Hellenic Cables S.A.

ENVIRONMENTAL PRODUCT DECLARATION

Product: name:

AXLJ-F 12/20 (24) kV 3X240 RM stranded

Site Plant:

69th km of Old National Road Athens-Thiva, 32200 Thiva, Greece

Program Operator	EPDItaly
Publisher	EPDItaly
Declaration Number	EI0001
Registration Number	EPDITALY 0772
Issue date	2024-07-01
Valid to	2029-06-30

in compliance with ISO 14025:2006 and EN 50693:2019

General information

EPD OWNER	Hellenic Cables S.A. Amaroussiou-Halandriou 33 str., Athens
SITE	69th km of Old National Road Athens-Thiva, 322 00 Thiva, Greece
FIELD OF APPLICATION-GEOGRAPHICAL SCOPE OF THE PRODUCT	The present document includes the environmental impact assessment of: • AXLJ-F 12/20 (24) kV 3X240 RM stranded Geographical scope is global for upstream module and manufacturing is performed in Greece and distribution (downstream) in Iceland.
PROGRAM OPERATOR	EPDItaly – info@epditaly.it (via Gaetano De Castillia n ° 10 - 20124 Milan, Italy)
VERIFICATION INFORMATION	The PCR EPDITALY007 review was performed by Ing. Massimo De Pieri, Arch. Michele Paleari, Ing. Sara Toniolo. - info@epditaly.it. (via Gaetano De Castillia n ° 10 - 20124 Milan, Italy). Accredited by Accredia Independent verification of the declaration and data, carried out according to ISO 14025: 2010. n Internal ☑ External Third party verification carried out by: SGS Italia S.p.A.,.0005VV
EPD type	Product specific EPD
CPC CODE	463 – family "Insulated wire and cable; optical fibre cables" and sub-sequent clusters
CONTACTS for information on the EPD	Konstantinos Loukas kloukas@hellenic-cables.com
PROJECT REPORT LCA	Hellenic Cables S.A. (internally performed)
COMPARABILITY STATEMENT	Environmental statements published within the same product category, but from different programs, may not be comparable.
LIABILITY STATEMENT	Hellenic Cables S.A. declares to comply with environmental legislation (ISO 14001 certified). The holder of the declaration will be responsible for the information and supporting evidence.
PRODUCT CATEGORY RULES – PCR	Core PCR: EPDITALY007 " Electronic and electrical product and systems" Rev. 3 ŧ3/01/2023 Sub-PCR: EPDITALY016 "Electronic and electrical product and systems – Cables and wires" Rev. 2 del 25/09/2020 EPDItaly regulation v.6.0
SYSTEM BOUNDARIES	Cradle-to-grave, excluding installation and de-installation stages

Introduction

Hellenic Cables operates two plants in Viotia, Greece that produce cables and plastic and elastomer compounds Fulgor plant in Corinth, Greece, which manufactures power cables, power and fiber optic submarine cables and copper wires. The company's wide product range extends to PVC, EPR and XLPE insulated power cables (rated up to 500kV), marine and low smoke halogen free cables, fire resistant cables, telecommunication, signal and data cables with copper conductors or optical fibers, as well as fire retardant halogen free plastic and elastomer compounds. Wires and cables are supplied to a variety of international standards. The Company's Quality Management System is certified to ISO 9001:2015, its Environmental Management System to ISO 14001:2015, GHG emissions Management System to ISO 14064:2018 and its Occupational Health and Safety to ISO 45001:2018. The present EPD follows EPD regulations v.6.0 from the EPDItaly.

Goal and scope of the study

The goal of the study is to evaluate the environmental performance of a medium voltage three core underground cable, in order to develop the Environmental Product Declaration (EPD) of this product. The scope of the study is to calculate the environmental performance of the production of medium voltage three core underground cable from cradle to grave, excluding the installation and de-installation stage (as it does not classify as a construction product). The additional/potential benefits at the EoL stage are excluded. Table 1 presents the modules included in the present study.

Table 1 Modules included under cradle to grave

<table>
<tr><th colspan="2">MANUFACTUR ING STAGE</th><th>DISTRIBUTION STAGE</th><th>USE STAGE</th><th>END-OF-LIFE STAGE</th></tr>
<tr><th>UPSTREAM MODULE</th><th>CORE MODULE</th><th colspan="3">DOWNSTREAM MODULE</th></tr>
<tr><td rowspan="2">Extraction and preparation of raw materials, including waste recycling-pretreatment processes</td><td rowspan="2">manufacturing of the product constituents, including relevant processes, energy flows and packaging materials</td><td>Transportation via ship and truck to the customer</td><td>Electrical losses of the cable during use stage (energy dissipated as heat)</td><td>Cable stripping and dismantling, treatment of different components (energy recovery, recycling)</td></tr>
<tr><td colspan="3" rowspan="4">According to EN 50693</td></tr>
<tr><td>transportation of raw materials to the manufacturing site</td><td>product assembly</td></tr>
<tr><td></td><td>packaging</td></tr>
<tr><td></td><td>waste management processes</td></tr>
</table>

Product Description

The present assessment was performed according to the guidelines of the EPDItaly Program Operator in accordance with standards (ISO 14040 and 14044) and other reference documents already cited in the introduction (PCR EPDItaly016 - Cables and wires). The power cable under assessment is the AXLJ-F 12/20 (24) kV 3X240 RM with stranded conductor. The cable is used to transmit and distribute electricity in installed grid systems and does not require further processing (apart from the installation). Electrical and mechanical properties are usually defined by the end customer and the design phase follows the corresponding technical specifications, to meet the use phase conditions (nominal voltage, power in Amperes etc.). Table 2 includes the main technical specifications.

Table 2 Technical specifications of the cable

General Description: Electric Cable 12 KV SS 424 14 16 (HD 620/10-M) 3x240RM/51AL AXLJ-F		
Standard specification:	SS 42 41 416, HD620/10-M (Triangular)	
Type of cable:	AXLJ-F	
Rated voltage Uo/U (Umax):	12/20 (24) kV	
Number of cores x Nominal cross-section:	3x240 mm²	
Approximate cable overall diameter:	77 mm	
Approximate cable overall weight:	4,6 kg/m	
Nominal drum length (Tolerance):	500 m (± 1%)	
Frequency:	50	Hz
Maximum conductor's temperature at continuous operation:	90	°C

The production includes utilization of primary aluminium ingots, used for the production of the cable conductor (melting primary aluminium to form a solid aluminium rod, which will then undergo a wire drawing process, reducing the rod diameter to the designed cross-section). The conductor will be then electrically insulated with 3 layers of cross-linked polyethylene. Triangular polyethylene fillers are then added for eccentricity and appropriate polyester-based, water blocking tapes are applied. Production is completed by adding aluminium wires for armouring and polyethylene jacket to the final cable.

Table 3 Cable bill of materials according to IEC 62474

Material class	Material category	Raw materials	Units	Amount
Inorganic materials	M-120	Aluminium conductor	Kg/km	1.857,0
Organic materials	M-251	Cross-linked polyethylene	Kg/km	1.396,0
Organic materials	M-301	Polyester-based tape	Kg/km	87,0
Inorganic materials	M-120	Aluminium armor	Kg/km	151,0
Inorganic materials	M-120	Aluminium and polyethylene tape	Kg/km	96,0
Organic materials	M-201	High density polyethylene	Kg/km	118,0
Organic materials	M-251	Low linear density polyethylene	Kg/km	483,0
Organic materials	M-201	Polyehtylene extruded filler	Kg/km	451,0
		Total weight	**Kg/km**	**4.643,0**

The total weight of the wood used for packaging (wooden drum) per 1 km is 1.582kg.

Manufacturing stage includes all the processes presented below:

1. Aluminium conductor
2. Conductor non-metallic extruded screen
3. Cross-linked polyethylene insulation
4. Core non-metallic extruded screen
5. Polyethylene filling material
6. Semiconductive polyester-based water blocking tape(s)
7. Aluminium metallic screen
8. Semiconductive polyester-based water blocking tape(s)
9. Radial watertightness (aluminium and polyethylene tape)
10. Polyethylene sheath

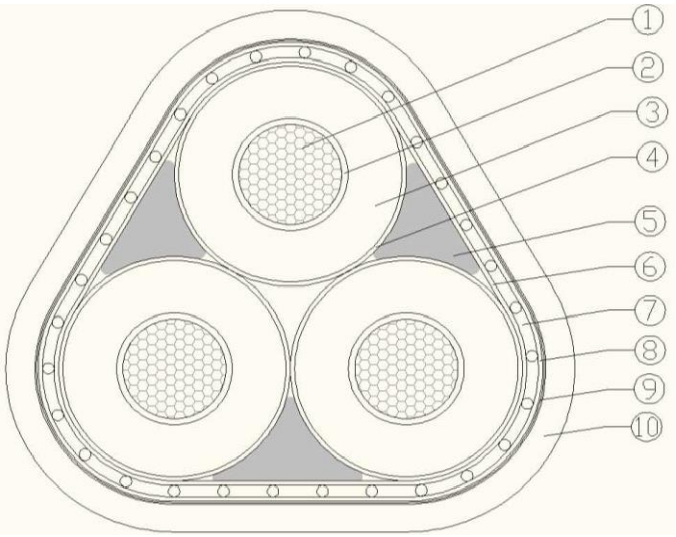

Figure 1 Cable manufacturing steps

The cable does not contain any hazardous substances, specifically identified as substances of very high concern, according to REACH regulation.

Description of modules included

The production starts with the material supply. This stage includes the mining and processing of raw materials. The company is part of a global supply chain, with suppliers and raw materials scattered across different continents. Main materials used in the production are the aluminium ingots used for the production of the cable conductor, cross-linked polyethylene for insulation purposes and high-density polyethylene used for outer jacket. Primary materials arrive to the company's gate mostly via trucks and container ships. During manufacturing, the company is using diesel oil (for inhouse transportation). In addition, manufacturing stage includes the treatment of generated waste, which considers plastics and metals recycling/landfilling. The manufactured product will be transported to Iceland, to the storage facility.

For the use stage of the product, an amount of electrical energy will be dissipated to the environment, as a result of the conductor's electrical losses from the resistivity of aluminium. To calculate the respective losses over the cable's life cycle, the following assumptions were used:

- Current: 1 A
- Resistivity of aluminium conductor: 0,375 (IEC 60228)
- Reference Service Life: 40 years and 100% use rate (seconds)

Losses are calculated as: $I^2*R*RSL$ *(in Joules)*

After deinstallation of the cable (excluded in this study), the dismantled cable will be transported to the recycling facility to reclaim recyclable parts, where plastics will be driven to energy recovery, via mechanical separation. Therefore, no disposal will take place with regards to stripped cable components.

Impact Assessment

Results per declared unit of the cable included in this study are presented below. (EN 15804:2012+A2:2019, EF 3.1)

AXLJ-F 12/20 (24) kV 3X240 RM

			Manufacturing		Distribution	Use	End of Life
INDICATOR	**UNIT**	**TOTAL**	**UPSTREAM**	**CORE**	**DOWNSTREAM**		
GWP-total*	kg CO2eq	5,95E+04	4,78E+04	-4,71E+01	3,67E+02	4,83E+01	1,13E+04
GWP-fossil	kg CO2eq	5,94E+04	4,77E+04	2,72E+03	3,67E+02	4,76E+01	8,51E+03
GWP-biogenic	kg CO2eq	7,05E+01	7,67E+01	-2,77E+03	-1,06E+00	6,55E-01	2,76E+03
GWP-luluc	kg CO2eq	1,83E+01	1,02E+01	6,33E+00	8,89E-01	7,01E-03	9,22E-01
ODP	kg CFC-11eq	1,83E-07	1,53E-07	2,75E-08	3,17E-11	1,17E-09	2,02E-09
POCP	kg NMVOC eq	1,45E+02	1,28E+02	8,71E+00	7,13E+00	5,00E-02	1,46E+00
AP	mol H+eq	2,26E+02	2,08E+02	1,06E+01	6,21E+00	8,26E-02	1,79E+00
EP-freshw	kg P eq	8,17E-02	5,75E-02	2,32E-02	3,07E-04	2,76E-04	4,71E-04
WDP	m3 depriv.	9,65E+03	7,98E+03	8,61E+02	1,38E+00	2,19E+01	7,80E+02
ADP-fossil	MJ	6,94E+05	6,43E+05	3,64E+04	4,38E+03	6,98E+02	9,02E+03
ADP-min&met	kg Sb eq	2,60E-03	2,21E-03	3,27E-04	1,14E-05	8,47E-06	4,14E-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. The results of ODP and WDP indicators should be used with caution as uncertainties are high or experience with the indicator is limited.
*GWP-total manufacturing core value is negative due to biogenic emissions from wooden packaging

			Manufacturing		Distribution	Use	End of Life
INDICATOR	**UNIT**	**TOTAL**	**UPSTREAM**	**CORE**	**DOWNSTREAM**		
PENRE	MJ	5,89E+05	5,39E+05	3,64E+04	4,38E+03	6,98E+02	9,02E+03
PERE	MJ	1,82E+05	1,27E+05	5,35E+04	7,77E+01	7,22E+02	1,11E+03
PENRM	MJ	1,04E+05	1,04E+05	0,00E+00	0,00E+00	0,00E+00	0,00E+00
PERM	MJ	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
PENRT	MJ	6,94E+05	6,43E+05	3,64E+04	4,38E+03	6,98E+02	9,02E+03
PERT	MJ	1,82E+05	1,27E+05	5,35E+04	7,77E+01	7,22E+02	1,11E+03
FW	m3	2,95E+02	2,58E+02	1,84E+01	8,88E-02	5,72E-01	1,80E+01
MS	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	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.

			Manufacturing		Distribution	Use	End of Life
INDICATOR	**UNIT**	**TOTAL**	**UPSTREAM**	**CORE**	**DOWNSTREAM**		
HWD	kg	3,96E-04	3,59E-04	3,43E-05	1,41E-07	6,42E-07	2,61E-06
NHWD	kg	1,06E+04	1,00E+04	5,14E+02	4,67E-01	8,08E-01	3,41E+01
RWD	kg	9,94E+00	8,74E+00	1,10E+00	5,50E-03	2,75E-02	7,32E-02
MER	kg	2,54E+03	0,00E+00	0,00E+00	0,00E+00	0,00E+00	2,54E+03
MFR	kg	2,11E+03	0,00E+00	0,00E+00	0,00E+00	0,00E+00	2,11E+03
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

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.

DECLARED UNIT 1 km of cable for all the life cycle stages besides use phase

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);
- materials and energy flows of the installation and deinstallation stages.

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.

Generic data refer to LCA for Experts, professional database CUP v.2023.2. The database used is regarded as representative on the basis of a comparative study, which examined the data for a reference product of the EPD Owner.

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. Primary data from the production stage have been allocated to the product on the basis of production mass. Mass allocation was used to estimate energy and resources consumption of each product.

STAGES

UPSTREAM CORE

Manufacturing stage:
- Extraction of raw materials and production of final cable products;
- Transport of materials in manufacturing site;
- Manufacturing and assembling of the product;
- Waste disposal and recycling.

DOWNSTREAM

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

Use and maintenance stage: the electrical energy losses of the cables 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 both cables under the present EPD consider stripping, plastics incineration and metals recycling.

Reference Service Life (RSL)

In this LCA study, functional to obtaining the EPD certification, a useful life was considered 40 years and 100% use rate, in accordance with the provisions of the reference PCR.

REFERENCES:

- General Programme Instructions of the EPDItaly, Version 6.0
- EPDItaly007-CORE-PCR-EN-50693_13012023-rev.3
- EN 15804:2012+A2:2019 Sustainability of construction works - Environmental Product Declarations, Core rules for the product category of construction products
- EN 50693:2019 Product category rules for life cycle assessments of electronic and electrical products and systems
- ISO 14020:2000 Environmental labels and declarations, General principles
- ISO 14025:2006 Environmental labels and declarations - Type III environmental declarations — Principles and procedures
- ISO 14040:2006 Environmental management - Life cycle assessment-Principles and framework
- ISO 14044:2006 Environmental management - Life cycle assessment - Requirements and guidelines
- EPDItaly016-SUB-PCR-EN-50693_cables_v2