WEG Equipamentos Elétricos S.A.

ENVIRONMENTAL PRODUCT DECLARATION

AUTOTRANSFORMER 150.000kVA 500kV CDC / 120kV (code 110.256)

Blumenau/SC/BR

In accordance with ISO 14025 and EN 50693:2019

Program Operator	EPDItaly
Publisher	EPDItaly

Declaration Number	EPDWEG0001_2025_rev. 1.0
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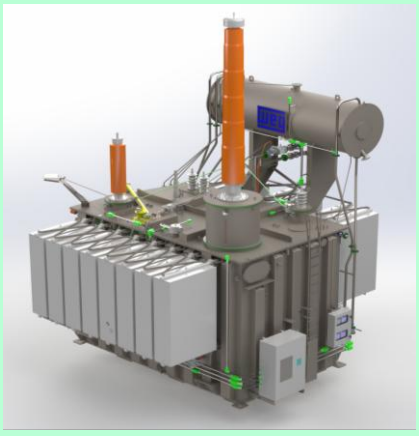


www.epditaly.it

GENERAL INFORMATION

EPD OWNER

Name of the company	WEG Equipamentos Elétricos S. A.
Registered office	Rua Dr. Pedro Zimmerma, 6751 - Itoupava Central, Blumenau - SC, 89068-001, Brazil
Contacts for information on the EPD	Ivan Carlos Coelho phone: +55 (47) 3276-4000 e-mail: icarlos@weg.net

PROGRAM OPERATOR

EPDItaly	Via Gaetano De Castillia n° 10 - 20124 Milano, Italy

INFORMATION ON THE EPD

Product name (s)	AUTOTRANSFORMER 150.000kVA 500kV CDC / 120kV (code 110.256)
Production Site (s)	Rua Dr. Pedro Zimmerma, 6751 - Itoupava Central, Blumenau - SC, 89068-001, Brazil
Summary description and technical information of product(s)	Power autotransformers are critical assets in high-voltage transmission systems, enabling efficient voltage transformation between transmission levels while optimizing material use and electrical performance. They are typically installed in large transmission substations to interconnect different voltage levels within national or regional grids, supporting bulk power transfer over long distances. The specific unit analyzed in this study (AUTOTRANSFORMER 150,000 kVA 500 kV CDC / 120 kV) is designed for operation in high-voltage transmission networks, stepping down voltage from 500 kV to 120 kV. With a rated power of 150 MVA, this autotransformer is intended for large-scale grid interconnection, ensuring system stability, voltage regulation, and reliable energy supply to downstream sub-transmission and distribution systems.
Scope of product(s)	A single piece of transformer operating for 35 years. Specific product EPD, concerning a specific product by a specific manufacturer, cradle-to-grave.
Type of EPD	Product EPD: a specific product by a specific manufacturer
Product (s) reference standards (if any)	-
CPC Code (number) https://unstats.un.org/unsd/classifications/Econ	46121 – Electrical transformers.

VERIFICATION INFORMATION

PCR (title, version, date of publication or update)	Core PCR EPDItaly007: Electronic and Electrical Products and Systems, revision 3.2 (2024-11-12) Sub PCR EPDItaly018: Electronic and Electrical Products and Systems – Power Transformers, version 3.6 (2024-07-01)
EPDItaly Regulation (version, date of publication or update)	Regulations of the EPDItaly Programme rev 7.1, 2025-09-05 EN 50693 is the framework reference for the Product Category Rules (PCR)
Project Report LCA	EPDITALY1344_2025_LCA-report_rev.2.0 (15 April 2026)
Independent Verification/Validation Statement	The PCR review was performed by EPDItaly - info@epditaly.it. Independent verification of the declaration and data, carried out 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 Statement	Environmental statements published within the same product category, but from different programs, may not be comparable.

	In particular, EPDs of construction products may not be comparable if they do not comply with EN 15804: 2012 + A2: 2019.
Liability Statement	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.
Statement Validation[1]	The production data used is considered representative on the basis of the representativeness analysis carried out with respect to the data of a reference product of the EPD Owner.

OTHER INFORMATION

[1] Declaration to be included only in the case of Validation of an EPD, refer to Annex 6.

Company information

Owner of the EPD:	WEG Equipamentos Elétricos S. A.
Address:	Rua Dr. Pedro Zimmermann, 6751
Location of production site(s):	Itoupava Central, Blumenau - SC, Brazil
Website:	https://www.weg.net
Tel:	+55 (47) 3276-4000
Email:	info-br@weg.net
Company contact:	Ivan Carlos Coelho | icarlos@weg.net | Quality planning

About the organization

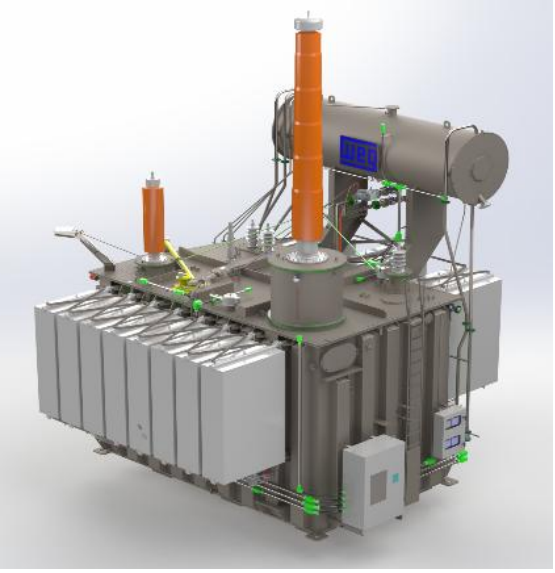
Founded in 1961, WEG is a global electro-electronic equipment company, operating mainly in the capital goods sector with solutions in electrical machines, automation and paints, for various sectors, including infrastructure, steel, pulp and paper, oil and gas, mining, among many others.

WEG stands out in innovation by constantly developing solutions to meet the major trends in energy efficiency, renewable energy, and electric mobility. With industrial operations in 15 countries and a commercial presence in more than 135 countries, the company has more than 40,000 employees distributed around the world.

The company is a global organization that develops technologies and solutions aligned with current societal and economic demands. Its activities include investments in energy-related technologies and in solutions for industry, agriculture, urban infrastructure, and residential applications, with the aim of improving operational efficiency and supporting the transition toward lower-impact systems.

Product-related or management system-related certifications:

Product information

Product name:	AUTOTRANSFORMER 150.000kVA 500kV CDC / 120kV (code 110.256)	
Product description:	Power autotransformers are critical assets in high-voltage transmission systems, enabling efficient voltage transformation between transmission levels while optimizing material use and electrical performance. They are typically installed in large transmission substations to interconnect different voltage levels within national or regional grids, supporting bulk power transfer over long distances. The specific unit analyzed in this study (AUTOTRANSFORMER 150,000 kVA 500 kV CDC / 120 kV) is designed for operation in high-voltage transmission networks, stepping down voltage from 500 kV to 120 kV. With a rated power of 150 MVA, this autotransformer is intended for large-scale grid interconnection, ensuring system stability, voltage regulation, and reliable energy supply to downstream sub-transmission and distribution systems.	
Average dimensions:	10,900 mm height x 6,955 mm length x 7,180 mm width	
Expedition weight:	213,230 kg	
Product weight: (Project)	196,150 kg	
Product weight: (LCI data)	188,609 kg	
Packaging weight:	17,080 kg	
Type:	AutoTransformer	
Number of phases:	3P	
Voltage class:	High	
Nominal primary voltage	550 kV	
Rated power:	150,000 kVA	
Cooled-oil type:	Insulating oil mineral naphthenic not inhibited	
Products covered:	AUTOTRANSFORMER 150.000kVA 500kV CDC / 120kV	
Geographical scope:	Brazil and Colombia	

LCA information

Declared unit:

A single piece of transformer operating for 35 years.

Time representativeness:

01 January 2025 to 31 December 2025.

Database(s) and LCA software used:

SimaPro® software v.9.6.0.1 developed by PRé Consultants was used to create the product system model. The ecoinvent® database v.3.10 provided the life cycle background data for product system modelling. The database used is regarded as representative on the basis of a comparative study, which examined the data for a reference product of the EPD Owner.

System boundaries:

Cradle-to-grave with upstream, core and downstream modules.

LIFE CYCLE MODULES ACCORDING THE EN 50693:

PHASES	Manufacturing Stage	Distribution Stage	Installation Stage	Use & Maintenance Stage	Deinstallation & End-of-Life Stage
Phases declared	X	X	X	X	X

Manufacturing:

The manufacturing process is organized into specialized production areas within WEG's industrial facility, reflecting the higher complexity, dimensions, and technical requirements of high-voltage transmission equipment. As with other transformer categories, the process begins with material reception and storage, which supplies all downstream manufacturing sectors with structural steel, silicon steel laminations, copper conductors, insulation materials, accessories, and auxiliary components. Structural steel plates are processed in the heavy fabrication ("calderaria pesada") sector, where the main tank, cover, radiators, and structural reinforcements are manufactured. Steel plates undergo cutting, bending, rolling, machining, and automated welding operations to meet strict mechanical and dimensional tolerances. Given the equipment's size and oil volume, the tank structure is reinforced to withstand vacuum filling, internal pressure variations, and transport loads. After fabrication, all external metallic components are subjected to surface preparation through abrasive shot blasting, followed by industrial painting using spray systems to ensure corrosion resistance and long-term outdoor performance. Components are then cured and prepared for final assembly. The magnetic core is manufactured from grain-oriented silicon steel laminations, which are precision-cut and step-lap assembled to minimize magnetic losses and noise levels. Core stacking is carried out under controlled conditions to ensure proper alignment and magnetic performance. In parallel, the windings (typically composed of high-conductivity copper conductors with multilayer cellulose-based insulation) are wound, insulated, and assembled to form the active part. Due to the autotransformer configuration, part of the winding system is electrically common between voltage levels, optimizing material usage and efficiency. Core and windings are then assembled together to form the active part, which undergoes mechanical clamping, drying, and vacuum processing to remove residual moisture and ensure dielectric integrity. Simultaneously, high-voltage bushings, tap changers, monitoring instruments, protection devices, and control panels are prepared and tested. During final assembly, the active part is inserted into the tank, accessories are installed, and the unit undergoes vacuum filling with mineral insulating oil. Comprehensive routine and type tests are performed in accordance with applicable international standards to verify electrical performance, dielectric withstand capability, losses, impedance, and functional operation. The final stages include sealing, final inspection, and preparation for transport. Due to its dimensions and mass, packaging and logistics are project-specific and may involve reinforced wooden structures, steel supports, and modular transport configurations. Once completed, the autotransformer is stored under controlled conditions and prepared for shipment to the installation site.

Manufacturing data (auxiliary inputs consumed and waste generation) were estimated at the product level using predefined manufacturing routings. These routings are structured according to the man-hours required for each production stage, allowing resource consumption and waste generation to be directly attributed to the specific transformer under study.

The electricity consumed during the manufacturing stage is from BR GRID. To represent this in the LCA model, the dataset " Electricity, medium voltage {BR}| market group for electricity, medium voltage | EN15804, U" was used, which has the following GWP emission factors: 0.24 kg CO2eq./kWh (for GWP-total), 0.12 kg CO2eq./kWh (for GWP-fossil), 0.11 kg CO2eq./kWh (for GWP-biogenic), and 0.01 kg CO2eq./kWh (for GWP-LULUC).

Distribution:

The transformer is transported to Colombia by road transportation in diesel-powered lorries and by container ship. The inland routes are 63 km from Blumenau plant until the port of Itajaí (Santa Catarina) and 980 km from the port of Cartagena (Colombia) until Cundinamarca. The maritime route considers a distance of 7,625 km from port to port.

Installation:

The transformer is transported from energy company storage until the installation site where the packaging (wooden based) is discarded and returns to the energy company control for final treatment. The installation requires the use of manual, pneumatic, and electrical tools to install the transformer at the operating site, with an estimated installation time of 135 hours, during which energy is supplied by a diesel generator.

Use stage:

The total energy consumed during 35 RSL by the transformer is **7.524E+07 kWh** (losses and operational consumptions). This value was calculated according to IEC 60076-1 technical standard, expressed in kWh via the following equation (PCR0018 v.3.6):

$$E_d[kWh] = [P_{load} \times K_{load}^2 + P_{noload}] \times t_{years} \times RSL + P_{aux} \times f_{aux} \times t_{years} \times RSL$$

Table 1. Values applied to estimate the energy dissipated during RSL.

Variable	Amount
Pload [kW]	**390.90**
kload²	0.49
Pnoload [kW]	**50.50**
tyear [h]	8760
RSL [anos]	35
Paux [kW]	6.75
faux [%]	0.50
tyear [h]	8760
RSL [anos]	35
Ed [kWh]	**7.524E+07**
Energy grid	Colombian mix high voltage

End-of-Life:

EoL stage assumes that the discontinued equipment is sent for material recovering. The disassembling process is manual or done with the aid of pneumatic tools at the secondary metal recovering market. Most valuable fractions (steel, aluminium and copper) are recycled within the default recycling recovering rate established in BSI EN 50693:2019. Insulating oil is treated without energy recovering and the remaining parts, based on mass balance, are sent to sanitary landfill. Based on direct consultation and project assumptions the transport distances from energy company storage into the to disassembly facility is 100 km, from disassembly facility to recycling plant and to the oil tretament company is 100 km, meanwhile the range into a landfill is 100 km.

Table 2. End-of-life baseline scenario definition per functional unit (downstream module).

Processes		Value	Unit
Collection process	From energy company storage to recovering market	196,150	kg
Recovery system specified by type	Reuse	0.00	kg
	Recycling	96,084	kg
	Incineration for energy recovery	0.00	kg
Disposal specified by type	Product or material for final deposition	43,815	kg
	Incineration	56,250	kg
Assumption for scenario development	Assuming that 100% of the transformer is sent for disassembling (based on direct consultation with energy company service supplier), assuming that 80% of steel is recycled, 70% of aluminium is recycled, 60% of cooper parts are recycled (G.5 section from BSI EN 50693:2019 - Default values) and that the insulating oil is incinerated without energy recovering (conservative principle). Following mass balance principle and Brazilian environmental laws, the remaining parts of the product are sent for final disposal at sanitary landfills		

Allocation:

Allocation can be defined as the impact factors distribution between the reference product and the coproducts when they are simultaneous and dependent. At WEG value chain there is one type of situation where allocation may be required located at two points in end-of-life processes (i.e., the recycling processes) that occurs: at assembling line (core module) due to process waste generation and at EoL (downstream module) due to metal recovering from obsolete transformers.

- **Assembling line and EoL**: regarding to the recycling of steel, silicon-steel, copper and aluminium generated during transformer manufacturing and recovered at EoL, it was considered the cut-off approach. According to the core EPDItaly core-PCR (PCR007), for recovery and recycling processes, which take place outside the boundaries of the product system, only impacts related to the transport of the waste to the treatment platform should be considered. Therefore, all the impacts of the waste transportation by road were fully attributed to the WEG product.

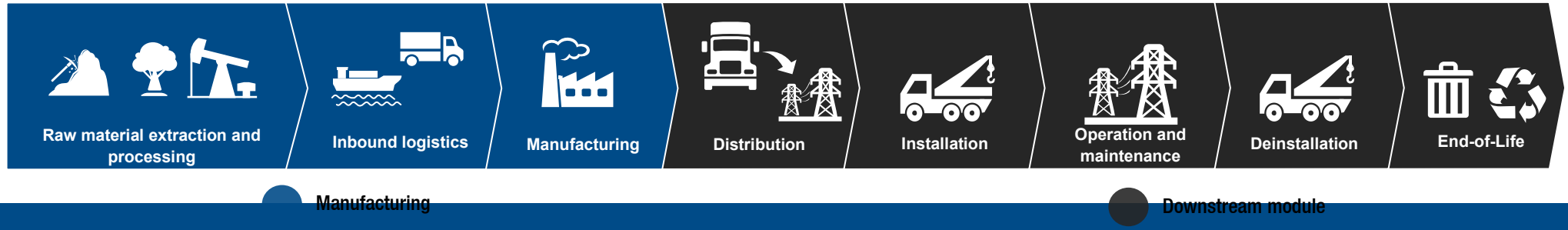
Cut-off criteria:

In accordance with the requirements of PCR EPDItaly 018 (Section 4.2.4.8), the cut-off criteria applied in this study follow Chapter 4.2.3.3 of EN 50693 and Section 6.3.6 of EN 15804. No material or energy flows have been excluded for the purpose of hiding significant environmental impacts. The EPDItaly Regulations and PCR EPDItaly 007 have been adopted as reference for defining the allowable exclusions. Accordingly, the following flows and operations may be cut off: (i) production, use, and disposal of packaging for components and semi-finished intermediates; (ii) materials constituting less than 1 % of the total product mass; (iii) material and energy flows associated with the installation stage; (iv) devices external to the product itself that are only required for installation; and (v) material and energy flows related to the dismantling phase, when dismantling is reasonably assumed to be performed manually (e.g., using screwdrivers or hammers).
The implementation of the cut-off rules, including the exclusion of LCI data based on cut-off criteria, is detailed in Table 3. The excluded flows were determined exclusively based on the mass cut-off criteria.

Table 3. Inputs/outputs considered/disregarded in the LCA model.

Stage	Main data	
Manufacturing	Steel parts {BR}; Steel sheet {BR}; Silicon steel {CN}; Silicon steel {KR}; Copper cables {GLO}; Copper parts {GLO} Aluminium parts {GLO}; Mineral oil - Base oil {US}; Sanitary ceramics {RoW}; Chemical, organic {GLO}; Chemical, inorganic {GLO}; Kraft paper {RoW}; Steel, chromium steel 18/8 {GLO}; Acrylonitrile-butadiene-styrene copolymer {GLO}; Sand {BR}; Sawnwood, board, softwood, raw, dried (u=20%) {RoW}	✓
	Packaging used for the transportation of ancillary materials	⛔
	Inbound logistics: Transport, freight, sea, container ship {GLO}and Transport, freight, lorry, unspecified {BR}	✓
	Inputs: Electricity; Compressed air; Cutting gases; Welding wire; Welding gases; Steel shot; Solvents; Water; Degreaser; Decapitating; Refiner; Phosphatizing. **Outputs:** Steel/Silicon-steel waste (recycling); Copper/Aluminium waste (recycling); Paper/paperboard waste (recycling); Plastics waste (recycling); Iron oxide (industrial landfill); Ink waste (industrial landfill); Sludge (industrial landfill); PM; VOC; Steam; Wastewater	✓
Distribution	Transport, freight, sea, container ship {GLO} and Transport, freight, lorry, unspecified {BR}	✓
Installation	Energy for installation	
	Product transport	✓
	Packaging waste for treatment	✓
Use	Energy consumed by the transformer to operate throughout its reference life;	✓
End-of-Life	Energy for deinstallation	✓
	Transport	✓
	Preparation for metals recycling	✓
	Landfill disposal	✓

Description of the system boundaries:



Manufacturing stage

The Transformer is majorly made of steel and silicon-steel, aluminium/copper, paper/paperboard and oil (tank filled for cooling purposes). There are also minor parts of polymers, chemicals (painting, varnish…), rubber and wood for packaging. The manufacturing stage considers all upstream processes to extract such materials and process them into the final components that are inserted into manufacturing line, including auxiliary consumptions at the factory such as electricity and others. This stage of the life-cycle accounts also for the road and maritime transport of all materials and components from suppliers to manufacturing plant (inbound logistics). The transformer manufacturing is an assembling line. Metal sheets are cut, bended, calendared, moulded and welded into the final transformer structure (tank, lid and bars). Those parts are cleaned and painted. In parallel, the core is made of silicon-steel and assembled from several different pieces that are cut to be geometrically positioned into the magnetic core that is wrapped with wildings prepared with insulated conductor wires and covered with insulating paper. Core and transformer body meet at the final assembling, with connections, cables and other minor parts and are tested for security, functioning and tightness. After packaging, the transformer is stored and ready for shipment. The manufacturing line requires ancillary inputs, such as electricity and water to operate and generate wastes and other outputs.

Downstream stage

This module encompasses all steps after product expedition from manufacturing plant until its End-of-life (EoL). The Transformer should be distributed to Cundinamarca (Colombia) by large diesel-truck through road transportation and by container ship through maritime transportation. The installation requires a lifting device that works for transport (from energy company storage into the operation point) and to elevate and install the transformer. During 35 years of Reference Service Life (RSL) the transformer will convert energy voltage for urban consumption and consumes high voltage electricity from Colombian national grid to operate and through losses in the transformation. During this period, an inspection should be made every 12 months of transformer operation to check for leakages, corrosion, and others. Every 5 years, some tests should be made as for example, oil sample for quality analysis, insulating check, etc. If there are no anomalies, no maintenance is necessary. According to product specialists, many transformers operate until its failure and maintenance is not a controlled practice. When discontinued, the transformer is generally disassembled for metal recovering due to its high aggregated value. This may be done at secondary scrap market or by specialized recycling companies. Steel, aluminium, copper and other metallic fractions are recovered and reinserted into the market. Other fractions are more likely to be discarded to sanitary landfill following environmental laws. Insulating oil should be incinerated in waste management specialized companies depending on its quality when discarded.

Content information

Product components	Material classes*	Weight, kg**	Weight-% (versus the product)
Other ferrous alloys, non-stainless steel	M-119	108170.80	55.1%
Copper and its alloys	M-121	7915.97	4.0%
Aluminium and its alloys	M-120	26.40	0.0%
Stainless steel	M-100	785.94	0.4%
Paper/paperboard	M-341	6124.88	3.1%
Oils and greases	M-410	56250.00	28.7%
Ceramics	-	238.28	0.1%
Plastics	-	48.93	0.0%
Chemicals (paints, varnish, dilutant, glues)	-	2147.19	1.1%
Sand	-	6475.00	3.3%
Other	-	7966.60	4.1%
TOTAL	**-**	**196,150**	**100.0%**
Packaging materials	**Material classes***	**Weight, kg**	**Weight-% (versus the product)**
Wooden bars	M-340	17,080	8.70%
TOTAL	**-**	**17,080**	**8.70%**

**According to IEC 62474 - Material Declaration for Products of and for the Electrotechnical Industry.*

***The masses presented in the content declaration are related to the Bill-of-Materials (BOM) of the product, which, depending on the components involved, may undergo minor variations due to processing details or technical specifications (such as the thickness of a steel sheet or the density of oil, for example). For this reason, they may slightly diverge from the projected product mass.*

Substances of very high concern (SVHC)

These products contain no substances of very high concern (SVHC) on the REACH Candidate List published by the European Chemicals Agency in a concentration that exceed 0.01% (w/w).

Environmental Information

Potential environmental impact – mandatory indicators according to core-PCR

Results per a single piece of transformer operating for 35 years							
Indicator*	Unit	Manufacturing stage	Distribution stage	Installation stage	Use and Maintenance stage	Deinstallation stage and End-of-Life	Total
			downstream				
GWP-total	kg CO_2 eq	7.39E+05	4.10E+04	4.59E+04	1.89E+07	2.04E+05	2.00E+07
GWP-fossil	kg CO_2 eq	7.53E+05	4.08E+04	9.07E+03	1.54E+07	1.83E+05	1.63E+07
GWP-biogenic**	kg CO_2 eq	-1.58E+04	6.18E+01	3.68E+04	2.10E+06	2.15E+04	2.14E+06
GWP-luluc	kg CO_2 eq	2.36E+03	1.51E+02	2.15E+01	1.47E+06	1.92E+01	1.48E+06
ODP	kg CFC11 eq	1.02E-02	6.82E-04	1.40E-04	6.48E-02	3.55E-04	7.62E-02
AP	mol H+ eq	1.62E+04	5.91E+02	3.71E+01	1.49E+05	1.21E+02	1.66E+05
EP-freshwater	kg P eq	5.73E+01	8.26E-02	2.43E-01	5.68E+02	9.47E-01	6.26E+02
EP-marine	kg N eq	1.06E+03	1.67E+02	3.04E+01	1.38E+04	6.46E+01	1.51E+04
EP-terrestrial	mol N eq	1.34E+04	1.84E+03	1.70E+02	1.55E+05	5.67E+02	1.71E+05
POCP	kg NMVOC eq	5.28E+03	5.14E+02	5.77E+01	4.96E+04	2.05E+02	5.57E+04
ADP-m***	kg Sb eq	1.91E+02	1.94E-03	5.52E-04	2.95E-01	5.32E-03	1.92E+02
ADP-f***	MJ	1.11E+07	5.27E+05	1.14E+05	1.92E+08	2.86E+05	2.04E+08
WDP***	m^3 depriv.	4.45E+05	9.00E+02	1.90E+02	8.79E+06	2.39E+03	9.24E+06
Acronyms	GWP-fossil = Global Warming Potential fossil fuels; GWP-biogenic = Global Warming Potential biogenic; GWP-luluc = Global Warming Potential land use and land use change; ODP = Depletion potential of the stratospheric ozone layer; AP = Acidification potential, Accumulated Exceedance; EP-freshwater = Eutrophication potential, fraction of nutrients reaching freshwater end compartment; POCP = Formation potential of tropospheric ozone; ADP-minerals & metals = Abiotic depletion potential for non-fossil resources; ADP-fossil = Abiotic depletion for fossil resources potential; WDP = Water (user) deprivation potential, deprivation-weighted water consumption.						

**The applied characterization factors are associated with the EF 3.1 method.*

***For the GWP-biogenic indicator, it was assumed that carbon uptake is fully emitted at the disposal point, even though degradation may occur over a more extended period within the 100-year timeframe of GWP analysis. Consequently, the biogenic carbon contents of the vegetable oil and paper within the product, as well as the wood composing the packaging (captured throughout their value chains, i.e., - 1 kg CO_2 eq), were manually adjusted to be 100% emitted during the installation phase (for wood packaging) and end-of-life phase (for the paper), resulting in +1 kg CO_2 eq.*

**** Disclaimer: The results of this environmental impact indicator shall be used with care as the uncertainties of these results are high or as there is limited experience with the indicator.*

Potential environmental impact – mandatory indicators according to core-PCR

Results per a single piece of transformer operating for 35 years							
Indicator*	Unit	Manufacturing stage	Distribution stage	Installation stage	Use and Maintenance stage	Deinstallation stage and End-of-Life	Total
			downstream				
PM	disease inc.	7.99E-02	2.56E-03	7.09E-04	1.55E-01	3.04E-03	2.41E-01
IRP*	kBq U-235 eq	1.53E+04	4.04E+01	1.33E+01	7.04E+03	4.05E+01	2.24E+04
ETP-fw**	CTUe	2.17E+07	1.78E+05	1.97E+05	7.89E+06	7.42E+05	3.07E+07
HTP-c**	CTUh	2.94E-02	7.15E-06	3.50E-06	9.84E-04	1.90E-05	3.04E-02
HTP-nc**	CTUh	1.64E-01	2.56E-04	1.33E-04	5.63E-02	2.00E-03	2.23E-01
SQP**	Pt	9.27E+06	4.68E+03	1.02E+04	-6.67E+07***	1.91E+04	-5.74E+07
Acronyms	PM = Potential incidence of disease due to PM emissions; IRP = Potential Human exposure efficiency relative to U235; ETP-fw = Potential Comparative Toxic Unit for ecosystems; HTP-c = Potential Comparative Toxic Unit for humans; HTP-nc = Potential Comparative Toxic Unit for humans; SQP = Potential Soil quality index.						

**Disclaimer: 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.*

***Disclaimer: The results of this environmental impact indicator shall be used with care as the uncertainties of these results are high or as there is limited experience with the indicator.*

****The negative SQP value observed in the use and maintenance phase is mainly driven by electricity consumption from the dataset "Electricity, high voltage {CO}", which is largely based on hydropower. This dataset includes the elementary flow "Transformation, from forest, unspecified", associated with reservoir occupation for hydropower generation. Within the applied LCIA method, this land transformation flow is assigned negative characterization factors for SQP, resulting in negative contributions to the impact category.*

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Use of resources

Results per a single piece of transformer operating for 35 years								
			Manufacturing stage	Distribution stage	Installation stage	Use and Maintenance stage	Deinstallation stage and End-of-Life	Total
Indicator*		unit		downstream				
Primary energy resources - Renewable	Use as energy carrier (PERE)	MJ, net calorific value	1.55E+06	1.31E+03	3.95E+02	2.12E+08	1.49E+03	2.13E+08
	Use as raw materials (PERM)	MJ, net calorific value	3.97E+05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.97E+05
	Total (PERT)	MJ, net calorific value	1.95E+06	1.31E+03	3.95E+02	2.12E+08	1.49E+03	2.14E+08
Primary energy resources - Non-renewable	Use as energy carrier (PENRE)	MJ, net calorific value	8.53E+06	5.28E+05	1.14E+05	1.92E+08	2.87E+05	2.01E+08
	Use as raw materials (PENRM)	MJ, net calorific value	2.66E+06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.66E+06
	Total (PERNT)	MJ, net calorific value	1.12E+07	5.28E+05	1.14E+05	1.92E+08	2.87E+05	2.04E+08
Secondary material (MS)		kg	3.22E+04	3.27E-01	3.62E-01	1.05E+02	1.14E+01	3.23E+04
Renewable secondary fuels (RSF)		MJ, net calorific value	8.68E+01	2.85E-02	3.84E-02	2.89E+01	2.45E-01	1.16E+02
Non-renewable secondary fuels (NRSF)		MJ, net calorific value	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Net use of fresh water (FW)		m^3	1.08E+04	2.14E+01	4.53E+00	2.30E+05	5.64E+01	2.41E+05

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Waste production and output flows

Waste production

Results per a single piece of transformer operating for 35 years							
Indicator	Unit	Manufacturing stage	Distribution stage	Installation stage	Use and Maintenance stage	Deinstallation stage and End-of-Life	Total
			downstream				
Hazardous waste disposed (HWD)	kg	1.66E+05	1.50E+02	4.08E+01	1.63E+06	1.53E+04	1.81E+06
Non-hazardous waste disposed (NHWD)	kg	5.63E+06	3.26E+03	1.78E+04	2.25E+07	1.00E+05	2.83E+07
Radioactive waste disposed (RWD)	kg	9.50E+00	2.20E-02	7.75E-03	1.74E+00	2.43E-02	1.13E+01

Output flows

Results per a single piece of transformer operating for 35 years							
Indicator	Unit	Manufacturing stage	Distribution stage	Installation stage	Use and Maintenance stage	Deinstallation stage and End-of-Life	Total
			downstream				
Materials for energy recovery (MER)	kg	2.07E+00	6.38E-04	4.18E-04	2.28E-01	6.67E-03	2.30E+00
Material for recycling (MFR)	kg	2.40E+04	1.32E-02	5.16E-02	2.44E+01	9.61E+04	1.20E+05
Components for reuse (CRU)	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Exported thermal energy (ETE)	MJ	4.02E+03	5.10E+00	1.72E+00	6.88E+02	8.81E+00	4.72E+03
Exported electricity energy (EEE)	MJ	2.50E+03	7.32E+00	2.71E+00	6.11E+02	8.42E+00	3.13E+03

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