HENAN HUAXING CABLE CO.,LTD

ENVIRONMENTAL PRODUCT DECLARATION

Copper Clad Steel CONDUCTORS: 35MM2, 16MM2

PLANT LOCATION:
No. 12 Dingxiang Road, Yong'an industry zone, Gongyi city , Henan province, China

In accordance with ISO 14025 and EN 50693

Program Operator	EPDItaly
Publisher	EPDItaly

Declaration Number	HX-CCS-2023
Registration Number	EPDITALY0450

Issue Date	13.06.2024
Valid to	13.06.2029

1. General information

DECLARATION OWNER:

Henan Huaxing Cable Co., Ltd
Production site location: No. 12 Dingxiang Road, Yong'an industry zone, Gongyi city, Henan province, China
Company contact person: Novira Cheng (Sales manager), noviracheng@huaxingcable.com

PROGRAM OPERATOR:

EPDITALY (WWW.EPDITALY.IT) VIA GAETANO DE CASTILLIA N° 10 - 20124 MILANO (MI), ITALIA

IDENTIFICATION OF THE PRODUCTS:

COPPER CLAD STEEL CONDUCTORS: 35MM2, 16MM2
Cables included in the category of "Electronic and electrical products and systems- Cables and wires" according to Sub-PCR EPDItaly016
CPC CODE: 463

REFERENCE DOCUMENTS AND RULES (PCR):

- Sub-PCR EPD Italy 016: "Electronic and Electrical Product and System – Cables and Wires", Rev.2, issue date 25/09/2020, valid until 25/09/2025, CPC 463 family "insulated wire and cable; optical fibre cables" and subsequent clusters, in conformity with:
- PCR EPDItaly007 Rev. 3 del 13.01.2023: "Electronic and electrical product and systems"
- EN 50693:2020 Product category rules for life cycle assessments of electronic and electrical products and systems
- EN 15804:2012 +A2:20219 Sustainability of construction works- Environmental product declarations- Core rules for the product category of construction products.

LCA STUDY realized by ANTHESIS

This declaration has been developed referring to the EPDItaly, following the "Regolamento di EPDItaly Rev.5.2, emission date: 16/02/2022"; further information and the document itself are available at: www.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 Spa (www.icmq.it) Via Gaetano De Castillia N° 10 - 20124 Milano (MI), Italia. Accredited by: Accredia.

EPDs relating to the same category of products but belonging to different programs may not be comparable.

Disclaimer: Henan Huaxing Cable Co., Ltd relieves EPDItaly from any non-compliance with the environmental legislation self-declared by the manufacturer himself. The declaration Owner will be responsible for the information and supporting evidence; EPDItaly declines all responsibility regarding the manufacturer's information, data and results of the life cycle assessment.

2. The company

Henan Huaxing Cable Co., Ltd is one of the leading cable and wire manufacturers in China. It is located in Yongan industrial zone, Gongyi city. The company was built in Jan. 1984, expanded in 2005, covering a total area of 67,000 square meters; the building area is 28,000 square meters.
The total investment is 260 million Yuan. The company has 180 employees, including five senior technical engineers; about one hundred are middle and junior technicians. The company integrates research, development, and production together.
The main products are AAC/AAAC/ACSR/ACAR conductors, Aerial Bundled Cable (ABC Cable), Control cable, Concentric Cable,Power Cable LV and MV voltage, plastic electric wire, solar cable, protect cable and so on. They also produce wire and cable products according to the standards of IEC, ASTM, BS, DIN, AS, CSA, JIS, KS etc to meet specific needs of customers.
These products have sold in more than 60 countries and regions, most are in the Middle East, Africa, South American and Southeast Asia. Besides, also set up many sales distributors in large and medium cities for domestic market.
Huaxing Cable also certificated by ISO9001 quality system, ISO14001 environmental system, OHSAS18001 occupational health system and CCC national product certifications.

3. Scope and type of EPD

This is a product EPD and applies to 2 conductors of the Copper clad steel family of wires and conductors.
The conductors are manufactured in China, distributed and installed in different world geographical areas, where they are used, treated and/or disposed at the end of life.

EPD document valid within the following geographical area: China and other countries worldwide according to sales market conditions.

Life Cycle Assessment (LCA) supporting this EPD was performed over 2 references of conductors, using the software Simapro 9.5.0.1 (PRé Consultants), based on activity data for the year 2020 and database Ecoinvent 3.9.1. The product and life cycle stages are described in the following sections.

3.1 Functional Unit

According to PCR EPDItaly016 – “Electronic and electrical product and systems – cables and wires”, the following functional unit was considered:

1 km of conductor for all the life cycle stages besides use phase.

As the cable may operate at variable loads during its lifetime, the use phase shall be modelled using a declared unit of 1 km of conductor with a load of 1 A. This allows to fairly compare EPDs based on this PCR even if the actual load of the cable is not known.

3.2 System boundaries

LCA had a “cradle to grave” scope and considered the following life cycle modules:

Table 1. Lifecycle stages

Life cycle stage	Module	Processes	
Manufacturing	Upstream module	A1. Raw Materials	X
		A2. Raw materials transport	X
	Core module	A3. Manufacturing	X
Distribution	Downstream Module	A4. Distribution	X
Installation		A5. Installation	X
Use & Maintainance		B1-7. Use and Maintenance	X
End-of-life		C1. Deinstallation	MND
		C2. Waste transport	X
		C3. Waste treatment	X
		C4. Waste Disposal	X
MND: *Modules not declared*			

Manufacturing

A1- Raw materials: it considers the extraction and production of raw materials for semifinished products received by external supplier and used to produce and assembly the conductor components. Packaging materials are not included. Datasets representing this stage consider the materials processing operations, the energy, the waste treatments, and the emissions arising from these procedures, which are included in background Simapro processes.

A2 - Raw materials transport: it considers the transportation of the raw materials from supplier to the manufacturing plant. Different suppliers of the raw materials are involved in the system.

A3. Conductor Manufacturing: it contemplates the manufacture of the final product, including drawing and stranding, product assembly and packaging operations. In this stage, considering the production of the auxiliary materials and the packaging materials. Standard packaging materials for distribution consist in wooden drums weighing 80 kg or 100kg, although other packaging solution are available for clients on demand. Water, and electricity consumptions as well as waste and wastewater generation are considered.

Distribution

A4. Conductor distribution: includes the impacts related to the distribution to the installation site.
In order to model the distribution pattern for the conductors, average data for costumers located in different geographical regions were considered, requiring ship and truck transport. For truck transportation from port to the final destination, the distance to the capital town were considered (Buenos Aires and Brasilia), in lack of further indications.

Installation

A5. Installation: Considering that the conductor’s installation does not require any relevant inputs in terms of materials and energy, a cut-off on the impacts included in this module was applied (according to EPDItaly 016). Only packaging material waste is considered in this stage.

Use and Maintenance

B1-7. Use: include the energy dissipates with the use energy due to the Joule effect, during the lifetime
Maintenance operations are included and declared in the cut-off criteria (according to EPDItaly 016).

End-of-life

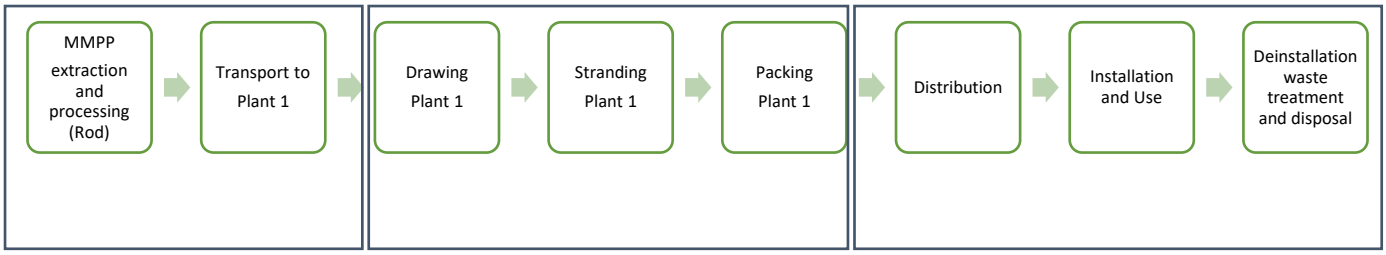
C1. Dismantling: Considering that the conductors deinstallation does not require any relevant inputs in terms of materials and energy, a cut-off on the impacts included in this module was applied (in conformity to EPDItaly016).

C2. Waste transport: the transportation of the conductors from the point of waste generation to the treatment platform. For recovery and recycling processes, which take place outside the boundaries of the product system, only impacts related to the transport of the waste to the treatment platform are considered, according to EPDItaly 007 (6.3).

C3. Waste treatment: includes collection of waste fractions from the dismantling and waste processing of material flows intended for reuse, recycling, and energy recovery. A shredding process requiring electricity is considered within this study. Further operations starting from the recycled are out of the system boundaries.

C4. Conductor Waste disposal: At the end of life (after dismantling), it is assumed 50% of the conductors are recycled (based on statistics in 2019, the collection rate of WEEE was 48,5% in the European Union). Therefore, the 50% are disposed to landfill or incinerated. The environmental impact derived from final waste treatment processes (landfill or incineration) are considered in this module.

Figure 1. Huaxing conductors manufacturing flow chart



4. Product description

The Copper Clad Steel conductors are copper coated steel wires.
The function is to transport high voltage electricity (max voltage 220kV), with main application in industrial installations.
Packaging materials for distribution consist in 100kg wooden drums.

Table 2: Technical characteristics and material composition

Conductor Reference	Max. Voltage (kV)	Material composition	Total weight (kg)
35mm2	220	35% Copper 65% Steel	306,9
16mm2	220	35% Copper 65% Steel	131,5

The product does not contain dangerous substances (according to Regulations (EU) 1907/2006 (REACH) and (EU) 1272/2008) and do not release the same in water, air or soil, in all phases of the life cycle.

5. LCA results and interpretations

The results of the underlying LCA are provided in this section as for environmental impacts, resource use and waste categories. All parameters required by the sub-PCR EPDItaly016 are included and reported in the following tables.

The main general conclusions of the LCA are:

Manufacturing stage is responsible for more than 90% of almost all the environmental impact categories. Raw materials (A1) and conductor manufacturing (A3), both included in the manufacturing stage, are the processes with the highest contribution in the life cycle environmental burden. Conductor distribution results with a minor contribution. The end-of-life stage does not result in any significant environmental impact. Thus, the overall environmental impacts of the conductors are largely dependent on conductor weight.

Within the CCS conductor family, the 2 conductors under study are all made of 65% of steel and 35% of copper The environmental impact of the life cycle of the conductor is mainly due to the extraction and processing of the materials in the stage (A1), with the production of copper being the main hotspot.

At stage of manufacturing (A3), the wire drawing process and the electricity consumption are the main contributing processes.. The wooden drums have relevant contribution especially in GWP biogenic category.

Copper Clad Steel: 35mm2

Table 3. Environmental impacts of the life cycle of the Copper Clad Steel conductors. Result values in absolute (A) and relative terms (B). Resource use per unit of product during the life cycle of the conductor (C). Waste production per unit of product during the life cycle of the Copper Clad Steel conductors (D).

TABLE 3A. Absolute values CCS 35mm2 ENVIRONMENTAL IMPACTS		Manufacturing	Distribution	Installation	Use&Maintenance	End of life	
Parameter	Unit	A1 – A3	A4	A5	B	C2 – C4	Total
GWP-total	kg CO2 eq	1,79E+03	1,04E+02	4,86E-01	7,97E-08	8,89E+00	**1,91E+03**
GWP-fossil	kg CO2 eq	1,78E+03	1,04E+02	4,86E-01	7,01E-08	8,87E+00	**1,90E+03**
GWP-biogenic	kg CO2 eq	5,22E+00	6,07E-03	3,10E-05	5,21E-09	1,04E-02	**5,23E+00**
GWP-luluc	kg CO2 eq	5,68E+00	3,75E-03	1,89E-05	4,34E-09	1,04E-02	**5,69E+00**
ODP	kg CFC11 eq	2,23E-05	1,54E-06	7,10E-09	2,49E-15	8,85E-08	**2,39E-05**
POFP	kg NMVOC eq	1,76E+01	1,67E+00	2,55E-03	1,86E-10	3,85E-02	**1,93E+01**
AP	mol H+ eq	9,06E+01	2,13E+00	1,84E-03	1,92E-10	4,00E-02	**9,28E+01**
EP-freshwater	kg P eq	3,13E-01	1,40E-04	1,13E-06	4,64E-13	2,39E-04	**3,13E-01**
EP-marine	kg N eq	3,89E+00	5,58E-01	7,43E-04	4,08E-11	1,14E-02	**4,46E+00**
EP-terrestrial	mol N eq	5,36E+01	6,16E+00	7,98E-03	4,29E-10	1,24E-01	**5,99E+01**
ADP-fossil	MJ	1,95E+04	1,32E+03	6,47E+00	1,22E-06	1,16E+02	**2,10E+04**
ADP-minerals&metals	kg Sb eq	1,23E+00	3,10E-06	2,86E-08	4,05E-15	3,75E-07	**1,23E+00**
WDP	m3 depriv.	1,48E+03	1,44E+00	9,04E-03	1,37E-07	3,63E-01	**1,48E+03**

TABLE 3B. Relative values ENVIRONMENTAL IMPACTS		Manufacturing	Distribution	Installation	Use&Maintenance	End of life	
Parameter	Unit	A1 – A3	A4	A5	B	C2 – C4	Total
GWP-total	%	94,05%	5,46%	0,03%	0,00%	0,47%	**100,00%**
GWP-fossil	%	94,01%	5,49%	0,03%	0,00%	0,47%	**100,00%**
GWP-biogenic	%	99,68%	0,12%	0,00%	0,00%	0,20%	**100,00%**
GWP-luluc	%	99,75%	0,07%	0,00%	0,00%	0,18%	**100,00%**
ODP	%	93,15%	6,45%	0,03%	0,00%	0,37%	**100,00%**
POFP	%	91,15%	8,64%	0,01%	0,00%	0,20%	**100,00%**
AP	%	97,65%	2,30%	0,00%	0,00%	0,04%	**100,00%**
EP-freshwater	%	99,88%	0,04%	0,00%	0,00%	0,08%	**100,00%**
EP-marine	%	87,22%	12,51%	0,02%	0,00%	0,26%	**100,00%**
EP-terrestrial	%	89,49%	10,29%	0,01%	0,00%	0,21%	**100,00%**
ADP-fossil	%	93,13%	6,29%	0,03%	0,00%	0,55%	**100,00%**
ADP-minerals&metals	%	100,00%	0,00%	0,00%	0,00%	0,00%	**100,00%**
WDP	%	99,88%	0,10%	0,00%	0,00%	0,02%	**100,00%**

TABLE 3C. Resource use		Manufacturing	Distribution	Installation	Use&Maintenance	End of life	
Parameter	Unit	A1 – A3	A4	A5	B	C2 – C4	Total
PERE	MJ	4,09E+03	2,10E+00	9,55E-03	8,04E-07	7,06E+00	**4,10E+03**
PERM	MJ	3,45E+02	0,00E+00	0,00E+00	0,00E+00	0,00E+00	**3,45E+02**
PERT	MJ	4,44E+03	2,10E+00	9,55E-03	8,04E-07	7,06E+00	**4,44E+03**
PENRE	MJ	2,07E+04	1,40E+03	6,88E+00	1,33E-06	1,24E+02	**2,23E+04**
PENRM	MJ	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	**0,00E+00**
PENRT	MJ	2,07E+04	1,40E+03	6,88E+00	1,33E-06	1,24E+02	**2,23E+04**
SM	kg	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**
NRSF	MJ	4,95E+01	0,00E+00	0,00E+00	0,00E+00	0,00E+00	**4,95E+01**
FW	m3	3,52E+01	5,93E-02	3,57E-04	4,82E-09	2,30E-02	**3,53E+01**

TABLE 3D. Waste Production		Manufacturing	Distribution	Installation	Use&Maintenance	End of life	
Parameter	Unit	A1 – A3	A4	A5	B	C2 – C4	Total
HWD	kg	1,80E+00	7,34E-03	4,36E-05	4,57E-12	4,67E-04	**1,81E+00**
NHWD	kg	4,55E+02	1,86E-01	1,65E-03	5,75E-10	1,22E+02	**5,77E+02**
RWD	kg	3,34E-02	5,16E-05	2,27E-07	4,99E-12	1,63E-04	**3,36E-02**
MER	kg	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	0,00E+00	0,00E+00	1,53E+02	**1,65E+02**
CRU	kg	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**
EEE	Mj	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	**0,00E+00**

ENVIRONMENTAL IMPACTS: Ozone depletion (ODP), Photochemical ozone formation (POFP), Acidification (AP), Eutrophication, freshwater (EP-freshwater), Resource use, fossils (ADP-fossil), Resource use, minerals and metals (ADP-minerals&metals), Water use (WDP).

RESOURCES USE PARAMETERS: Use of non-renewable primary energy excluding non- renewable primary energy resources used as raw material (PENRE), Use of renewable primary energy excluding renewable primary energy resources used as raw material (PERE), Use of non-renewable primary energy resources used as raw material (PENRM), Use of renewable primary energy resources used as raw material (PERM), Total use of non-renewable primary energy resources (primary energy and primary energy resources used as raw materials) (PENRT), Total use of renewable primary energy resources (primary energy and primary energy resources used as raw materials) (PERT), Net use of fresh water (FW), Use of secondary materials (MS), Use of renewable secondary fuels (RSF), Use of non-renewable secondary fuels (NRSF).

WASTE PRODUCTION PARAMETERS: Hazardous waste disposed (HWD), Non-hazardous waste disposed (NHWD), Radioactive waste disposed (RWD), Materials for energy recovery (MER), Material for recycling (MFR), Components for reuse (CRU), Exported thermal energy (ETE), Exported electricity energy (EEE).

Copper Clad Steel: 16mm2

Table 4. Environmental impacts of the life cycle of the Copper Clad Steel conductors. Result values in absolute (A) and relative terms (B). Resource use per unit of product during the life cycle of the conductor (C). Waste production per unit of product during the life cycle of the Copper Clad Steel conductors (D).

TABLE 4A. Absolute values CCS 16mm2 ENVIRONMENTAL IMPACTS		Manufacturing	Distribution	Installation	Use&Maintenance	End of life	
Parameter	Unit	A1 – A3	A4	A5	B	C2 – C4	Total
GWP-total	kg CO2 eq	7,69E+02	4,46E+01	2,43E-01	3,50E-08	3,81E+00	**8,18E+02**
GWP-fossil	kg CO2 eq	7,64E+02	4,46E+01	2,43E-01	3,08E-08	3,80E+00	**8,13E+02**
GWP-biogenic	kg CO2 eq	2,24E+00	2,60E-03	1,55E-05	2,29E-09	4,48E-03	**2,25E+00**
GWP-luluc	kg CO2 eq	2,44E+00	1,61E-03	9,44E-06	1,90E-09	4,45E-03	**2,44E+00**
ODP	kg CFC11 eq	9,55E-06	6,60E-07	3,55E-09	1,09E-15	3,79E-08	**1,02E-05**
POFP	kg NMVOC eq	7,56E+00	7,16E-01	1,28E-03	8,17E-11	1,65E-02	**8,29E+00**
AP	mol H+ eq	3,88E+01	9,14E-01	9,19E-04	8,43E-11	1,71E-02	**3,97E+01**
EP-freshwater	kg P eq	1,34E-01	6,01E-05	5,63E-07	2,04E-13	1,02E-04	**1,34E-01**
EP-marine	kg N eq	1,67E+00	2,39E-01	3,71E-04	1,79E-11	4,90E-03	**1,91E+00**
EP-terrestrial	mol N eq	2,30E+01	2,64E+00	3,99E-03	1,88E-10	5,32E-02	**2,57E+01**
ADP-fossil	MJ	8,38E+03	5,65E+02	3,24E+00	5,37E-07	4,98E+01	**9,00E+03**
ADP-minerals&metals	kg Sb eq	5,26E-01	1,33E-06	1,43E-08	1,78E-15	1,61E-07	**5,26E-01**
WDP	m3 depriv.	6,33E+02	6,19E-01	4,52E-03	6,02E-08	1,55E-01	**6,34E+02**

TABLE 4B. Relative values ENVIRONMENTAL IMPACTS		Manufacturing	Distribution	Installation	Use&Maintenance	End of life	
Parameter	Unit	A1 – A3	A4	A5	B	C2 – C4	Total
GWP-total	%	94,05%	5,46%	0,03%	0,00%	0,47%	**100,00%**
GWP-fossil	%	94,01%	5,49%	0,03%	0,00%	0,47%	**100,00%**
GWP-biogenic	%	99,68%	0,12%	0,00%	0,00%	0,20%	**100,00%**
GWP-luluc	%	99,75%	0,07%	0,00%	0,00%	0,18%	**100,00%**
ODP	%	93,15%	6,44%	0,03%	0,00%	0,37%	**100,00%**
POFP	%	91,15%	8,63%	0,02%	0,00%	0,20%	**100,00%**
AP	%	97,65%	2,30%	0,00%	0,00%	0,04%	**100,00%**
EP-freshwater	%	99,88%	0,04%	0,00%	0,00%	0,08%	**100,00%**
EP-marine	%	87,22%	12,50%	0,02%	0,00%	0,26%	**100,00%**
EP-terrestrial	%	89,50%	10,28%	0,02%	0,00%	0,21%	**100,00%**
ADP-fossil	%	93,13%	6,28%	0,04%	0,00%	0,55%	**100,00%**
ADP-minerals&metals	%	100,00%	0,00%	0,00%	0,00%	0,00%	**100,00%**
WDP	%	99,88%	0,10%	0,00%	0,00%	0,02%	**100,00%**

TABLE 4C. Resource use		Manufacturing	Distribution	Installation	Use&Maintenance	End of life	
Parameter	Unit	A1 – A3	A4	A5	B	C2 – C4	Total
PERE	MJ	1,80E+03	8,98E-01	4,77E-03	3,53E-07	3,03E+00	**1,80E+03**
PERM	MJ	1,73E+02	0,00E+00	0,00E+00	0,00E+00	0,00E+00	**1,73E+02**
PERT	MJ	1,97E+03	8,98E-01	4,77E-03	3,53E-07	3,03E+00	**1,97E+03**
PENRE	MJ	8,90E+03	6,01E+02	3,44E+00	5,84E-07	5,29E+01	**9,56E+03**
PENRM	MJ	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	**0,00E+00**
PENRT	MJ	8,90E+03	6,01E+02	3,44E+00	5,84E-07	5,29E+01	**9,56E+03**
SM	kg	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**
NRSF	MJ	2,12E+01	0,00E+00	0,00E+00	0,00E+00	0,00E+00	**2,12E+01**
FW	m3	1,51E+01	2,54E-02	1,79E-04	2,12E-09	9,86E-03	**1,51E+01**

TABLE 4D. Waste Production		Manufacturing	Distribution	Installation	Use&Maintenance	End of life	
Parameter	Unit	A1 – A3	A4	A5	B	C2 – C4	Total
HWD	kg	7,70E-01	3,15E-03	2,18E-05	2,01E-12	2,00E-04	**7,74E-01**
NHWD	kg	1,95E+02	7,97E-02	8,27E-04	2,53E-10	5,23E+01	**2,47E+02**
RWD	kg	1,43E-02	2,21E-05	1,14E-07	2,19E-12	6,99E-05	**1,44E-02**
MER	kg	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	**0,00E+00**
MFR	kg	4,74E+00	0,00E+00	0,00E+00	0,00E+00	6,58E+01	**7,05E+01**
CRU	kg	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**
EEE	Mj	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	**0,00E+00**

ENVIRONMENTAL IMPACTS: Ozone depletion (ODP), Photochemical ozone formation (POFP), Acidification (AP), Eutrophication, freshwater (EP-freshwater), Resource use, fossils (ADP-fossil), Resource use, minerals and metals (ADP-minerals&metals), Water use (WDP).

RESOURCES USE PARAMETERS: Use of non-renewable primary energy excluding non- renewable primary energy resources used as raw material (PENRE), Use of renewable primary energy excluding renewable primary energy resources used as raw material (PERE), Use of non-renewable primary energy resources used as raw material (PENRM), Use of renewable primary energy resources used as raw material (PERM), Total use of non-renewable primary energy resources (primary energy and primary energy resources used as raw materials) (PENRT), Total use of renewable primary energy resources (primary energy and primary energy resources used as raw materials) (PERT), Net use of fresh water (FW), Use of secondary materials (MS), Use of renewable secondary fuels (RSF), Use of non-renewable secondary fuels (NRSF).

WASTE PRODUCTION PARAMETERS: Hazardous waste disposed (HWD), Non-hazardous waste disposed (NHWD), Radioactive waste disposed (RWD), Materials for energy recovery (MER), Material for recycling (MFR), Components for reuse (CRU), Exported thermal energy (ETE), Exported electricity energy (EEE).

6. LCA Calculation rules

6.1 Data source quality and allocation

Primary data was collected from different departments for the manufacturing plant of Huaxing Cable for the year 2020. Secondary data comes from the Ecoinvent 3.9.1. database set. The main assumptions and considerations are described in the next section.

The allocation for the energy, water and packaging material consumptions and for the waste was done using mass allocation method based on inventory data.

6.2 Scenarios, assumptions, and considerations

- The electricity consumption is modelled as "medium voltage", and for China mix provided by EcoInvent 3.9.1, based on the source mentioned in Ecoinvent process (China Electric Power Yearbook 2015, with data for 2014)
- The PPP (Polluter Pays Principle) is applied to determine the system boundaries for waste: for recovery and recycling processes, which take place outside the boundaries of the product system, only impacts related to the transport of the waste to the treatment platform are included in the system boundaries. Incineration and disposal processes are included in the system boundaries, at stage A5 (installation) and C4 (Conductor disposal).
- For the waste generated in the manufacturing stage (A3 process) the following scenario are assumed:
  Metal scrap is assumed to be 100% recycled in other systems.
  Hazardous Waste: 100% Incineration.
- Wooden drums for distribution are acquired as new (not reused), and assumed 100% reused at the end of life in A5.
- For distribution, transport was considered EURO IV category vehicle, in absence of primary data on the fleet of vehicle used, as a precautionary approach following PCR 016 (4.2.3.3).
- In the use phase, the conductor dissipates energy due to the Joule effect was calculating according to the formula:

$$E_{use}\left[\frac{J}{km * A^2}\right] = R_{linear} * I^2 * RSL$$

- A RSL of 40 years was assumed.
- For the conductors end of life (after dismantling), it was assumed 50% conductors are recycled (based on the statistics in 2019, the collection rate of WEEE was 48.5 % in the European Union), thus the following End-of-life scenarios are assumed for each material:
  Copper: 25% Incineration/ 75% recycled
  Steel: 50% Landfill/ 50% recycled.
- Waste treatment (shredding as a preparation to recycling) of conductors is included (C3). Further recycling operations are out of boundary, as PPP principle is applied.
- The distance to waste treatment plant is assumed to be 100 Km.

6.3 Cut-off rules

As established in the PCR of construction products, at least 95% of each input and output of the system have been included. For this study, more than 98% of the weight of the declared product was considered in this study and packaging materials for distribution are also included.

According to the EPDItaly Regulations and PCR EPDItaly007, the following flows and operations were cut-off:

- Production, use and disposal of the packaging of components and semi-finished intermediates.

- Materials making up the conductor itself whose total mass does not exceed 2% of the total weight of the conductor.
- Material and energy flows related to the installation stage, whenever it is reasonable to assume that installation is performed manually.
- Devices external to the conductor itself (e.g. insulators, poles) required for installation.
- Any extraordinary maintenance done on the conductors.
- Material and energy flows related to the conductors' removal from the installation site, whenever it is reasonable to assume that dismantling is performed by adopting manual tools (e.g. screwdrivers, hammers, etc.).

Moreover, the processes listed below have not been included:

- Manufacturing of production equipment, buildings, and other capital goods.
- Business travel of personnel.
- Travel to and from work by personnel.
- Long term emissions.

REFERENCES

- ISO 14040:2006 – Environmental management – Life Cycle Assessment – Principles and framework
- ISO 14044:2006 – Environmental management – Life Cycle Assessment – Requirements
- EN ISO 14025:2006- Labels and environmental declarations.
- ISO/TR 14047: 2003 – Gestión Medioambiental – Análisis del cicle de vida – Ejemplos de aplicación de LCI (Inventario del Ciclo de Vida)
- ISO/TS 14048: 2003 – Environmental management – Life Cycle Assessment – Data inventory
- ISO/TR 14049: 2000 – Environmental management – Life Cycle Assessment – Objectives, scope and inventory interpretation
- PCR EPD Italy 007: "Electronic and electrical product and systems" Rev. 3 del 13.01.2023, valid until 19/01/2025, CPC 46, in conformity with EN 50693:2019
- Sub-PCR EPD Italy 016: "Electronic And Electrical Products And Systems –Cables And Wires" Rev.2, issue date 25/09/2020, valid until 25/09/2025, CPC 463 family "Insulated wire and cable; optical fibre cables" and sub-sequent clusters , in conformity with:
- EN 50693:2020 Product category rules for life cycle assessments of electronic and electrical products and systems
- EN 15804:2012 +A2:2019 Sustainability of construction works -Environmental product declarations -Core rules for the product category of construction products
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- LIFE CYCLE ASSESSMENT OF ELECTRICAL CONDUCTORS PRODUCED BY HENAN HUAXING CABLE CO., LTD, ACCORDING TO EN 50693:2020, June 2024
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- https://eplca.jrc.ec.europa.eu/LCDN/developerEF.xhtml
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