Changzhou Sieyuan Toshiba Transformer Co.,LTD.

ENVIRONMENTAL PRODUCT DECLARATION

Product Name:

Transformer OSFSZ-200000/230
Transformer SFPSZ-315000/400

Site:

No. 26 Chunjiang Road, Changzhou City, Jiangsu Province， China

In accordance with ISO 14025 and EN 50693:2019

Program Operator	EPDItaly
Publisher	EPDItaly

Declaration Number	*Sieyuan -Transformer-003*
Registration Number	EPDITALY1298

Issue date	06 / 05 / 2026
Valid to	06 / 05 / 2031





www.epditaly.it

GENERAL INFORMATION

EPD OWNER	
Name of the company	Changzhou Sieyuan Toshiba Transformer Co.,LTD.
Registered office	No. 26 Chunjiang Road, Changzhou City, Jiagsu Province， China
Contacts for information on the EPD	王文佳 1 <wwj.191267@sieyuan.com>

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

INFORMATION ON THE EPD	
Product name (s)	TRANSFORMER OSFSZ-200000/230、TRANSFORMER SFPSZ-315000/400
Site (s)	No. 26 Chunjiang Road, Changzhou City, Jiangsu Province, China
Short description and technical information of the product (s)	200kVA and 315kVA are two common transformer capacity specifications in power distribution systems, typically used in small and medium-sized industrial plants, commercial complexes, residential areas, or large public facilities. The 200kVA transformer has good economic efficiency and flexible installation characteristics. The 315KVA transformer has strong load-bearing capacity and can easily handle the simultaneous operation of multiple air conditioning units, elevators, water pumps, and small and medium-sized motors. Compared to 200kVA, it has a larger buffer space in the face of future load growth and is less prone to overload tripping.
Field of application of the product (s)	200kVA Transformer: Small processing plants (such as clothing factories, small injection molding workshops), medium-sized convenience stores, small supermarkets, or individual office buildings, temporary construction power supply (as the main power source). 315 KVA: Medium sized machinery manufacturing plant, food processing plant. Large shopping mall shops, medium-sized hotels, and school teaching buildings. Charging pile power station, unit power distribution for high-rise residential buildings.
Product (s) reference standards (if any)	IEC 60076-1 (General) IEC 60076-2 (Temperature rise) IEC 60076-3 (Insulation levels and dielectric tests) IEC 60076-5 (Ability to withstand short circuit) IEC 60076-7 (Loading guide for oil-immersed power transformers) IEC 60076-10 (Determination of sound levels)
CPC Code (number) https://unstats.un.org/unsd/classifications/Econ	46121'Electricial transformer'

VERIFICATION INFORMATION	
PCR (title, version, date of publication or update)	EN 50693:2019 – Product category rules for life cycle assessment of electronic and electrical products and systems EPDItaly007 – PCR for Electronic and electrical products and systems, Rev. 3.2, 10/12/2025 reviewed by Ing. Ugo Pannuti, ICMQ Spa (Moderator), Eng. Elena Neri, Indaco (Committee) EPDItaly018 – Electronic and electrical products and systems – Power transformers, Rev. 3.6, 01/02/2021 NA - Implementation of the Core-PCR EPDItaly007 Rev.3 (Moderator & Committee)
EPDItaly Regulation (version, date of publication or update)	REGULATIONS OF THE EPDItaly PROGRAMME VER. 6.0, ISSUED ON 2023/10/30
Project Report LCA	SIEYUAN TRANSFORMER OSFSZ-200000/230、TRANSFORMER SFPSZ-315000/400 LCA Report version 6.0, 28/04/2026

Independent Verification Statement	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 electronic and electrical products may not be comparable if they do not comply with EN50693:2019
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.

OTHER INFORMATION	**The reference production year of the product is 2024**

Contents

GENERAL INFORMATION ii

1. Company information 1

2. Product Information 2

3. Life Cycle Assessment Information 4

3.1. Declared unit 4
3.2. System, temporal, and geographical boundaries 4
3.3. Impact categories 9
3.4. Cut-off 10
3.5. Allocation Principles 10
3.6. Limitation and Assumption 10

4. Inventory analysis 12

5. Environmental Impact Assessment 13

6. References 18

1. Company information

Changzhou Sieyuan Toshiba Transformer Co., Ltd was established through a joint venture between Changzhou Toshiba Transformer Co., Ltd and Sieyuan Electric Co., Ltd. It has more than 280 employees, including about 70 technicians, 11 quality engineers and 10 test engineers. The registered capital is CNY 100,100,000. The total factory area is 80000m2, and the production capacity is 60000MVA/year. The CST products is 35-500kV oil immersed power transformers, shunt reactors, ester-oil transformers, gas insulated transformers.

In the operation of the company, the respective roles of Toshiba and Sieyuan are Toshiba to provide technical information such as design specification, process specification, inspection procedure, and dispatch technical chief engineer to the factory for technical guidance and quality supervision, and Sieyuan is responsible for management of capital investment, finance, personnel and other aspects.

The company's products are widely used in wind power, photovoltaic, hydropower, rail transit, data center, metallurgical construction and other industries. The products have operation performance in the Grid Company, such as China State Grid, ENEL, Solaria, Celsia,METKA, ANDRITZ, SIMENS,CFE, Vietnam State Grid, Nigeria State grid. Meanwhile, it has been successfully put into operation in major construction projects such as the South-to-North Water Diversion project, West-to-east gas transmission project and Hong Kong-Zhuhai-Macao Bridge. The products produced by the company are also exported to Europe, Central Asia, North America, South America, Southeast Asia, Africa, Australia and other more than 40 countries and regions, deeply trusted by users.

2. Product Information

Product Name: Power transformer; Product Model: OSFSZ-200000/230 Transformer

RATED FREQUENCY：50 Hz

RATED POWER：200/200/63 MVA

VOLTAGE COMBINATION：（230±12×1.25%）/138/13.8 kV

RATED CURRENT：502.0/836.7/2636 A

COOLING TYPE：ONAN/ONAF160/160/50.4 - 200/200/63 MVA

Table 2.1: Material composition of the Transformer OSFSZ-200000/230 (in accordance with EN IEC 62474)

Product Identification Code			OSFSZ-200000/230
Rated power (kVA)	200000/200000/63000		
Country of installation	Spain		
Total product mass, without packaging and transformer oil (kg)	151064.71		
Material content	**ID**	**kg**	**%**
Stainless steel	M-100	56046.3	37.10%
Other ferrous alloys, non-stainless steels	M-119	70710.37	46.81%
Aluminium and its alloys	M-120	675.3	0.45%
Copper and its alloys	M-121	327.93	0.22%
Ceramics	M-160	40	0.03%
Polyamide (unfilled)	M-208	0	0.00%
Other unfilled thermoplastics	M-249	431.4	0.29%
NBR	M-320	65.4	0.04%
Paper	M-341	1834.27	1.21%
Oils and greases	M-410	0	0.00%
Other material（cable，BVR，etc）		20933.74	13.86%

Product Name: Power transformer; Product Model: SFPSZ-315000/400 Transformer

RATED FREQUENCY：50 Hz

RATED POWER：315/315/80 MVA

VOLTAGE COMBINATION：（400±15×1%）/132 (110) /26.4 kV

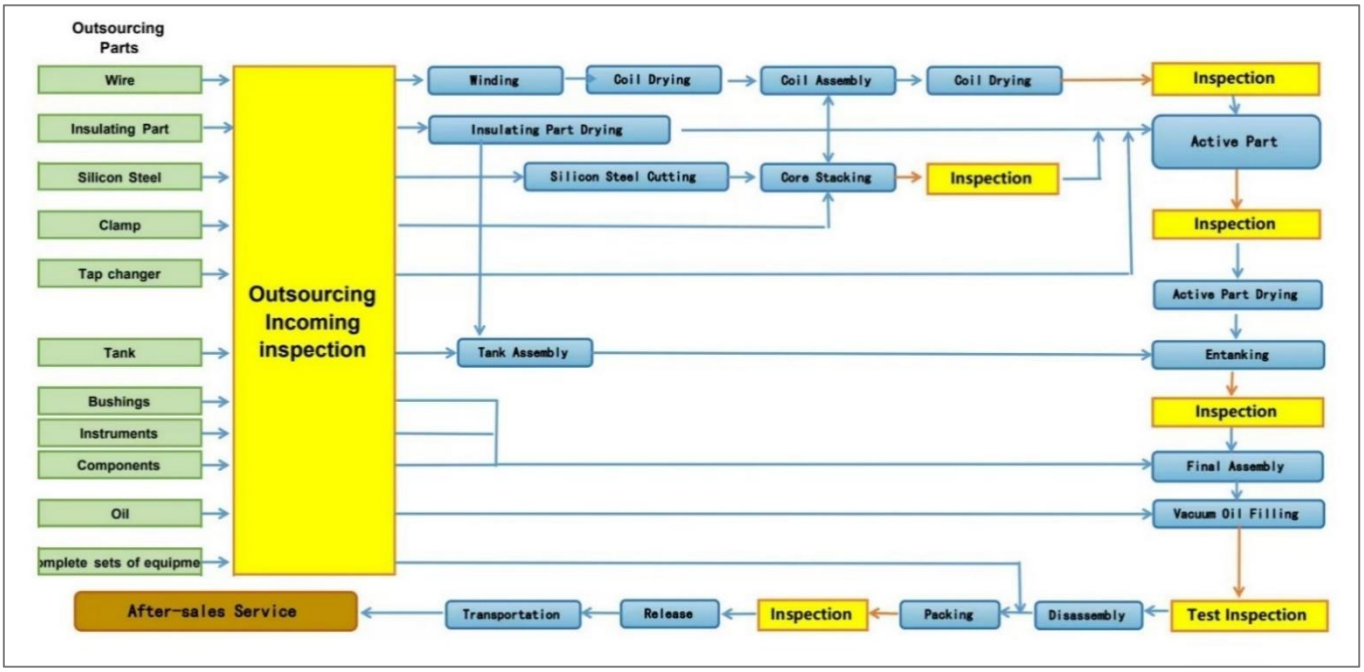
RATED CURRENT：454.7.0/1377.8/1749.5 A

COOLING TYPE：ONAN/ONAF160/160/50.4 - 200/200/63 MVA

Table 2.2: Material composition of the Transformer SFPSZ-315000/400 (in accordance with EN IEC 62474)

Product Identification Code	OSFSZ-315000/400		
Rated power (kVA)	200000/200000/63000		
Country of installation	Spain		
Total product mass, without packaging and transformer oil (kg)	332917.03		
Material content	**ID**	**kg**	**%**
Stainless steel	M-100	101843.9	30.59%
Other ferrous alloys, non-stainless steels	M-119	146843.77	44.11%
Aluminium and its alloys	M-120	831.3	0.25%
Copper and its alloys	M-121	487.63	0.15%
Ceramics	M-160	20	0.01%
Polyamide (unfilled)	M-208	0	0.00%
Other unfilled thermoplastics	M-249	547.8	0.16%
NBR	M-320	67	0.02%
Paper	M-341	717.74	0.22%
Oils and greases	M-410	0	0.00%
Other material（cable，BVR，etc）		81557.89	24.50%

The product manufacturing process is as follows.



No substance in the product greater than 0.10% by weight is present on the "List of Potentially Hazardous Substances" (SVHC in English) candidates for authorization under the REACH legislation.

3. Life Cycle Assessment Information

A Life Cycle Assessment (LCA) is a methodology for assessing the environmental impacts associated with the entire life cycle of a particular product or process. LCA consists of 4 stages (Goal and Scope, Inventory Analysis, Impact Assessment, and review/presentation) which must follow similar procedures to a PCR (Product Category Rules) and helps to evaluate the carbon footprint and natural resources of a product or process. In this EPD, LCA is conducted separately to obtain environmental impact information.

3.1. Declared unit

According to PCR EPDItaly018, the transformer is defined as an assembly of electric and electronic devices adjusting and regulating voltage and current intensity components of electric power, during a reference service life of 35 years.

The declared unit is therefore defined as a single piece of transformer operating for 35 years. Reference flow is one single piece of transformer.

Sieyuan Declaration: This EPD report is a specific product EPD

3.2. System, temporal, and geographical boundaries

The system boundary includes the whole life cycle of the analyzed product, according to a “from cradle to grave” application, covering the following life cycle stages:

PHASES	MANUFACTURING STAGE	DISTRIBUTION STAGE	INSTALLATION STAGE	USE & Maintenance STAGE	END-OF-LIFE STAGE De-installation	BENEFITS & LOADS BEYOND THE SYSTEM BOUNDARIES*
	IN ACCORDANCE TO EN 50693					
Phases declared	X	X	X	X	X	Opt.
Data quality indicator[11]	%	-				

Table 3.2.1 - Life cycle modules

The manufacturing stage covers 57.58% of the emissions assessed for data quality.

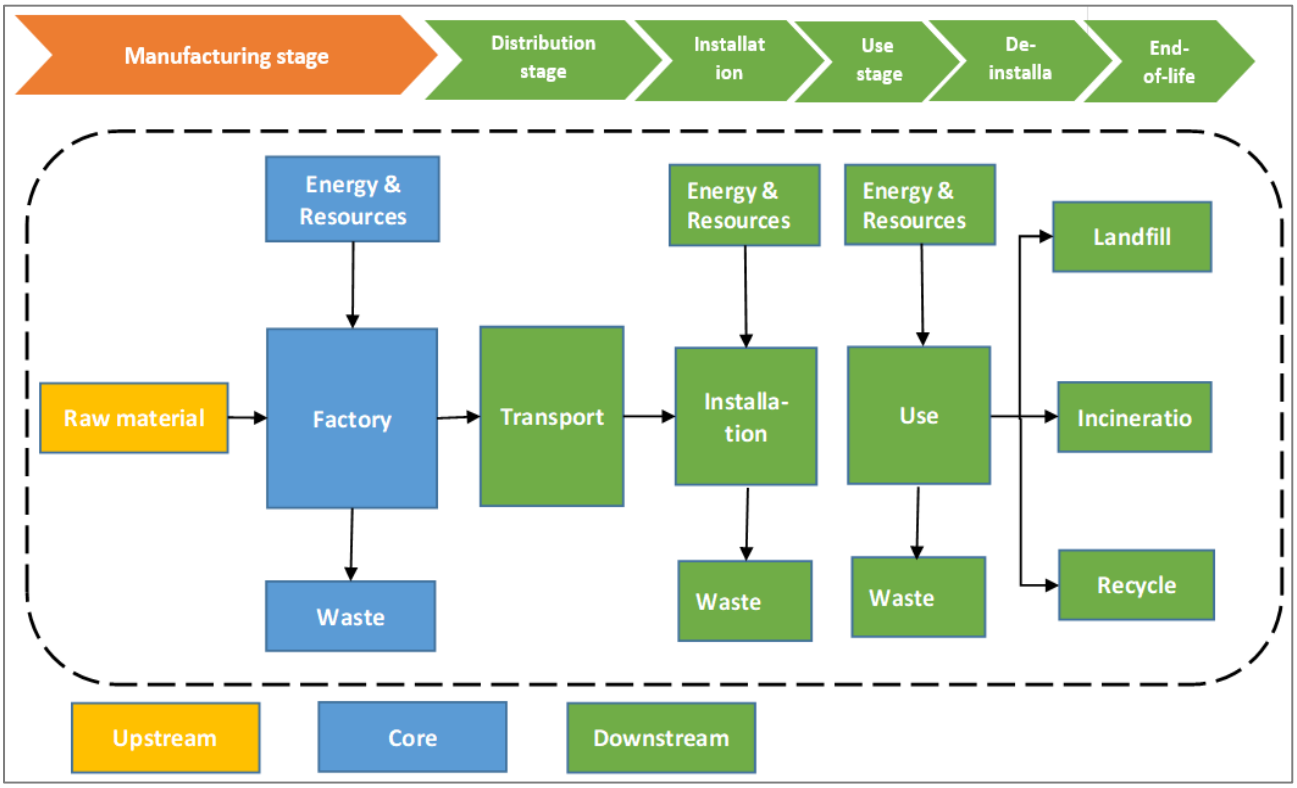


Figure 3.2.2: Phases and processes included

Manufacturing stage. This phase includes the upstream and core modules described earlier (raw material conversion, raw material transportation, generation of process waste, including its transportation to disposal sites, as well as energy and material consumption related to plant operations); the upstream module primarily involves the procurement of primary and auxiliary materials, as well as the acquisition and transportation of electronic components and control equipment. The core module mainly covers the processing of grain-oriented and non-grain-oriented silicon steel sheets and mineral oil, along with the transportation and treatment of waste. It also involves the consumption of electricity, natural gas, and diesel during the processing stage. The data for transportation distance of purchased raw materials is summarized in the tables in LCA report.

Distribution stage. This module covers energy consumption during product transportation. Mainly includes the transportation of transformers from the Siyuan factory to Shanghai Port, from Shanghai Port to Spanish ports, and from Spanish ports to local factories in Spain.

Installation stage. This module includes the end of packaging life, energy consumption related to installation and setup, waste and debris generated during the installation phase; It mainly involves the energy consumption generated in the lifting and hoisting of transformers and the purification of mineral oil.

Use & Maintenance Stage. This module includes the energy consumed by the transformer throughout its entire reference service life, regular maintenance, and special maintenance periods. The function of the transformer is to convert high voltage electricity into low voltage electricity, and the service life of these two units is 35 years. The disposal method for waste wooden pallets and paper generated during installation is incineration.

The total energy consumed shall be expressed in kWh and it can be computed via the following formula:

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

End of Life Stage. This module includes transporting transformers to collection locations, dismantling operations, distribution and destination of various material flows for recycling or processing. The processing method for easily recyclable single materials such as scrap steel and aluminum is recycling, while incineration is mainly used for difficulty recycling waste electrical wires and waste electrical control devices. The treatment method for wasting mineral oil is incineration.

Table 4.6.2 – EoI treatment inventory (TRANSFORMER OSFSZ-200000/230)

Stage	Material	Material	Waste to be treated (kg)	Weight of materail to be recycled (kg)	Weight of materail to be incinerated (kg)	Weight of materail to be landfilled (kg)	Waste treatment methode
End of Life Stage	Treated as single material	Steel (Main Material+Auxiallary Material)	62702	62702	0	0	100% recycled from 100% recovered
		copper (Main Material)	12	12	0	0	100% recycled from 95% recovered
		oil tank	49228	49228	0	0	100% recycled from 100% recovered
		carboard (Main Material)	9673	0	9673	0	0% recycled from 100% recovery, all incinerated
		wires ((Main Material))	7368	6140	1228	0	90% recycled from 60% recovered, rest incinerated
	Separation before treatment	Aluminum（parts and components）	608	540	0	68	90% recylced from 90% recovered, rest incinerated
		Copper (parts and components)	242	227	0	14	95% recylced from 85% recovered, rest incinerated
		Steel（parts and components）	13755	13755	0	0	100% recylced from 94% recovered
		Plastics（parts and components）	388	345	43	0	90% recylced from 90% recovered, rest incinerated
		Rubber（parts and components）	470	0	470	0	0% recycling from 90% recovery, all incinerated
		Ceramics（parts and components）	40	0	0	40	0% recycling from 100% recovery, all landfilled

		Paper（parts and components）	246	0	246	0	0% recycling from 100% recovery, all incinerated
		Glass（parts and components）	0	0	0	0	0% recycling from 100% recovery, all landfilled
		Zinc（parts and components）	0	0	0	0	0% recycling from 100% recovery, all landfilled
		Nitrile rubber	59	0	59	0	0% recycled from 90% recovery, all incinerated
		Waste oil	73103	0	73103	0	0% recycled from 100% recovery, all incinerated
	Special treatment	Power cord（wires form auxialary Material+air-cooled control cabinet)	17	4	13	0	25% recycled from 100% recovery, rest incinerated
		Rest of Electronic wastes	227	114	0	114	50% recycled from 100% recovery, rest landfilled

Table 4.6.2 – Eol treatment inventory (TRANSFORMER SFPSZ-315000/400)

Stage	**Material**	**Material**	**Waste to be treated (kg)**	**Weight of materail to be recycled (kg)**	**Weight of materail to be incinerated (kg)**	**Weight of materail to be landfilled (kg)**	**Waste treatment methode**
End of Life Stage	Treated as single material	Steel (Main Material+Auxiallary Material)	147917	147917	0	0	100% recycled from 100% recovered
		copper (Main Material)	35	35	0	0	100% recycled from 95% recovered
		oil tank	78751	78751	0	0	100% recycled from 100% recovered
		carboard (Main Material)	25622	0	25622	0	0% recycled from 100% recovery, all incinerated

		wires ((Main Material))	33303	27752	5550	0	90% recycled from 60% recovered, rest incinerated
	Separation before treatment	Aluminum（parts and components）	748	665	0	83	90% recylced from 90% recovered, rest incinerated
		Copper (parts and components)	356	335	0	21	95% recylced from 85% recovered, rest incinerated
		Steel（parts and components）	20586	20586	0	0	100% recylced from 94% recovered
		Plastics（parts and components）	493	438	55	0	90% recylced from 90% recovered, rest incinerated
		Rubber（parts and components）	622	0	622	0	0% recycling from 90% recovery, all incinerated
		Ceramics（parts and components）	20	0	20		0% recycling from 100% recovery, all landfilled
		Paper（parts and components）	329	0	329	0	0% recycling from 100% recovery, all incinerated
		Glass（parts and components）	0	0	0	0	0% recycling from 100% recovery, all landfilled
		Zinc（parts and components）	0	0	0	0	0% recycling from 100% recovery, all landfilled
		Nitrile rubber	59	0	59	0	0% recycled from 90% recovery, all incinerated
		Waste oil	77064	0	77064	0	0% recycled from 100% recovery, all incinerated
	Special treatment	Power cord (wires form auxialary Material+air-cooled control cabinet)	17	4	13	0	25% recycled from 100% recovery, rest incinerated

		Rest of Electronic wastes	227	114	0	114	50% recycled from 100% recovery, rest landfilled

It should be noted that the construction, maintenance, and decommissioning of infrastructure, i.e. buildings and machinery, as well as the occupation of industrial land have not been considered, as their contribution to the environmental impact of the declared unit is considered negligible.

For the study, reference was made to the data deriving from the BOMs of the specific products, whose production began in 2024 (reference year). For plant consumption, reference was made to the data related to the Sieyuan production plant and referred to the year 2024 (January – December), considered representative (at the time of conducting the study, this is the last complete calendar year for which the data are available).

The suppliers of raw materials and semifinished products are located in China. Where possible, the specific origin of the raw material has been investigated and characterized accordingly. For the downstream phases, and Spain scenario was considered, knowing the exact position of where the transformers will be installed.

3.3. Impact categories

The methodology chosen to evaluate the potential environmental impacts of the product subject of this study includes all the impact categories required by the Standard EN 50693:2019. The models used are those shown in EN 15804 + A2: 2019, as implemented in the SimaPro software. The categories analyzed are therefore:

Indicator name and abbrevation (EN)	Unit (EN)
Global Warming Potential – fossil fuels (GWP-fossil)	kg CO_2 eq.
Global Warming Potential – biogenic (GWP-biogenic)	kg CO_2 eq.
Global Warming Potential – land use and land use change (GWP-luluc)	kg CO_2 eq.
Global Warming Potential – total (GWP-total)	kg CO_2 eq.
Depletion potential of the stratospheric ozone layer (ODP)	kg CFC-11 eq.
Acidifcation potential, Accumulated Exceedance (AP)	mol H+ eq.
Eutrophication potential – freshwater (EP-freshwater)	kg P eq.
Eutrophication aquatic marine (EP-marine)	kg N eq.
Eutrophication terrestrial (EP-terrestrial)	mol N eq.
Photochemical Ozone Creation Potential (POCP)	kg NMVOC eq.
Abiotic depletion potential – non-fossil resources (ADPE)	kg Sb eq.
Abiotic depletion potential – fossil resources (ADPF)	MJ, net calorific value
Water deprivation potential (WDP)	m^3 world eq. Deprived

*Please also noted that the EN 15804+A2 method is based on the EF 3.1 version for this study.

3.4. Cut-off

According to EPD Italy Regulations and PCR EPDItaly007, the following flows and operations are cut-offed:

- Production, use and disposal of the packaging of components and the packaging of 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 which is performed by adopting manual tools (e.g. screwdrivers, hammers, etc.).
- Manufacture of equipment used in production, buildings or any other capital goods;
- The transportation of personnel to the plant;
- Transportation of personnel within the plant;
- Research and development activities;
- Long-term emissions.

  During the production process, auxiliary materials such as alcohol (used for cleaning agents), machine oil are utilized. However, due to their minimal consumption and the resulting waste generation being far less than 1% of the weight of the raw materials per unit of product produced, they have negligible impact on the overall results of the life cycle assessment (LCA) and are therefore cut-offed in accordance with cut-off principle from the calculation.

  As far as possible, the entire calculation is based primarily on primary data, and secondary data is obtained based on life-cycle databases or literature, among them, energy consumption is mainly geographical, that is, refer to local data.

3.5. Allocation Principles

Firstly, the principle of "modularity" is followed. The life cycle phases of OSFSZ-200000/230 and SFPSZ-315000/400 transformer according to EN 50693:2019 are divided to five modules: Manufacturing, Distribution, Installation, Use and maintenance, End of life. Secondly, the energy and resources usage per functional unit in the production stage of the product is calculated by dividing the annual energy or resource consumption by the total output of the company's product, In detail, the allocation of energy resources for plant processing use is converted using the proportion of rated power of transformer OSFSZ-200000/230 and transformer SFPSZ-315000/400 to the total rated power of transformers produced in the plant in 2024.that is, the physical allocation method is used for allocation.

In addition, the default distribution rule for the environmental impacts and benefits of reuse, recovery and/or recycling is based on the polluter pays principle (PPP), which means that the recovery or reuse beneficiary bears the environmental impacts and benefits associated with the recovery or reuse treatment, and the original product manufacturer does not have to bear this part of the impact burden. It also does not participate in the sharing of benefits (environmental impact of the production of the same product avoided by recycling and reuse).

3.6. Limitation and Assumption

The results are only valid for the situation defined by the assumptions described in the present report, and they are subject to change if these manufacturing conditions change. The following assumptions are used in this assessment:

Table 3.6.1 – Assumptions for each stage of the life cycle

Life cycle module	Life cycle stage	Assumption
MANUFACTURING STAGE	Upstream Module	• Raw material information is provided by SIEYUAN according to product's bill of material, losses for metal cutting, wood and transformer oil are considered while others were excluded. Raw material loss rate is

		assumed to be 5% for silicon steel sheet, 5% for wires, 5% for carboard insulation parts. • The density of wood package is assumed to be 740 kg/m3 as glued solid timber is used.
	Core Module	• China consumption electricity mix from East Centre China Grid was used in the core module. For 1kWh electricity used, upstream CO2 emission is 0.78 kgCO2e. • Assume same amount of energy and resource consumption were used to produce each unit of rated power of transformers in the manufacturing phase. • Assume that loss rate of transformer materials of the same type of transformer is the same, and the material processing loss is proportional to the weight of input of raw material. • The distance from the SIEYUAN plant to the downstream waste disposal site is assumed to be 200 km.
DISTRIBUTION STAGE	Downstream Module	• The product is to be used in Spain. Downstream distribution distances are estimated from the GAODE map and SEARATE website for shipment distances, inland transport is by truck freight and sea transport is by ship. • The distance from Port of Spain to the client is assumed to be 500 km.
INSTALLATION STAGE		• Energy and resources needed during installation are provided by SIEYUAN, it is assumed that the energy for transformer installation is related to the weight of transformer and oil weight of each unit of transformer. • The distance from the user installation site to the downstream waste disposal site is also assumed to be 200 km • In this stage, package of the transformer and oil tank were disposed, of which 95% of steel is assumed to be recycled and 5% is assumed to be landfilled in accordance with IEC/TR 62635, and 100% of waste wood package is assumed to be incinerated.
USE & Maintenance STAGE		• Energy used during the product service life is provided by SIEYUAN in accordance with PCR EPDItaly018, it is assumed the same amount were used to install each unit of transformer. • According to expert judgement and from various users provided by SIEYUAN, inspection and maintenance do not require replacement parts during the service life, and transformer oil changes are not necessary or foreseen, therefore are not considered in the study.
END-OF-LIFE STAGE De-installation		• In the end of life disposal stage, materials of transformer components can be categorized into several categories - Major components (steel and copper) that can be easily recycled as a single material, components that need to be disassembled and then processed as separate materials, components that are processed as a whole, materials that need to be treated as hazardous waste, and components that need special treatment such as power cords and paper based insulation parts. Global waste material treatment data were used to calculate the potential environment impact at the disposal stage. Recycling rate of each material is assumed in accordance with IEC TR 62635:2012.

4. Inventory analysis

In this EPD, where available, reference was made to primary data. Where access to this type of data was not possible, datasets from the Ecoinvent v3.11 database were used as reference.

Data collection was carried out by preparing a sheet that collected input and output data, in terms of mass, energy consumption were obtained within production site. The data collection sheet was verified and checked by mass balances and reporting any inconsistencies that were clarified and resolved.

In the study, SimaPro 10.2.0.0 software was used to establish the model for the life cycle of products and calculate LCA results.

According to EN 15804:2012 data quality for transformer OSFSZ 200000/400 and transformer SFPSZ 315000/400 will be estimated. Conclusion: The use of datasets for the stage of transformer uses accounts for more than 90% of the GWP impact. Raw material purchasing accounts for more than 40% of the rest GWP impact.

Table 4.1: Data quality description for Transformer OSFSZ 200000/400 and transformer SFPSZ 315000/400

Data collection	1/1/2024-31/12/2024
Sites used	1 seite owned by Changzhou Sieyuan Toshiba Transformer Co.,Ltd
Geography	Changzhou Sieyuan Toshibia Transformer Co.Ltd. produces 100% of its transformers in Changzhou. The transformer is sold to Spain. The EPD is modelled for use and disposal in Spain.
Technology	The transformer is manufactured by processing raw materials like silicon steel sheet, magnetic shielding and mineral oil. Parts and components and electronic control cabinet units will be purchased from provider and assembled together.
Averaging	Production weighted average covering 100% of production by Sieyuan
LCI/LCA database	Ecoinvent 3.11
EPD used	Sieyuan EPD Program, EPD for Transformer OSFSZ 200000/230 and Transformer SFPSZ 315000/400
Data Quality Scheme	EN 15804:2012+A2:2019, Annex E, Table E.2
Use of Fair data with more than 30% of a core impact	The use of datasets for the stage of transformer use accounts for more than 90% of the GWP impact. Datasets for manufacturing stage accounts for more than 50% of the total datasests for evaluating the GWP impacts.
Use of Poor relevant data	Data quality for parts and components in the manufacturing stage and end-of-life stage is both geographically relatively average, because they summaries a big area of data sources. Parts and components accounts for less than 1% and en-of-life accounts for less than 2% of GWP impact.
Use of Ver Poor relevant data	No very poor data used.

5. Impact Assessment

Potential Environmental impact of each lifecycle stage are shown below.

Table 5.1.1 – Environmental impact descriptive parameters

TRANSFORMER OSFSZ-200000/230

Impact category	Unit	Total	Manufacturing Stage	Distribution Stage	Installation Stage	Use & Maintenance Stage	End of Life Stage
Climate change -total	kg CO2 eq	1.25E+07	5.70E+05	6.39E+04	1.20E+04	1.16E+07	2.39E+05
Climate change - Fossil	kg CO2 eq	1.22E+07	5.71E+05	6.39E+04	1.42E+03	1.14E+07	2.24E+05
Climate change - Biogenic	kg CO2 eq	1.32E+05	-1.81E+03	3.52E-01	1.06E+04	1.07E+05	1.55E+04
Climate change - Land use and LU change	kg CO2 eq	1.63E+05	3.88E+02	3.30E+01	4.91E+00	1.63E+05	3.83E+00
Ozone depletion	kg CFC11 eq	1.12E+00	9.38E-01	9.16E-04	2.33E-05	1.78E-01	1.77E-04
Acidification	mol H+ eq	5.01E+04	3.65E+03	1.35E+03	1.33E+01	4.51E+04	4.31E+01
Eutrophication, freshwater	kg P eq	1.71E+03	2.78E+02	3.77E+00	1.76E-01	1.41E+03	1.43E+01
Eutrophication, marine	kg N eq	1.14E+04	5.57E+02	3.35E+02	5.60E+00	1.05E+04	1.58E+01
Eutrophication, terrestrial	mol N eq	1.19E+05	5.89E+03	3.72E+03	6.03E+01	1.09E+05	1.72E+02
Photochemical ozone formation	kg NMVOC eq	4.38E+04	2.48E+03	1.05E+03	1.73E+01	4.02E+04	5.13E+01
Depletion of abiotic resources – minerals and metals	kg Sb eq	3.16E+01	1.70E+01	1.01E-01	9.44E-03	1.44E+01	1.72E-02
Depletion of abiotic resources – fossil fuels	MJ	3.74E+08	1.01E+07	8.34E+05	2.50E+04	3.63E+08	1.16E+05
Water use	m3 depriv.	1.25E+07	8.51E+04	2.75E+03	4.45E+02	1.24E+07	7.24E+03

Note: The negative value of Climate change -Biogenic indicator in manufacturing stage is due to the use of plywood as auxiliary material in upstream that will be used for sea transportation. Plywood will be seen as CO2e absorbed, since they are from biogenic material. Due to the fact that the total biological carbon emissions of the main materials, parts and components and Air-cooled control cabinet and transportation of raw material (positive values) are less than those of the plywood as auxiliary material, the total biological carbon emissions in manufacturing stage is negative.

TRANSFORMER SFPSZ-315000/400

	Unit	Total	Manufacturing Stage	Distribution Stage	Installation Stage	Use & Maintenance Stage	End of Life Stage
Climate change -total	kg CO2 eq	3.20E+07	9.68E+05	1.16E+05	1.41E+04	3.06E+07	3.10E+05
Climate change - Fossil	kg CO2 eq	3.12E+07	9.59E+05	1.16E+05	2.00E+03	2.99E+07	2.69E+05
Climate change - Biogenic	kg CO2 eq	3.43E+05	7.37E+03	6.37E-01	1.21E+04	2.82E+05	4.08E+04
Climate change - Land use and LU change	kg CO2 eq	4.29E+05	7.79E+02	5.97E+01	5.21E+00	4.28E+05	1.27E+01
Ozone depletion	kg CFC11 eq	1.73E+00	1.26E+00	1.66E-03	3.21E-05	4.68E-01	3.76E-04
Acidification	mol H+ eq	1.28E+05	6.91E+03	2.44E+03	2.02E+01	1.19E+05	8.53E+01
Eutrophication, freshwater	kg P eq	4.33E+03	5.89E+02	6.81E+00	1.99E-01	3.71E+03	1.73E+01
Eutrophication, marine	kg N eq	2.93E+04	1.01E+03	6.06E+02	8.73E+00	2.77E+04	2.86E+01
Eutrophication, terrestrial	mol N eq	3.05E+05	1.07E+04	6.73E+03	9.45E+01	2.87E+05	2.97E+02
Photochemical ozone formation	kg NMVOC eq	1.12E+05	4.12E+03	1.89E+03	2.69E+01	1.06E+05	9.46E+01
Depletion of abiotic resources – minerals and metals	kg Sb eq	7.80E+01	3.98E+01	1.82E-01	1.02E-02	3.80E+01	3.69E-02
Depletion of abiotic resources – fossil fuels	MJ	9.71E+08	1.48E+07	1.51E+06	3.28E+04	9.54E+08	2.47E+05
Water use	m3 depriv.	3.28E+07	2.43E+05	4.97E+03	4.82E+02	3.25E+07	2.17E+04

Parameters describing resource use are shown below.

Table 5.2 – Parameters describing resource use

TRANSFORMER OSFSZ-200000/230

Parameter	Unit	Total	Manufacturing Stage	Distribution Stage	Installation Stage	Use & Maintenance Stage	End of Life Stage
Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw material (PENRE)	MJ, net calorific value	3.74E+08	7.22E+06	8.51E+05	2.50E+04	3.63E+08	2.67E+06
Use of renewable primary energy excluding renewable primary energy resources used as raw material (PERE)	MJ, net calorific value	1.15E+08	3.16E+05	7.91E+03	1.05E+05	1.15E+08	1.61E+05
Use of non-renewable primary energy resources used as raw material (PENRM)	MJ, net calorific value	3.49E+05	2.90E+06	0.00E+00	0.00E+00	0.00E+00	-2.55E+06
Use of renewable primary energy resources used as raw material (PERM)	MJ, net calorific value	4.30E+02	2.59E+05	0.00E+00	-1.01E+05	0.00E+00	-1.58E+05
Total use of non-renewable primary energy resources (primary energy and primary energy resources used as raw materials) (PENRT)	MJ, net calorific value	3.74E+08	1.01E+07	8.34E+05	2.50E+04	3.63E+08	1.16E+05
Total use of renewable primary energy resources (primary energy and primary energy resources used as raw materials) (PERT)	MJ, net calorific value	1.15E+08	5.75E+05	7.91E+03	4.61E+03	1.15E+08	3.52E+03
Net use of fresh water (FW)	m3	1.70E+05	3.59E+03	8.44E+01	8.07E+00	1.66E+05	2.26E+02
Use of secondary raw materials (MS)	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Use of renewable secondary fuels (RSF)	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Use of non-renewable secondary fuels (NRSF)	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

TRANSFORMER SFPSZ-315000/400

Parameter	Unit	Total	Manufacturing Stage	Distribution Stage	Installation Stage	Use & Maintenance Stage	End of Life Stage
Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw material (PENRE)	MJ, net calorific value	9.69E+08	1.06E+07	1.53E+06	3.28E+04	9.54E+08	2.94E+06
Use of renewable primary energy excluding renewable primary energy resources used as raw material (PERE)	MJ, net calorific value	3.02E+08	4.89E+05	1.43E+04	1.20E+05	3.01E+08	4.24E+05
Use of non-renewable primary energy resources used as raw material (PENRM)	MJ, net calorific value	1.53E+06	4.22E+06	0.00E+00	0.00E+00	0.00E+00	-2.69E+06
Use of renewable primary energy resources used as raw material (PERM)	MJ, net calorific value	5.89E+02	5.29E+05	0.00E+00	-1.16E+05	0.00E+00	-4.13E+05
Total use of non-renewable primary energy resources (primary energy and primary energy resources used as raw materials) (PENRT)	MJ, net calorific value	9.71E+08	1.48E+07	1.51E+06	3.28E+04	9.54E+08	2.47E+05
Total use of renewable primary energy resources (primary energy and primary energy resources used as raw materials) (PERT)	MJ, net calorific value	3.02E+08	1.02E+06	1.43E+04	4.88E+03	3.01E+08	1.11E+04
Net use of fresh water (FW)	m3	4.44E+05	7.07E+03	1.53E+02	8.94E+00	4.36E+05	7.43E+02
Use of secondary raw materials (MS)	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Use of renewable secondary fuels (RSF)	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Use of non-renewable secondary fuels (NRSF)	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Waste production descriptive parameters are shown below.

Table 5.3 – Waste production descriptive parameters

TRANSFORMER OSFSZ-200000/230

Parameter	Unit	Total	Manufacturing Stage	Distribution Stage	Installation Stage	Use & Maintenance Stage	End of Life Stage
Hazardous waste disposed (HWD)	kg	6.55E+03	5.24E+02	1.46E+01	5.97E+01	5.01E+03	9.42E+02
Non-hazardous waste disposed (NHWD)	kg	7.80E+05	7.03E+04	2.51E+04	3.11E+02	6.05E+05	7.97E+04
Radioactive waste disposed (RWD)	kg	2.96E+03	5.86E+00	1.19E-01	9.71E-02	2.95E+03	6.11E-02
Materials for energy recovery (MER)	kg	9.25E+04	4.95E+02	0.00E+00	7.21E+03	0.00E+00	8.48E+04
Material for recycling (MFR)	kg	1.37E+05	3.69E+03	0.00E+00	0.00E+00	0.00E+00	1.33E+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	1.98E+06	1.20E+04	0.00E+00	2.52E+04	0.00E+00	1.94E+06
Exported electricity energy (EEE)	MJ	2.17E+05	1.17E+03	0.00E+00	1.25E+04	0.00E+00	2.04E+05

TRANSFORMER SFPSZ-315000/400

Impact category	Unit	Total	Manufacturing Stage	Distribution Stage	Installation Stage	Use & Maintenance Stage	End of Life Stage
Hazardous waste disposed (HWD)	kg	1.71E+04	1.55E+03	2.64E+01	6.84E+01	1.32E+04	2.28E+03
Non-hazardous waste disposed (NHWD)	kg	1.92E+06	1.10E+05	4.53E+04	3.54E+02	1.59E+06	1.75E+05
Radioactive waste disposed (RWD)	kg	7.76E+03	1.04E+01	2.15E-01	1.03E-01	7.75E+03	1.89E-01
Materials for energy recovery (MER)	kg	1.18E+05	6.30E+02	0.00E+00	8.26E+03	0.00E+00	1.09E+05
Material for recycling (MFR)	kg	2.86E+05	9.76E+03	0.00E+00	0.00E+00	0.00E+00	2.77E+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	2.20E+06	6.75E+02	0.00E+00	6.19E+04	0.00E+00	2.13E+06
Exported electricity energy (EEE)	MJ	2.89E+05	6.70E+01	0.00E+00	3.08E+04	0.00E+00	2.59E+05

6. References

- ISO 14040:2006 Environmental management — Life cycle assessment — Requirements and guidelines
- ISO 14044:2006 Environmental management — Life cycle assessment — Principles and framework
- EPDItaly007 – PCR for Electronic and electrical products and systems, Rev. 3.2, 10/12/2025
- EPDItaly018 – Electronic and electrical products and systems – Power transformers, Rev. 3.6, 01/02/2021
- EN 50693:2019 Product category rules for life cycle assessments of electronic and electrical products and systems
- Regulations of the EPDItaly Programm Rev.6.0, 2023/10/30
- SIEYUAN TRANSFORMER OSFSZ-ENEL 111271 & TRANSFORMER OSFSZ-ENEL 111273 LCA Report Date of Report 28.04.2026 version 6.0