CONDUMAX

ENVIRONMENTAL PRODUCT DECLARATION

PRODUCT NAME:	SITE:
Cable 1: WIRE FOR MOORING AL 1350 T0 NU 6 AWG – RL 30KG Cable 2: SOLID WIRE A/C 750V 6,00 MM2 PR CX Cable 3: C MAXLINK FLEX CONTR CL BBFC 1KV 4X4 MM2 ENEL Cable 4: C MAXLINK FLEX CONTR CL BBFC 1KV 7X2,5 MM2 ENEL	Brazil, Olímpia – SP

in accordance with ISO 14025 and EN 50693:2019

Program Operator	EPDItaly
Publisher	EPDItaly

Declaration Number	EPD003
Registration Number	EPDITALY0778

Issue Date	30/08/2024
Valid to	30/08/2029

Cable 1

Cable 2

Cable 3

Cable 4

GENERAL INFORMATION

EPD OWNER

Name of the company	Condumax – Eletro Metalurgica Ciafundi LTDA
Registered office	Rodovia Wilquem Manoel Neves, s/n km 3,5, Olímpia – SP, Brazil, 15405-370
Contacts for information on the EPD	Robson Micheletto Quality and Environment Manager robson.micheletto@condumax.com.br

PROGRAM OPERATOR

EPDItaly	Via Gaetano De Castillia, 10 20124 – Milano Italy

INFORMATION ON THE EPD

Product name (s)	Electrical wires and cables: Cable 1: WIRE FOR MOORING AL 1350 T0 NU 6 AWG – RL 30KG Cable 2: SOLID WIRE A/C 750V 6,00 MM2 PR CX Cable 3: C MAXLINK FLEX CONTR CL BBFC 1KV 4X4 MM2 ENEL Cable 4: C MAXLINK FLEX CONTR CL BBFC 1KV 7X2,5 MM2 ENEL
Site (s)	Rodovia Wilquem Manoel Neves, s/n km 3,5, Olímpia – SP, Brazil, 15400-000
Short description and technical information of product (s)	Cable 1: Assembled with aluminum wire without insulation and sheath. Cable 2: Electrolytic copper wire with PVC insulation. Cable 3: Cable formed by electrolytic copper wires, with XLPE insulation, PVC inner layer, metallic shielding and PVC sheath. Cable 4: Cable formed by electrolytic copper wires, with XLPE insulation, PVC inner layer, metallic shielding and PVC sheath. Declared unit for cable 1, 2, 3 and 4: To transmit energy expressed for 1A over a distance of 1 km (cable length) for 40 years (RSL) and 100% of use rate.
Field of application of the product(s)	Used in the public low-voltage power distribution network and customers entries.
Product reference standard(s)	Cable 1: ENEL STANDARD PM-Br 760.01, VERSION 0. Cable 2: ENEL STANDARD PM-Br 204.01, VERSION 0. Cable 3: ENEL STANDARD MAT-OMBR-MAT-18-0114-EDCE, VERSION 01. Cable 4: ENEL STANDARD MAT-OMBR-MAT-18-0114-EDCE, VERSION 01.
CPC Code	463 family “Insulated wire and cable; optical fibre cables” and sub-sequent clusters

VERIFICATION INFORMATION

Product category rules (PCR): (title, version, date of publication or update)	Core PCR EPDItaly007 - PCR for electronic and electrical product and systems. Revision 3 – 2023/01/13; Conducted by ICMQ S.p.A. – Certificazioni e controlli per le costruzioni Moderator: Eng. Vito D’Incognito, Take Care International Sub PCR EPDItaly016 - PCR for electronic and electrical product and systems – cables and wires. Revision 2 – 25/09/2020; Conducted by Enel S.p.A.; Life Cycle Engineering - Viale Regina Margherita 125 - 00198 Rome, Italy
EPDItaly Regulations (version, date of publication or update)	Regulation of the EPDItaly Program – rev.6.0 (2023/10/30)
Project Report LCA	Life Cycle Assessment (LCA) Report – Condumax ((1) WIRE FOR MOORING AL 1350 T0 NU 6 AWG – RL 30KG; (2) SOLID WIRE A/C 750V 6,00 MM2 PR CX; (3) C MAXLINK FLEX CONTR CL BBFC 1KV 4X4 MM2 ENEL; (4) C MAXLINK FLEX CONTR CL BBFC 1KV 7X2,5 MM2 ENEL) – Rev 2_Aug 12, 2024.
Independent Verification Statement	This declaration has been developed in accordance with the EPDItaly Regulations; further information and the Regulations themselves are available on the website: www.epditaly.it The PCR review was performed by ICMQ S.p.A. (PCR EPDItaly007) and Enel S.p.A (PCR EPDItaly016) - info@epditaly.it EN 50693 is the framework reference for PCRs. Independent verification of the declaration and data according to ISO 14025:2010. Internal ☐ External ☒ Third party verification carried out by: ICMQ S.p.A., via Gaetano De Castillia n ° 10 - 20124 Milan, Italy. Accredited by Accredia.
Comparability	Environmental statements published within the same product category, but from different programs, may not be comparable. EPDs of Electrical wires and cables may not be comparable if they do not comply with EN 50693. For further information about comparability, see EN 50693 and ISO 14025.
Liability Statement	The EPD owner has the sole ownership, liability, and responsibility for the EPD. The EPD Owner releases EPDItaly from any non-compliance with environmental legislation. The holder of the declaration will be responsible for the information and supporting evidence. EPDItaly disclaims any responsibility for the information, data and results provided by the EPD Owner for life cycle assessment.

Company information

Founded in 1964, Condumax is an electrical wire and cable supplier to the main energy concessionaires in Brazil and abroad. The company is located in São Paulo, Brazil, with more than 700 employees and more than 1000 indirect employees. All Condumax cables are environmentally friendly, heavy metal free and meet international RoHs directives.

The ISO 9001, IATF 16949, ISO 14001 and ISO 45001 standards certify Condumax manufacturing unit. Some of Condumax cables and wires also are Environmental Product Declaration certified according to ISO 14025. While the International Standard Industrial Classification of All (ISIC) classifies the factory as Division 27, Group 273 and Class 2732. The ABNT also granted the license for using the ABNT Environmental Mark – ABNT Ecolabel, meeting the requirements of the document PE-425, ISO 14020 and ISO 14024.

EPD Information:

Scope of EPD:

The EDP aims to communicate the impact of the cables to its customer, being a B2B communication. The Condumax customer seeks to reduce the environmental impact of its value chain and, for that, has implemented a sustainability management policy (Sustainable Purchases), starting to request actions to quantify and mitigate environmental impacts of its suppliers, such as Condumax.

Type of EPD:

This declaration is specific for electrical wires and cables.

Declared unit:

To transmit energy expressed for 1A over a distance of 1 km (cable length) for 40 years (RSL) and 100% of use rate.
For the cable 1, 1 km (cable length) is equal to 36.27 kg; for the Cable 2, 1 km (cable length) is equal to 62.14 kg; for the cable 3, 1 km (cable length) is equal to 384.04 kg; for the Cable 4, 1 km (cable length) is equal to 403.44 kg.

Reference flow:

The reference flow of the cable 1, WIRE FOR MOORING AL 1350 T0 NU 6 AWG – RL 30KG, is 36.27kg.
The reference flow of the cable 2, SOLID WIRE A/C 750V 6,00 MM2 PR CX, is 62.14 kg.
The reference flow of the cable 3, C MAXLINK FLEX CONTR CL BBFC 1KV 4X4 MM2 ENEL, is 384.04 kg.
The reference flow of the cable 4, C MAXLINK FLEX CONTR CL BBFC 1KV 7X2,5 MM2 ENEL, is 403.44 kg.

Data:

Condumax has provided all information for the study execution, so it has described all the raw materials used, the acquisition method, product characteristics, production stages, waste generated and all other information for the impact's calculation.
Condumax team of experts manages the production of the cables in its factory, being possible to obtain the total quantity of the cable manufactured in 2023. The data about the cables technical specifications (or the "product structure" that contains all the information about the quantity of raw materials consumed per meter of cable produced), was obtained through the product cost sector, with the support of the engineering team that is responsible for maintaining these cables technical specifications data sheet updated. That updated cables technical specifications data sheet was used as the cable study data sheet, and given this two information (quantity production and product structure) it was possible to calculate the raw material consumption of Condumax production in 2023.
The company has its own greenhouse gas (GHG) emission management data collection standard.

Time representativeness:

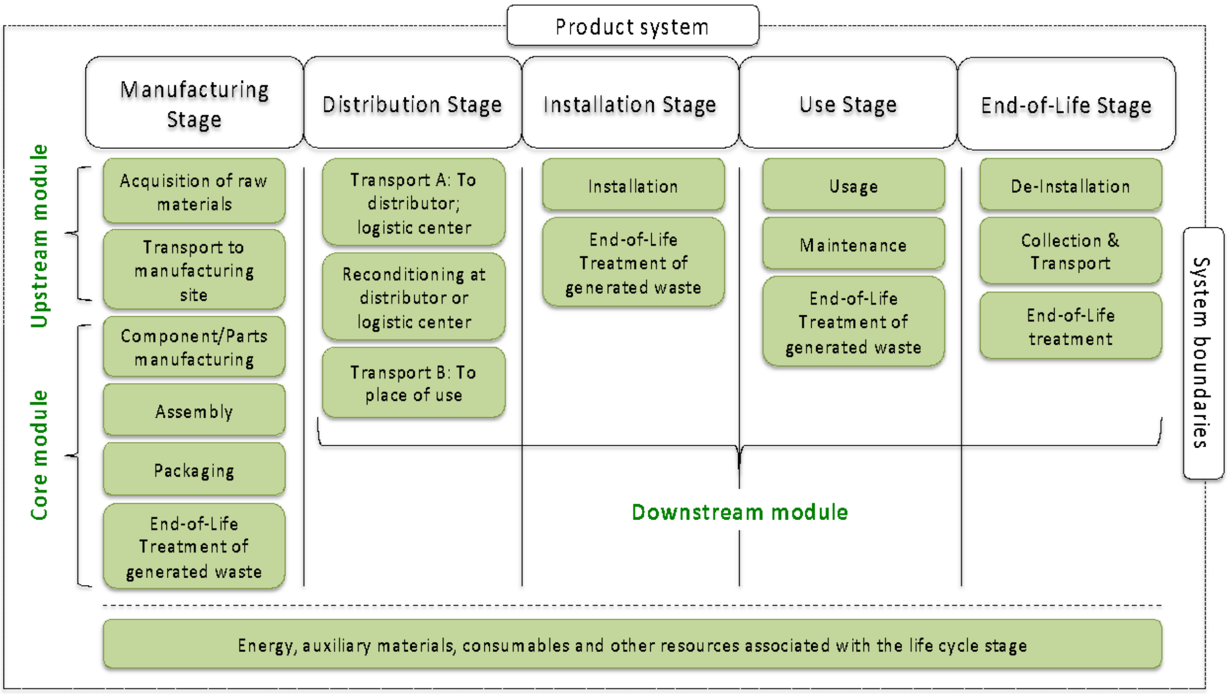
January 2023 to December 2023.

Database and LCA software used:

The source inventory and the emission factors of inputs and outputs used in the study are from the EN 15804 add-on for ecoinvent version 3.8 database, calculated using the OpenLCA software v. 1.11.0.

Description of system boundaries:

Cradle to grave: All stages until the end of life.



Source: Adapted from EN 50693:2019

Upstream module:

Manufacturing stage: The upstream module of the manufacturing stage considers all upstream processes to extract and process all the raw materials used by Condumax to manufacturing its products, including electricity consumption and other. This stage also accounts the emissions for the road and maritime transportation of all materials and components from suppliers to Condumax plant.

Core module:

Manufacturing stage: The core module of the manufacturing stage includes all the material transformation, assembling and packing for the cables manufacturing process; the water, gas and electricity consumptions; and the residues and effluent treatment, considering also the recycling processes of the metal end plastics scrapes generates during the manufacturing process. The processes stages to manufacturing the cables are as follow.

- Drawing – The drawing process is used to reduce the cross-section (area) of the filament and change the material’s mechanical properties.
- Twist – This process aims the filaments to twist, transforming them into ropes and giving the cable certain flexibility.

- Taping – This process bandages the material using a tape. At Condumax, they can wrap study cables in aluminum or polymeric tape, to protect against electromagnetic interference.
- Extrusion - It comprises the process of the polymeric material covering the entire product surface. At Condumax, they intend the polymeric extrusion for electrical insulation.
- Measurement and packing – The measurement and packaging sector aims to ensure that products are measured, fractionated, packaged and identified in the characteristics expected by customers. They can package the products in coils, plastic spools, rolls or cardboard boxes.

Downstream module:

Distribution: The cables are transported from Condumax's factory to the client warehouse, place where the cables is stored until be sent to the installation. As the cables can be transported from São Paulo to any Brazilian state, an overland distribution scenario of 1000 km is adopted.

Installation: It was considered that the installation process generates 5% of the cable total mass and the package as waste, that is transported to its final destinations (200 km distance).

Use: During the use stage, the cable dissipates energy due to the Joule effect. The dissipation energy calculation followed the Sub PCR EPDItaly016, considering a current of 1A during a lifetime of 40 years. The equation is presented below:

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

Where:

E_{use} is the energy dissipated by the cable during its operating time

R_{linear} is the linear resistivity of the cable, expressed in Ω/km

I is the current, expressed in A

RSL is the reference service life of the product in second.

End-of-life: The stage considers the transport of the cable de-installed to the client warehouse (250 km distance); the cable disassembly operations, that consider the separation of the cable metal and plastic materials; the transportation of the residues from the warehouse to its disposal site (200 km) and, finally, the recycling processes of the EoL product's metal and plastic.

Allocation:

- The cable and packaging materials mass are in accordance with the structure file provided by Condumax.
- To emission of the raw materials transport, from the supplier to Condumax, it was considered the materials consumed for the cables manufacturing. That includes the material allocated in the cables and its proportional waste generated during manufacturing process.
- The scraps allocation of aluminum and copper was calculated according to the relative metal mass consumed in the product manufacture.
- It was considered mass allocation to obtain the electricity, water and LPG consumption of the manufactured cable, and also the allocation of the mass of miscellaneous waste disposal. This means that it was considered the proportion

of cable-produced mass in front of the mass of all cables produced in the evaluated time of the study to obtain the mass of the utility and waste allocated for each cable.

- The discarded aqueous emulsion mass per cable was also calculated proportionally mass of the cable, but had considered only the fraction of the metal mass consumed to produce the cables.
- The discarded production scraps and various contaminated residues mass was calculated proportionally to the mass of the cable, considering the fraction of the metal and polymers mass.

Cut-off criteria:

The cut-off criteria are applied to support an efficient calculation procedure. Following the EPDItaly 016, it was considered the following operations in the cut-off criteria:

- The cable installation and de-installation operations were disregarded, since it was assumed that these operations are performed using manual tools (chapter 4.2.3.9);
- Maintenance operation was disregarded, since it was considered no scheduled interventions during the life of the product (chapter 4.2.3.5);

Additional information:

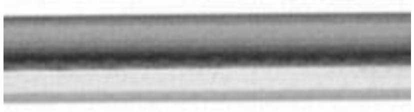
- During the manufacturing stage, the waste is generated during the production process and packaging (waste from raw materials), and contaminated residues and aqueous emulsion generated from production process and machine operation.
- The production and packaging generated waste are inert and sent to recycling, the contaminated residues are sent to incineration, and the aqueous emulsion is sent to effluent treatment process.
- In order to calculate the allocations based on the cable produced mass (e.g.: Energy, LPG, waste and etc.), it was considered the proportion of the produced cable mass in comparison with all raw materials used for all the cables manufactured in Condumax in the period of the inventory analysis, even if the raw materials are not used for the cables production analyzed in this report.
- Condumax customer and Condumax plant confirm that all material used in the finished product (installation waste, packaging and EoL product) are sent to recycling. The polyethylene, even if a percentage goes to the landfill, it is recovered and sold by collectors and reused, turning into sustainable products, a common practice in Brazil.
- In Brazil, commercial diesel has a 12 % biodiesel fraction (biodiesel minimum percentage added to commercial diesel).
- Electricity used to manufacture the product comes from the Brazilian Electricity Matrix.
- It was considered the Condumax technical specifications of the cable structure to obtain the life cycle inventory (LCI) of the raw material emission source. e.g.: 0.1 of aluminum to 1 meter of cable.

Detailed product description

Following ABNT ISO 14025 and EN 50693:2019, the study presents the environmental declaration of two cables produced by Condumax to meet its necessity in front of its customers.

Analyzed cable 1:

WIRE FOR MOORING AL 1350 T0 NU 6 AWG – RL 30KG:



The cable detail is presented as following:

Conductors: ALUMINUM WIRE ALOY 1350, SOFT TEMPER, TO

Insulation: WITHOUT INSULATION

Sheath: WITHOUT SHEATH

Standard: ENEL STANDARD PM-Br 760.01, VERSION 0.

Main raw materials:

In 2023, January to December interval, Condumax has manufactured 29.21 km of finished product. Its mass composition is as followed:

Product Components	Weight, kg (per km of cable)	%
Aluminum (Al)	36.27	100
Total	**36.27**	**100**
Packaging materials	**Weight (kg per km of cable)**	**%**
Plastic	2.643	99.93
Polypropylene	1.805E-03	0.07
Total	**2.645E+00**	**100**

Environmental performance

Besides the total results, parameters are declared separately for stage.

Environmental impact descriptive parameters

Impact category	Unit	Manufacturing		Distribution	Installation	Use	End-of-life	Total
		Upstream module	Core module	Downstream module				
Climate change – total	kg CO_2 eq.	286.51	10.30	4.46	-15.57	162.11	51.29	499.10
Climate change – fossil	kg CO_2 eq.	251.19	6.59	4.03	0.09	89.75	50.93	402.57
Climate change –	kg CO_2 eq.	15.67	3.36	0.11	-15.67	65.77	0.15	69.39

biogenic								
Climate change – land use and land use change	kg CO_2 eq.	19.65	0.35	0.32	0.01	6.60	0.21	27.14
Acidification	mol H^+ eq.	1.67	0.02	0.02	0.00	0.22	0.14	2.08
Eutrophication aquatic freshwater	kg P eq.	0.03	0.00	0.00	0.00	0.00	0.01	0.05
Eutrophication aquatic marine	kg N eq.	0.18	0.01	0.01	0.00	0.07	0.03	0.30
Eutrophication terrestrial	mol N eq.	1.80	0.06	0.08	0.00	0.76	0.34	3.04
Photochemical ozone formation	kg NMVOC eq.	0.62	0.02	0.02	0.00	0.17	0.09	0.92
Ozone depletion	kg CFC-11 eq.	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Depletion of abiotic resources – minerals and metals	kg Sb eq.	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Depletion of abiotic resources – fossil fuels	MJ	266.58	8.44	6.63	0.15	8.74	143.34	433.88
Water use	m^3 eq.	838.67	14.26	0.61	0.01	291.66	70.21	1215.42

Parameters describing resource use

Renewable resource	**Unit**	**Manufacturing**		**Distribution**	**Installation**	**Use**	**End-of-life**	**Total**
		Upstream module	**Core module**	**Downstream module**				
Use of renewable primary energy excluding renewable primary energy resources used as raw material	MJ	2613.02	44.90	0.64	0.01	857.01	30.33	3545.91
Use of renewable primary energy resources used as raw material	MJ	56.92	6.43	3.65	0.08	108.37	12.75	188.20
Total use of renewable primary energy resources	MJ	2669.94	51.33	4.29	0.10	965.38	43.08	3734.11

Non-renewable resource	**Unit**	**Manufacturing**		**Distribution**	**Installation**	**Use**	**End-of-life**	**Total**
		Upstream module	**Core module**	**Downstream module**				
Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw material	MJ	337.25	44.62	6.64	0.15	692.28	178.42	1259.37

Use of non-renewable primary energy resources used as raw material	MJ	2509.62	95.08	54.75	1.25	1526.86	206.47	4394.04
Total use of non-renewable primary energy resources	MJ	2848.28	139.92	63.73	1.46	2221.01	385.86	5660.26

Water and secondary raw	**Unit**	**Manufacturing**		**Distribution**	**Installation**	**Use**	**End-of-life**	**Total**
		Upstream module	**Core module**	**Downstream module**				
Net use of fresh water	m^3	19.53	0.36	0.02	0.00	6.79	1.64	28.35
Use of secondary materials	kg	0.00	3.97	0.07	0.00	18.62	38.32	60.98
Use of renewable secondary fuels	MJ	0.30	0.02	0.01	0.00	0.01	0.28	0.62
Use of non-renewable secondary fuels	MJ	0.50	0.04	0.01	0.00	0.03	0.60	1.18

Waste production descriptive parameters

Impact category	**Unit**	**Manufacturing**		**Distribution**	**Installation**	**Use**	**End-of-life**	**Total**
		Upstream module	**Core module**	**Downstream module**				
Hazardous waste disposed	kg	0.12	0.01	0.00	0.00	0.00	0.09	0.23
Non-hazardous waste disposed	kg	8.47	0.59	6.13	0.14	1.02	35.50	51.85
Radioactive waste disposed	kg	0.04	0.02	0.00	0.00	0.42	0.02	0.50
Materials for energy recovery	kg	0.16	0.01	0.02	0.00	0.03	0.03	0.25
Materials for recycling	kg	1.17	0.72	0.04	0.00	13.46	0.72	16.11
Components for reuse	kg	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Exported thermal energy	MJ	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Exported electricity energy	MJ	0.00	0.00	0.00	0.00	0.00	0.00	0.00

For different impact categories, the manufacturing stage is the most significant, being the aluminum acquisition the most relevant contributor for the emissions. The end-of-life stage is the second most relevant for different impact categories, mainly due to the cable dissemble process and the final materials treatment for recycling. In some impact categories (e.g., Hazardous and Non-hazardous waste disposed), the distribution of the cable from factory to warehouse was also more significant than the use stage due to the distance used that had considered the Brazilian geographical dimensions. Finally, the installation stage was the less relevant for all impacts categories due to the study boundaries that consider only the transport of the cable from warehouse to installation site and the transport of the generated waste to the final collection site.

Analyzed cable 2:

SOLID WIRE A/C 750V 6,00 MM2 PR CX;

The cable detail is presented as following:

Conductor: ELECTROLYTIC COPPER WIRE, SOFT TEMPER

Insulation: PVC, CONTINUOUS OPERATION TEMPERATURE 70°C, BLACK COLOR, RATED VOLTAGE 450/750V

Standard: ENEL STANDARD PM-Br 204.01, VERSION 0.

Main raw materials:

In 2023, January to December interval, Condumax has manufactured 43.92 km of finished product. Its mass composition is as followed:

Product Components	Weight, kg (per km of cable)	%
COPPER	49.84	80.21
PVC	12.05	19.40
Master Batch PVC	0.25	0.40
Total	**62.14**	**100**
Packaging materials	**Weight (kg per km of cable)**	**%**
Papper	0.27	100
Total	**0.27**	**100**

Environmental performance

Besides the total results, parameters are declared separately for stage.

Environmental impact descriptive parameters

Impact category	Unit	Manufacturing		Distribution	Installation	Use	End-of-life	Total
		Upstream module	Core module	Downstream module				
Climate change – total	kg CO_2 eq.	254.93	20.78	7.15	7.00	356.65	136.54	783.06
Climate change – fossil	kg CO_2 eq.	254.03	13.89	6.46	0.07	197.44	128.39	600.28
Climate change –	kg CO_2 eq.	-6.92	6.22	0.18	6.92	144.69	6.72	157.81

biogenic								
Climate change – land use and land use change	kg CO_2 eq.	7.82	0.68	0.51	0.01	14.52	1.43	24.97
Acidification	mol H^+ eq.	7.96	0.38	0.03	0.00	0.49	4.87	13.73
Eutrophication aquatic freshwater	kg P eq.	4.42	0.02	0.00	0.00	0.00	0.22	4.67
Eutrophication aquatic marine	kg N eq.	1.89	0.02	0.01	0.00	0.16	0.22	2.31
Eutrophication terrestrial	mol N eq.	27.21	0.27	0.13	0.00	1.66	2.86	32.13
Photochemical ozone formation	kg NMVOC eq.	5.25	0.08	0.04	0.00	0.38	0.85	6.60
Ozone depletion	kg CFC-11 eq.	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Depletion of abiotic resources – minerals and metals	kg Sb eq.	0.12	0.01	0.00	0.00	0.00	0.11	0.24
Depletion of abiotic resources – fossil fuels	MJ	1512.73	45.83	10.63	0.12	19.24	717.63	2306.17
Water use	m^3 eq.	453.90	29.41	0.97	0.01	641.64	176.66	1302.59

Parameters describing resource use

Renewable resource	Unit	Manufacturing		Distribution	Installation	Use	End-of-life	Total
		Upstream module	Core module	Downstream module				
Use of renewable primary energy excluding renewable primary energy resources used as raw material	MJ	1177.97	94.15	1.03	0.01	1885.42	288.92	3447.50
Use of renewable primary energy resources used as raw material	MJ	820.76	15.58	5.85	0.06	238.41	85.48	1166.13
Total use of renewable primary energy resources	MJ	1998.73	109.73	6.87	0.07	2123.83	374.40	4613.64

Non-renewable resource	Unit	Manufacturing		Distribution	Installation	Use	End-of-life	Total
		Upstream module	Core module	Downstream module				
Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw material	MJ	1684.50	107.57	10.66	0.12	1523.02	778.59	4104.45

Use of non-renewable primary energy resources used as raw material	MJ	2040.05	168.54	87.81	0.95	3359.08	465.45	6121.88
Total use of non-renewable primary energy resources	MJ	3731.16	276.46	102.22	1.11	4886.22	1246.20	10243.37

Water and secondary raw	**Unit**	**Manufacturing**		**Distribution**	**Installation**	**Use**	**End-of-life**	**Total**
		Upstream module	**Core module**	**Downstream module**				
Net use of fresh water	m^3	10.68	0.74	0.03	0.00	14.94	4.15	30.53
Use of secondary materials	kg	13.14	7.67	0.11	0.00	40.96	87.66	149.53
Use of renewable secondary fuels	MJ	0.87	0.02	0.01	0.00	0.03	0.39	1.32
Use of non-renewable secondary fuels	MJ	19.92	3.93	0.02	0.00	0.06	53.11	77.04

Waste production descriptive parameters

Impact category	**Unit**	**Manufacturing**		**Distribution**	**Installation**	**Use**	**End-of-life**	**Total**
		Upstream module	**Core module**	**Downstream module**				
Hazardous waste disposed	kg	21.24	0.18	0.00	0.00	0.01	2.39	23.82
Non-hazardous waste disposed	kg	57.87	1.06	9.83	0.11	2.25	62.14	133.26
Radioactive waste disposed	kg	0.11	0.04	0.00	0.00	0.93	0.04	1.11
Materials for energy recovery	kg	1.68	0.01	0.03	0.00	0.06	0.07	1.85
Materials for recycling	kg	31.75	1.61	0.06	0.00	29.62	6.35	69.39
Components for reuse	kg	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Exported thermal energy	MJ	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Exported electricity energy	MJ	0.00	0.00	0.00	0.00	0.00	0.00	0.00

For different impact categories, the manufacturing stage is the most significant, being the copper acquisition the most relevant contributor for the emissions, followed by the PVC acquisition. Furthermore, the use stage also presents its relevance due to the energy consumption during the use of the cable during its life time, being the emission related with the electrical resistance value (Ω/km) of the cable since it is considered a current of 1A. The end-of-life stage is also relevant for almost all impact categories, mainly due to the cable dissemble process and the final materials (metal and plastic) treatment for recycling. Furthermore, the distribution stage that considers the transportation of the cable from Condumax factory to the client warehouse and installation site presents its relevance due to the distance used that had considered the Brazilian geographical dimensions. Finally, the installation and use stages were the less relevant stages for different impacts categories, being the use stage more relevant for some impacts and the installation stage more relevant for others.

Analyzed cable 3:

C MAXLINK FLEX CONTR CL BBFC 1KV 4X4 MM2 ENEL

The cable detail is presented as following:

Conductor: CABLE FORMED BY ELECTROLYTIC COPPER WIRES, SOFT TEMPER
Insulation: Insulation: XLPE, COLORED CORES
Inner layer: PVC
Metallic shielding: ELECTROLYTIC COPPER TAPE
Sheath: PVC, BLACK COLOR
Standard: ENEL STANDARD MAT-OMBR-MAT-18-0114-EDCE, VERSION 01.

Main raw materials:

In 2023, January to December interval, Condumax has manufactured 3.89 km of finished product. Its mass composition is as followed:

Product Components	Weight, kg (per km of cable)	%
COPPER	169.77	44.21
PVC	167.50	43.61
Master Batch PVC	1.76	0.46
PE	40.87	10.64
Master Batch PE	2.07	0.54
Master Catalytic	2.07	0.54
Total	**384.04**	**100**
Packaging materials	**Weight (kg per km of cable)**	**%**
Wood	44.00	99.00
Plastic	0.44	0.98
Polypropylene	0.01	0.02
Total	**44.44**	**100**

Environmental performance

Besides the total results, parameters are declared separately for stage.

Environmental impact descriptive parameters

Impact category	Unit	Manufacturing		Distribution	Installation	Use	End-of-life	Total
		Upstream module	Core module	Downstream module				
Climate change – total	kg CO_2 eq.	1227.36	113.32	49.10	86.04	573.19	701.98	2750.99
Climate change – fossil	kg CO_2 eq.	1284.05	72.42	44.37	1.32	317.32	670.76	2390.24
Climate change – biogenic	kg CO_2 eq.	-84.62	37.03	1.25	84.62	232.54	25.65	296.46
Climate change – land use and land use change	kg CO_2 eq.	27.93	3.86	3.48	0.10	23.34	5.57	64.29
Acidification	mol H^+ eq.	28.82	1.35	0.22	0.01	0.79	17.14	48.33
Eutrophication aquatic freshwater	kg P eq.	15.13	0.06	0.00	0.00	0.01	0.80	16.00
Eutrophication aquatic marine	kg N eq.	6.77	0.10	0.10	0.00	0.26	0.88	8.11
Eutrophication terrestrial	mol N eq.	95.86	1.14	0.88	0.03	2.68	10.93	111.51
Photochemical ozone formation	kg NMVOC eq.	19.04	0.31	0.27	0.01	0.61	3.21	23.46
Ozone depletion	kg CFC-11 eq.	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Depletion of abiotic resources – minerals and metals	kg Sb eq.	0.43	0.03	0.00	0.00	0.00	0.38	0.84
Depletion of abiotic resources – fossil fuels	MJ	7349.54	190.59	72.98	2.17	30.91	3751.52	11397.72
Water use	m^3 eq.	1818.57	170.01	6.68	0.20	1031.21	761.58	3788.25

Parameters describing resource use

Renewable resource	Unit	Manufacturing		Distribution	Installation	Use	End-of-life	Total
		Upstream module	Core module	Downstream module				
Use of renewable primary energy excluding renewable primary energy resources used as raw material	MJ	4228.31	526.17	7.04	0.21	3030.14	1064.86	8856.73
Use of renewable primary energy resources used as raw material	MJ	3457.26	78.81	40.16	1.19	383.16	306.11	4266.69
Total use of renewable primary energy resources	MJ	7685.57	604.98	47.20	1.40	3413.30	1370.97	13123.43

Non-renewable resource	Unit	Manufacturing		Distribution	Installation	Use	End-of-life	Total
		Upstream module	Core module	Downstream module				
Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw material	MJ	8330.94	564.49	73.16	2.17	2447.71	4038.64	15457.12
Use of non-renewable primary energy resources used as raw material	MJ	15430.74	954.25	602.86	17.91	5398.53	1973.63	24377.91
Total use of non-renewable primary energy resources	MJ	23789.98	1520.29	701.73	20.84	7852.86	6024.11	39909.82

Water and secondary raw	Unit	Manufacturing		Distribution	Installation	Use	End-of-life	Total
		Upstream module	Core module	Downstream module				
Net use of fresh water	m^3	42.79	4.29	0.18	0.01	24.01	17.88	89.16
Use of secondary materials	kg	44.74	35.47	0.76	0.02	65.82	476.91	623.73
Use of renewable secondary fuels	MJ	4.31	0.07	0.08	0.00	0.04	1.86	6.37
Use of non-renewable secondary fuels	MJ	71.70	13.41	0.14	0.00	0.09	181.83	267.18

Waste production descriptive parameters

Impact category	Unit	Manufacturing		Distribution	Installation	Use	End-of-life	Total
		Upstream module	Core module	Downstream module				
Hazardous waste disposed	kg	72.84	0.60	0.02	0.00	0.01	8.38	81.86
Non-hazardous waste disposed	kg	230.01	3.91	67.46	2.00	3.62	384.04	691.05
Radioactive waste disposed	kg	0.50	0.23	0.00	0.00	1.49	0.18	2.40
Materials for energy recovery	kg	6.30	0.05	0.22	0.01	0.09	0.30	6.97
Materials for recycling	kg	112.41	8.71	0.40	0.01	47.61	22.73	191.87
Components for reuse	kg	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Exported thermal energy	MJ	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Exported electricity energy	MJ	0.00	0.00	0.00	0.00	0.00	0.00	0.00

For different impact categories, the manufacturing stage is the most significant, being the copper acquisition the most relevant contributor for the emissions, followed by the PVC acquisition. Furthermore, the use stage, due to the energy consumption during the use of the cable during its life time, and end-of-life stage, due to the cable dissemble process and the final materials (metal and plastic) treatment for recycling, are also relevant stages for almost all impact categories. Furthermore, the distribution stage that considers the transportation of the cable from Condumax factory to the client warehouse and installation site presents its relevance due to the distance used that had considered the Brazilian geographical dimensions. Finally, the installation and use stages were the less relevant stages for different impacts categories, being the use stage more relevant for some impacts and the installation stage more relevant for others.

Analyzed cable 4:
C MAXLINK FLEX CONTR CL BBFC 1KV 7X2,5 MM2 ENEL

The cable detail is presented as following:

Conductor: CABLE FORMED BY ELECTROLYTIC COPPER WIRES, SOFT TEMPER
Insulation: XLPE, COLORED CORES
Inner layer: PVC
Metallic shielding: ELECTROLYTIC COPPER TAPE
Sheath: PVC, BLACK COLOR
Standard: ENEL STANDARD MAT-OMBR-MAT-18-0114-EDCE, VERSION 01.

Main raw materials:

In 2023, January to December interval, Condumax has manufactured 0 km of finished product. Since the cable 4, C MAXLINK FLEX CONTR CL BBFC 1KV 7X2,5 MM2 ENE, was not produced during the referred period of time, it was used a similar produced cable to estimate all the inputs of scrapes generation and utilities consumption. Its mass composition is as followed:

Product Components	Weight, kg (per km of cable)	%
COPPER (Al)	184.03	45.62
PVC	155.89	38.64
Master Batch PVC	3.18	0.79
PE	54.31	13.46
Master Batch PE	3.02	0.75
Master Catalytic	3.02	0.75
Total	**403.44**	**100**
Packaging materials	**Weight (kg per km of cable)**	**%**

Wood	44.00	99.00
Plastic	0.44	0.98
Polypropylene	0.01	0.02
Total	**44.44**	**100**

Environmental performance

Besides the total results, parameters are declared separately for stage.

Environmental impact descriptive parameters

Impact category	Unit	Manufacturing		Distribution	Installation	Use	End-of-life	Total
		Upstream module	Core module	Downstream module				
Climate change – total	kg CO_2 eq.	1298.40	126.60	51.56	86.92	924.05	717.12	3204.65
Climate change – fossil	kg CO_2 eq.	1353.48	82.59	46.59	1.33	511.56	684.70	2680.25
Climate change – biogenic	kg CO_2 eq.	-85.48	39.81	1.31	85.48	374.88	26.45	442.44
Climate change – land use and land use change	kg CO_2 eq.	30.40	4.20	3.66	0.10	37.62	5.98	81.96
Acidification	mol H^+ eq.	31.48	1.90	0.23	0.01	1.27	18.42	53.31
Eutrophication aquatic freshwater	kg P eq.	16.40	0.08	0.00	0.00	0.01	0.86	17.36
Eutrophication aquatic marine	kg N eq.	7.31	0.13	0.10	0.00	0.41	0.92	8.88
Eutrophication terrestrial	mol N eq.	103.78	1.46	0.92	0.03	4.31	11.53	122.03
Photochemical ozone formation	kg NMVOC eq.	20.60	0.40	0.28	0.01	0.99	3.40	25.69
Ozone depletion	kg CFC-11 eq.	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Depletion of abiotic resources – minerals and metals	kg Sb eq.	0.47	0.04	0.00	0.00	0.00	0.41	0.93
Depletion of abiotic resources – fossil fuels	MJ	7710.68	245.82	76.63	2.19	49.84	3632.72	11717.87
Water use	m^3 eq.	1966.96	185.27	7.02	0.20	1662.44	811.57	4633.46

Parameters describing resource use

Renewable resource	Unit	Manufacturing		Distribution	Installation	Use	End-of-life	Total
		Upstream module	Core module	Downstream module				
Use of renewable primary energy excluding renewable primary energy resources used as raw material	MJ	4587.86	582.80	7.39	0.21	4884.96	1130.67	11193.89
Use of renewable primary energy resources used as raw material	MJ	3615.49	91.28	42.17	1.21	617.69	329.89	4697.73
Total use of renewable primary energy resources	MJ	8203.35	674.08	49.56	1.42	5502.65	1460.55	15891.61

Non-renewable resource	Unit	Manufacturing		Distribution	Installation	Use	End-of-life	Total
		Upstream module	Core module	Downstream module				
Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw material	MJ	8734.08	644.74	76.82	2.20	3946.01	3929.42	17333.28
Use of non-renewable primary energy resources used as raw material	MJ	16306.45	1044.76	632.99	18.10	8703.08	2061.50	28766.88
Total use of non-renewable primary energy resources	MJ	25071.26	1691.21	736.81	21.07	12659.76	6003.47	46183.59

Water and secondary raw	Unit	Manufacturing		Distribution	Installation	Use	End-of-life	Total
		Upstream module	Core module	Downstream module				
Net use of fresh water	m^3	46.28	4.67	0.19	0.01	38.71	19.05	108.90
Use of secondary materials	kg	48.50	43.31	0.80	0.02	106.11	443.09	641.83
Use of renewable secondary fuels	MJ	4.47	0.10	0.09	0.00	0.07	1.96	6.68
Use of non-renewable secondary fuels	MJ	81.95	19.38	0.15	0.00	0.15	196.89	298.52

Waste production descriptive parameters

Impact category	Unit	Manufacturing		Distribution	Installation	Use	End-of-life	Total
		Upstream module	Core module	Downstream module				

Hazardous waste disposed	kg	79.11	0.87	0.02	0.00	0.02	9.02	89.03
Non-hazardous waste disposed	kg	247.36	4.74	70.83	2.03	5.84	403.44	734.25
Radioactive waste disposed	kg	0.52	0.25	0.00	0.00	2.41	0.18	3.36
Materials for energy recovery	kg	6.76	0.06	0.23	0.01	0.15	0.31	7.52
Materials for recycling	kg	122.03	9.80	0.42	0.01	76.75	24.47	233.48
Components for reuse	kg	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Exported thermal energy	MJ	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Exported electricity energy	MJ	0.00	0.00	0.00	0.00	0.00	0.00	0.00

For different impact categories, the manufacturing stage is the most significant, being the copper acquisition the most relevant contributor for the emissions, followed by the PVC acquisition. Furthermore, the use stage, due to the energy consumption during the use of the cable during its life time, and end-of-life stage, due to the cable dissemble process and the final materials (metal and plastic) treatment for recycling, are also relevant stages for almost all impact categories. Furthermore, the distribution stage that considers the transportation of the cable from Condumax factory to the client warehouse and installation site presents its relevance due to the distance used that had considered the Brazilian geographical dimensions. Finally, the installation and use stages were the less relevant stages for different impacts categories, being the use stage more relevant for some impacts and the installation stage more relevant for others.

Additional information

From the data provided by Condumax, it was possible to build a model to calculate the EPD impacts categories of the life cycle assessment for each selected cable, being also possible to analyze the results in order to allow actions to compensate and improve the impact categories and to improve the environmental performance of the products and meet the demand of Condumax customers.

Reference

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