

HENGTONG OPTIC ELECTRIC CO., LTD



ENVIRONMENTAL PRODUCT DECLARATION

Product: name:

Underground medium voltage
cable

Al/XLPE/CWS/PO 8,7/15kV
3x1x240mm²

Site Plant:

Hengtong avenue 88, Qidu, 215200, Suzhou City
(China)



Program Operator	EPDItaly
Publisher	EPDItaly
Declaration Number	HENGTONG004
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Valid to	13/12/2029

in compliance with ISO 14025 and EN 50693

General information

EPD OWNER	Hengtong Optic-Electric co., LTD
SITE	Hengtong avenue 88, Qidu, 215200, Suzhou City (China)
FIELD OF APPLICATION OF THE PRODUCT	This document refers to the study of one underground cable: Al/XLPE/CWS/PO 8,7/15kV 3x1x240mm ²
PROGRAM OPERATOR	EPDItaly – info@epditaly.it
VERIFICATION INFORMATION	<p>The PCR EPDITALY007 review was performed by Ing. Massimo De Pieri, Arch. Michele Paleari, Ing. Sara Toniolo. - info@epditaly.it. Independent verification of the declaration and data, carried out according to ISO 14025: 2010. <input type="checkbox"/> Internal <input checked="" type="checkbox"/> External</p> <p>Third party verification carried out by: ICMQ S.p.A., via Gaetano De Castillia n ° 10 - 20124 Milan, Italy. Accredited by Accredia.</p>
EPD type	Product specific EPD (Regolamento EPDItaly rev. 6.0 del 30/10/2023)
CPC CODE	463 – family “Insulated wire and cable; optical fibre cables” and sub-sequent clusters
CONTACTS for information on the EPD	Elena Xu < xuyinong@htgd.com.cn >
PROJECT REPORT LCA	Rete Clima Via Cacciatori delle Alpi 1/a, 22070 Capiago Intimiano (CO) web: www.reteclima.it email: info@reteclima.it
REPORT LCA	LCA of underground medium voltage electric cable: Al/XLPE/CWS/PO 8.7/15kV 3x1x240mm ² . Edition 1, July 2024
COMPARABILITY STATEMENT	Environmental statements published within the same product category, but from different programs, may not be comparable.
LIABILITY STATEMENT	Hengtong Optic-Electric co., LTD releases EPDItaly non-compliance with environmental legislation. The holder of the declaration will be responsible for the information and supporting evidence. from any disclaims any responsibility for the information, data and results provided by the EPD Owner for life cycle assessment.
PRODUCT CATEGORY RULES – PCR	<p>Core-PCR: EPDITALY007 " Electronic and electrical product and systems" Rev. 3 – 13/01/2023</p> <p>Sub-PCR: EPDITALY016 "Electronic and electrical product and systems – Cables and wires" Rev. 2 del 25/09/2020</p>

In this study is analyzed one underground cable (Al/XLPE/CWS/PO 8.7/15kV 3x1x240mm²) for transporting medium-voltage electricity. The conductor body is made of aluminum. The coating of the conducting elements is made up of various materials such as cross-linked polyethylene and insulating copper and tapes that give thermal insulation and impermeability to the cable.

The assessment of the cable followed the EPDItaly Program in accordance with standards (ISO 14040 and 14044) and other reference documents already cited in the introduction (PCR EPDItaly016 - Cables and wires). The PCR identifies and records: the objective and scope of LCA-based information for the product category; the rules for producing additional environmental information; the life cycle stages to be included; the parameters to consider and how the data should be collected and communicated in a report.

Table 1 shows components and total weight of the cable.

Table 1 Components and total weight

Materials	Unit	Al underground 15kV Colombia
Aluminum conductor	kg/km	1.953
Insulation material	kg/km	1.246
Outer Sheath	kg/km	1.042
Other	kg/km	1.083
Cable total weight	kg/km	5.325

Hengtong Optic-Electric CO., LTD

Hengtong Group is a company based in China engaged in research and development, design, production, and sale of products for fiber optic communication networks and for energy transport; it ranks seventh in Integer's Top 100 Electric Cable Manufacturers ranking. The company owns multiple management systems certified according to 7S, ISO9001, ISO14001, OHSAS18001, IEC, AMD standards; this means that the quality control mode, the whole process, the full performance, have been implemented in a comprehensive way.

Goal and scope of the study

In this study were analyzed one underground cable (Al/XLPE/CWS/PO 8.7/15kV 3x1x240mm²) for transporting medium-voltage electricity. The conductor body is made of aluminum. The coating of the conducting elements is made up of various materials such as cross-linked polyethylene and insulating copper and tapes that give thermal insulation and impermeability to the cable. This cable will be installed in Colombia. Here in after the cable will be named Al underground 15kV Colombia.

After production, the cable is rolled up on wood drum and covered with wood; they are then transported first by truck and then by ship to the installation site (Colombia). The medium voltage underground cable is laid underground within a high-density polyethylene pipe. The end-of-life scenario includes landfill, incineration, and recycling with varying percentages for the different types of materials.

This study considers the life cycle of the product, from the extraction of raw materials to disposal and disposal

at the end of its life, according to the cradle to grave approach - "from cradle to grave". The modules included in the evaluation, in accordance with the PCR and the reference technical regulations.

Table 2: Modules considered in the evaluation, according to the approach "from cradle to grave"

MANUFACTURING STAGE		DISTRIBUTION STAGE	INSTALLATION STAGE	USE STAGE	END-OF-LIFE STAGE
UPSTREAM MODULE	CORE MODULE	DOWNSTREAM MODULE			
extraction of raw materials, including waste recycling processes and the production of semi-finished and ancillary products	manufacturing of the product constituents, including all the stages	In accordance with EN 50693			
transportation of raw materials to the manufacturing company	product assembly				
	packaging				
	waste recycling processes				

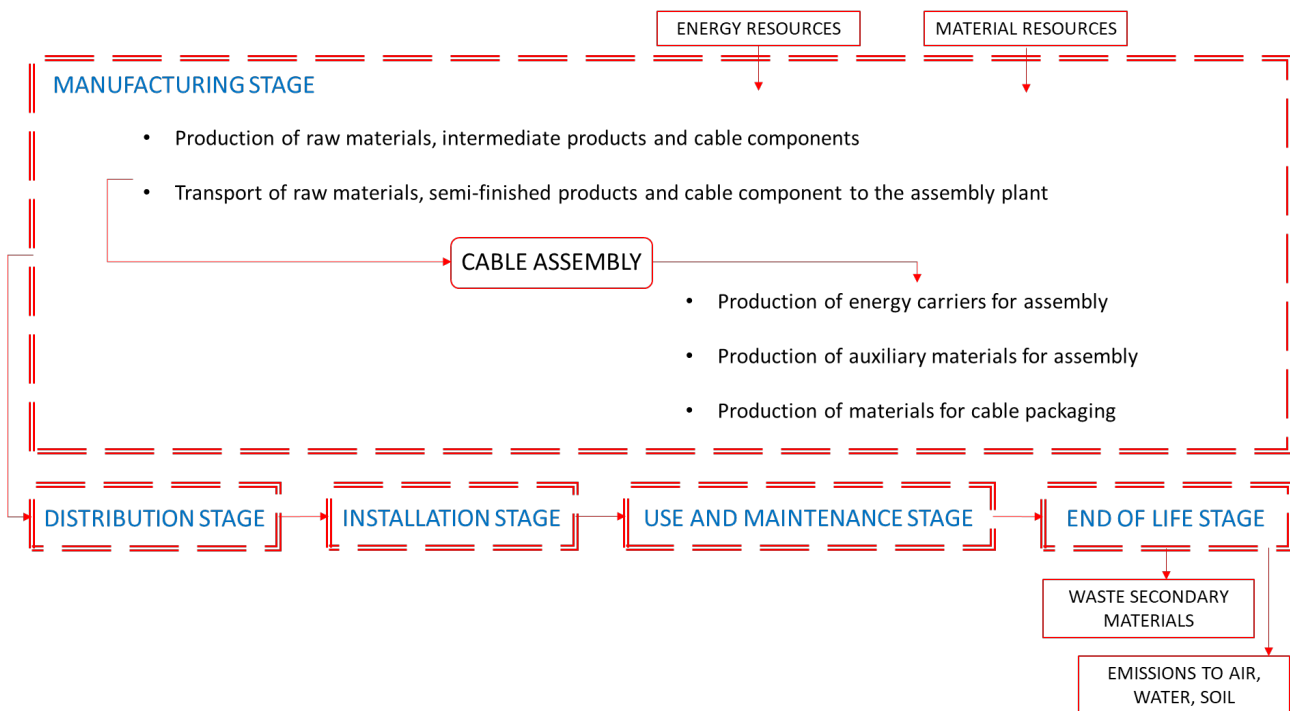


Figure 1: System boundaries flowchart

EPD TYPE	The EPD followed a cradle to grave approach.
Geographical validity	The assessment was carried out in relation to the production site in Suzhou City (China). The main reference market is located in Colombia.
Database	Ecoinvent 3.8
Software	SimaPro 9.6
Method	EN 15804+A2:2019/EF 3.1

Product features and components

The construction, dimensions and technical parameters of the cable are detailed below (all data provided by Hengtong Group CO).

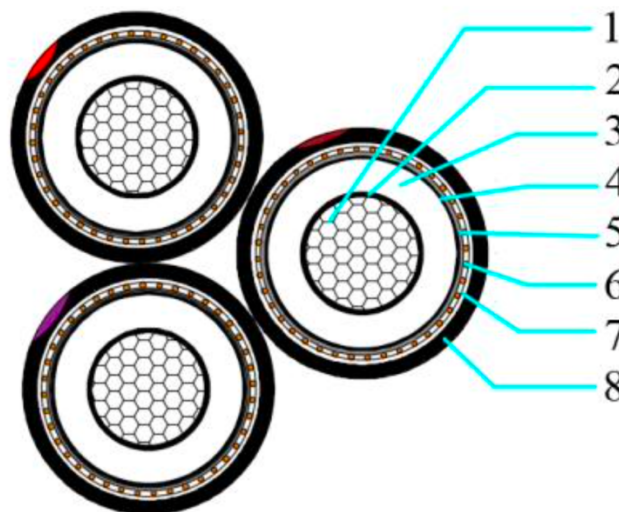


Table 3 shows all the cable components with description

Table 3 Cable features of Al underground 15kV Colombia

No.	Construction	Description
1	Conductor	Class 2, circular compacted aluminium conductor
2	Conductor screen	Semi-conductive compound
3	Insulation	XLPE
4	Insulation screen	Semi-conductive compound
5	Separation layer	Semi-conducting water blocking tape
6	Metallic screen	Plain annealed copper wires
7	Binder tape	Non-conducting water blocking tape
8	Outer sheath	PO

Table 4 shows the cable technical parameters and specifically the mechanical and electrical parameter.

Tabella 4 Cable mechanical e technical parameter of AI underground 15kV Colombia

No.	Description	unit	Parameters
Mechanical Parameters			
1	Approx. diameter of conductor	mm	18,4
2	Nominal thickness of insulation	mm	4,5
3	Nominal thickness of outer sheath	mm	3,0
4	Max. diameter of cable	mm	92,9
5	Total weight of completed cable (Approx.)	kg/km	5.325
Electrical Parameters			
1	Rated voltage of cable, U0/U(Um)	kV	8,7/15
3	Maximum DC resistance of conductor at 20°C	Ohm/km	0,125
4	Maximum AC resistance of conductor at 90°C	Ohm/km	0,161
5	Fault current carrying of conductor, 1s	kA	22,7
6	Fault current carrying of screen, 1s	kA	3,0
7	Conductor to screen capacitance	μF/km	0,373

Impact Assessment

Impact assessment of AI underground 15kV Colombia:

Table 5: Impact assessment of AI underground 15kV Colombia

IMPACT ASSESSMENT								
		1. Manufacturing Stage		2. Distribution Stage	3. Installation Stage	4. Use and Maintenance Stage	5. End of Life Stage	
INDICATOR	UM	TOTAL	UPSTREAM	CORE	DOWNSTREAM			
GWP – total	kg CO ₂ eq	6,61E+04	5,50E+04	5,30E+02	1,36E+03	5,26E+03	1,32E+01	3,95E+03
GWP – fossil	kg CO ₂ eq	6,32E+04	5,46E+04	5,20E+02	1,36E+03	5,10E+03	1,02E+01	1,67E+03
GWP – biogenic	kg CO ₂ eq	2,88E+03	4,32E+02	1,03E+01	5,60E-01	1,55E+02	1,74E+00	2,28E+03
GWP – luluc	kg CO ₂ eq	3,01E+01	2,64E+01	3,31E-01	4,81E-02	1,99E+00	1,22E+00	6,52E-02
ODP	kg CFC-11eq	2,33E-03	2,25E-03	9,29E-07	2,03E-05	5,29E-05	4,19E-08	1,30E-05
POCP	kg NMVOC eq	2,52E+02	1,98E+02	1,61E+00	2,26E+01	2,22E+01	3,31E-02	7,61E+00
AP	mol H ⁺ eq	4,59E+02	4,02E+02	2,85E+00	2,90E+01	2,01E+01	1,01E-01	5,09E+00
EP- marine	kg N eq	7,85E+01	6,11E+01	5,75E-01	7,57E+00	5,07E+00	9,89E-03	4,20E+00
EP- freshwater	kg P eq	1,58E+01	1,48E+01	8,88E-02	1,49E-02	7,89E-01	3,12E-03	9,39E-02
EP- terrestrial	mol N eq	8,17E+02	6,49E+02	5,90E+00	8,35E+01	5,32E+01	1,04E-01	2,50E+01
WDP	m ³ depriv.	1,24E+04	7,46E+03	7,20E+02	1,87E+01	4,13E+03	1,20E+00	8,12E+01
ADP – fossil	MJ	7,75E+05	5,76E+05	6,11E+03	1,73E+04	1,67E+05	1,19E+02	8,61E+03
ADP - min&met	kg Sb eq	9,13E-01	9,13E-01	6,42E-05	3,93E-05	3,33E-04	1,95E-07	5,52E-05

GWP-total = Global Warming Potential; 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, Accumulated Exceedance; EP-freshwater = Eutrophication potential, fraction of nutrients reaching freshwater end compartment; POCP = Formation potential of tropospheric ozone; ADP-minerals&metals = Abiotic depletion potential for non-fossil resources; ADP-fossil = Abiotic depletion for fossil resources potential; WDP = Water deprivation potential, deprivation weighted water consumption

Table 6: Use of resources of AI underground 15kV Colombia

USE OF RESOURCES								
			1. Manufacturing Stage		2. Distribution Stage	3. Installation Stage	4. Use and Maintenance Stage	5. End of Life Stage
INDICATOR	UM	TOTAL	UPSTREAM	CORE	DOWNSTREAM			
PENRE	MJ	7,75E+05	5,76E+05	6,11E+03	1,73E+04	1,67E+05	1,19E+02	8,61E+03
PERE	MJ	2,99E+04	2,29E+04	1,51E+03	2,76E+01	5,21E+03	1,77E+02	4,18E+01
PENRM	MJ	8,52E+00	3,59E+00	4,82E+00	1,26E-02	7,79E-02	2,39E-05	1,37E-02
PERM	MJ	1,71E+02	9,49E+01	4,07E-02	6,85E-02	7,53E+01	1,39E-03	9,04E-01
PENRT	MJ	7,75E+05	5,76E+05	6,11E+03	1,73E+04	1,67E+05	1,19E+02	8,61E+03
PERT	MJ	3,01E+04	2,30E+04	1,51E+03	2,76E+01	5,28E+03	1,77E+02	4,27E+01
FW	m ³	2,75E+02	1,87E+02	1,68E+01	7,73E-01	6,77E+01	1,85E-01	2,44E+00
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

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 nonrenewable 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.

Table 7: Waste production and output flows of AI underground 15kV Colombia

WASTE PRODUCTION AND OUTPUT FLOWS								
			1. Manufacturing Stage		2. Distribution Stage	3. Installation Stage	4. Use and Maintenance Stage	5. End of Life Stage
INDICATOR	UM	TOTAL	UPSTREAM	CORE	DOWNSTREAM			
HWD	kg	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
NHWD	kg	3,04E+03	0,00E+00	1,25E+01	0,00E+00	0,00E+00	0,00E+00	3,03E+03
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	2,52E+03	0,00E+00	8,58E+01	0,00E+00	1,37E+02	0,00E+00	2,29E+03
CRU	kg	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	9,00E+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

HWD = Hazardous waste disposed; NHWD = Non-hazardous waste disposed; RWD = Radioactive waste disposed; MER = Materials for energy recovery; MFR = Materials for recycling; CRU = Components for reuse; ETE= Exported thermal energy; EEE= Exported electricity energy.

METHODOLOGY

The methodology followed as a reference standard is that of the Life Cycle Assessment, which considers all environmental aspects and potential environmental impacts along the life cycle of the product, from the extraction and transport of raw materials through manufacture and use, up to at the end of life.

FUNCTIONAL UNIT

The functional unit of the study is 1km of cable with a charge conventionally set at 1A for 40 years and a 100% utilization rate, as determined by the PCR.

EXCLUSIONS AND CUT OFF

The impacts from these things are not considered in the present study:

- electricity consumption for office;
- production, transport and installation of capital goods (buildings, infrastructures, machinery);
- production, use and disposal of packaging for individual components and intermediate products;
- materials and energy flows of the installation and dismantling phases, if these are carried out manually;
- devices external to the cable itself, necessary for installation.

DATA QUALITY

In the context of this study, the activity data are mainly of “primary type”, i.e., collected with the support of the Company for the specific production site.

Secondary data refer to specific databases or to the most updated technical reference literature, to ensure a good level of reliability. In this study the secondary data that were used concern the installation phase, the use phase, and the end of life of the product.

REFERENCE PERIOD

The primary data collected in the context of this study refer to the year 2023.

ALLOCATION

The allocation criteria adopted for the LCA model comply with the reference standards. Most of the primary data used were provided by the client directly referring to the U.F. Some data from the production stage has instead been allocated to the product on the basis of production volumes.

In detail, the allocation procedures were applied to the following processes relating to the cable production phase:

- Distribution of the cable to the place of destination;
 - Energy and resource consumption.
-

STAGE

The following life cycle stages considered in the study:

UPSTREAM E CORE

Manufacturing stage:

- Extraction of raw materials and production of materials / semi-finished / accessory products;
- Packaging production;
- Transport of materials / semi-finished products / accessory products;
- Manufacturing and assembling of the product;
- Waste disposal and recycling.

DOWNSTREAM

Distribution stage: transport of the finished product to the final customer.

Installation stage: The activities included in this phase of the life cycle concern the transport of cable to the installation site, the actual installation and disposal of packaging. Includes excavation operations, production and processing of the HDPE pipe for underground medium voltage cable.

Use and maintenance stage: the electrical energy losses of the cable encountered during operation, for the whole duration of their life cycle (40 years).

End of life stage: the transport of the product to the treatment site and the final disposal of the product.

The disposal scenario of the cable is defined on the basis of the following assumptions: for aluminum: 30% landfill and 70% recycling; for copper: 40% landfill and 60% recycling; for plastic fractions 80% incineration and 20% recycling; for metal tape 100% landfill.

Reference Service Life (RSL)

In this LCA study, functional to obtaining the EPD certification, a useful life was considered 40 years, in accordance with the provisions of the reference PCR.

REFERENCES:

- ISO 14040:2006 Environmental management - Life cycle assessment - Principles and framework
- ISO 14044:2006 Environmental management - Life cycle assessment - Requirements and guidelines
- ISO 14020:2000 Environmental labels and declarations -- General principles
- UNI EN ISO 14025:2010, Etichette e dichiarazioni ambientali - Dichiarazioni ambientali di Tipo III - Principi e procedure
- EN 50693:2019 Product category rules for life cycle assessments of electronic and electrical products and systems
- UNI EN 15804:2012+A1:2013+A2:2019 Sustainability of construction works - Environmental product declarations - Core rules for the product category of construction products
- Regolamento EPDIItaly rev. 6.0 del 30/10/2023
- PCR EPDIItaly007 – PCR for electronic and electrical product and systems – Rev.3 13/01/2023
- PCR EPDIItaly016 – PCR for electronic and electrical product and systems – Cables and wires – Rev.2 25/09/2020
- Report LCA, LCA of underground medium voltage electric cable: Al/XLPE/CWS/PO 8.7/15kV 3x1x240mm². Edition 1, July 2024
- Ecoinvent, 2021, The Swiss Centre for Life Cycle Inventories, Ecoinvent v3.8
- SimaPro, <https://simapro.com/>
- Chen et al. 2019. Life cycle assessment of end-of-life treatments of waste plastics in China
- GIOTTO. Tubazioni corrugate pieghevoli in PE per passaggio e protezione interrata di cavi elettrici, telefonici e sistemi di telecomunicazioni
- Power System Operation, 2020. Life Cycle Assessment of Underground Cables
- EPD – Prysmian Group: Low voltage 0,6/1 kV underground cables: ARE4EX 3x1x150+95N mm² ARE4EX 3x1x240+150N mm²
- EPD – Prysmian Group: Medium voltage 12/20 kV underground cables: ARP1H5EX 3x1x185 mm² ARP1H5EX 3x1x240 mm²