Environmental Product Declaration

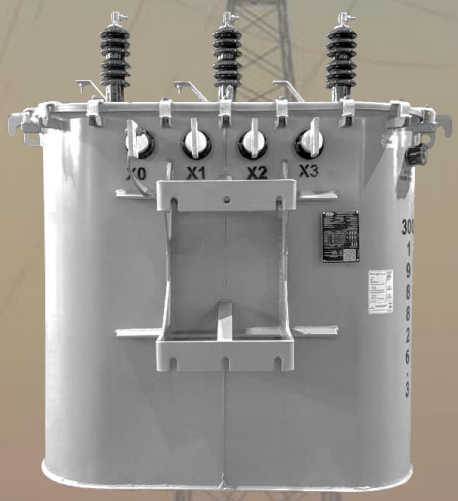
In accordance with ISO 14025 and EN 50693:2019 for:

Distribution Transformer – 300kVA (111321 and 111292)

from

ITB Equipamentos Elétricos Ltda.

Declaration number:	EPDITB03
Production site:	Birigui, São Paulo - Brazil
Programme:	EPD Italy®, www.epditaly.it
Programme operator:	EPD Italy
EPD registration number:	EPDITALY0285
Issue date:	2022-04-01
Valid until:	2027-04-01



General information

Programme information

Programme:	EPD Italy®
Address:	EPDItaly Via Gaetano De Castillia, 10 20124 – Milano/Italy
Website:	www.epditaly.it
E-mail:	info@epditaly.it

Scope of application:	*Distribution Transformer – 300kVA (code 111321) and 300kVA (code 111292): two variations of three-phase distribution transformer in mineral cooled oil, with low level of loss and noise and 300kVA of nominal power. Cradle to grave with 35 years of reference service life (RSL)*
Functional unit:	*A single piece of transformer operating for 35 years*
CPC code:	*46121 - Electrical transformers*
Geography:	*World (raw materials), Brazil (production, use and end-of-life)*
LCA report	*Life Cycle Assessment of Distribution Transformers v2.0(2022)*
Product category rules (PCR):	*Core PCR EPDItaly007:20 Electronic and Electrical Products and Systems, revision 2 (2020-10-21)* *Sub PCR EPDItaly018:21 Electronic and Electrical Products and Systems – Power Transformers, version 3.5 (2021-12-13)*
Other references:	*Regulations of the EPDItaly Programme rev 5.0, 2020-01-07* EN 50693 is the framework reference for the Product Category Rules (PCR)
Core PCR review was conducted by:	*ICMQ S.p.A. – Certificazioni e controlli per le costruzioni* *Moderator: Eng. Vito D'Incognito, Take Care International*
Sub PCR review was conducted by	*ENEL S.p.A.; Life Cycle Engineering* *Moderator: Massimo De Pieri, Life Cycle Engineering*

Independent third-party verification of the declaration and data, according to ISO 14025:2006:
☐ internal ☒ external

Third party verification carried out by:
ICMQ spa - Via Gaetano De Castillia, 10 - 20124 – Milano/Italy

Procedure for follow-up of data during EPD validity involves third party verifier:
☒ Yes ☐ No

The EPD owner has the sole ownership, liability, and responsibility for the EPD.
EPDs relating to the same category of products but belonging to different programmes may not be comparable. EPDs of electronic and electrical products may not be comparable if they do not comply with EN 50693. For further information about comparability, see EN 50693 and ISO 14025.

Company information

Owner of the EPD:	ITB Equipamentos Elétricos Ltda.
Address:	Rua Devanir Terence, 161 – Parque Industrial
Location of production site(s):	Birigui, State of São Paulo, Brazil
Website:	www.itb.ind.br www.itb.ind.br/en/ www.itb.ind.br/es/
Tel:	+55 (18) 3643 8000
Email:	itb@itb.ind.br
Company contact:	Rodrigo Stábile Christovam – rodrigo.vendas@itb.ind.br Sales/Commercial manager

About the organization

ITB Equipamentos Elétricos Ltda. Is a reference company and one of the largest manufacturers of electrical distribution transformers in Latin America, with a diversified line of distribution transformers for different applications in urban, rural and industrial networks. ITB's product portfolio also includes lines of single-phase automatic voltage regulators and dynamic reactive power compensators. Founded in 1974, ITB's policy is to practice competitive prices, excellence in quality and efficient technical assistance. These factors, linked to professional management, permanent qualification of its employees, developed technology and constant investments in new equipment turned ITB to a company known and recognized for the excellence in our products and for the excellent professional relationship with our partners.

EQUIPAMENTOS ELÉTRICOS
QUALITY, TECHNOLOGY AND EFFICIENCY IN POWER DISTRIBUTION

Sustainability

Sustainability is one of the core values of ITB, present in the company governance from the environmental compliance, passing through the environmental management and continuous improvement, developing the supply chain through the sustainable purchase policy, until the company's commitment to implement the SDGs from 2030 agenda. ITB Equipamentos Eletricos Ltda has a formal interventional guideline to meet the UN recommendations, listing 14 priority objectives in a materiality matrix, tracing actions to promote sustainable development.

Owned certifications

Product information

Product name:	Distribution Transformer – 300kVa
Product description:	The 111321 and the 111292 Distribution Transformers are electrical devices that transfer energy from one circuit to another by magnetic coupling without requiring relative motion between its parts and comprises three coupled windings and a magnetic core to concentrate magnetic flux made of silicon-steel. They are three-phase transformers in mineral cooled oil, with nominal power of 300kVa and final mass (without packaging) of 1475 kg and 1362 kg, for 111321 and 111292, respectively. The packaging consists of wood bars and steel nails.

Product:	111321	111292
Dimensions:	1800 mm length x 1650 mm height x 1150 mm width	
Expedition weight:	1565.24 kg	1450.88 kg
Product weight:	1475.34 kg	1362.05 kg
Packaging weight:	89.90 kg	88.83 kg
Type:	Distribution, oil-immersed	
Number of phases:	3P	
Voltage class:	low	
Nominal primary voltage	13.8 kV	
Nominal power:	300.0 kVA	
Cooled-oil type:	Mineral class U	
Products covered:	300kVA three-phase oil immersed power transformer	
Geographical scope:	Brazil	

Power Transformer

This EPD is representative of the two 300kVa power transformer from ITB Equipamentos Elétricos Ltda. The 300kVA (111321) and 300kVA (111292) have similar environmental profile with the operation phase dominating the LCIA impacts and small differences regarding their composition. Because the operational phase concentrates more than 95% of the impacts, those variations affect only ADP-m, impact category that is driven by materials acquisition.

LCA information

Functional unit / declared unit:

A single piece of transformer operating for 35 years

Time representativeness:

January 2020 to December 2020

Database(s) and LCA software used:

SimaPro® software v.9.2 developed by PRé Consultants was used to create the product system model. The ecoinvent® database version 3.7.1 provided the life cycle background data for product system modelling.

System boundaries:

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

Modules declared, geographical scope, share of specific data and data variation:

	Raw material supply	Transport	Manufacturing	Distribution	Installation	Use and Maintenance	End-of-Life and Deinstallation
Module	**Upstream**		**Core**	**Downstream**			
Supply chain processes	extraction of raw materials and the production of semi-finished products and auxiliary items; electricity and LPG production; transport of raw materials to ITB plant		transformer assembling, waste and effluent management at plant; air emissions from LPG and paint solvents	transformer transport into the operation site, installation and packaging waste management, operating for 35 years (RSL) in Brazil, deinstallation and transformer EoL, including metal recycling, mineral oil incineration and final disposal of non-recyclable fractions at sanitary landfill. Transport of waste flows			
Modules declared	X	X	X	X	X	X	X
Geography	GLO	BR	BR	BR	BR	BR	BR
Specific data used	>95%						
Variation – sites	Not relevant						

Distribution:

The transformer is transported to Rio de Janeiro (south-eastern Brazil) and Ceara (north-eastern Brazil) by road transportation in diesel-powered lorries. The distance was estimated according to the most probable road from Birigui plant until Itaboraí and Maracanau Municipalities, with 975 km and 2,780 km, respectively.

Installation:

The installation phase implies in the transportation of 100km of the transformer and its packaging from energy company storage until the operation site. Then, the transformer is lifted and (generally) installed through manual/pneumatic tools. This phase also includes the disposal of the packaging of the Transformer, first returning until the energy company waste management central (100 km) and then transported until the waste management company that co-process it into energy (100km).

Use stage:

The total energy consumed by each 300kVA transformers during 35 RSL is 583,490.00 kWh (losses and operational consumptions). This value was calculated according to IEC 60076-1 technical standard, expressed in kWh via the following equation

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

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. Mineral oil is incinerated 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 disassembly facility is 100km, from disassembly facility to recycling plant and to the oil treatment company is 200 km, meanwhile the range into a landfill is 50 km.

Table 1. End-of-life baseline scenario definition per functional unit (downstream module).

Processes		Value (111321)	Value (111292)	Unit
Collection process	From energy company storage to recovering market	1475.34	1362.05	kg
Recovery system specified by type	Reuse	0.00	0.00	kg
	Recycling	853.99	779.38	kg
	Incineration for energy recovery	0.00	0.00	kg
Disposal specified by type	Product or material for final deposition	621.35	582.67	kg
	Incineration	312.80	300.90	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 mineral 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 ITB value chain there is one type of situation where allocation may be required located at three points in end-of-life processes (i.e., the recycling processes) that occurs: at assembling line (core module) due to process waste generation, at transformer installation step (downstream module) due to wooden packaging waste generation that follows for energy recovering and at EoL (downstream module) due to metal recovering from obsolete transformers

- **Assembling line, Installation and EoL**: regarding to the recycling of steel, silicon-steel, copper and aluminium generated during transformer manufacturing, as well as wood waste from packaging sent for energy recovering (co-processing) we 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 ITB product.

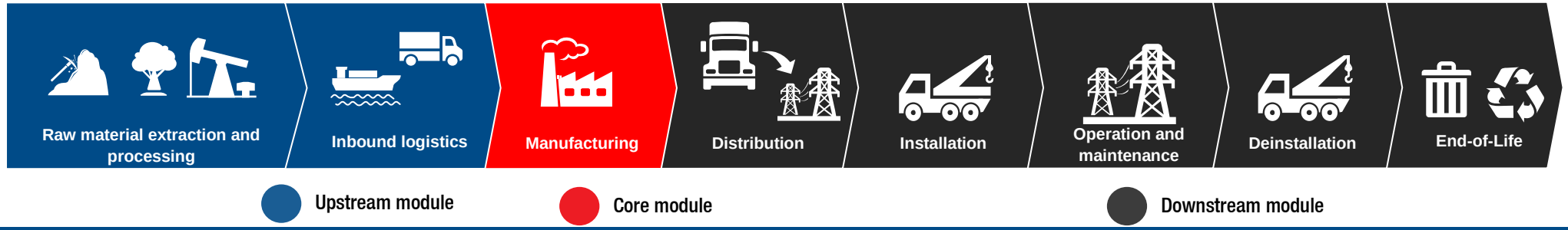
Cut-off criteria:

The cut-off criteria are applied to support an efficient calculation procedure. According to EN 50693 (2019) and PCR018 (2021), specifically the following flows and operations may be cut-off:

- Production, use and disposal of the packaging of components and semi-finished intermediates;
- Materials making up the transformer itself whose total mass does not exceed 1% of the total weight of the device;
- Material and energy flows related to dismantling phase, whenever it is reasonable to assume that dismantling is performed by adopting manual tools (e.g., screwdrivers, hammers, etc.);
- Devices external to the product itself required for installation;
- Maximum 5% of the overall environmental impact of the analysed product system;

In this LCA, all input and output flows have been considered at 100%, including raw materials as per the product composition provided by the manufacturer as well as the final product. Cut-off criteria was the environmental relevance for infrastructure impacts, although some irrelevant inputs may eventually not be considered, e.g., the cardboard used to clean the moulding machine. For inbound logistics, mass-based cut-off criteria was applied for minor components (screws, washers, rivets, etc). The coverage of inbound logistics was of 99.4% of mass composition for both transformers. At core module, non GHG emissions potentially arising from LGP combustion and welding smokes were cut-off.

Description of the system boundaries:



Upstream module

The distribution 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, glue…), cotton, rubber and wood for packaging. The upstream module considers all upstream processes to extract such materials and process them into the final components that are inserted into ITB manufacturing line, including auxiliary consumptions at the factory such as electricity, LPG and others. This stage of the life-cycle accounts for the road and maritime transport of all materials and components from suppliers to ITB plant (inbound logistics).

Core module

The distribution transformer manufacturing is an assembling line. Metal sheets and tubes are cut, bended, calendared, moulded and welded into the final distribution transformer structure (tank, lid and radiator). Those parts are cleaned and painted. In parallel the core made of silicon-steel and assembled from several different pieces that are cut to be geometrically positioned into the magnetic core and wildings prepared with insulated conductor wires and covered with insulating paper. Core and body meet at the final assembling, with connections, cables and other minor parts and are tested for security, functioning and tightness. After packaging (wood bars and steel nails), the transformer is stored and ready for shipment. The manufacturing line at ITB plant requires ancillary inputs, such as electricity and water to operate and generate wastes and other output. Electricity consumed at Birigui plant is 100% from renewable source (hydro) meanwhile a major part of wastes is recycled following the internal policies on waste management. Wastes are majorly from metallic scraps and are recycled meanwhile there are effluent generation from washing process as well as atmospheric emissions from LPG combustion and solvent volatilization at painting process.

Downstream module

This module encompasses all steps after product expedition from ITB manufacturing plant until its End-of-life (EoL). The distribution transformer is distributed to Rio de Janeiro and Ceara states by large diesel-truck through road 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 distribution transformer will convert energy voltage for urban consumption and consumes medium voltage electricity from Brazilian 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 ITB product specialists, in Brazil many transformers operate until its failure and maintenance is not a controlled practice. When discontinued, a power transformer is generally disassembled for metal recovering due to its high aggregated value. In Brazil 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 Brazilian environmental laws. Mineral oil may be recycled or incinerated in waste management specialized companies depending on its quality when discarded (e.g., PCB content above 50 ppm).

Content information* for the 111321 Transformer

Product components	Material classes*	Weight, kg	Weight-% (versus the product)
Cast and sintered irons; Other ferrous alloys, non-stainless steels	M-101 and M-119	852.23	54.45%
Aluminium and its alloys; Copper and its alloys	M-120 and M-121	246.76	15.77%
Stainless steel, Tin and its alloys; Other non-ferrous metals and alloys	M-100; M-126 and M-149	14.62	0.93%
Paper	M-341	11.90	0.76%
Wood	M-340	9.12	0.58%
Ceramics	M-160	16.71	1.07%
Oils and greases	M-410	312.80	19.98%
Chemicals (paints, varnish, dilutant)	-	9.31	0.59%
Polyethylene and Polyamide	M-201 and M-208	0.51	0.03%
SBR, Fibre, Other organics	M326, M-342 and M-399	1.39	0.09%
TOTAL	-	**1,475.34**[1]	**94.26%**
Packaging materials	**Material classes***	**Weight, kg**	**Weight-% (versus the product)**
Wood	M-340	88.76	5.67%
Other ferrous alloys, non-stainless steels	M-119	1.14	0.07%
TOTAL	-	**89.90**	**5.74%**

**Due to confidential reasons, some flows were aggregated into a unique content value, e.g., aluminium and copper inputs;*
***According to IEC 62474 - Material Declaration for Products of and for the Electrotechnical Industry;*

Substances of very high concern (SVHC)

This product contains 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).

[1] *small variations from the transformer project weight are common within a expected range*

Content information* for the 111292 Transformer

Product components	Material classes**	Weight, kg	Weight-% (versus the product)
Cast and sintered irons; Other ferrous alloys, non-stainless steels	M-101 and M-119	770.59	53.11%
Aluminium and its alloys; Copper and its alloys	M-120 and M-121	232.91	16.05%
Stainless steel, Tin and its alloys; Other non-ferrous metals and alloys	M-100; M-126 and M-149	9.36	0.65%
Paper	M-341	14.86	1.02%
Wood	M-340	7.81	0.54%
Ceramics	M-160	16.67	1.15%
Oils and greases	M-410	300.90	20.74%
Chemicals (paints, varnish, dilutant)	-	7.05	0.49%
Polyethylene and Polyamide	M-201 and M-208	0.49	0.03%
SBR, Fibre, Other organics	M326, M-342 and M-399	1.41	0.10%
TOTAL	-	**1,362.05**[2]	**93.88%**
Packaging materials	**Material classes****	**Weight, kg**	**Weight-% (versus the product)**
Wood	M-340	87.71	6.05%
Other ferrous alloys, non-stainless steels	M-119	1.12	0.08%
TOTAL	-	**88.83**	**6.12%**

**Due to confidential reasons, some flows were aggregated into a unique content value, e.g., aluminium and copper inputs;*
***According to IEC 62474 - Material Declaration for Products of and for the Electrotechnical Industry;*

Substances of very high concern (SVHC)

This product contains 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).

[2] *small variations from the transformer project weight are common within a expected range*

Environmental Information for the 111321 Transformer

Potential environmental impact – mandatory indicators according to core-PCR

Results per a single piece of transformer operating for 35 years								
		Manufacturing stage		Distribution stage	Installation stage	Use and Maintenance stage	End-of-Life and deinstallation stage	Total
Indicator	unit	upstream	core	downstream				
GWP-fossil	kg CO_2 eq	8.65E+03	51.11	113.11	25.07	1.01E+05	21.80	1.10E+05
GWP-biogenic	kg CO_2 eq	-123.10	3.5E-03	8.01E-02	1.80E-02	5.62E+04	4.41E-02	5.60E+04
GWP-luluc	kg CO_2 eq	33.71	3.9E-05	1.49E-03	3.35E-04	8.92E+03	2.84E-04	8.95E+03
GWP-total	kg CO_2 eq	8.56E+03	51.11	113.19	25.09	1.66E+05	21.84	1.75E+05
ODP	kg CFC11 eq	4.2E-04	5.6E-07	2.54E-05	5.72E-06	9.70E-03	2.40E-05	1.02E-02
AP	mol H+ eq	67.96	1.7E-02	0.78	0.17	797.48	0.77	867.17
EP-freshwater	kg P eq	0.46	7.6E-06	2.62E-04	5.88E-05	1.74	4.12E-03	2.20
POCP	kg NMVOC eq	34.57	2.0E-02	0.91	0.20	294.36	0.93	330.99
ADP-minerals & metals*	kg Sb eq	0.24	1.4E-07	6.59E-06	1.48E-06	2.96E-03	1.06E-05	0.25
ADP-fossil*	MJ	1.05E+05	34.79	1.58E+03	3.56E+02	1.46E+06	1.51E+03	1.57E+06
WDP*	m^3 depriv.	1075.23	0.03	0.52	0.12	6210.77	11.32	7.30E+03
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.							

** 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.*

Environmental Information for the 111292 Transformer

Potential environmental impact – mandatory indicators according to core-PCR

Results per a single piece of transformer operating for 35 years								
		Manufacturing stage		Distribution stage	Installation stage	Use and Maintenance stage	End-of-Life and deinstallation stage	Total
Indicator	unit	upstream	core	downstream				
GWP-fossil	kg CO_2 eq	8.15E+03	51.11	298.95	23.42	1.01E+05	950.20	1.11E+05
GWP-biogenic	kg CO_2 eq	-132.12	3.5E-03	0.21	1.68E-02	5.62E+04	35.16	5.61E+04
GWP-luluc	kg CO_2 eq	32.40	3.9E-05	3.94E-03	3.13E-04	8.92E+03	5.66E-03	8.95E+03
GWP-total	kg CO_2 eq	8.05E+03	51.11	299.17	23.44	1.66E+05	985.37	1.76E+05
ODP	kg CFC11 eq	3.9E-04	5.6E-07	6.73E-05	5.34E-06	9.70E-03	2.22E-05	1.02E-02
AP	mol H+ eq	62.16	1.7E-02	2.05	0.16	797.48	0.71	862.58
EP-freshwater	kg P eq	0.43	7.6E-06	6.92E-04	5.50E-05	1.74	3.96E-03	2.17
POCP	kg NMVOC eq	32.23	2.0E-02	2.41	0.19	294.36	0.87	330.07
ADP-minerals & metals*	kg Sb eq	0.17	1.4E-07	1.74E-05	1.38E-06	2.96E-03	9.98E-06	0.17
ADP-fossil*	MJ	9.95E+04	34.79	4.19E+03	332.65	1.46E+06	1.40E+03	1.57E+06
WDP*	m^3 depriv.	969.12	0.03	1.37	0.11	6.21E+03	10.88	7.19E+03
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.							

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Use of resources for the 111321 Transformer

Results per a single piece of transformer operating for 35 years									
			Manufacturing stage		Distribution stage	Installation stage	Use and Maintenance stage	End-of-Life and deinstallation stage	Total
Indicator		unit	upstream	core	downstream				
Primary energy resources - Renewable	Use as energy carrier (PERE)	MJ, net calorific value	8.42E+03	4.96E-02	2.04	0.46	1.91E+06	6.47	1.92E+06
	Use as raw materials (PERM)	MJ, net calorific value	2.13E+03	0.00	0.00	0.00	0.00	0.00	2.13E+03
	Total (PERT)	MJ, net calorific value	1.05E+04	4.96E-02	2.04	0.46	1.91E+06	6.47	1.92E+06
Primary energy resources - Non-renewable	Use as energy carrier (PENRE)	MJ, net calorific value	9.04E+04	34.79	1.58E+03	356.09	1.47E+06	1514.68	1.56E+06
	Use as raw materials (PENRM)	MJ, net calorific value	1.48E+04	0.00	0.00	0.00	0.00	0.00	1.48E+04
	Total (PERNT)	MJ, net calorific value	1.05E+05	34.79	1.58E+03	356.09	1.47E+06	1514.68	1.58E+06
Secondary material (MS)		kg	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Renewable secondary fuels (RSF)		MJ, net calorific value	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Non-renewable secondary fuels (NRSF)		MJ, net calorific value	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Net use of fresh water (FW)		m^3	43.62	8.30E-03	3.58E-02	8.04E-03	452.51	0.29	496.47

Use of resources for the 111292 Transformer

Results per a single piece of transformer operating for 35 years									
			Manufacturing stage		Distribution stage	Installation stage	Use and Maintenance stage	End-of-Life and deinstallation stage	Total
Indicator		unit	upstream	core	downstream				
Primary energy resources - Renewable	Use as energy carrier (PERE)	MJ, net calorific value	8.05E+03	4.96E-02	5.39	0.43	1.91E+06	6.19	1.92E+06
	Use as raw materials (PERM)	MJ, net calorific value	2.14E+03	0.00	0.00	0.00	0.00	0.00	2.14E+03
	Total (PERT)	MJ, net calorific value	1.02E+04	4.96E-02	5.39	0.43	1.91E+06	6.19	1.92E+06
Primary energy resources - Non-renewable	Use as energy carrier (PENRE)	MJ, net calorific value	8.53E+04	34.79	4.19E+03	332.65	1.47E+06	1401.58	1.56E+06
	Use as raw materials (PENRM)	MJ, net calorific value	1.43E+04	0.00	0.00	0.00	0.00	0.00	1.43E+04
	Total (PERNT)	MJ, net calorific value	9.95E+04	34.79	4.19E+03	332.65	1.47E+06	1401.58	1.57E+06
Secondary material (MS)		kg	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Renewable secondary fuels (RSF)		MJ, net calorific value	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Non-renewable secondary fuels (NRSF)		MJ, net calorific value	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Net use of fresh water (FW)		m^3	40.21	8.30E-03	9.46E-02	7.51E-03	452.51	0.28	493.11

Waste production and output flows for the 111321 Transformer

Waste production

Results per a single piece of transformer operating for 35 years								
		Manufacturing stage		Distribution stage	Installation stage	Use and Maintenance stage	End-of-Life and deinstallation stage	Total
Indicator	unit	upstream	core	downstream				
Hazardous waste disposed (HWD)	kg	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Non-hazardous waste disposed (NHWD)	kg	0.00	0.30	0.00	1.14	0.00	621.35	622.79
Radioactive waste disposed (RWD)	kg	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Output flows

Results per a single piece of transformer operating for 35 years								
		Manufacturing stage		Distribution stage	Installation stage	Use and Maintenance stage	End-of-Life and deinstallation stage	Total
Indicator	unit	upstream	core	downstream				
Materials for energy recovery (MER)	kg	0.00	0.00	0.00	88.76	0.00	0.00	88.76
Material for recycling (MFR)	kg	0.00	174.91	0.00	0.00	0.00	854.00	1,028.91
Components for reuse (CRU)	kg	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Exported thermal energy (ETE)	MJ	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Exported electricity energy (EEE)	MJ	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Waste production and output flows for the 111292 Transformer

Waste production

Results per a single piece of transformer operating for 35 years								
		Manufacturing stage		Distribution stage	Installation stage	Use and Maintenance stage	End-of-Life and deinstallation stage	Total
Indicator	unit	upstream	core	downstream				
Hazardous waste disposed (HWD)	kg	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Non-hazardous waste disposed (NHWD)	kg	0.00	0.30	0.00	1.12	0.00	582.67	584.09
Radioactive waste disposed (RWD)	kg	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Output flows

Results per a single piece of transformer operating for 35 years								
		Manufacturing stage		Distribution stage	Installation stage	Use and Maintenance stage	End-of-Life and deinstallation stage	Total
Indicator	unit	upstream	core	downstream				
Materials for energy recovery (MER)	kg	0.00	0.00	0.00	87.71	0.00	0.00	87.71
Material for recycling (MFR)	kg	0.00	174.91	0.00	0.00	0.00	779.38	954.29
Components for reuse (CRU)	kg	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Exported thermal energy (ETE)	MJ	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Exported electricity energy (EEE)	MJ	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Additional information

Recyclability potential

According to the waste treatment scenario calculation in SimaPro®, based on the recycling rate in the British standard BS EN 50639:2019 - Table G.4, the following recyclability potentials were calculated.

BS EN 50693:2019 (Annex G)	Product	
	111321	111292
Recyclability potential baseline	**58%**	**57%**
Recyclability potential with oil recycling	**79%**	**79%**
Recyclability potential with oil recycling and 100% recovering of steel and aluminium	**96%**	**96%**

Other certifications

Voluntary Cancellation of Certified Emission Reductions (CERs) from the CDM Project 0268: Lages Methane Avoidance Project, made by Lages Bioenergética, fully owned by ENGIE Brasil Energia, on behalf of ITB – Equipamentos Elétricos Ltda., to offset CO_2 emissions related to the reported GHG Emissions from 2020 (CDM Project 0268: Lages Methane Avoidance Project).

Redemption Statement by The International REC Standard for ITB - Equipamentos Elétricos by Engie Brasil Energia SA confirming the Redemption of 4,624 MWh of electricity generated from renewable sources This Statement relates to electricity consumption located at or in Brazil in respect of the reporting period 2020-01-01 to 2020-12-31. Device Engie do Brasil S. A./Usina Sao Salvador. Energy source: Hydro-electric.

References

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ISO (2006b) 14044: Environmental Management - Life Cycle Assessment - Requirements and guidelines.

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