MAGNETRON

ENVIRONMENTAL PRODUCT DECLARATION

T/D 3F 250 10kV E-MT-021
EDELNOR (Peru)

SITE
Pereira, Risaralda, Colombia

In accordance with ISO 14025 and EN 50693:2019

Program Operator	EPDItaly
Publisher	EPDItaly

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General information

EPD OWNER	Industrias Electromecánicas Magnetrón S.A.S.
MANUFACTURER ADDRESS	Pereira, Risaralda, Colombia
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PROGRAM OPERATOR	EPDItaly - info@epditaly.it , via Gaetano De Castillia n° 10 - 20124 Milano, Italia
Declared product & Functional unit	FU: single POWER transformer, which transmitting electrical power from one circuit to another without changing the frequency, during a service of 35 years(According to PCR) But actual RSL is 22.5 years.
INDEPENDENT VERIFICATION	This declaration has been developed referring to EPDItaly, following the "Regolamento di EPDItaly"; further information and the document itself are available at: www.epditaly.it. EPD document valid within the following geographical area: Italy and other countries worldwide according to sales market conditions Independent verification of the declaration and data carried out according to ISO 14025: 2010. ☐INTERNAL ☒EXTERNAL Third party verification carried out by: SGS Italia spa, Accredited by: ACCREDIA certificate number 0005VV.
CPC CODE	46121 "Electrical transformers"
PCR	EPDItaly007 – PCR for Electronic and Electrical Products and Systems, Rev. 3, 2023/01/13. SubPCR: EPDItaly018 – ELECTRONIC AND ELECTRICAL PRODUCTS AND SYSTEMS – POWER TRANSFORMERS, Rev 3.5, 13/12/2021.
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TECHNICAL SUPPORT	Marcel Gómez Consultoría Ambiental, Barcelona, Spain www.marcelgomez.com | info@marcelgomez.com
Reference PCR and version number	Core PCR: EPDItaly007 – PCR for Electronic and Electrical Products and Systems, Rev. 3, 2023/01/13.
Other reference documents	EN 50693:2019 Product category rules for life cycle assessments of electronic and electrical products and systems Regulations of the EPDItaly Programme rev. 5.2 (2022/02/16)
Product RSL description	35 years(According to PCR) But actual RSL is 22.5 years.
Markets of applicability	World (raw materials), Colombia (production), Peru (use and end of life)
LCA study	This EPD is based on the LCA study described in the LCA report
EPD type	Product specific
EPD scope	Cradle to grave
Year of reported primary data	2021
LCA software	SimaPro 9.3 (2020)
LCI database	Ecoinvent v3.8 (2020)
LCIA methodology	EN 50693:2019
Comparability	EPDs published within the same product category, though originating from different programs, may not be comparable. Full conformance with a PCR allows EPD comparability only when all stages of a life cycle have been considered. However, variations and deviations are possible.

Liability	EPDItaly declines any responsibility regarding the manufacturer's information, data and results of the life cycle assessment.

2. INTRODUCTION

MAGNETRON S.A.S., is an organization committed to the preservation of the environment through the identification and control of its significant environmental aspects. For this, it has an Environmental Management System that involves modern infrastructure works and the maintenance of a permanent culture of its human resources towards respect for its environment.

Among the works mentioned are the domestic and industrial wastewater treatment plants, which ensure high levels of removal of the contaminants of these discharges and the collection center for solid waste, where they are classified, segregated and stored in an orderly manner to be subsequently incorporated into the recycling chain and reused in new production processes.

The Department of Environmental Management, led by qualified personnel, constantly assesses environmental performance through the cycle of continuous improvement, defining and guiding the activities towards the achievement of the proposed goals and the fulfillment of the Organization's mission.

The above is achieved through strict operational controls on environmental matters and the use of various technical and technological tools, which demonstrate the Organization's efforts towards achieving cleaner production and compliance with environmental legal requirements, giving added value to their products and contributing to the sustainable development of the region.

3. THE COMPANY

Since the 1960s our planet has been undergoing a series of major transformations, characterized mainly by unexpected changes occurring at unprecedented and often dazzling speeds. Our organization is part of a world that, due to these changes, has become increasingly globalized, with the result, among many other factors, of a growing flow of trade among the various countries, resulting in an indiscriminate level of competition. In order to survive in this highly competitive environment, our organization had to adapt to these new circumstances, going to great lengths to create innovation in our products, processes and customer service, in an effort to match our level of competitiveness with that of world-class companies participating in our market.

To respond to these pressing needs, our Organization has focused its efforts on the implementation of a management process with three components: · Improved efficiency in all our productive processes. · An integrated management system under the models of the NTC-ISO 9001 Quality Management, NTC-ISO 14001 Environmental Management and ISO 45001:2018 Industrial Safety and Occupational Health Management Systems. · A Product Safety Management and Administration system covering our products, as well as all areas and activities of our Organization, in accordance with the standards of the OEA (Authorised Economic Operator). Under these circumstances, and with the support and effort of our entire team of employees, we have adopted these guiding principles as part of the fundamental philosophy of our Organization, in order to keep the certification of our products current and up to date and to maintain our highly competitive capacity both in domestic and international markets

MISSION

Produce and market transformers and equipment for the global energy sector, promoting the development of national engineering, product reliability, service and ethics.

VISION

Obtain an optimal company positioning in the global energy and renewable energy sector, based on innovation, diversification, operational excellence and training of human resources in continuous improvement.

INTEGRAL POLICY

"MAGNETRON S.A.S, through the efficient use of its resources, the commitment of its staff and the continuous improvement of its integrated management system, provides its customers with timely, competitive and compliant products, based on the prevention of injuries and staff illnesses, the control of risk factors, the prevention of illicit activities, corruption, bribery and environmental pollution, by complying with the legal framework and other applicable and existing requirements."
Based on the previous postulates, in January 1999 we obtained from Bureau Veritas Quality International (BVQI), the certification of our Quality Management System in accordance with ISO 9001:2015.

- Since 2020, our organization has been certified OEA (Authorised Economic Operator)
- We currently have the Integrated Management System ISO 9001:2015 certification, ISO 14001:2015 and ISO 45001:2018.

MAGNETRON S.A. supplies its customers with a product built according to the most advanced manufacturing technology using the best quality materials.

Through the years we have managed to establish a system for the design and calculation of transformers that allows us to obtain the most economical alternative according to the customer's needs, following the requirements of the technical standards and the equipment reliability concept.

Our manufacturing processes are the product of more than 40 years of experience in the sector and have been developed by Colombian engineers inspired by the basic concepts of manufacturing the best technologies worldwide.

Quality control is a fundamental part of our organization, which is why we choose our raw material suppliers in accordance with the quality management system of their products. We have established a strict control in the receipt of materials in the factory.

The process and the finished product control on each produced unit, results in a high reliability product, allowing our product to always successfully support all the controls and tests to which they have been submitted by our client quality control systems.

The aforementioned has allowed us to maintain our Quality Management System certified under ISO 9001: 2015 since 1999, it has also allowed us to guarantee our customers satisfaction and to demonstrate our ability to supply products that meet the world highest quality standards.

4. LCA INFORMATION

Functional unit: 1 transformer, during a service of 35 years (according to PCR 35 years), including related accessories.

Reference service life: 35 years. According to the PCR, a reference period of 35 years must be considered. But from the manufacturer side RSL is 22.5 years.

PRODUCT DESCRIPTION: This EPD presents the LCA results of each power transformers which uses Acetate mineral oil, with power of 250 kVA and rated voltage 10 - 0,23/0,133 kV.

Table 1:Product Description

Unit (power and voltage)	Weight (kg)	Power (kVA)	Voltage (kV)
T/D 3F 250 10kV E-MT-021 EDELNOR (Peru)	1598,35	250	10 - 0,23/0,133

The results are representative for each of the transformers included in the EPD.

Material content

The material composition of this transformers series is shown in the following table and figures:

Table 2:Material and packaging composition

Product	**T/D 3F 250 10kV E-MT-021 EDELNOR (Peru)**
Country of installation	Peru
Product composition, in kg	**T/D 3F 250 10kV E-MT-021 EDELNOR (Peru)**
Silicon Steel	400
Steel*	429,40
Oil	687,3
Others	81,64
Total	1598,35
Accessories	59,03
Packaging	-
Wood	24,833

*Steel used in Magnetron transformers have a content of 100% virgin Steel.

Accessories is made up mainly with steel. For the packaging of the transformer only wood is used.

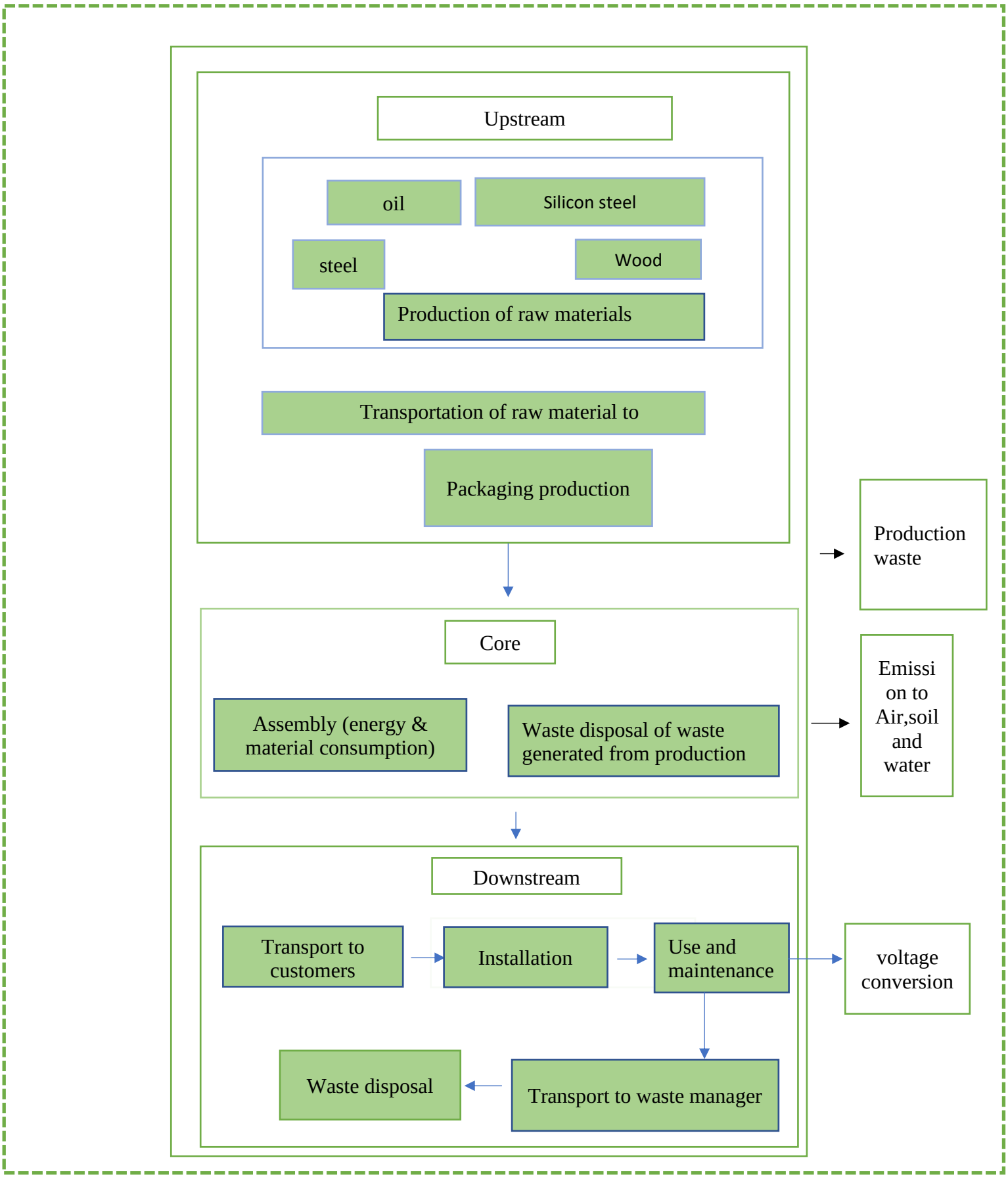
Time and geographical representativeness: data from factory (primary data) is from 2021, which is a representative production year. Magnetron manufacturing plant is based in Colombia. The amount used of raw materials as well as energy consumption, waste production, pollutant emissions and transport distance have been obtained from the manufacturing plant (primary data).

Database(s) and LCA software used: generic data on the impact per unit of matter or energy have been taken to determine emissions per kg of matter, kWh of energy or tkm transported. These data have been obtained from the Ecoinvent database version 3.8, allocation cut off by classification and SimaPro 9.3 Software used for the calculations. The impact models used are those indicated in EN 50693:2019.

5. SYSTEM BOUNDARIES, SCENARIOS AND ADDITIONAL TECHNICAL INFORMATION.

Description of system boundaries: From cradle to grave.
System diagram:

Figure 1:System boundary



The following table shows the stages of the product life cycle and the information stages according to EN 50693 for the evaluation of electronic and electrical products and systems

Table 3:LIFE CYCLE MODULES

<table>
<tr><th colspan="2">MANUFACTURING STAGE</th><th>DISTRIBUTION STAGE</th><th>INSTALLATION STAGE</th><th>USE & Maintenance STAGE</th><th>END-OF-LIFE STAGE

De-installation</th></tr>
<tr><th>UPSTREAM MODULE</th><th>CORE MODULE</th><th colspan="4">DOWNSTREAM MODULE</th></tr>
<tr><td>Extraction of raw materials,</td><td>Manufacturing of the product</td><td rowspan="3">Transport to customers</td><td rowspan="3">Installation of the transformer</td><td rowspan="3">Maintenance and use cycle of transformer</td><td>Transport to waste manager</td></tr>
<tr><td rowspan="2">Transportation of raw materials to the manufacturing company , Packaging</td><td>Product assembly</td><td rowspan="2">Shredding/Landfill / recycling</td></tr>
<tr><td></td></tr>
</table>

More information: http://www.magnetron.com.co

- The modularity principle, as well as the polluter-payer principle have been followed.
- Cut off rules: according to EN 50693 a maximum of 5% of the overall environmental impact of the analysed product system could be cut-off. This is specified in PCR EPDItaly018-Power transformers as “Materials making up the transformer itself whose total mass do not exceed 1% of the total weight of the device”. The data included in the input flows for matter and energy contribute to 99% of the raw materials and processes.
- Allocation procedure: where necessary (energy, waste generation) an allocation based in mass has been used.
- The quality of the input data has been evaluated according to its technological, temporal and geographical coverage.
- According to EN 50693, the next processes have not been included since its impact is not significant:
    - Environmental impact from infrastructure, construction, production equipment, and tools that are not directly consumed in the production process.
    - Personnel-related impacts, such as transportation to and from work.
    - Long term emissions.

Scope of EPD: The life cycle of the product is considered, from the extraction of raw materials to disposal of the product 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 standard are reported.

The stages of the product life cycle and the information considered for the evaluation of Magnetron transformer are:

UPSTREAM

This module takes into account the extraction and processing of raw materials and the production of energy which is consumed at the manufacturing plant and the transport of the different raw materials from the manufacturer to the factory where the final product is assembled. The transformer is made of many materials like Silicon Steel, Steel, acetate oil etc.

On this module is also considered the processing of the materials as those can be used by Magnetron, for example, in the case of the steel and the aluminum, a metal working process is considered as an upstream processing.

CORE

This module includes the consumption of energy during the manufacturing process of the different Magnetron products. At the same time, the transport and management of factory-originated waste are considered. Product losses that occur during the manufacturing are considered on the study, which are assessed as a waste going out the plant.

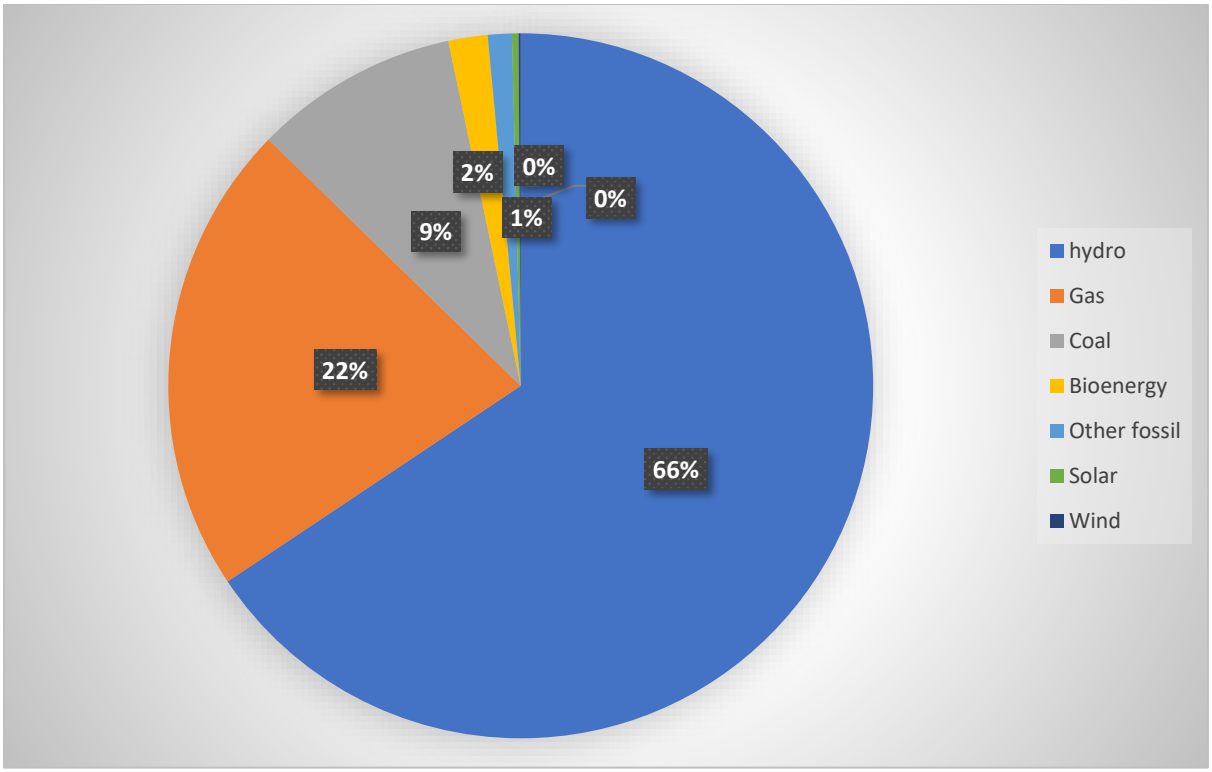
Only wood is used as packaging materials for the distribution of the transformers.

Regarding the electricity mix, the electricity mix of Colombia 2020[1] is used for the production. For the use phase, electricity mix of Peru 2021[2] is used.

[1] https://www.statista.com/statistics/617820/share-of-electricity-production-in-colombia-by-source/#:~:text=In%202021%2C%20renewable%20sources%20accounted,almost%2022%20percent%20that%20year.

[2] https://www.statista.com/statistics/1237558/Peru-distribution-of-electricity-production-by-source/

Table 4:Electricity mix of Colombia 2020



DOWNSTREAM

Description of scenarios and additional technical information about the transportation of the product to the customer. For this stage, a distance from the production site to capital of customer country is considered, representing the distance traveled by the analyzed product.

Downstream also consider installation, use and maintenance, transport of the product to the waste manager and disposal of the product. For the installation no material or energy is consumed. In the normal and typical use of this transformer, maintenance operations are not typically required.

It's considered on the use phase the electricity consumption due to the losses, as expressed on the PCR. The following formula is used for the calculation of this energetic input.

$$E_d[kWh] = [P_{load} * k_{load}^2 + P_{noload}] * t_{year} * RSL + P_{aux} * f_{aux} * t_{year} * RSL$$

P_{load} is the load loss of the transformer at 75 °C reference temperature at nominal power. It is expressed in kW.

k_{load} represents an average load factor for the equipment. For calculations based on this PCR, 70% of nominal power shall be adopted.

P_{noload} is the power dissipated in case no losses shall occur. It is expressed in kW.

P_{aux} is the power loss due to auxiliary activities at no load (such as cooling). It is expressed in kW.

f_{aux} - represents the fraction of time in which ancillary equipment is operating. It is expressed in % over 1 year.

t_{year} is the total amount of hours during a year.

RSL represents the Reference Service Life, defined as 35 years according to the PCR.

For the EOL scenario, 50 km distance is considered as distance from dismantle site to the waste management site. A process of shredding is considered for the dismantling, for the whole weight of the transformer.

All the material are landfilled. Except for Steel and aluminium. Steel 85[3] % Recycled, and aluminium is 76[4] % recycled.

[3] https://www.gem.wiki/Steel_recycling_capacity#:~:text=Scrap%20can%20even%20be%20used,rates%20of%20up%20to%2098%25.

[4] https://international-aluminium.org/wp-content/uploads/2021/01/wa_factsheet_final.pdf

6. ENVIRONMENTAL IMPACT ASSESSMENT

The environmental impact assessment has been done for each product. The results of the LCIA (Life Cycle Impact Assessment) are relative expressions and do not predict final impacts by category, exceedances of thresholds, safety margins or risks.

Table 5:Environmental impacts

Indicator	Unit	Total	Upstream	Core	Downstream			
			Manufacturing		Distribution	Installation	Use	EoL
Global Warming Potential total (GWP-total)	kg CO_2 eq.	5,42E+04	5,87E+03	1,37E+02	7,55E+01	2,19E-01	4,80E+04	1,04E+02
Global Warming Potential total (GWP-fossil)	kg CO_2 eq.	5,41E+04	5,85E+03	1,31E+02	7,54E+01	2,19E-01	4,79E+04	1,04E+02
Global Warming Potential total (GWPbiogenic)	kg CO_2 eq.	1,14E+02	1,12E+01	4,08E+00	2,19E-02	7,21E-05	9,78E+01	3,78E-01
Global Warming Potential total (GWP-luluc)	kg CO_2 eq.	1,04E+01	6,40E+00	2,34E+00	3,96E-02	8,93E-05	1,50E+00	1,68E-01
Depletion potential of the stratospheric ozone layer (ODP)	kg CFC 11 eq.	7,95E-03	7,93E-04	8,72E-06	1,63E-05	4,82E-08	7,12E-03	8,76E-06
Acidification potential, Accumulated Exceedance (AP)	mol H^+ eq.	3,50E+02	4,63E+01	5,03E-01	1,24E+00	9,05E-04	3,01E+02	6,08E-01
Eutrophication potential, fraction of nutrients reaching freshwater end compartment (EPfreshwater)	kg P eq.	4,00E-01	2,85E-01	2,03E-03	4,67E-04	1,85E-06	1,07E-01	4,68E-03
Formation potential of tropospheric ozone (POCP)	kg NMVOC eq.	1,67E+02	4,19E+01	3,37E-01	9,41E-01	8,88E-04	1,24E+02	3,82E-01
Abiotic Depletion for non-fossil resources potential (ADP-minerals&metals)	kg Sb eq.	2,73E-01	2,70E-01	3,29E-04	1,42E-04	7,46E-07	1,30E-03	1,34E-03
Abiotic Depletion for non-fossil resources potential (ADP-fossil)	MJ	7,56E+05	9,94E+04	1,48E+03	1,07E+03	3,23E+00	6,53E+05	1,50E+03
Water deprivation potential, deprivationweighted water consumption (WDP)	m^3	3,71E+05	1,52E+03	4,01E+01	3,10E+00	1,08E-02	3,70E+05	2,79E+01

Table 6:Use of resources

Indicator	Unit	Total	Upstream	Core	Downstream			
			Manufacturing		Distribution	Installation	Use	EoL
Use of renewable primary energy, excluding the resources of non-renewable primary energy used as a raw materials	MJ	4,28E+05	6,38E+03	3,64E+02	1,01E+01	3,72E-02	4,21E+05	1,42E+02
Use of renewable primary energy used as raw materials	MJ	3,82E+02	3,82E+02	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Total use a renewable primary energy (primary energy and resources of renewable primary energy used as raw materials)	MJ	4,29E+05	6,76E+03	3,64E+02	1,01E+01	3,72E-02	4,21E+05	1,42E+02
Use of non-renewable primary energy, excluding the resources of non-renewable primary energy used as a raw materials	MJ	8,19E+05	1,06E+05	1,62E+03	1,14E+03	3,43E+00	7,09E+05	1,59E+03
Use of non-renewable primary energy used as raw materials	MJ	2,76E+04	2,76E+04	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Total use of non-renewable primary energy (primary energy and resources of renewable primary energy used as raw materials)	MJ	8,46E+05	1,33E+05	1,62E+03	1,14E+03	3,43E+00	7,09E+05	1,59E+03
Use of secondary materials	kg	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Use of renewable secondary fuels	MJ	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Use of non-renewable secondary fuels	MJ	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Net use of fresh water	m3	1,48E+04	4,10E+01	1,25E+00	9,42E-02	3,23E-04	1,48E+04	8,32E-01

Table 7:Waste generation and inputs/outputs of the system

Indicator	Unit	Total	Upstream	Core	Downstream			
			Manufacturing		Distribution	Installation	Use	EoL
Non-Hazardous waste disposed (HWD)	kg	3,50E+03	1,97E+03	6,44E+00	6,16E+01	1,64E-01	1,85E+02	1,28E+03
Hazardous waste disposed (NHWD)	kg	1,57E+00	2,73E-01	1,47E-03	1,98E-03	8,40E-06	1,29E+00	1,60E-03
Radioactive waste disposed (RWD)	kg	2,70E+00	3,83E-01	1,41E-03	7,20E-03	2,09E-05	2,30E+00	5,94E-03
Materials for energy recovery (MER)	kg	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Material for recycling (MFR)	kg	4,01E+02	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	4,01E+02
Components for reuse (CRU)	kg	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Exported thermal energy (ETE)	MJ	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Exported electricity energy (EEE)	MJ	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00

7. Interpretation of results

The interpretation of results is done for a T/D 3F 250 10kV E-MT-021 EDELNOR (Peru). The Downstream life cycle stage has the the greatest impact for all the impact categories analyzed, representing between 90% (Ozone layer depletion (ODP)) to 1% (ADP-Mineral and metal).

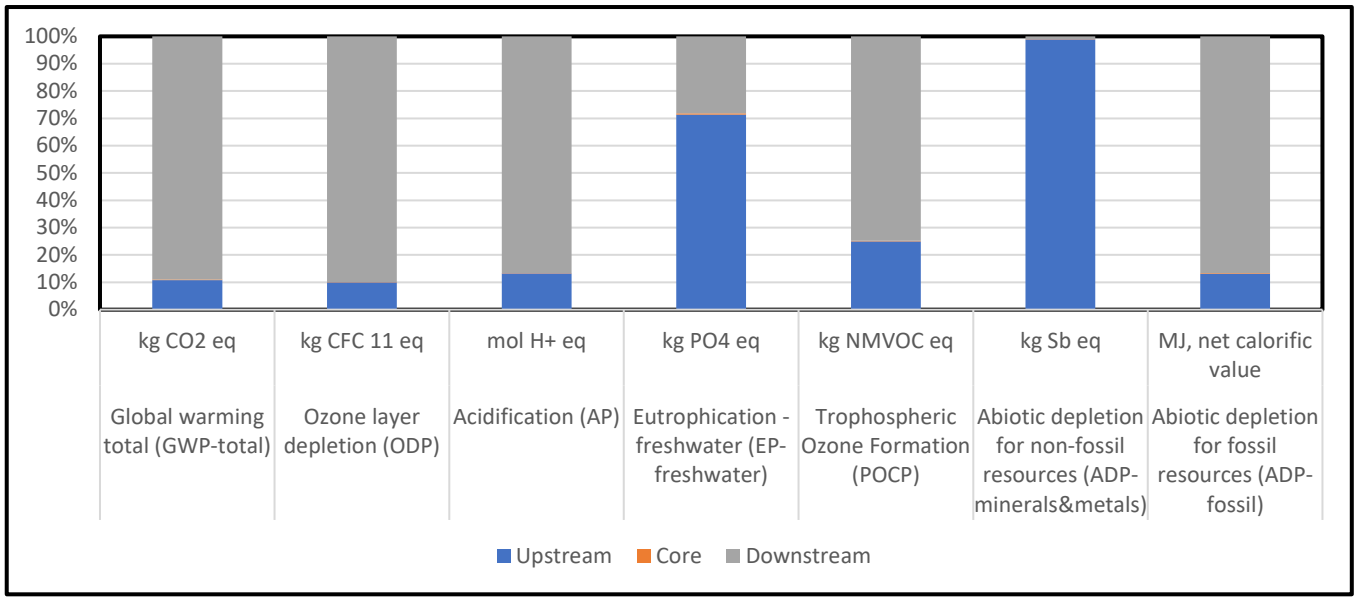
The Core module represents a lowest impact for all the impact categories analyzed.
In relation to Upstream it represents between 10% (ODP) to 99% (ADP-Mineral and metal).

The electricity consumption during use is the main contributor of the life cycle environmental impacts.

Table 8:Environmental impact on percentage

Impact category	**Unit**	**Upstream**	**Core**	**Downstream**
Global warming total (GWP-total)	kg CO2 eq	10,8%	0,3%	88,9%
Ozone layer depletion (ODP)	kg CFC 11 eq	10,0%	0,1%	89,9%
Acidification (AP)	mol H+ eq	13,2%	0,1%	86,6%
Eutrophication - freshwater (EP-freshwater)	kg PO4 eq	71,4%	0,5%	28,1%
Trophospheric Ozone Formation (POCP)	kg NMVOC eq	25,0%	0,2%	74,8%
Abiotic depletion for non-fossil resources (ADP-minerals&metals)	kg Sb eq	98,9%	0,1%	1,0%
Abiotic depletion for fossil resources (ADP-fossil)	MJ, net calorific value	13,1%	0,2%	86,7%

Table 9:Environmental impact on percentage



8. Bibliography

- Core PCR: EPDItaly007 – PCR for Electronic and Electrical Products and Systems, Rev. 3, 2023/01/13.
- SubPCR: EPDItaly018 – ELECTRONIC AND ELECTRICAL PRODUCTS AND SYSTEMS – POWER TRANSFORMERS, Rev 3.5, 13/12/2021.
- EPDItaly Regulations rev. 5.2 (2022/02/16)
- EN 50693:2019-Product category rules for life cycle assessments of electronic and electrical products and systems.
- BS8001:2017-Framework for implementing the principles of the circular economy in organizations.
- CirculAbility© Model-Methodology for the quantification of the circular ability of a product or service. Details are available at the Enel website.
- ISO 14040:2006 Environmental management Life cycle assessment Principles and framework.
- ISO 14044:2006 Environmental management Life cycle assessment Requirements and guidelines.
- Ecoinvent, 2019. Swiss Centre for Life Cycle Assessment, v3.8 (www.ecoinvent.ch).
- PRé Consultants, 2020. Software SimaPro version 9.3.0.3 (www.simapro.com).
- Magnetron LCA background internal report, 2023