUFACTURING STAGE		DISTRIBUTION STAGE	INSTALLATION STAGE	USE STAGE	END-OF-LIFE STAGE
		UPSTREAM MODULE	CORE MODULE	DOWNSTREAM MODULE			
HWD (kg)	5.00E-03	0.00E+00	5.00E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NHWD (kg)	7.76E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.76E+00
RWD (kg)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
MER (kg)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
MFR (kg)	1.11E+01	0.00E+00	1.26E-01	0.00E+00	4.13E+00	0.00E+00	6.82E+00
CRU (kg)	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	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
EEE (MJ)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

	<p>HWD = Hazardous waste disposed,</p> <p>NHWD = Non-hazardous waste disposed,</p> <p>RWD = Radioactive waste disposed,</p> <p>MER= Materials for energy recovery,</p> <p>MFR =Material for recycling,</p> <p>CRU =Components for reuse,</p> <p>ETE =Exported thermal energy,</p> <p>EEE= Exported electricity energy.</p> <p>INA = Indicator not accessed due to a limitation of the LCA tools and databases used to calculate the required resource flows. INA does not imply zero impact.</p>
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