



ENVIRONMENTAL PRODUCT DECLARATION

IN ACCORDANCE WITH EN 15804+A2 & ISO 14025

26/45 kV single-core 400 mm² copper conductor cable, XLPE insulated, copper wire screened (CWS), MDPE sheathed.

Energya Power Cables



EPD HUB, HUB-5641

Published on 06.03.2026, last updated on 06.03.2026, valid until 05.03.2031

Life Cycle Assessment study has been performed in accordance with the requirements of EN 15804, EPD Hub PCR version 1.2 (24 Mar 2025) and JRC characterization factors EF 3.1.



Created with One Click LCA

Prepared By: EPD SUSTAIN



GENERAL INFORMATION

MANUFACTURER

Manufacturer	Energya Power Cables
Address	10th of Ramadan city, 3rd Industrial zone, Al-Sharqia Governorate, Egypt.
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Website	www.energyacables.com

EPD STANDARDS, SCOPE AND VERIFICATION

Program operator	EPD Hub, hub@epdhub.com
Reference standard	EN 15804:2012+A2:2019/AC:2021 and ISO 14025
PCR	EPD Hub Core PCR Version 1.2, 24 Mar 2025
Sector	Electrical product
Category of EPD	Third party verified EPD
Parent EPD number	-
Scope of the EPD	Cradle to gate with modules A4-A5, B6 and C1-C4, D
EPD author	Samaa Ahmed Mohamed Mostafa - EPD Sustain
EPD verification	Independent verification of this EPD and data, according to ISO 14025: <input type="checkbox"/> Internal verification <input checked="" type="checkbox"/> External verification
EPD verifier	Yazan Badour as an authorized verifier for EPD Hub

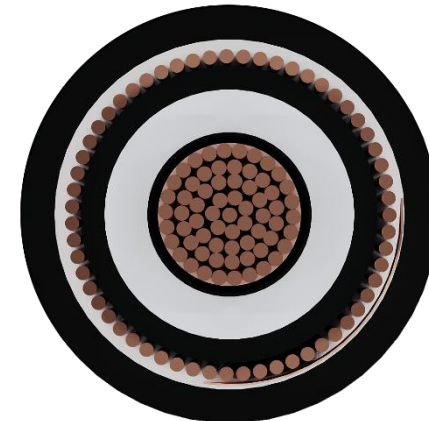
This EPD is intended for business-to-business and/or business-to-consumer communication. The manufacturer has the sole ownership, liability, and responsibility for the EPD. EPDs within the same product category but from different programs may not be comparable. EPDs of construction products may not be comparable if they do not comply with EN 15804 and if they are not compared in a building context.

PRODUCT

Product name	26/45 kV single-core 400 mm ² copper conductor cable, XLPE insulated, copper wire screened (CWS), MDPE sheathed.
Product reference	H25L144XCSM
Place(s) of raw material origin	UAE, Egypt
Place of production	Egypt
Place(s) of installation and use	EU
Period for data	Financial Year: 1 Jul 2024 – 30 June 2025
Averaging in EPD	No grouping
Variation in GWP-fossil for A1-A3 (%)	Not relevant
A1-A3 Specific data (%)	0,97

ENVIRONMENTAL DATA SUMMARY

Declared unit	1 linear meter of cable
Declared unit mass	9,494 kg
Mass of packaging	1,2566 kg
GWP-fossil, A1-A3 (kgCO ₂ e)	58,6
GWP-total, A1-A3 (kgCO ₂ e)	58,8
Secondary material, inputs (%)	7,12
Secondary material, outputs (%)	44,1
Total energy use, A1-A3 (kWh)	323
Net freshwater use, A1-A3 (m ³)	1,81



PRODUCT AND MANUFACTURER

ABOUT THE MANUFACTURER

Energya Industries is a leading regional manufacturer in the field of electrical industries and building materials with an exceptional history spanning over 80 years. Our commitment to excellence and innovation is the pillar that assists our goals in exceeding our customers' expectations. Over the last decades, Energya Industries successfully managed to build an extremely solid brand equity with elevated degree of quality and excellence in the field of electrical cables, steel fabrication, cement manufacturing, and arrangement of EPC construction solutions. Through its core divisions, Energya Industries continues to power progress on a global scale, delivering high-performance products and comprehensive industrial solutions. A flagship division of the group is recognized as one of the largest manufacturers of low, medium, high, and extra-high voltage power cables (up to 500 KV) in Egypt and the Middle East. The division also produces a wide range of specialty cables, delivering dependable energy solutions and comprehensive technical support tailored to meet diverse market needs.

PRODUCT DESCRIPTION

The declared product is a High-voltage (26 / 45 kV) 1-core electric traction cable , featuring stranded copper conductors (conforming to BS EN 60228), insulated with cross-linked polyethylene (XLPE), screened by copper wire screen with open helix copper tape , and sheathed with a Medium density polyethylene (MDPE) compound and coated with graphite , designed for traction supplies ,D.C Electrified Lines and A.C Electrified lines. Energya Power Cables manufactures this product using 100% renewable energy— 94% from wind (Gabal El-Zayt and Zafarana wind farms) and 6% from solar (Benban and Kom Ombo plants). The declared product has a reference service life (RSL) of 20 years for standard indoor applications.

Further information can be found at:

www.energyacables.com

PRODUCT RAW MATERIAL MAIN COMPOSITION

Raw material category	Amount, mass %	Material origin
Metals	74	UAE, Egypt
Minerals	-	-
Fossil materials	26	Egypt
Bio-based materials	-	-

BIOGENIC CARBON CONTENT

Product's biogenic carbon content at the factory gate

Biogenic carbon content in product, kg C	0
Biogenic carbon content in packaging, kg C	0,57

FUNCTIONAL UNIT AND SERVICE LIFE

Declared unit	1 m cable
Mass per declared unit	9,494 kg
Functional unit	1 m of installed cable for electricity distribution, from cradle-to-grave, with activities needed for the study period of 20 years.
Reference service life	20

SUBSTANCES, REACH - VERY HIGH CONCERN

The product does not contain any REACH SVHC substances in amounts greater than 0,1 % (1000 ppm).

PRODUCT LIFE-CYCLE

SYSTEM BOUNDARY

This EPD covers the life-cycle modules listed in the following table.

Product stage			Assembly stage		Use stage							End of life stage				Beyond the system boundaries	
A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D	
x	x	x	x	x	ND	ND	ND	ND	ND	x	ND	x	x	x	x	x	
Raw materials	Transport	Manufacturing	Transport	Assembly	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	Deconstruction/ demolition	Transport	Waste processing	Disposal	Reuse	Recycling

Not declared = ND.

MANUFACTURING AND PACKAGING (A1-A3)

The environmental impacts considered for the product stage cover the manufacturing of raw materials used in the production as well as packaging materials and other ancillary materials. Also, fuels used by machines, and handling of waste formed in the production processes at the manufacturing facilities are included in this stage. The study also considers the material losses occurring during the manufacturing processes as well as losses during electricity transmission.

A market-based approach is used in modelling the electricity mix utilized in the factory.

The product stage (A1–A3) covers the manufacturing of a high-voltage (26/45 kV) single-core electric traction power cable, consisting of a stranded copper conductor (to BS EN 60228), XLPE insulation applied by triple extrusion with inner and outer semi-conducting shields, a copper wire screen with open-helix copper tape, and an MDPE outer sheath with graphite coating. All upstream processes for raw material production are included, such as copper rod and copper tape production, XLPE and semi-conductive compound manufacturing, and MDPE sheath compound production.

Within the manufacturing facility, the process sequence comprises copper wire drawing from 8 mm rod to the required diameters, conductor stranding, triple extrusion of the inner semi-conducting layer, XLPE insulation and outer semi-conducting layer, application of the copper wire screen and helically wound copper tape, and extrusion of the MDPE outer sheath followed by graphite coating for improved outer surface conductivity. All electricity required for wire drawing, extrusion, curing, ancillary machinery and plant services is supplied under a renewable-energy Power Purchase Agreement, with 94 % of electricity sourced from wind power (Gabal El-Zayt and Zafarana wind farms) and 6 % from solar PV (Benban and Kom Ombo plants).

Packaging for finished cables, including wooden drums and protective plastic film, is modeled in A3 together with other ancillary materials used in production, such as lubricants and process aids. All upstream impacts of these materials, as well as fuel use for on-site handling equipment and internal transport, are included.

Process-related material losses during conductor production, insulation and sheathing, cutting to length and quality control are included and are assumed to represent approximately 1 % of the total product mass per meter of finished cable. Copper production scrap from conductor and screen formation is collected and sent for recycling through dedicated metal-recycling routes, while polymer production scrap (XLPE and MDPE) is managed through local waste treatment pathways in line with prevailing waste regulations. Waste lubricants and other hazardous process residues are collected, stored safely and sent to licensed hazardous-waste treatment facilities.

.No additional manufacturing processes or packaging operations outside the system boundary are considered relevant for A1–A3.

The use of green energy in manufacturing is demonstrated through contractual instruments (GOs, RECs, etc.), and its use is ensured throughout the validity period of this EPD.

TRANSPORT AND INSTALLATION (A4-A5)

Transportation impacts occurred from final products delivery to construction site (A4) cover fuel direct exhaust emissions, environmental impacts of fuel production, as well as related infrastructure emissions.

Transportation impacts that occurred from final product delivery to the construction site (A4) cover fuel direct exhaust emissions, environmental impacts of fuel production, as well as related infrastructure emissions.

Transportation distance is defined according to the PCR. For 1 m of installed cable, transportation to site includes delivery of the product and its packaging over an average distance of 285 km by road and 5,300 km by ship

from the manufacturing facility to the construction site. Road transport is modeled with lorries at 100% outbound load utilization; empty returns are assumed to serve other clients and are therefore not allocated to this product. Transport does not cause product losses because the cable is properly packaged, and a volume capacity utilization factor of 100% is assumed for the packed products.

Installation into the building (A5) considers material loss during handling and cutting to length on-site. This loss is treated as installation waste and follows the same end-of-life scenarios as for the product stage.

Environmental impacts from installation in the construction site include waste packaging materials and release of biogenic carbon dioxide from waste processing of cardboard and wood pallets. Electricity consumption for installation of the cable is considered negligible. Further, a 5% product loss during installation, as well as its waste treatment, is included.

Packaging waste generated during installation includes LDPE film and wood drum material. The LDPE is assumed to be sent for plastic waste treatment (landfill or incineration depending on local infrastructure), while the wood drum material is managed through wood waste treatment or recycling pathways.

Cable installation itself is assumed to be manual or mechanically assisted without significant additional resource consumption. No water consumption or hazardous waste generation occurs during the installation process beyond packaging and off-cut waste.

PRODUCT USE AND MAINTENANCE (B1-B7)

The use phase covers modules B1 to B7 in accordance with EN 15804. For the declared product, modules B1 (use), B2 (maintenance), B3 (repair), B4 (replacement), B5 (refurbishment), and B7 (operational water use) are declared not relevant, as the cable does not require maintenance, repair, replacement, or refurbishment, and does not consume water or emit substances during use under normal operating conditions.

Module B6 (operational energy use) is relevant and included. Energy losses are calculated based on resistive losses in the conductor using the equation $P = I^2 \times R$, where I is the operating current (A) and R is the electrical resistance per meter (Ω/m). The calculated power loss per meter (kW/m) is multiplied by the total operating hours over the reference service life to determine the cumulative energy loss (kWh/m). The total operating hours are calculated as $RSL \times 365 \times 24$, assuming continuous operation over the declared service life.

Losses due to cable resistance, as recommended for ECO Platform EPDs, are calculated for the declared unit (1 m) using a representative continuous-operation scenario. The operating current is assumed to be 630 A, and the conductor resistance is $0.000055 \Omega/m$ at operating temperature. This results in a power loss of approximately 21.8 W/m and a cumulative energy loss of approximately 3,825 kWh per meter over a 20-year reference service life. Results reported for module B6 are scenario-dependent and are comparable only where identical operating assumptions are applied.

Air, soil, and water impacts during the use phase have not been studied.

PRODUCT END OF LIFE (C1-C4, D)

The End-of-Life stage for the 26/45 kV single-core traction power cable covers deconstruction, transport, waste processing and final disposal in accordance with EN 15804+A2. The scenario is based on typical European

26/45 kV single-core 400 mm² copper conductor cable, XLPE insulated, copper wire screened (CWS), MDPE sheathed.

practice and reflects the material composition of the assessed cable (copper conductor and screen, XLPE insulation, semi-conductive layers and MDPE sheath).

Module C1 (deconstruction and dismantling) considers removal of the cable from ducts, trays or buried installations at the end of its service life. As this is a mechanical operation carried out with standard construction equipment and does not require specific additional processes beyond usual demolition activities, the environmental loads in C1 are assumed to be negligible.

Module C2 (transport to waste processing) includes the transport of cable waste to relevant treatment facilities. Plastic-rich fractions (insulation, semi-conductive layers, sheath) are assumed to be transported on average 150 km by road to thermal treatment or landfill sites, while metal-rich fractions (copper conductor and wire screen) are transported 250 km by road to metal-recycling facilities. These distances are representative of typical EU waste-logistics conditions.

Module C3 (waste processing for reuse, recovery and recycling) reflects differentiated routes by material:

For polymer components (XLPE insulation, semi-conducting screens, MDPE jacket), 50 % of the mass is incinerated with energy recovery, 25 % is incinerated without energy recovery and 25 % is landfilled as inert waste. Energy recovery is modeled using an energy content of 30.79 MJ/kg and EU-average waste-to-energy plant efficiencies (38 % total, with electricity and heat shares in line with Zero Waste Europe, 2023).

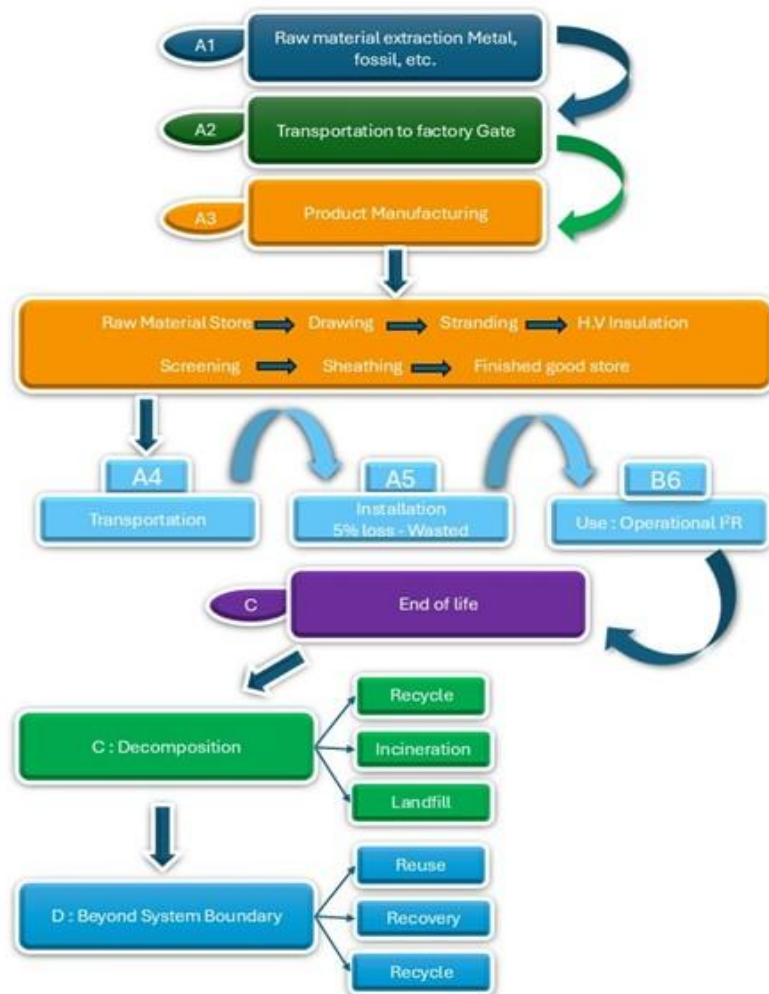
For copper from conductor and screen, a 60 % recycling rate is applied in

line with EN 50693 guidance for electrical components, with the remaining 40 % treated as residual waste sent to landfill or retained as low-grade scrap after mechanical separation.

Module C4 (final disposal) accounts for emissions and burdens associated with landfilling of unrecovered materials, including 25 % of the polymer mass and 40 % of the copper that is not recycled. Landfill emissions are modeled using inert material landfill datasets appropriate to each material type.

Module D (benefits and loads beyond the system boundary) captures the potential environmental benefits from material and energy recovery. Credits are assigned for secondary copper replacing primary copper production and for net electricity and heat generated from incineration with energy recovery, using system expansion / avoided burden according to EN 15804+A2 and the EPD Hub rules. These benefits are reported separately from the life-cycle stages A–C.

One Click LCA Created with One Click LCA



LIFE-CYCLE ASSESSMENT

CUT-OFF CRITERIA

The study does not exclude any modules or processes which are stated mandatory in the reference standard and the applied PCR. The study does not exclude any hazardous materials or substances. The study includes all major raw material and energy consumption. All inputs and outputs of the unit processes, for which data is available for, are included in the calculation. There is no neglected unit process more than 1% of total mass or energy flows. The module specific total neglected input and output flows also do not exceed 5% of energy usage or mass.

The production of capital equipment, construction activities, and infrastructure, maintenance and operation of capital equipment, personnel-related activities, energy and water use related to company management and sales activities are excluded.

All relevant processes for raw material supply (A1), transport to manufacturing (A2), manufacturing (A3), construction installation (A4–A5), use stage (B1–B7, where applicable) and end-of-life (C1–C4, D) are included in the system boundaries. The following minor processes are excluded in accordance with EN 15804 and the EPD Hub PCR due to their negligible contribution to total impacts: (i) materials and substances each representing less than 0.1 % of product mass where detailed data are unavailable (e.g. trace additives or catalysts in polymer compounds), (ii) packaging of incoming raw materials such as protective wrapping on copper rod and fillers, (iii) capital goods, buildings and infrastructure (factory construction, maintenance and depreciation of machinery), and (iv) personnel-related energy and water use such as office operations and general lighting. These exclusions do not significantly affect the overall LCA results or omit any known environmental hotspots for the assessed cable.

VALIDATION OF DATA

Data collection for production, transport, and packaging was conducted using time and site-specific information, as defined in the general information section on page 1 and 2. Upstream process calculations rely on generic data as defined in the Bibliography section. Manufacturer-provided specific and generic data were used for the product's manufacturing stage. The analysis was performed in One Click LCA EPD Generator, with the 'Cut-Off, EN 15804+A2' allocation method, and characterization factors according to EN 15804:2012+A2:2019/AC:2021 and JRC EF 3.1.

ALLOCATION, ESTIMATES AND ASSUMPTIONS

Allocation is required if some material, energy, and waste data cannot be measured separately for the product under investigation. All allocations are done as per the reference standards and the applied PCR. In this study, allocation has been done in the following ways:

Data type	Allocation
Raw materials	No allocation
Packaging material	No allocation
Ancillary materials	Allocated by mass or volume
Manufacturing energy and waste	Allocated by mass or volume

PRODUCT & MANUFACTURING SITES GROUPING

Type of grouping	No grouping
Grouping method	Not applicable
Variation in GWP-fossil for A1-A3, %	Not relevant

This EPD represents a single 26/45 kV, 1-core 400 mm² copper XLPE/MDPE traction power cable manufactured at one production site, using one defined manufacturing process and bill of materials. No grouping of multiple products, factories or manufacturers is applied; therefore, the declared results are fully representative of this specific cable design and manufacturing site only.

LCA SOFTWARE AND BIBLIOGRAPHY

This EPD has been created using One Click LCA EPD Generator for EPD Hub V3 and EPD Process Certification v3.2.3. The LCA and EPD have been prepared according to the reference standards and ISO 14040/14044. The EPD Generator uses Ecoinvent v3.10.1/3.11 and One Click LCA databases as sources of environmental data. Allocation used in Ecoinvent 3.10.1/3.11 environmental data sources follow the methodology 'allocation, Cut-off, EN 15804+A2'.

ENVIRONMENTAL IMPACT DATA

The estimated impact results are only relative statements which do not indicate the end points of the impact categories, exceeding threshold values, safety margins or risks.

CORE ENVIRONMENTAL IMPACT INDICATORS – EN 15804+A2, EF 3.1

Impact category	Unit	A1	A2	A3	A1-A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
GWP – total ¹⁾	kg CO ₂ e	5,00E+01	5,37E-01	8,24E+00	5,88E+01	9,02E-01	3,04E+00	ND	ND	ND	ND	ND	2,79E+03	ND	0,00E+00	2,94E-01	3,11E+00	1,58E+00	-2,50E+01
GWP – fossil	kg CO ₂ e	4,98E+01	5,36E-01	8,22E+00	5,86E+01	9,01E-01	3,03E+00	ND	ND	ND	ND	ND	2,78E+03	ND	0,00E+00	2,93E-01	3,11E+00	1,58E+00	-2,51E+01
GWP – biogenic	kg CO ₂ e	1,24E-01	9,85E-05	1,06E-04	1,25E-01	1,66E-04	3,04E-06	ND	ND	ND	ND	ND	4,19E+00	ND	0,00E+00	6,41E-05	-5,17E-04	-1,34E-04	6,48E-02
GWP – LULUC	kg CO ₂ e	8,95E-02	2,71E-04	2,37E-02	1,14E-01	4,64E-04	5,77E-03	ND	ND	ND	ND	ND	5,52E+00	ND	0,00E+00	1,30E-04	1,57E-04	2,64E-05	-3,94E-02
Ozone depletion pot.	kg CFC ₋₁₁ e	6,08E-07	7,83E-09	9,96E-08	7,16E-07	1,35E-08	3,74E-08	ND	ND	ND	ND	ND	1,93E-05	ND	0,00E+00	4,10E-09	2,33E-09	1,24E-09	-2,32E-07
Acidification potential	mol H ⁺ e	4,97E+00	1,03E-02	5,26E-02	5,04E+00	1,80E-02	2,53E-01	ND	ND	ND	ND	ND	1,44E+01	ND	0,00E+00	9,78E-04	1,90E-03	5,18E-04	-7,41E-01
EP-freshwater ²⁾	kg Pe	2,72E-01	2,67E-05	2,17E-03	2,74E-01	4,38E-05	1,37E-02	ND	ND	ND	ND	ND	1,26E+00	ND	0,00E+00	2,28E-05	7,10E-05	6,90E-06	-5,37E-01
EP-marine	kg Ne	1,91E-01	2,60E-03	1,43E-02	2,08E-01	4,47E-03	1,09E-02	ND	ND	ND	ND	ND	2,73E+00	ND	0,00E+00	3,17E-04	6,59E-04	1,57E-03	-2,15E-01
EP-terrestrial	mol Ne	2,73E+00	2,88E-02	1,57E-01	2,92E+00	4,96E-02	1,49E-01	ND	ND	ND	ND	ND	2,77E+01	ND	0,00E+00	3,45E-03	6,36E-03	2,38E-03	-3,17E+00
POCP ("smog") ³⁾	kg NMVOCe	8,39E-01	8,18E-03	5,60E-02	9,03E-01	1,41E-02	4,62E-02	ND	ND	ND	ND	ND	8,25E+00	ND	0,00E+00	1,36E-03	1,73E-03	6,86E-04	-6,12E-01
ADP-minerals & metals ⁴⁾	kg Sbe	7,99E-02	9,08E-07	3,77E-05	7,99E-02	1,49E-06	4,00E-03	ND	ND	ND	ND	ND	1,59E-02	ND	0,00E+00	9,63E-07	6,93E-06	1,51E-07	-9,87E-03
ADP-fossil resources	MJ	7,08E+02	7,06E+00	1,15E+02	8,30E+02	1,19E+01	4,29E+01	ND	ND	ND	ND	ND	3,60E+04	ND	0,00E+00	4,12E+00	1,93E+00	8,78E-01	-2,89E+02
Water use ⁵⁾	m ³ e depr.	3,77E+01	2,63E-02	4,17E+00	4,19E+01	4,35E-02	2,12E+00	ND	ND	ND	ND	ND	7,00E+02	ND	0,00E+00	1,91E-02	2,19E-01	1,01E-01	-1,02E+01

1) GWP = Global Warming Potential; 2) EP = Eutrophication potential. Required characterisation method and data are in kg P-eq. Multiply by 3,07 to get PO4e; 3) POCP = Photochemical ozone formation; 4) ADP = Abiotic depletion potential; 5) EN 15804+A2 disclaimer for Abiotic depletion and Water use and optional indicators except Particulate matter and Ionizing radiation, human health. The results of these environmental impact indicators shall be used with care as the uncertainties on these results are high or as there is limited experience with the indicator.

ADDITIONAL (OPTIONAL) ENVIRONMENTAL IMPACT INDICATORS – EN 15804+A2, EF 3.1

Impact category	Unit	A1	A2	A3	A1-A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
Particulate matter	Incidence	9,42E-06	3,06E-08	1,23E-06	1,07E-05	4,84E-08	5,42E-07	ND	ND	ND	ND	ND	1,23E-04	ND	0,00E+00	2,33E-08	2,05E-08	5,72E-09	-6,02E-06
Ionizing radiation ⁶⁾	kBq 11235e	4,29E+00	4,47E-03	3,32E-01	4,63E+00	7,36E-03	2,33E-01	ND	ND	ND	ND	ND	3,79E+02	ND	0,00E+00	3,33E-03	5,88E-03	9,65E-04	-1,89E+00
Ecotoxicity (freshwater)	CTUe	4,55E+03	7,28E-01	5,31E+01	4,60E+03	1,20E+00	2,30E+02	ND	ND	ND	ND	ND	7,40E+03	ND	0,00E+00	6,51E-01	6,67E+00	5,17E+00	-6,42E+03
Human toxicity, cancer	CTUh	7,07E-07	1,04E-10	4,84E-08	7,55E-07	1,77E-10	3,78E-08	ND	ND	ND	ND	ND	4,94E-07	ND	0,00E+00	4,99E-11	3,47E-10	1,38E-10	-1,40E-08
Human tox. non-cancer	CTUh	7,20E-05	2,96E-09	8,08E-08	7,20E-05	4,81E-09	3,60E-06	ND	ND	ND	ND	ND	2,67E-05	ND	0,00E+00	2,58E-09	1,48E-08	5,97E-09	-7,94E-07
SQP ⁷⁾	-	1,77E+03	3,41E+00	4,59E+03	6,36E+03	5,36E+00	3,19E+02	ND	ND	ND	ND	ND	6,48E+03	ND	0,00E+00	2,46E+00	2,71E+00	1,29E+00	-5,65E+02

6) EN 15804+A2 disclaimer for Ionizing radiation, human health. This impact category deals mainly with the eventual impact of low-dose ionizing radiation on human health of the nuclear fuel cycle. It does not consider effects due to possible nuclear accidents, occupational exposure nor due to radioactive waste disposal in underground facilities. Potential ionizing radiation from the soil, from radon and from some construction materials is also not measured by this indicator; 7) SQP = Land use related impacts/soil quality.

USE OF NATURAL RESOURCES

Impact category	Unit	A1	A2	A3	A1-A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
Renew. PER as energy ⁸⁾	MJ	1,32E+02	7,26E-02	3,21E+02	4,52E+02	1,20E-01	4,07E+00	ND	ND	ND	ND	ND	5,44E+03	ND	0,00E+00	5,64E-02	2,33E-01	1,88E-02	-1,38E+02
Renew. PER as material	MJ	0,00E+00	0,00E+00	3,14E+02	3,14E+02	0,00E+00	-3,14E+02	ND	ND	ND	ND	ND	0,00E+00	ND	0,00E+00	0,00E+00	0,00E+00	0,00E+00	1,06E+00
Total use of renew. PER	MJ	1,32E+02	7,26E-02	6,35E+02	7,67E+02	1,20E-01	-3,10E+02	ND	ND	ND	ND	ND	5,44E+03	ND	0,00E+00	5,64E-02	2,33E-01	1,88E-02	-1,37E+02
Non-re. PER as energy	MJ	6,05E+02	7,06E+00	9,17E+01	7,03E+02	1,19E+01	3,65E+01	ND	ND	ND	ND	ND	3,60E+04	ND	0,00E+00	4,12E+00	-4,39E+01	-4,49E+01	-2,89E+02
Non-re. PER as material	MJ	0,00E+00	0,00E+00	2,21E+01	2,21E+01	0,00E+00	-2,21E+01	ND	ND	ND	ND	ND	0,00E+00	ND	0,00E+00	0,00E+00	0,00E+00	0,00E+00	3,49E-01
Total use of non-re. PER	MJ	6,05E+02	7,06E+00	1,14E+02	7,25E+02	1,19E+01	1,45E+01	ND	ND	ND	ND	ND	3,60E+04	ND	0,00E+00	4,12E+00	-4,39E+01	-4,49E+01	-2,89E+02
Secondary materials	kg	6,76E-01	3,21E-03	9,63E-01	1,64E+00	5,44E-03	8,28E-02	ND	ND	ND	ND	ND	5,15E+00	ND	0,00E+00	1,85E-03	2,09E-03	4,30E-04	2,94E+00
Renew. secondary fuels	MJ	1,48E-02	2,07E-05	8,30E+00	8,31E+00	3,32E-05	4,16E-01	ND	ND	ND	ND	ND	3,26E-02	ND	0,00E+00	2,35E-05	8,82E-05	1,20E-05	-1,53E-02
Non-ren. secondary fuels	MJ	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	ND	ND	ND	ND	ND	0,00E+00	ND	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Use of net fresh water	m ³	1,72E+00	7,27E-04	9,02E-02	1,81E+00	1,20E-03	8,91E-02	ND	ND	ND	ND	ND	1,96E+01	ND	0,00E+00	5,45E-04	3,97E-03	-1,93E-04	-4,27E-01

8) PER = Primary energy resources.

END OF LIFE – WASTE

Impact category	Unit	A1	A2	A3	A1-A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
Hazardous waste	kg	2,38E+01	1,05E-02	7,25E-01	2,46E+01	1,75E-02	1,23E+00	ND	ND	ND	ND	ND	2,42E+02	ND	0,00E+00	7,17E-03	6,21E-02	2,66E-02	-5,29E+00
Non-hazardous waste	kg	1,89E+03	1,68E-01	1,28E+01	1,90E+03	2,77E-01	9,79E+01	ND	ND	ND	ND	ND	6,09E+03	ND	0,00E+00	1,35E-01	1,69E+00	3,84E+00	5,88E+00
Radioactive waste	kg	1,13E-03	1,09E-06	8,12E-05	1,21E-03	1,80E-06	6,11E-05	ND	ND	ND	ND	ND	9,25E-02	ND	0,00E+00	8,16E-07	1,46E-06	2,41E-07	-4,66E-04

END OF LIFE – OUTPUT FLOWS

Impact category	Unit	A1	A2	A3	A1-A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
Components for re-use	kg	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	ND	ND	ND	ND	ND	0,00E+00	ND	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Materials for recycling	kg	0,00E+00	0,00E+00	9,52E-02	9,52E-02	0,00E+00	9,06E-01	ND	ND	ND	ND	ND	0,00E+00	ND	0,00E+00	0,00E+00	4,19E+00	0,00E+00	0,00E+00
Materials for energy rec	kg	0,00E+00	0,00E+00	5,00E-04	5,00E-04	0,00E+00	8,60E-01	ND	ND	ND	ND	ND	0,00E+00	ND	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Exported energy	MJ	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	2,00E+00	ND	ND	ND	ND	ND	0,00E+00	ND	0,00E+00	0,00E+00	1,47E+01	0,00E+00	0,00E+00
Exported energy – Electricity	MJ	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	8,41E-01	ND	ND	ND	ND	ND	0,00E+00	ND	0,00E+00	0,00E+00	6,18E+00	0,00E+00	0,00E+00
Exported energy – Heat	MJ	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	1,16E+00	ND	ND	ND	ND	ND	0,00E+00	ND	0,00E+00	0,00E+00	8,52E+00	0,00E+00	0,00E+00

ADDITIONAL INDICATOR – GWP-GHG

Impact category	Unit	A1	A2	A3	A1-A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
GWP-GHG ⁹⁾	kg CO ₂ e	4,99E+01	5,36E-01	8,24E+00	5,87E+01	9,01E-01	3,04E+00	ND	ND	ND	ND	ND	2,78E+03	ND	0,00E+00	2,94E-01	3,11E+00	1,58E+00	-2,51E+01

9) This indicator includes all greenhouse gases excluding biogenic carbon dioxide uptake and emissions and biogenic carbon stored in the product. In addition, the characterisation factors for the flows – CH₄ fossil, CH₄ biogenic and Dinitrogen monoxide – were updated. This indicator is identical to the GWP-total of EN 15804:2012+A2:2019 except that the characterisation factor for biogenic CO₂ is set to zero.

SCENARIO DOCUMENTATION

DATA SOURCES

Manufacturing energy scenario documentation

1. Electricity production, wind, 1-3MW turbine, onshore, World, Ecoinvent, 0.0156 kgCO₂e/kWh
2. Electricity production, solar thermal parabolic trough, 50 MW, World, Ecoinvent, 0.0538 kgCO₂e/kWh
3. Diesel, burned in diesel-electric generating set, 18.5kW, World, Ecoinvent, 0.10 kgCO₂e/MJ

Transport scenario documentation - A4 (Transport resources)

1. Market for transport, freight, lorry >32 metric ton, EURO6, 285 km
2. Market for transport, freight, sea, container ship, 5300 km

Transport scenario documentation A4

Scenario parameter	Value
Capacity utilization (including empty return) %	100% (outbound full load; return trips used to transport other materials)
Bulk density of transported products	0,00E+00
Volume capacity utilization factor	1

Installation scenario documentation - A5 (Installation waste)

1. Treatment of waste polyethylene, for recycling, unsorted, sorting, Ecoinvent, Materials for recycling, 2.2E-4 kg
2. Treatment of waste polyethylene, municipal incineration, Ecoinvent, Materials for energy recovery, 2.0E-4 kg
3. Exported Energy: Electricity, Ecoinvent, 0.0014 MJ
4. Exported Energy: Electricity, Ecoinvent, 0.84 MJ

5. Exported Energy: Thermal, Ecoinvent, 0.0019 MJ
6. Exported Energy: Thermal, Ecoinvent, 1.16 MJ
7. Treatment of waste polyethylene, sanitary landfill, Ecoinvent, Materials for energy recovery, 1.3E-4 kg
8. Treatment of waste wood, post-consumer, sorting and shredding, Ecoinvent, Materials for recycling, 0.4012 kg
9. Treatment of waste wood, untreated, municipal incineration, Ecoinvent, Materials for energy recovery, 0.38 kg
10. Treatment of waste wood, untreated, sanitary landfill, Ecoinvent, Materials for energy recovery, 0.48 kg
11. Treatment of used cable, Ecoinvent, Materials for recycling, 0.5 kg

Use stages scenario documentation - B2 Maintenance

Scenario information	Value
Maintenance process / Description or source where description can be found	No planned maintenance; cable is designed for continuous operation without routine interventions over the reference service life.
Maintenance cycle / Number per RSL or year <i>(Not applicable if only B2 is declared)</i>	0 (no regular maintenance events during the 20-year RSL).

Use stages scenario documentation - B3 Repair

Scenario information	Value
Repair process / Description or source where description can be found	Repairs are not planned; in case of major failure, damaged sections are replaced rather than repaired in situ.
Inspection Process / Description or source where description can be found	Visual and electrical inspections are part of regular railway infrastructure maintenance; they do not require product-specific materials or energy and are outside the system boundary.
Repair cycle / Number per RSL or year	0 (no scheduled repairs per RSL).

Use stages scenario documentation - B4 Replacement

Scenario information	Value
Replacement cycle / Number per RSL or year	0 (no scheduled replacement within 20-year RSL; replacement occurs only in case of failure, which is not modeled).

Use stages scenario documentation - B5 Refurbishment

Scenario information	Value
Refurbishment process / Description or source where description can be found	Not applicable; cables are not refurbished.
Refurbishment cycle / Number per RSL or year	0
Further assumptions for scenario development, e.g., frequency and time period of use, number of occupants / Units as appropriate	Traction cable operates continuously within rated current and voltage; no user-dependent variation is modeled beyond the nominal electrical loading already included in B6.

Use stages scenario documentation - B6 (Energy data source)

1. Market group for electricity, low voltage, World, Ecoinvent, 3825.0 kWh

Use stages scenario documentation - B7 (Water data source)

Use stages scenario documentation - B6-B7 Use of energy and use of water

Scenario information	Value
Ancillary materials specified by material / kg or units as appropriate	None – no ancillary materials required during use
Characteristic performance, e.g., energy efficiency, emissions, variation of performance with capacity utilization, etc.	Electrical transmission losses modeled using $P = I^2 \times R$ based on nominal current and conductor resistance; cumulative energy loss calculated over 20-year RSL.
Further assumptions for scenario development, e.g., frequency and period of use, number of occupants	Continuous operation over a 20-year reference service life (175,200 h)

End-of-life scenario documentation - C1-C4 (Data source)

1. Treatment of waste plastic, mixture, municipal incineration, Ecoinvent, 1.26 kg
2. Treatment of waste plastic, mixture, municipal incineration, Ecoinvent, 0.63 kg
3. Exported Energy: Electricity, Ecoinvent, 6.182 MJ
4. Exported Energy: Thermal, Ecoinvent, 8.52 MJ
5. Treatment of waste plastic, mixture, sanitary landfill, Ecoinvent, 0.63 kg
6. Sorting and pressing of iron scrap, Ecoinvent, Materials for recycling, 4.19 kg
7. Treatment of scrap steel, inert material landfill, Ecoinvent, 2.792 kg

Scenario information	Value
Scenario assumptions e.g. transportation	<p>Cable waste is mechanically removed and transported with trucks to treatment facilities (typical EU averages: ~150 km to WtE/incineration or landfill for polymer fractions; ~250 km to metal recyclers for copper). Polymer fractions are split between incineration with energy recovery, incineration without recovery and landfill according to the EoL scenario described in section C1–C4; copper fractions are predominantly recycled, with unrecovered copper landfilled. Energy recovery efficiency 38 % (EU average; electricity/heat split per Zero Waste Europe, 2023).</p>

THIRD-PARTY VERIFICATION STATEMENT

EPD Hub declares that this EPD is verified in accordance with ISO 14025 by an independent, third-party verifier. The project report on the Life Cycle Assessment and the report(s) on features of environmental relevance are filed at EPD Hub. EPD Hub PCR and ECO Platform verification checklist are used.

EPD Hub is not able to identify any unjustified deviations from the PCR and EN 15804+A2 in the Environmental Product Declaration and its project report.

EPD Hub maintains its independence as a third-party body; it was not involved in the execution of the LCA or in the development of the declaration and has no conflicts of interest regarding this verification.

The company-specific data and upstream and downstream data have been examined as regards plausibility and consistency. The publisher is responsible for ensuring the factual integrity and legal compliance of this declaration.

The software used in creation of this LCA and EPD is verified by EPD Hub to conform to the procedural and methodological requirements outlined in ISO 14025:2010, ISO 14040/14044, EN 15804+A2, and EPD Hub Core Product Category Rules and General Program Instructions.

Verified tools

Tool verifier: Magaly Gonzalez Vazquez

Tool verification validity: 27 March 2025 - 26 March 2028

Yazan Badour as an authorized verifier for EPD Hub Limited 06.03.2026

