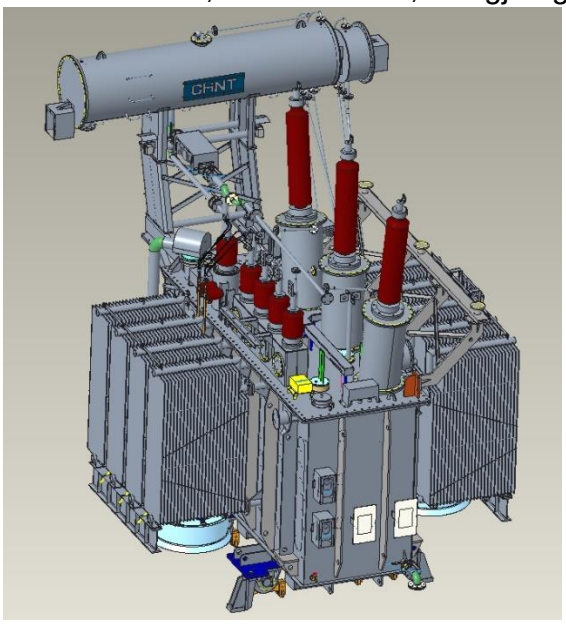
Environmental Product Declaration

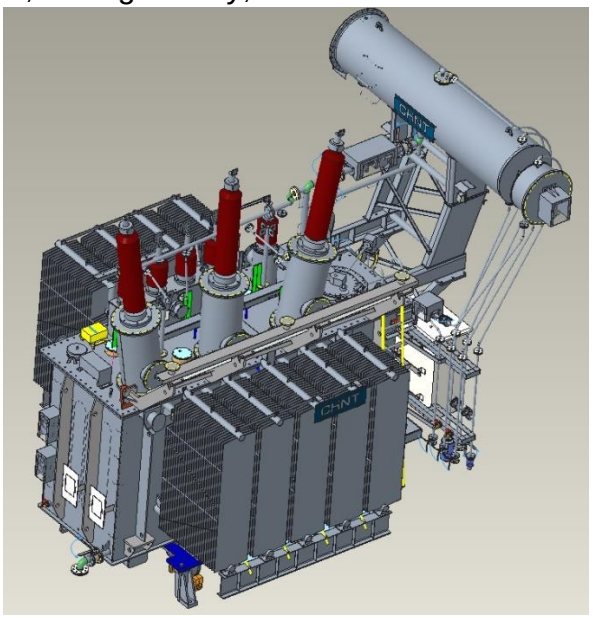
Power Transformer SFZ-40000/115-111087

In compliance with ISO 14025 and EN 50693

EPD Owner: CHINT ELECTRIC Co.,LTD.

Adress： No.3555, Si Xian Road, Songjiang District, Shanghai City, P.R. China





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EPDItaly	EPDItaly
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EPDCHINT-40MVA-001	EPDITALY0468
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General Information

EPD Owner	CHINT ELECTRIC Co.,LTD.
Address of EPD Owner	No.3555, Si Xian Road, Songjiang District, Shanghai City, P.R. China
Location of the production site	No.3555, Si Xian Road, Songjiang District, Shanghai City, P.R. China
Company Contact	Yang Zhou Zhouyang1@chintglobal.com
Program operator and publisher	EPDItaly – www.epditaly.it Via Gaetano De Castillia 10, 20124 Milan (MI), Italy
Declared Products	Power Transformer SFZ-40000/115-111087
CPC code	46121'Electricial transformer'
Independent Verification	This declaration has been developed referring to EPDItaly, following the 'Regolamento di EPDItaly"; further information and the document itself are available at: www.epditaly.it. EPD document valid within the following geographical area: Colombia. Independent verification of the declaration and data carried out according to ISO 14025:2010. [ ] Internal [X] External Third-party verification carried out by: ICMQ.Via G. De Castillia, 10 20124 MILANO - ITALIA
Reference documents	EN 50693:2019 – Product category rules for life cycle assessment of electronic and electrical products and systems
Reference PCRs	EPDItaly007 – PCR for Electronic and electrical products and systems, Rev. 2, 2020/10/21 EPDItaly018 – Electronic and electrical products and systems – Power trans- formers, Rev. 3.5, 2021/12/13
Technical support	Jean.Yang@sgs.com Eric.Ma@sgs.com Larry-xl.Wang@sgs.com SGS-CSTC Standards Technical Services Co., Ltd.
Comparability	EPDs published within the same product category, though originating from different programs, may not be comparable. Full conformance with a PCR allows the comparability of EPD only when all stages of a life cycle have been considered. However, variations and deviations are possible.
Liability	EPDItaly declines any responsibility regarding the manufacturer's information, data, and results of the life-cycle assessment.

Contents

1. Company information

CHINT Electric Co., Ltd. Is a subsidiary of CHINT Group Corporation. With the wide range of transmission and distribution products, as well as the systematic and professional solution, CHINT Electric has supplied products and EPC services to customers over 140 countries across different industrial sectors, including power utility, renewable energy, oil and gas, metallurgy, railway and so on. Now CHINT Electric Co., Ltd has become one of the main players for Power T&D equipment and EPC services in the world.

CHINT Electric Transformer Division is a governing unit of the national transformer industry, with more than 500 employees，30% of whom are technicians. It has 40,000 square meters of production plant, with annual production capacity of 30 million kVA；Products Range mainly include 35kV～750kV Power Transformers,35kV～500kV Reactors and 35kV～750kV Special Transformers.

CHINT Electric devotes itself to the R&D of transformers with high quality and efficiency, and always strives to reduce the noise and loss of transformers, and to promote the application of new materials such as energy saving and environmental protection，reflect our social responsibility. CHINT serves various industries such as new energy sources, wind energy, solar energy, biomass power generation, and widely serves these industries such as hydropower, thermal power, steel, metallurgy, rail transportation, petroleum and chemical industries etc.

2. Product Information

Product Name: Power transformer; Product Model: SFZ-40000/115

Table 1 Material composition of the products (in accordance with EN IEC 62474) considered in the analysis. Materials accounting for less than 1% of the total mass was not considered.

Product Identification Code	SFZ-40000/115		
Operating power (kVA)	40000		
Operating primary voltage (kV)	115		
Operating secondary voltage (kV)	34.5		
Country of installation	The Repiblic of Colombia		
Total product mass, without packaging and transformer oil(kg)	43795		
Material content	**ID**	**kg**	**%**
Stainless steel	M-100	363.00	0.39%
Other ferrous alloys, non-stainless steels	M-119	34445.43	57.50%
Aluminium and its alloys	M-120	231.53	0.14%
Copper and its alloys	M-121	6062.29	0.15%
Ceramics	M-160	474.00	0.26%
Polyamide (unfilled)	M-208	14.15	0.03%
Other unfilled thermoplastics	M-249	127.71	0.22%
NBR	M-320	80.00	0.33%
Paper	M-341	1693.16	3.09%
Oils and greases	M-410	13100.00	24.80%
Other material（cable，BVR，etc）		304.08	13.09%

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 conduted speately 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.

3.2. System, temporal, and geographical boundaries

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

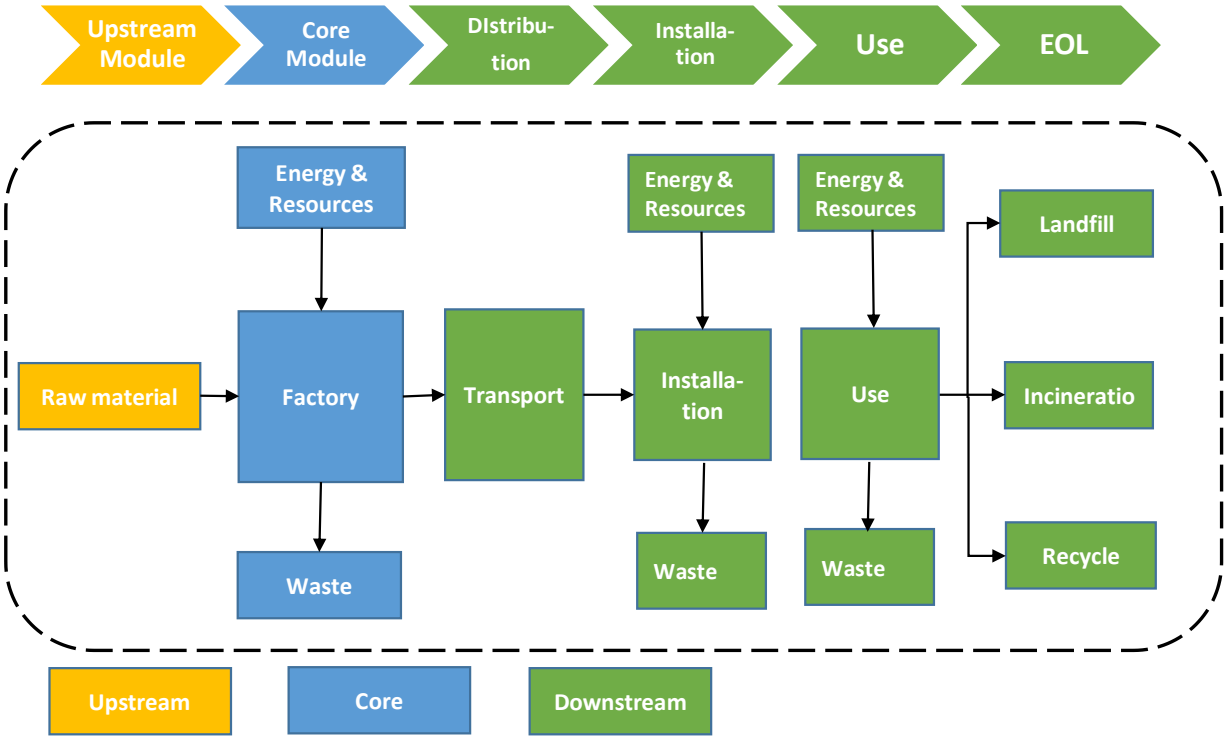

Figure 1: Phases and processes included

Manufacturing stage. This phase includes the upstream and core modules described previously (raw material transformation, transportation of raw materials and semi-finished products, produc- tion of the finished product packaging, generation of process waste including its transportation to the disposal sire, energy and material consumption associated to plant operations);

Distribution stage. This module includes the impacts related to the distribution of the product at the installation site;

Installation stage. This module includes the end of life of packaging, the energy consumption as- sociated to installation and setup, scrap and waste generated during the installation stage;

Use & Maintenance Stage. This module includes the energy consumed by the transformer to op- erate during its entire reference service life, ordinary scheduled maintenance and extraordinary scheduled maintenance.

End of Life Stage. This module includes the transportation of the transformer to the collection site, disassembly operations, distribution and destination of the various material flows to be sent for re- cycling or disposal.

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 produc- tion began in 2022 (reference year). For plant consumption, reference was made to the data related to the CHINT production plant and referred to the year 2022 (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 Jiangsu, Zhejiang and Shanghai provinces. Where possible, the specific origin of the raw material has been investigated and characterized accordingly. For the downstream phases, an Columbia scenario was considered, knowing the exact position of where the transformers will be in- stalled.

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 CO2 eq.
Global Warming Potential – biogenic (GWP-biogenic)	kg CO2 eq.
Global Warming Potential – land use and land use change (GWP-luluc)	kg CO2 eq.
Global Warming Potential – total (GWP-total)	kg CO2 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.
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 (user) deprivation potential (WDP)	m3 world eq. Deprived

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.).
- Minor parts such as spring, oil level gauge, valve stem, etc., have small weight and the material is mostly single metal material, so its input and output and potential environmental impact are cut-offed. Weight of the cut-offed part is 118.7kg in total, accounting for 0.27% of the transformer body weight, which comply with the Cut-off criteria.

3.5. Allocation Principles

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 SFZ-40000/115-111087-111087 to the total rated power of transformers produced in the plant in 2022.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:

Table2 – 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 CHINT according to product's bill of material, losses for metal cutting, wood and painting are considered while others were excluded. Raw material loss rate is assumed to be 3% for silicon steel sheet, 25% for steel, 20% for carboard insulation parts and 5% for wood packaging manufacturing. Loss of paint per transformer is assumed to be 60kg. Loss rates were provided by CHINT in accordance with expertise judgement from technical department. • For raw material transportation, due to large amount of raw material and various of supplier, it is assumed that average transport distance for raw material is 1000km,each shipment of raw material travels the same distance. • The density of wood package is assumed to be 740kg/m3 as glued solid timber is used.
	Core Module	• China consumption electricity mix was used in the core module as residual mix is not available. • Assume same amount of energy and resource consumption were used to produce each unit of rated power of transformer in the manufacturing phase. • Assume same amount of waste were produced to produce each unit of transformer in the manufacturing phase. • The distance from the CHINT plant to the downstream waste disposal site is assumed to be 1000km.

DISTRIBUTION STAGE	Downstream Module	• The product is to be used in Colombia. 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 Colombia to the client is assumed to be 1000km.
INSTALLATION STAGE		• Energy and resources needed during installation are provided by CHINT, it is assumed the same amount were used to install each unit of transformer. • The distance from the user installation site to the downstream waste disposal site is also assumed to be 1000km • 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 CHINT in accordance with PCR EPDItaly018, it is assumed the same amount were used to install each unit of transformer. • It should be noted that For transformer SFZ-40000/115-111087, the downstream client only requested load losses for the 30MVA scenario (93kW), so in order to calculate the load losses for 40MVA, calculation was required. Pload=93*(40/30)^2=165.3kw. • Pnoload is the power dissipated in case no losses shall occur. It is expressed in kW. For transformer SFZ-40000/115-111087, Pnoload is 20kw according to clients' requirement and CHINT test report. • Paux is the power loss due to auxiliary activities at no load (such as cooling). It is expressed in kW. For transformer SFZ-40000/115-111087, Paux is 0.37*4kw, calculated by the rated power of fan(0.37kw each) multiply by the number of fan(4) used in transformer SFZ-40000/115-111087. • According to expert judgement and from various users provided by CHINT, 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 v3.9 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 9.5 software was used to establish the model for the life cycle of products and calculate LCA results.

5. Environmental Impact Assessment

Environmental impact descriptive parameters

Table 3

Indicator	Unit	Total	Upstream Module	Core	Downstream			
			Manufacturing		Distribution	Installation	Use	End of Life
GWP-total	kg CO2 eq	7.84E+06	1.72E+05	1.63E+04	1.76E+04	5.51E+03	7.59E+06	3.41E+04
GWP-biogenic	kg CO2 eq	1.18E+06	-3.60E+03	-4.49E+01	1.28E+00	4.55E+03	1.17E+06	3.11E+03
GWP-fossil	kg CO2 eq	5.99E+06	1.75E+05	1.64E+04	1.76E+04	9.58E+02	5.75E+06	3.09E+04
GWP-luluc	kg CO2 eq	6.67E+05	4.60E+02	3.91E+00	1.19E+01	7.89E+00	6.67E+05	3.43E+00
AP	mol H+ eq	6.20E+04	4.06E+03	4.96E+01	3.44E+02	5.32E+00	5.75E+04	2.27E+01
EP-freshwater	kg P eq	2.11E+03	3.18E+02	1.78E+00	9.25E-01	8.96E-02	1.79E+03	2.17E+00
ODP	kg CFC11 eq	3.01E-02	3.18E-03	1.27E-04	2.79E-04	1.24E-05	2.63E-02	1.40E-04
POCP	kg NMVOC eq	2.16E+04	1.30E+03	3.53E+01	2.70E+02	6.63E+00	2.00E+04	3.10E+01
ADPF	MJ	7.10E+07	2.60E+06	1.45E+05	2.35E+05	1.08E+04	6.79E+07	9.66E+04
ADPE	kg Sb eq	4.73E+01	4.48E+01	3.54E-02	2.93E-02	2.68E-03	2.47E+00	1.82E-02
WDP	m3 depriv.	8.09E+05	6.15E+04	4.93E+03	8.14E+02	1.26E+01	7.41E+05	1.16E+03

Parameters describing resource use

Table 4

Parameter	Unit	Total	Upstream Module	Core	Downstream			
			Manufacturing		Distribution	Installation	Use	End of Life
PENRE	MJ, net calorific value	7.05E+07	2.06E+06	1.45E+05	2.35E+05	1.08E+04	6.80E+07	9.66E+04
PERE	MJ, net calorific value	9.69E+07	3.16E+05	9.93E+03	2.23E+03	1.22E+03	9.66E+07	1.44E+03
PENRM	MJ, net calorific value	5.49E+05	5.49E+05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PERM	MJ, net calorific value	4.90E+04	4.90E+04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PENRT	MJ, net calorific value	7.10E+07	2.61E+06	1.45E+05	2.35E+05	1.08E+04	6.80E+07	9.66E+04
PERT	MJ, net calorific value	9.70E+07	3.65E+05	9.93E+03	2.23E+03	1.22E+03	9.66E+07	1.44E+03
FW	m^3	1.06E+05	1.80E+03	1.19E+02	2.69E+01	1.79E+00	1.04E+05	3.43E+01
MS	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
RSF	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NRSF	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

PENRE = Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials; **PERE =** Use of renewable primary energy excluding renewable primary energy resources used as raw materials; **PENRM =** Use of non-renewable primary energy resources used as raw materials; **PERM =** Use of renewable primary energy resources used as raw materials; **PENRT =** Total use of non-renewable primary energy resources; **PERT =** Total use of renewable primary energy resources; **FW** = Use of net fresh water; **MS** = Use of secondary material; **RSF** = Use of renewable secondary fuels**; NRSF** = Use of non-renewable secondary fuels. The figures reported are rounded, leading to a small difference between the sum of the impacts of the individual phases and the total impact reported for each category.

Waste production descriptive parameters

Table 5

Parameter	Unit	Total	Upstream Module	Core	Downstream			
			Manufacturing		Distribution	Installation	Use	End of Life
Hazardous waste disposed (HWD)	kg	1.40E+04	0.00E+00	2.07E+02	0.00E+00	0.00E+00	0.00E+00	1.38E+04
Non-hazardous waste disposed (NHWD)	kg	1.16E+04	0.00E+00	0.00E+00	0.00E+00	3.16E+03	0.00E+00	8.39E+03
Radioactive waste disposed (RWD)	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Materials for energy recovery (MER)	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Material for recycling (MFR)	kg	3.95E+04	0.00E+00	3.64E+03	0.00E+00	1.23E+03	0.00E+00	3.46E+04
Components for reuse (CRU)	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Exported thermal energy (ETE)	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Exported electricity energy (EEE)	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

*****The figures reported are rounded, leading to a small difference between the sum of the impacts of the individual phases and the total impact reported for each category.

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. 2, 2020/10/21
- EPDItaly018 – Electronic and electrical products and systems – Power transformers, Rev. 3.5, 2021/12/13
- EN 15804:2012+A2:2019 Sustainability of construction works – Environmental product declarations – Core rules for the product category of construction products
- EN 50693:2019 Product category rules for life cycle assessments of electronic and electrical products and systems
- CHINT TRANSFORMER SFZ-40000/115-111087 LCA Report