襄阳国网合成绝缘子有限责任公司
Xiangyang Guowang Composite Insulators Co.,Ltd.

Xiangyang Guowang Composite Insulators Co., Ltd.

EPD ITALY

ENVIRONMENTAL PRODUCT DECLARATION

Composite Insulators

300587/300648/300659/300782/300016（990293）/300020/300644/990291（300010）/990292/990294

High & New Tech Park, Industry District, Xiangyang, Hubei, 441000 P. R. China

In accordance with ISO 14025 and EN 50693:2019

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GENERAL INFORMATION

EPD OWNER	
Name of the company	Xiangyang Guowang Composite Insulators Co., Ltd.
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INFORMATION ON THE EPD	
Product name (s)	Composite Insulators 300587/300648/300659/300782/300016（990293）/300020/300644/990291（300010）/990292/990294
Site (s)	High & New Tech Park, Industry District, Xiangyang, Hubei, 441000 P. R. China
Short description and technical information of the product (s)	Composite Insulators
Field of application of the product (s)	Insulators
Product (s) reference standards (if any)	EN 50693:2019 – Product category rules for life cycle assessment of electronic and electrical products and systems
CPC Code (number) https://unstats.un.org/unsd/classifications/Econ	4621'Insulator'

VERIFICATION INFORMATION	
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Project Report LCA	Xiangyang Guowang Composite Insulators LCA Report
Independent Verification Statement	The PCR review was performed by XXXX - info@epditaly.it. Independent verification of the declaration and data, carried out according to ISO 14025: 2010. g 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.
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.

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1. Company information

Xiangyang Guowang Composite Insulators Co., Ltd. (Formerly known as Xiangfan Guowang Composite Insulators Co., Ltd.) was located in High & New Tech Park of Xiangyang City (Formerly name is Xiangfan City). It was established in 1988 while the company name was Xiangfan Electric Power Equipment Plant, and in 1997, the company was incorporated and registered as Xiangfan Guowang Composite Insulators Co., Ltd. In 2012, the company was merged in Nari Group Corporation.
In the early 1980's, the company has taken the lead in researching and developing composite insulators in China and introduced her series products of TONLY™ composite insulators to utilities. All its products for various voltage applications were firstly passing tests and accredited with national level in China, and its 500kV AC and DC, 800kV DC and 1000kV AC composite insulators were firstly served in the power grid of China.
Picture 2.1.1 - Aerial view of Xiangyang Guowang

Figure 1.1.1: Aerial view of Xiangyang Guowang

Due to the service experiences gained, TONLY™ composite insulators have been recognized as very reliable components for HV transmission lines and have become the first batch of highly recommended equipment for use in the National Urban and Rural Power Grid Reconstruction Engineering. Up to now, there have been more than 15,000,000 units of varied TONLY™ composite insulators served in HV and EHV transmission lines with safety and reliability, they have covered 30 provinces, municipalities and autonomous regions of China.
Moreover, composite insulators can also be manufactured in Xiangyang Guowang according to ANSI, BS, AS, DIN or other standards. Also, the insulators can be made according to customers' requirements.
Now the company have set up an annually production capacity of 1,000,000 pcs of composite insulator (converted into 110kV product) and have about 440 employees. Composite insulators are exported to many countries such as Italy, The Netherlands, Greece, Cyprus, Chile, Peru, Brazil, Colombia, Morocco, Zambia, Ethiopia, Jordan, Oman, Iran, Vietnam, Philippines, India, etc.

2. Product Information

In this study, life cycle assessment of a total of 10 insulators were conducted. Parameters of the insulators were shown below.

Table 2.2.1 – Parameters of the insulator(per unit)

Product TCA code	Insulator Reference	Max. voltage (kV)	Specified mechanical load (kN)	Min. creepage distance (mm)	Min. arcing distance (mm)	Wet power frequency withstand voltage (kV)	Drying lightning impulse withstand voltage (kV)	Total Weight (kg)
HV insulators family according to GSCH004								
300648	GSCH004/2 (CS 120 SB-325/2.250)	72.5	120	2250	570	140	325	4.02
300782	GSCH004/8 (CS 120 SB-650/3.625)	145	120	3625	1195	275	650	5.27
300587	GSCH004/9 (CS 120 SB-650/4.500)	145	120	4500	1195	275	650	6.27
300659	ELT-002 R12,5EH325L	72.5	12.5	2300	710	150	350	24.51
MV insulators family according to GSCC010								
990291（300010）	GSCC010/08	24	10	745	210	50	125	5.2
990293 (300016)	GSCC010/01	24	70	900	320	50	125	1.51
300644	GSCC010/14	24	12.5	560	241	70	160	3.53
990294	GSCC010/09	36	10	1120	285	70	170	6.98
300020	GSCC010/21	24	10	385	240	50	145	4.20
990292	GSCC010/02	36	70	1250	420	70	170	1.79

The percentage of product composition are shown in table below.

Table 2.2.2 – Composition of the insulator(per unit)

Composition ratio	**Code**	**300587**	**300648**	**300659**	**300782**	**300016（990293）**
Rubber	M-321	67.52%	57.52%	19.36%	60.75%	35.59%
Steel	M-119	21.36%	33.37%	60.53%	26.02%	50.36%
Glass	M-161	8.90%	7.29%	16.09%	10.58%	11.24%
Epoxy resin	M-302	2.22%	1.82%	4.02%	2.65%	2.81%
Ceramic	M160	0.00%	0.00%	0.00%	0.00%	0.00%

Composition ratio	**Code**	**300020**	**300644**	**990291（300010）**	**990292**	**990294**
Rubber	M-321	11.42%	20.80%	25.72%	42.56%	26.68%
Steel	M-119	78.94%	54.08%	63.75%	42.52%	63.86%
Glass	M-161	7.71%	12.85%	8.43%	11.93%	7.56%
Epoxy resin	M-302	1.93%	3.21%	2.11%	2.98%	1.89%
Ceramic	M160	0.00%	9.06%	0.00%	0.00%	0.00%

Table 2.2.3 – Weight of the insulator(per unit)

Item	**300587**	**300648**	**300659**	**300782**	**300016（990293）**
Composite Insulator	6.27	4.02	24.51	5.27	1.51
Packaging-PE	0.01	0.00	0.01	0.01	0.00
Packaging-Wood box	2.45	1.63	3.67	1.72	0.50
Total	8.73	5.65	28.19	7.00	2.01

Item	300020	300644	990291（300010）	990292	990294
Composite Insulator	4.20	3.53	5.20	1.79	6.98
Packaging-Paperboard	0.00	0.00	0.00	0.00	0.00
Packaging-Wood box	0.89	1.11	1.83	0.78	1.25
Total	5.09	4.64	7.04	2.57	8.24

3. Life Cycle Assessment Information

A Life Cycle Assessment (LCA) is a methodology for assessing the environmental impacts associated with the entire life cycle of a particular product or process. LCA consists of 4 stages (Goal and Scope, Inventory Analysis, Impact Assessment, and review/presentation) which must follow similar procedures to a PCR (Product Category Rules) and helps to evaluate the carbon footprint and natural resources of a product or process. In this EPD, LCA is conduted speately to obtain environmental impact information.

3.1. Declared unit

According to PCR EPDItaly010, the declared unit related to the functional unit is a single insulator during a service life of 20 years.

3.2. System, temporal, and geographical boundaries

The system boundary includes the whole life cycle of the analysed product, according to a “from cradle to grave” application, covering the following life cycle stages:

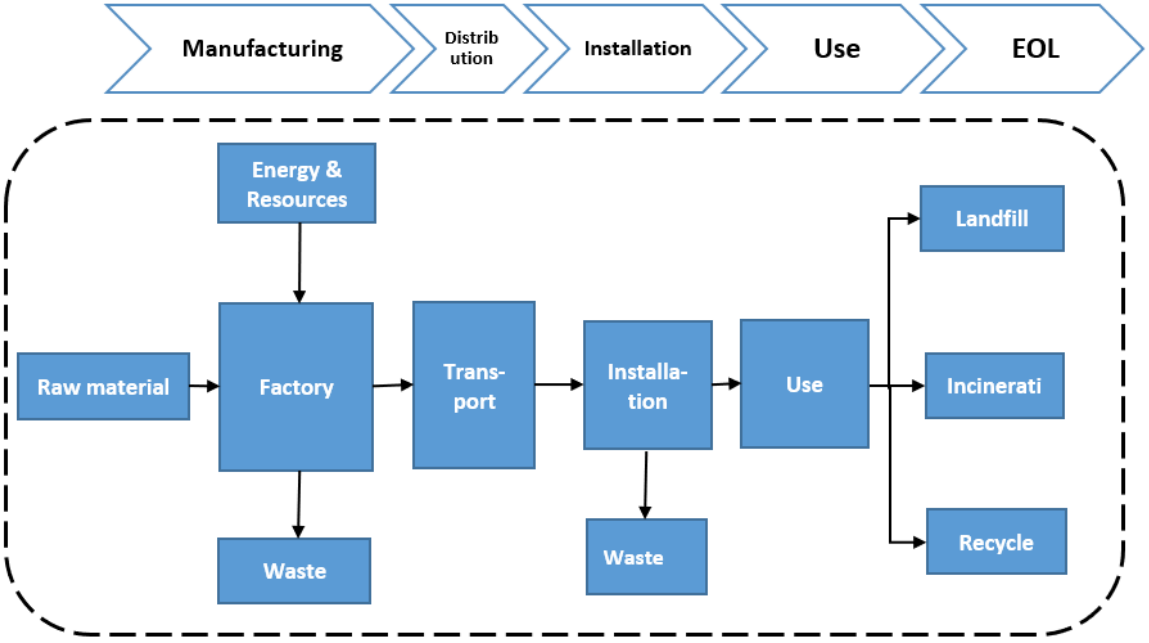

Figure 3.2.1: Phases and processes included

Manufacturing stage. This phase includes the upstream and core modules described previously (raw material transformation, transportation of raw materials and semi-finished products, production of the finished product packaging, generation of process waste including its transportation to the disposal site, energy and material consumption associated to plant operations);

Distribution stage. This module includes the impacts related to the distribution of the product at the installation site;

Installation stage. This module includes the end of life of packaging.

Use & Maintenance Stage. The module includes the impacts related to the insulator’s operation. According to PCR, unlike other electrical devices that have a constant (albeit modest) electrical power usage during operation, the insulator is a passive component. Consequently, the product’s use stage is cut-offed.

End of Life Stage. This module includes the transportation of the insulator to the collection site, disassembly operations, distribution and destination of the various material flows to be sent for recycling or disposal.

It should be noted that the construction, maintenance, and decommissioning of infrastructure, i.e. buildings and machinery, as well as the occupation of industrial land have not been considered, as their contribution to the environmental impact of the declared unit is considered negligible.

For the study, reference was made to the data deriving from the BOMs of the specific products, whose production began in 2022 (reference year). For plant consumption, reference was made to the data related to the Xiangyang Guowang production plant and referred to the year 2022 June –2023 May, considered representative (at the time of conducting the study, this is the last complete calendar year for which the data are available).

The suppliers of raw materials and semifinished products are located in China. Where possible, the specific origin of the raw material has been investigated and characterized accordingly. For the downstream phases, an Brazil scenario was considered, as downstream buyers are mainly Brazilian.

3.3. Impact categories

The methodology chosen to evaluate the potential environmental impacts of the product subject of this study includes all the impact categories required by the Standard EN 50693:2019. The models used are those shown in Core PCR, as implemented in the SimaPro software. The categories analyzed are therefore:

Indicator name and abbrevation (EN)	Unit (EN)
Global Warming Potential – fossil fuels (GWP-fossil)	kg CO2 eq.
Global Warming Potential – biogenic (GWP-biogenic)	kg CO2 eq.
Global Warming Potential – land use and land use change (GWP-luluc)	kg CO2 eq.
Global Warming Potential – total (GWP-total)	kg CO2 eq.
Depletion potential of the stratospheric ozone layer (ODP)	kg CFC-11 eq.
Acidifcation potential, Accumulated Exceedance (AP)	mol H+ eq.
Eutrophication potential – freshwater (EP-freshwater)	kg P eq.
Eutrophication aquatic marine (EP-marine)	kg N eq.
Eutrophication terrestrial (EP-terrestrial)	mol N eq.
Photochemical Ozone Creation Potential (POCP)	kg NMVOC eq.
Abiotic depletion potential – non-fossil resources (ADPE)	kg Sb eq.
Abiotic depletion potential – fossil resources (ADPF)	MJ, net calorific value
Water (user) deprivation potential (WDP)	m3 world eq. Deprived

*Please also noted that the EN 15804+A2 method is based on the EF 3.1 version for this study.

3.4. Cut-off

According to EPD Italy Regulations and PCR EPDItaly010, the following flows and operations are cut-offed:

- Production, use and disposal of the packaging of components and the packaging of semi-finished intermediates.
- Materials making up the insulator itself whose total mass does not exceed 1% of the total weight of the device.
- Impacts related to the insulator's use and maintenance, as insulators does not have a constant (albeit modest) electrical power usage during operation and no scheduled interventions are foreseen.
- Input and output of masterbatch used during rubber mixing are cut offed as they only accounts for 0.3% of rubber weight and less than 0.5% of insulator weight, which comply with the Cut-off criteria.

3.5. Allocation Principles

Due to the characteristics of insulator products, different types of insulators size and weight differently, and their power consumption per unit product differ. In order to reasonably allocate the total electricity consumption of producing one certain type of insulator, Xiangyang Guowang converts the annual output of all products into the target insulator product output according to the characteristics of targeted insulator, and then uses the physical mass allocation method to allocate the electricity consumption.

In addition, the default distribution rule for the environmental impacts and benefits of reuse, recovery and/or recycling is based on the polluter pays principle (PPP), which means that the recovery or reuse beneficiary bears the environmental impacts and benefits associated with the recovery or reuse treatment, and the original product manufacturer does not have to bear this part of the impact burden. It also does not participate in the sharing of benefits (environmental impact of the production of the same product avoided by recycling and reuse).

3.6. Limitation and Assumption

The results are only valid for the situation defined by the assumptions described in the present report, and they are subject to change if these manufacturing conditions change.The following assumptions are used in this assessment:

Table 3.6.1 – Assumptions for each stage of the life cycle

Life cycle module	Life cycle stage	Assumption
MANUFACTURING STAGE	Upstream Module	• Raw material information is provided by Xiangyang Guowang according to product's bill of material. The reference annual average rubber yield is 98.97% for rubber mixing process, and rubber utilization rate is 96.08% for insulator manufacturing. • Raw material transportation distance was provided by Xiangyang Guowang according to its upstream supplier and online map. • The density of wood package is assumed to be 768.6kg/m3 as plywood is used.
	Core Module	• China consumption electricity mix was used in the core module as residual mix is not available. • Waste rubber generated in this module is 100% recycled according to Xiangyang Guowang as downstream buyer would pay for their waste rubber, , transport distance from Xiangyang Guowang to its buyer is 860km according to online map.
DISTRIBUTION STAGE	Downstream Module	• The product is to be used in Brazil. Downstream distribution distances are estimated from the GAODE map and SEARATE website for shipment distances, inland transport is by truck freight and sea transport is by ship. • The distance from Xiangyang Guowang to port is assumed to be 268km， the distance from China and Brazil port is assumed to be 22596km, and port of Colombia to the client is assumed to be 1610km.

INSTALLATION STAGE		• The transportation packaging of insulators were disposed after distribution of client, it is assumed to be incinerated for woods and treated as average PE treatment method in Brazil market.
USE & Maintenance STAGE		/
END-OF-LIFE STAGE De-installation		• According to Xiangyang Guowang's expert judgement, disposed insulators are manually cut to separate recyclable fittings and rubber, of which 80% of rubber and metal can be downcycled, and the remaining 20% disposed, with rubber being incinerated and steel being landfilled. • The remaining material is ECR fiberglass rod, it is assumed to be incinerated as hazardous waste. • In this module, it is assumed that transport distance from installation to waste treatment is 1000km as it may cover most destination.

4. Inventory analysis

In this EPD, where available, reference was made to primary data. Where access to this type of data was not possible, datasets from the Ecoinvent v3.9 database were used as reference.

Data collection was carried out by preparing a sheet that collected input and output data, in terms of mass, energy consumption were obtained within production site. The data collection sheet was verified and checked by mass balances and reporting any inconsistencies that were clarified and resolved.

In the study, SimaPro 9.5 software was used to establish the model for the life cycle of products and calculate LCA results.

5. Environmental Impact Assessment

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Potential Environmental impact of each lifecycle stage are shown below.

Table 5.1.1 – Environmental impact descriptive parameters

Impact category	Unit	Total	Upstream Module	Core	Downstream			
			Manufacturing		Distribution	Installation	Use	End of Life
Climate change	kg CO2 eq	5.73E+01	3.84E+01	5.21E+00	4.42E+00	3.96E+00	0.00E+00	5.24E+00
Climate change - Biogenic	kg CO2 eq	5.30E-01	-3.07E+00	-2.93E-02	2.79E-02	3.59E+00	0.00E+00	1.54E-02
Climate change - Fossil	kg CO2 eq	5.66E+01	4.15E+01	5.24E+00	4.32E+00	3.55E-01	0.00E+00	5.20E+00
Climate change - Land use and LU change	kg CO2 eq	1.66E-01	4.14E-02	2.14E-03	7.61E-02	1.30E-02	0.00E+00	3.35E-02
Ozone depletion	kg CFC11 eq	2.14E-03	2.14E-03	1.35E-08	1.09E-07	1.32E-08	0.00E+00	1.47E-07
Acidification	mol H+ eq	3.56E-01	2.53E-01	2.78E-02	6.81E-02	1.52E-03	0.00E+00	5.68E-03
Eutrophication, freshwater	kg P eq	1.32E-02	1.14E-02	9.66E-04	2.56E-04	4.34E-05	0.00E+00	5.52E-04
Eutrophication, marine	kg N eq	7.94E-02	5.24E-02	5.91E-03	1.84E-02	6.98E-04	0.00E+00	1.97E-03
Eutrophication, terrestrial	mol N eq	8.42E-01	5.60E-01	6.29E-02	1.96E-01	6.04E-03	0.00E+00	1.76E-02
Photochemical ozone formation	kg NMVOC eq	2.65E-01	1.84E-01	1.67E-02	5.60E-02	2.05E-03	0.00E+00	6.38E-03
Resource use, minerals and metals	kg Sb eq	3.58E-04	3.34E-04	6.81E-06	1.01E-05	1.24E-06	0.00E+00	5.37E-06
Resource use, fossils	MJ	6.46E+02	5.11E+02	5.12E+01	5.76E+01	4.99E+00	0.00E+00	2.05E+01
Water use	m3 depriv.	1.05E+01	8.93E+00	6.17E-01	4.50E-01	3.56E-02	0.00E+00	5.00E-01

Parameters describing resource use are shown below.

Table 5.1.2 – Parameters describing resource use

Parameter	Unit	Total	Upstream Module	Core	Downstream			
			Manufacturing		Distribution	Installation	Use	End of Life
PENRE	MJ, net calorific value	4.86E+02	3.51E+02	5.12E+01	5.81E+01	5.08E+00	0.00E+00	2.07E+01
PERE	MJ, net calorific value	1.01E+02	9.17E+01	7.82E+00	8.13E-01	1.06E-01	0.00E+00	6.11E-01
PENRM	MJ, net calorific value	1.61E+02	1.61E+02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PERM	MJ, net calorific value	4.41E+01	4.41E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PENRT	MJ, net calorific value	6.46E+02	5.11E+02	5.12E+01	5.81E+01	5.08E+00	0.00E+00	2.07E+01
PERT	MJ, net calorific value	1.45E+02	1.36E+02	7.82E+00	8.13E-01	1.06E-01	0.00E+00	6.11E-01
FW	m^3	4.02E-01	3.17E-01	1.54E-02	3.86E-02	5.71E-03	0.00E+00	2.50E-02
MS	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

Waste production descriptive parameters are shown below.

Table 5.1.3 – Waste production descriptive parameters

Parameter	Unit of measurement	Total	Upstream Module	Core	Downstream			
			Manufacturing		Distribution	Installation	Use	End of Life
HWD	kg	6.98E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.98E-01
NHWD	kg	3.57E+00	0.00E+00	0.00E+00	0.00E+00	2.46E+00	0.00E+00	1.12E+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	4.63E+00	0.00E+00	1.73E-01	0.00E+00	0.00E+00	0.00E+00	4.46E+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

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Potential Environmental impact of each lifecycle stage are shown below.

Table 5.2.1 – Environmental impact descriptive parameters

Impact category	Unit	Total	Upstream Module	Core	Downstream			
			Manufacturing		Distribution	Installation	Use	End of Life
Climate change	kg CO2 eq	3.44E+01	2.27E+01	3.34E+00	2.86E+00	2.64E+00	0.00E+00	2.91E+00
Climate change - Biogenic	kg CO2 eq	2.88E-01	-2.11E+00	-1.88E-02	1.81E-02	2.39E+00	0.00E+00	9.53E-03
Climate change - Fossil	kg CO2 eq	3.40E+01	2.48E+01	3.35E+00	2.79E+00	2.36E-01	0.00E+00	2.88E+00
Climate change - Land use and LU change	kg CO2 eq	1.05E-01	2.47E-02	1.37E-03	4.93E-02	8.66E-03	0.00E+00	2.14E-02
Ozone depletion	kg CFC11 eq	1.17E-03	1.16E-03	8.58E-09	7.05E-08	8.77E-09	0.00E+00	8.08E-08
Acidification	mol H+ eq	2.13E-01	1.47E-01	1.78E-02	4.41E-02	1.01E-03	0.00E+00	3.33E-03
Eutrophication, freshwater	kg P eq	8.14E-03	7.03E-03	6.19E-04	1.66E-04	2.89E-05	0.00E+00	2.98E-04
Eutrophication, marine	kg N eq	4.83E-02	3.09E-02	3.79E-03	1.19E-02	4.65E-04	0.00E+00	1.18E-03
Eutrophication, terrestrial	mol N eq	5.11E-01	3.30E-01	4.03E-02	1.27E-01	4.02E-03	0.00E+00	1.05E-02
Photochemical ozone formation	kg NMVOC eq	1.63E-01	1.11E-01	1.07E-02	3.62E-02	1.37E-03	0.00E+00	3.82E-03
Resource use, minerals and metals	kg Sb eq	1.99E-04	1.84E-04	4.35E-06	6.55E-06	8.28E-07	0.00E+00	3.17E-06
Resource use, fossils	MJ	3.89E+02	3.04E+02	3.27E+01	3.73E+01	3.33E+00	0.00E+00	1.21E+01
Water use	m3 depriv.	6.31E+00	5.32E+00	3.95E-01	2.91E-01	2.37E-02	0.00E+00	2.84E-01

Parameters describing resource use are shown below.

Table 5.2.2 – Parameters describing resource use

Parameter	Unit	Total	Upstream Module	Core	Downstream			
			Manufacturing		Distribution	Installation	Use	End of Life
PENRE	MJ, net calorific value	3.02E+02	2.16E+02	3.27E+01	3.76E+01	3.39E+00	0.00E+00	1.23E+01
PERE	MJ, net calorific value	6.20E+01	5.60E+01	5.01E+00	5.26E-01	7.04E-02	0.00E+00	3.50E-01
PENRM	MJ, net calorific value	8.75E+01	8.75E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PERM	MJ, net calorific value	2.94E+01	2.94E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PENRT	MJ, net calorific value	3.90E+02	3.04E+02	3.27E+01	3.76E+01	3.39E+00	0.00E+00	1.23E+01
PERT	MJ, net calorific value	9.14E+01	8.54E+01	5.01E+00	5.26E-01	7.04E-02	0.00E+00	3.50E-01
FW	m^3	2.40E-01	1.86E-01	9.87E-03	2.50E-02	3.80E-03	0.00E+00	1.50E-02
MS	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

Waste production descriptive parameters are shown below.

Table 5.2.3 – Waste production descriptive parameters

Parameter	Unit of measurement	Total	Upstream Module	Core	Downstream			
			Manufacturing		Distribution	Installation	Use	End of Life
HWD	kg	3.66E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.66E-01
NHWD	kg	2.37E+00	0.00E+00	0.00E+00	0.00E+00	1.64E+00	0.00E+00	7.30E-01
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	3.01E+00	0.00E+00	9.42E-02	0.00E+00	0.00E+00	0.00E+00	2.92E+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

5.3 300659

Potential Environmental impact of each lifecycle stage are shown below.

Table 5.3.1 – Environmental impact descriptive parameters

Impact category	Unit	Total	Upstream Module	Core	Downstream			
			Manufacturing		Distribution	Installation	Use	End of Life
Climate change	kg CO2 eq	1.57E+02	9.84E+01	2.03E+01	1.43E+01	5.92E+00	0.00E+00	1.84E+01
Climate change - Biogenic	kg CO2 eq	6.10E-01	-4.81E+00	-1.14E-01	9.01E-02	5.37E+00	0.00E+00	6.76E-02
Climate change - Fossil	kg CO2 eq	1.56E+02	1.03E+02	2.04E+01	1.39E+01	5.30E-01	0.00E+00	1.82E+01
Climate change - Land use and LU change	kg CO2 eq	4.96E-01	8.99E-02	8.32E-03	2.46E-01	1.94E-02	0.00E+00	1.32E-01
Ozone depletion	kg CFC11 eq	2.40E-03	2.40E-03	5.11E-08	3.52E-07	1.97E-08	0.00E+00	9.21E-07
Acidification	mol H+ eq	8.92E-01	5.33E-01	1.08E-01	2.20E-01	2.27E-03	0.00E+00	2.88E-02
Eutrophication, freshwater	kg P eq	4.09E-02	3.26E-02	3.77E-03	8.26E-04	6.49E-05	0.00E+00	3.64E-03
Eutrophication, marine	kg N eq	2.09E-01	1.17E-01	2.30E-02	5.94E-02	1.04E-03	0.00E+00	9.16E-03
Eutrophication, terrestrial	mol N eq	2.21E+00	1.24E+00	2.44E-01	6.31E-01	9.03E-03	0.00E+00	8.23E-02
Photochemical ozone formation	kg NMVOC eq	7.43E-01	4.64E-01	6.48E-02	1.81E-01	3.07E-03	0.00E+00	3.02E-02
Resource use, minerals and metals	kg Sb eq	1.57E-03	1.49E-03	2.63E-05	3.26E-05	1.86E-06	0.00E+00	2.77E-05
Resource use, fossils	MJ	1.76E+03	1.26E+03	1.99E+02	1.86E+02	7.47E+00	0.00E+00	1.05E+02
Water use	m3 depriv.	2.47E+01	1.85E+01	2.41E+00	1.45E+00	5.32E-02	0.00E+00	2.32E+00

Parameters describing resource use are shown below.

Table 5.3.2 – Parameters describing resource use

Parameter	Unit	Total	Upstream Module	Core	Downstream			
			Manufacturing		Distribution	Installation	Use	End of Life
PENRE	MJ, net calorific value	1.54E+03	1.04E+03	1.99E+02	1.88E+02	7.60E+00	0.00E+00	1.06E+02
PERE	MJ, net calorific value	1.87E+02	1.51E+02	3.06E+01	2.62E+00	1.58E-01	0.00E+00	3.42E+00
PENRM	MJ, net calorific value	2.16E+02	2.16E+02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PERM	MJ, net calorific value	6.60E+01	6.60E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PENRT	MJ, net calorific value	1.76E+03	1.26E+03	1.99E+02	1.88E+02	7.60E+00	0.00E+00	1.06E+02
PERT	MJ, net calorific value	2.53E+02	2.17E+02	3.06E+01	2.62E+00	1.58E-01	0.00E+00	3.42E+00
FW	m^3	9.26E-01	6.26E-01	6.00E-02	1.25E-01	8.54E-03	0.00E+00	1.07E-01
MS	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

Waste production descriptive parameters are shown below.

Table 5.3.3 – Waste production descriptive parameters

Parameter	Unit of measurement	Total	Upstream Module	Core	Downstream			
			Manufacturing		Distribution	Installation	Use	End of Life
HWD	kg	4.93E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.93E+00
NHWD	kg	7.59E+00	0.00E+00	0.00E+00	0.00E+00	3.68E+00	0.00E+00	3.92E+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	1.59E+01	0.00E+00	1.94E-01	0.00E+00	0.00E+00	0.00E+00	1.57E+01
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

5.4 300782

Potential Environmental impact of each lifecycle stage are shown below.

Table 5.4.1 – Environmental impact descriptive parameters

Impact category	Unit	Total	Upstream Module	Core	Downstream			
			Manufacturing		Distribution	Installation	Use	End of Life
Climate change	kg CO2 eq	4.60E+01	3.08E+01	4.38E+00	3.54E+00	2.78E+00	0.00E+00	4.45E+00
Climate change - Biogenic	kg CO2 eq	4.02E-01	-2.13E+00	-2.46E-02	2.24E-02	2.52E+00	0.00E+00	1.33E-02
Climate change - Fossil	kg CO2 eq	4.55E+01	3.29E+01	4.40E+00	3.46E+00	2.49E-01	0.00E+00	4.41E+00
Climate change - Land use and LU change	kg CO2 eq	1.32E-01	3.22E-02	1.80E-03	6.10E-02	9.12E-03	0.00E+00	2.83E-02
Ozone depletion	kg CFC11 eq	1.62E-03	1.62E-03	1.13E-08	8.73E-08	9.24E-09	0.00E+00	1.41E-07
Acidification	mol H+ eq	2.83E-01	1.98E-01	2.33E-02	5.46E-02	1.07E-03	0.00E+00	5.13E-03
Eutrophication, freshwater	kg P eq	1.07E-02	9.15E-03	8.11E-04	2.05E-04	3.04E-05	0.00E+00	5.39E-04
Eutrophication, marine	kg N eq	6.31E-02	4.11E-02	4.97E-03	1.47E-02	4.90E-04	0.00E+00	1.74E-03
Eutrophication, terrestrial	mol N eq	6.68E-01	4.39E-01	5.28E-02	1.57E-01	4.24E-03	0.00E+00	1.56E-02
Photochemical ozone formation	kg NMVOC eq	2.12E-01	1.46E-01	1.40E-02	4.49E-02	1.44E-03	0.00E+00	5.65E-03
Resource use, minerals and metals	kg Sb eq	3.16E-04	2.96E-04	5.71E-06	8.11E-06	8.72E-07	0.00E+00	4.86E-06
Resource use, fossils	MJ	5.17E+02	4.06E+02	4.30E+01	4.62E+01	3.50E+00	0.00E+00	1.85E+01
Water use	m3 depriv.	8.23E+00	6.88E+00	5.18E-01	3.61E-01	2.50E-02	0.00E+00	4.45E-01

Parameters describing resource use are shown below.

Table 5.4.2 – Parameters describing resource use

Parameter	Unit	Total	Upstream Module	Core	Downstream			
			Manufacturing		Distribution	Installation	Use	End of Life
PENRE	MJ, net calorific value	3.95E+02	2.83E+02	4.30E+01	4.66E+01	3.57E+00	0.00E+00	1.87E+01
PERE	MJ, net calorific value	7.59E+01	6.81E+01	6.57E+00	6.51E-01	7.41E-02	0.00E+00	5.67E-01
PENRM	MJ, net calorific value	1.23E+02	1.23E+02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PERM	MJ, net calorific value	3.09E+01	3.09E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PENRT	MJ, net calorific value	5.18E+02	4.06E+02	4.30E+01	4.66E+01	3.57E+00	0.00E+00	1.87E+01
PERT	MJ, net calorific value	1.07E+02	9.90E+01	6.57E+00	6.51E-01	7.41E-02	0.00E+00	5.67E-01
FW	m^3	3.14E-01	2.45E-01	1.29E-02	3.10E-02	4.01E-03	0.00E+00	2.16E-02
MS	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

Waste production descriptive parameters are shown below.

Table 5.4.3 – Waste production descriptive parameters

Parameter	Unit of measurement	Total	Upstream Module	Core	Downstream			
			Manufacturing		Distribution	Installation	Use	End of Life
HWD	kg	6.98E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.98E-01
NHWD	kg	2.64E+00	0.00E+00	0.00E+00	0.00E+00	1.73E+00	0.00E+00	9.15E-01
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	3.79E+00	0.00E+00	1.31E-01	0.00E+00	0.00E+00	0.00E+00	3.66E+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

5.5 300016（990293）

Potential Environmental impact of each lifecycle stage are shown below.

Table 5.5.1 – Environmental impact descriptive parameters

Impact category	Unit	Total	Upstream Module	Core	Downstream			
			Manufacturing		Distribution	Installation	Use	End of Life
Climate change	kg CO2 eq	1.12E+01	7.04E+00	1.25E+00	1.02E+00	8.07E-01	0.00E+00	1.07E+00
Climate change - Biogenic	kg CO2 eq	6.73E-02	-6.68E-01	-7.05E-03	6.42E-03	7.33E-01	0.00E+00	3.84E-03
Climate change - Fossil	kg CO2 eq	1.11E+01	7.70E+00	1.26E+00	9.94E-01	7.22E-02	0.00E+00	1.05E+00
Climate change - Land use and LU change	kg CO2 eq	3.62E-02	7.43E-03	5.13E-04	1.75E-02	2.65E-03	0.00E+00	8.09E-03
Ozone depletion	kg CFC11 eq	2.71E-04	2.71E-04	3.18E-09	2.51E-08	2.68E-09	0.00E+00	4.21E-08
Acidification	mol H+ eq	6.71E-02	4.29E-02	6.67E-03	1.57E-02	3.10E-04	0.00E+00	1.48E-03
Eutrophication, freshwater	kg P eq	2.78E-03	2.32E-03	2.32E-04	5.89E-05	8.84E-06	0.00E+00	1.62E-04
Eutrophication, marine	kg N eq	1.56E-02	9.29E-03	1.42E-03	4.24E-03	1.42E-04	0.00E+00	4.96E-04
Eutrophication, terrestrial	mol N eq	1.65E-01	9.89E-02	1.51E-02	4.50E-02	1.23E-03	0.00E+00	4.42E-03
Photochemical ozone formation	kg NMVOC eq	5.39E-02	3.49E-02	4.01E-03	1.29E-02	4.18E-04	0.00E+00	1.62E-03
Resource use, minerals and metals	kg Sb eq	8.30E-05	7.74E-05	1.63E-06	2.33E-06	2.53E-07	0.00E+00	1.42E-06
Resource use, fossils	MJ	1.26E+02	9.42E+01	1.23E+01	1.33E+01	1.02E+00	0.00E+00	5.41E+00
Water use	m3 depriv.	1.97E+00	1.59E+00	1.48E-01	1.04E-01	7.26E-03	0.00E+00	1.21E-01

Parameters describing resource use are shown below.

Table 5.5.2 – Parameters describing resource use

Parameter	Unit	Total	Upstream Module	Core	Downstream			
			Manufacturing		Distribution	Installation	Use	End of Life
PENRE	MJ, net calorific value	1.05E+02	7.27E+01	1.23E+01	1.34E+01	1.04E+00	0.00E+00	5.46E+00
PERE	MJ, net calorific value	1.84E+01	1.61E+01	1.88E+00	1.87E-01	2.15E-02	0.00E+00	1.67E-01
PENRM	MJ, net calorific value	2.14E+01	2.14E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PERM	MJ, net calorific value	9.00E+00	9.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PENRT	MJ, net calorific value	1.26E+02	9.42E+01	1.23E+01	1.34E+01	1.04E+00	0.00E+00	5.46E+00
PERT	MJ, net calorific value	2.74E+01	2.51E+01	1.88E+00	1.87E-01	2.15E-02	0.00E+00	1.67E-01
FW	m^3	7.39E-02	5.41E-02	3.70E-03	8.89E-03	1.16E-03	0.00E+00	6.01E-03
MS	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

Waste production descriptive parameters are shown below.

Table 5.5.3 – Waste production descriptive parameters

Parameter	Unit of measurement	Total	Upstream Module	Core	Downstream			
			Manufacturing		Distribution	Installation	Use	End of Life
HWD	kg	2.12E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.12E-01
NHWD	kg	7.61E-01	0.00E+00	0.00E+00	0.00E+00	5.01E-01	0.00E+00	2.59E-01
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	1.06E+00	0.00E+00	2.19E-02	0.00E+00	0.00E+00	0.00E+00	1.04E+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

5.6 300020

Potential Environmental impact of each lifecycle stage are shown below.

Table 5.6.1 – Environmental impact descriptive parameters

Impact category	Unit	Total	Upstream Module	Core	Downstream			
			Manufacturing		Distribution	Installation	Use	End of Life
Climate change	kg CO2 eq	2.45E+01	1.51E+01	3.47E+00	2.58E+00	1.44E+00	0.00E+00	1.88E+00
Climate change - Biogenic	kg CO2 eq	5.73E-02	-1.25E+00	-1.96E-02	1.63E-02	1.30E+00	0.00E+00	9.95E-03
Climate change - Fossil	kg CO2 eq	2.43E+01	1.64E+01	3.49E+00	2.52E+00	1.28E-01	0.00E+00	1.85E+00
Climate change - Land use and LU change	kg CO2 eq	8.69E-02	1.39E-02	1.42E-03	4.44E-02	4.71E-03	0.00E+00	2.24E-02
Ozone depletion	kg CFC11 eq	2.43E-04	2.42E-04	8.71E-09	6.35E-08	4.76E-09	0.00E+00	8.69E-08
Acidification	mol H+ eq	1.39E-01	7.69E-02	1.85E-02	3.97E-02	5.50E-04	0.00E+00	3.39E-03
Eutrophication, freshwater	kg P eq	6.69E-03	5.56E-03	6.45E-04	1.49E-04	1.57E-05	0.00E+00	3.23E-04
Eutrophication, marine	kg N eq	3.39E-02	1.78E-02	3.93E-03	1.07E-02	2.52E-04	0.00E+00	1.19E-03
Eutrophication, terrestrial	mol N eq	3.57E-01	1.88E-01	4.18E-02	1.14E-01	2.19E-03	0.00E+00	1.04E-02
Photochemical ozone formation	kg NMVOC eq	1.23E-01	7.51E-02	1.11E-02	3.26E-02	7.43E-04	0.00E+00	3.89E-03
Resource use, minerals and metals	kg Sb eq	1.57E-04	1.43E-04	4.50E-06	5.90E-06	4.50E-07	0.00E+00	3.33E-06
Resource use, fossils	MJ	2.77E+02	1.95E+02	3.40E+01	3.36E+01	1.81E+00	0.00E+00	1.29E+01
Water use	m3 depriv.	3.77E+00	2.82E+00	4.12E-01	2.63E-01	1.29E-02	0.00E+00	2.53E-01

Parameters describing resource use are shown below.

Table 5.6.2 – Parameters describing resource use

Parameter	Unit	Total	Upstream Module	Core	Downstream			
			Manufacturing		Distribution	Installation	Use	End of Life
PENRE	MJ, net calorific value	2.56E+02	1.74E+02	3.40E+01	3.39E+01	1.84E+00	0.00E+00	1.30E+01
PERE	MJ, net calorific value	3.29E+01	2.67E+01	5.24E+00	4.74E-01	3.82E-02	0.00E+00	3.69E-01
PENRM	MJ, net calorific value	2.10E+01	2.10E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PERM	MJ, net calorific value	1.60E+01	1.60E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PENRT	MJ, net calorific value	2.77E+02	1.95E+02	3.40E+01	3.39E+01	1.84E+00	0.00E+00	1.30E+01
PERT	MJ, net calorific value	4.89E+01	4.27E+01	5.24E+00	4.74E-01	3.82E-02	0.00E+00	3.69E-01
FW	m^3	1.43E-01	9.33E-02	1.03E-02	2.25E-02	2.07E-03	0.00E+00	1.45E-02
MS	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

Waste production descriptive parameters are shown below.

Table 5.6.3 – Waste production descriptive parameters

Parameter	Unit of measurement	Total	Upstream Module	Core	Downstream			
			Manufacturing		Distribution	Installation	Use	End of Life
HWD	kg	4.05E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.05E-01
NHWD	kg	1.65E+00	0.00E+00	0.00E+00	0.00E+00	8.90E-01	0.00E+00	7.59E-01
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	1.96E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00
MFR	kg	3.06E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.04E+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

5.7 300644

Potential Environmental impact of each lifecycle stage are shown below.

Table 5.7.1 – Environmental impact descriptive parameters

Impact category	Unit	Total	Upstream Module	Core	Downstream			
			Manufacturing		Distribution	Installation	Use	End of Life
Climate change	kg CO2 eq	2.35E+01	1.33E+01	2.92E+00	2.35E+00	1.79E+00	0.00E+00	3.11E+00
Climate change - Biogenic	kg CO2 eq	9.38E-02	-1.54E+00	-1.65E-02	1.48E-02	1.63E+00	0.00E+00	1.04E-02
Climate change - Fossil	kg CO2 eq	2.33E+01	1.48E+01	2.93E+00	2.29E+00	1.60E-01	0.00E+00	3.09E+00
Climate change - Land use and LU change	kg CO2 eq	8.11E-02	1.44E-02	1.20E-03	4.05E-02	5.88E-03	0.00E+00	1.91E-02
Ozone depletion	kg CFC11 eq	3.71E-04	3.71E-04	7.37E-09	5.79E-08	5.96E-09	0.00E+00	1.61E-07
Acidification	mol H+ eq	1.36E-01	7.91E-02	1.56E-02	3.62E-02	6.87E-04	0.00E+00	4.77E-03
Eutrophication, freshwater	kg P eq	6.01E-03	4.67E-03	5.42E-04	1.36E-04	1.96E-05	0.00E+00	6.45E-04
Eutrophication, marine	kg N eq	3.25E-02	1.76E-02	3.31E-03	9.78E-03	3.15E-04	0.00E+00	1.47E-03
Eutrophication, terrestrial	mol N eq	3.43E-01	1.87E-01	3.52E-02	1.04E-01	2.73E-03	0.00E+00	1.33E-02
Photochemical ozone formation	kg NMVOC eq	1.13E-01	6.83E-02	9.34E-03	2.98E-02	9.28E-04	0.00E+00	4.87E-03
Resource use, minerals and metals	kg Sb eq	2.04E-04	1.90E-04	3.79E-06	5.38E-06	5.63E-07	0.00E+00	4.56E-06
Resource use, fossils	MJ	2.60E+02	1.82E+02	2.86E+01	3.06E+01	2.26E+00	0.00E+00	1.72E+01
Water use	m3 depriv.	4.13E+00	3.14E+00	3.46E-01	2.39E-01	1.61E-02	0.00E+00	3.90E-01

Parameters describing resource use are shown below.

Table 5.7.2 – Parameters describing resource use

Parameter	Unit	Total	Upstream Module	Core	Downstream			
			Manufacturing		Distribution	Installation	Use	End of Life
PENRE	MJ, net calorific value	2.29E+02	1.50E+02	2.86E+01	3.09E+01	2.30E+00	0.00E+00	1.73E+01
PERE	MJ, net calorific value	3.73E+01	3.18E+01	4.40E+00	4.32E-01	4.78E-02	0.00E+00	5.80E-01
PENRM	MJ, net calorific value	3.17E+01	3.17E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PERM	MJ, net calorific value	2.00E+01	2.00E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PENRT	MJ, net calorific value	2.61E+02	1.82E+02	2.86E+01	3.09E+01	2.30E+00	0.00E+00	1.73E+01
PERT	MJ, net calorific value	5.73E+01	5.18E+01	4.40E+00	4.32E-01	4.78E-02	0.00E+00	5.80E-01
FW	m^3	1.51E-01	1.02E-01	8.64E-03	2.05E-02	2.58E-03	0.00E+00	1.68E-02
MS	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

Waste production descriptive parameters are shown below.

Table 5.7.3 – Waste production descriptive parameters

Parameter	Unit of measurement	Total	Upstream Module	Core	Downstream			
			Manufacturing		Distribution	Installation	Use	End of Life
HWD	kg	9.17E-01	0.00E+00	3.00E-02	0.00E+00	0.00E+00	0.00E+00	8.87E-01
NHWD	kg	1.64E+00	0.00E+00	0.00E+00	0.00E+00	1.11E+00	0.00E+00	5.29E-01
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	2.14E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.11E+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

5.8 990291（300010）

Potential Environmental impact of each lifecycle stage are shown below.

Table 5.8.1 – Environmental impact descriptive parameters

Impact category	Unit	Total	Upstream Module	Core	Downstream			
			Manufacturing		Distribution	Installation	Use	End of Life
Climate change	kg CO2 eq	3.55E+01	2.18E+01	4.30E+00	3.56E+00	2.96E+00	0.00E+00	2.91E+00
Climate change - Biogenic	kg CO2 eq	1.65E-01	-2.53E+00	-2.43E-02	2.25E-02	2.69E+00	0.00E+00	1.25E-02
Climate change - Fossil	kg CO2 eq	3.52E+01	2.43E+01	4.32E+00	3.48E+00	2.64E-01	0.00E+00	2.87E+00
Climate change - Land use and LU change	kg CO2 eq	1.24E-01	2.32E-02	1.77E-03	6.14E-02	9.71E-03	0.00E+00	2.78E-02
Ozone depletion	kg CFC11 eq	6.75E-04	6.75E-04	1.09E-08	8.78E-08	9.83E-09	0.00E+00	1.16E-07
Acidification	mol H+ eq	2.12E-01	1.28E-01	2.30E-02	5.49E-02	1.13E-03	0.00E+00	4.43E-03
Eutrophication, freshwater	kg P eq	9.16E-03	7.69E-03	7.99E-04	2.06E-04	3.24E-05	0.00E+00	4.34E-04
Eutrophication, marine	kg N eq	5.04E-02	2.86E-02	4.88E-03	1.48E-02	5.20E-04	0.00E+00	1.54E-03
Eutrophication, terrestrial	mol N eq	5.32E-01	3.04E-01	5.19E-02	1.58E-01	4.51E-03	0.00E+00	1.36E-02
Photochemical ozone formation	kg NMVOC eq	1.77E-01	1.12E-01	1.38E-02	4.51E-02	1.53E-03	0.00E+00	5.01E-03
Resource use, minerals and metals	kg Sb eq	2.29E-04	2.10E-04	5.59E-06	8.15E-06	9.28E-07	0.00E+00	4.30E-06
Resource use, fossils	MJ	4.03E+02	2.94E+02	4.22E+01	4.64E+01	3.73E+00	0.00E+00	1.65E+01
Water use	m3 depriv.	6.21E+00	4.97E+00	5.10E-01	3.63E-01	2.66E-02	0.00E+00	3.47E-01

Parameters describing resource use are shown below.

Table 5.8.2 – Parameters describing resource use

Parameter	Unit	Total	Upstream Module	Core	Downstream			
			Manufacturing		Distribution	Installation	Use	End of Life
PENRE	MJ, net calorific value	3.50E+02	2.40E+02	4.22E+01	4.68E+01	3.80E+00	0.00E+00	1.67E+01
PERE	MJ, net calorific value	6.03E+01	5.26E+01	6.48E+00	6.55E-01	7.89E-02	0.00E+00	4.83E-01
PENRM	MJ, net calorific value	5.36E+01	5.36E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PERM	MJ, net calorific value	3.30E+01	3.30E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PENRT	MJ, net calorific value	4.03E+02	2.94E+02	4.22E+01	4.68E+01	3.80E+00	0.00E+00	1.67E+01
PERT	MJ, net calorific value	9.33E+01	8.56E+01	6.48E+00	6.55E-01	7.89E-02	0.00E+00	4.83E-01
FW	m^3	2.32E-01	1.65E-01	1.27E-02	3.11E-02	4.26E-03	0.00E+00	1.88E-02
MS	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

Waste production descriptive parameters are shown below.

Table 5.8.3 – Waste production descriptive parameters

Parameter	Unit of measurement	Total	Upstream Module	Core	Downstream			
			Manufacturing		Distribution	Installation	Use	End of Life
HWD	kg	5.48E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.48E-01
NHWD	kg	2.77E+00	0.00E+00	0.00E+00	0.00E+00	1.84E+00	0.00E+00	9.31E-01
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	3.78E+00	0.00E+00	5.46E-02	0.00E+00	0.00E+00	0.00E+00	3.72E+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

5.9 990292

Potential Environmental impact of each lifecycle stage are shown below.

Table 5.9.1 – Environmental impact descriptive parameters

Impact category	Unit	Total	Upstream Module	Core	Downstream			
			Manufacturing		Distribution	Installation	Use	End of Life
Climate change	kg CO2 eq	1.42E+01	8.81E+00	1.48E+00	1.30E+00	1.26E+00	0.00E+00	1.38E+00
Climate change - Biogenic	kg CO2 eq	9.55E-02	-1.05E+00	-8.36E-03	8.20E-03	1.14E+00	0.00E+00	4.61E-03
Climate change - Fossil	kg CO2 eq	1.41E+01	9.85E+00	1.49E+00	1.27E+00	1.12E-01	0.00E+00	1.36E+00
Climate change - Land use and LU change	kg CO2 eq	4.67E-02	1.00E-02	6.09E-04	2.24E-02	4.12E-03	0.00E+00	9.59E-03
Ozone depletion	kg CFC11 eq	3.84E-04	3.84E-04	3.79E-09	3.20E-08	4.17E-09	0.00E+00	5.24E-08
Acidification	mol H+ eq	8.71E-02	5.68E-02	7.91E-03	2.00E-02	4.81E-04	0.00E+00	1.82E-03
Eutrophication, freshwater	kg P eq	3.46E-03	2.90E-03	2.75E-04	7.52E-05	1.38E-05	0.00E+00	2.03E-04
Eutrophication, marine	kg N eq	2.02E-02	1.23E-02	1.68E-03	5.41E-03	2.21E-04	0.00E+00	6.04E-04
Eutrophication, terrestrial	mol N eq	2.13E-01	1.31E-01	1.79E-02	5.75E-02	1.91E-03	0.00E+00	5.40E-03
Photochemical ozone formation	kg NMVOC eq	6.88E-02	4.50E-02	4.75E-03	1.65E-02	6.50E-04	0.00E+00	1.97E-03
Resource use, minerals and metals	kg Sb eq	1.06E-04	9.92E-05	1.93E-06	2.97E-06	3.94E-07	0.00E+00	1.73E-06
Resource use, fossils	MJ	1.61E+02	1.21E+02	1.46E+01	1.69E+01	1.58E+00	0.00E+00	6.59E+00
Water use	m3 depriv.	2.67E+00	2.20E+00	1.76E-01	1.32E-01	1.13E-02	0.00E+00	1.51E-01

Parameters describing resource use are shown below.

Table 5.9.2 – Parameters describing resource use

Parameter	Unit	Total	Upstream Module	Core	Downstream			
			Manufacturing		Distribution	Installation	Use	End of Life
PENRE	MJ, net calorific value	1.31E+02	9.11E+01	1.46E+01	1.71E+01	1.61E+00	0.00E+00	6.66E+00
PERE	MJ, net calorific value	2.62E+01	2.35E+01	2.23E+00	2.39E-01	3.35E-02	0.00E+00	2.05E-01
PENRM	MJ, net calorific value	3.01E+01	3.01E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PERM	MJ, net calorific value	1.40E+01	1.40E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PENRT	MJ, net calorific value	1.61E+02	1.21E+02	1.46E+01	1.71E+01	1.61E+00	0.00E+00	6.66E+00
PERT	MJ, net calorific value	4.02E+01	3.75E+01	2.23E+00	2.39E-01	3.35E-02	0.00E+00	2.05E-01
FW	m^3	9.87E-02	7.38E-02	4.39E-03	1.14E-02	1.81E-03	0.00E+00	7.33E-03
MS	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

Waste production descriptive parameters are shown below.

Table 5.9.3 – Waste production descriptive parameters

Parameter	Unit of measurement	Total	Upstream Module	Core	Downstream			
			Manufacturing		Distribution	Installation	Use	End of Life
HWD	kg	2.67E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.67E-01
NHWD	kg	1.08E+00	0.00E+00	0.00E+00	0.00E+00	7.79E-01	0.00E+00	3.04E-01
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	1.25E+00	0.00E+00	3.10E-02	0.00E+00	0.00E+00	0.00E+00	1.22E+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

5.10 990294

Potential Environmental impact of each lifecycle stage are shown below.

Table 5.10.1 – Environmental impact descriptive parameters

Impact category	Unit	Total	Upstream Module	Core	Downstream			
			Manufacturing		Distribution	Installation	Use	End of Life
Climate change	kg CO2 eq	4.62E+01	3.03E+01	5.87E+00	4.23E+00	2.02E+00	0.00E+00	3.76E+00
Climate change - Biogenic	kg CO2 eq	2.29E-01	-1.61E+00	-3.32E-02	2.67E-02	1.83E+00	0.00E+00	1.65E-02
Climate change - Fossil	kg CO2 eq	4.58E+01	3.19E+01	5.90E+00	4.13E+00	1.81E-01	0.00E+00	3.71E+00
Climate change - Land use and LU change	kg CO2 eq	1.47E-01	2.76E-02	2.41E-03	7.28E-02	6.63E-03	0.00E+00	3.73E-02
Ozone depletion	kg CFC11 eq	9.40E-04	9.40E-04	1.49E-08	1.04E-07	6.71E-09	0.00E+00	1.43E-07
Acidification	mol H+ eq	2.69E-01	1.66E-01	3.13E-02	6.52E-02	7.74E-04	0.00E+00	5.68E-03
Eutrophication, freshwater	kg P eq	1.19E-02	1.00E-02	1.09E-03	2.45E-04	2.21E-05	0.00E+00	5.30E-04
Eutrophication, marine	kg N eq	6.27E-02	3.61E-02	6.66E-03	1.76E-02	3.56E-04	0.00E+00	2.01E-03
Eutrophication, terrestrial	mol N eq	6.62E-01	3.83E-01	7.08E-02	1.87E-01	3.08E-03	0.00E+00	1.76E-02
Photochemical ozone formation	kg NMVOC eq	2.23E-01	1.43E-01	1.88E-02	5.36E-02	1.05E-03	0.00E+00	6.51E-03
Resource use, minerals and metals	kg Sb eq	2.86E-04	2.62E-04	7.63E-06	9.68E-06	6.34E-07	0.00E+00	5.53E-06
Resource use, fossils	MJ	5.20E+02	3.83E+02	5.76E+01	5.51E+01	2.55E+00	0.00E+00	2.13E+01
Water use	m3 depriv.	7.16E+00	5.57E+00	6.97E-01	4.31E-01	1.82E-02	0.00E+00	4.45E-01

Parameters describing resource use are shown below.

Table 5.10.2 – Parameters describing resource use

Parameter	Unit	Total	Upstream Module	Core	Downstream			
			Manufacturing		Distribution	Installation	Use	End of Life
PENRE	MJ, net calorific value	4.47E+02	3.10E+02	5.76E+01	5.56E+01	2.59E+00	0.00E+00	2.15E+01
PERE	MJ, net calorific value	6.06E+01	5.03E+01	8.85E+00	7.78E-01	5.39E-02	0.00E+00	6.11E-01
PENRM	MJ, net calorific value	7.37E+01	7.37E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PERM	MJ, net calorific value	2.25E+01	2.25E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PENRT	MJ, net calorific value	5.21E+02	3.83E+02	5.76E+01	5.56E+01	2.59E+00	0.00E+00	2.15E+01
PERT	MJ, net calorific value	8.31E+01	7.28E+01	8.85E+00	7.78E-01	5.39E-02	0.00E+00	6.11E-01
FW	m^3	2.77E-01	1.95E-01	1.74E-02	3.70E-02	2.91E-03	0.00E+00	2.47E-02
MS	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

Waste production descriptive parameters are shown below.

Table 5.10.3 – Waste production descriptive parameters

Parameter	Unit of measurement	Total	Upstream Module	Core	Downstream			
			Manufacturing		Distribution	Installation	Use	End of Life
HWD	kg	7.81E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.81E-01
NHWD	kg	2.52E+00	0.00E+00	0.00E+00	0.00E+00	1.25E+00	0.00E+00	1.26E+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	5.13E+00	0.00E+00	7.60E-02	0.00E+00	0.00E+00	0.00E+00	5.06E+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

Note:
PENRE = Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials; **PERE =** Use of renewable primary energy excluding renewable primary energy resources used as raw materials; **PENRM =** Use of non-renewable primary energy resources used as raw materials; **PERM =** Use of renewable primary energy resources used as raw materials; **PENRT =** Total use of non-renewable primary energy resources; **PERT =** Total use of renewable primary energy resources; **FW** = Use of net fresh water; **MS** = Use of secondary material; **RSF** = Use of renewable secondary fuels**; NRSF** = Use of non-renewable secondary fuels.
HWD = Hazardous waste disposed; **NHWD** = Non-hazardous waste disposed; **RWD** = Radioactive waste disposed; **MER** = Materials for energy recovery; **MFR** = Material for recycling; **CRU** = Components for reuse; **ETE** = Exported thermal energy; **EEE** = Exported electricity energy
The figures reported are rounded, leading to a small difference between the sum of the impacts of the individual phases and the total impact reported for each category.

6. References

- ISO 14044:2006 Environmental management — Life cycle assessment — Principles and framework
- EPDItaly007 – PCR for Electronic and electrical products and systems, Rev. 3, 2023/01/13
- EPDItaly010 – PCR for Electronic and electrical products and systems - Insulators, Rev. 0, 2020/03/16
- EN 50693:2019 Product category rules for life cycle assessments of electronic and electrical products and systems
- Xiangyang Guowang Composite Insulator LCA Report
- Regulations of the EPDItaly Programm Rev.5.2, 2022/02/16