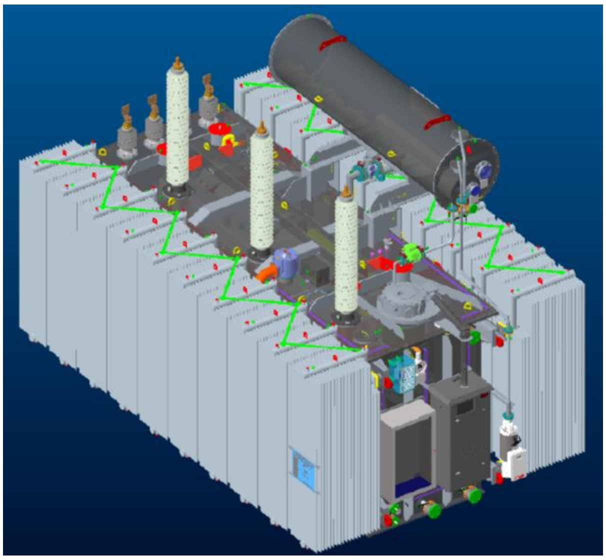
Environmental Product Declaration

Mineral and vegetable oil immersed transformers (40 MVA)

In compliance with ISO 14025 and EN 50693

EPD Owner: Hitachi Energy Italy Spa
Products ID: GST002-40MVA-HV132-MV15,6 ONAN; GST002-40MVA-HV150-MV20,8 ONAN; GST002-40MVA-HV132-MV15,6 KNAN; GST002-40MVA-HV150-MV20,8 KNAN
Site plant: Via Campestrin 6/A, 35043 Monselice (PD), Italy



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General Information

EPD Owner	**Hitachi Energy Italy Spa**
Location of the production site	Via Campestrin 6/A, 35043 Monselice (PD), Italy https://www.hitachienergy.com/
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Reference documents	EN 50693:2019 – Product category rules for life cycle assessment of electronic and electrical products and systems Regolamento del programma EPDItaly rev.5
Reference PCRs	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
Technical support	Spin Life s.r.l. - Spin-off of University of Padova Via E. degli Scrovegni 29 - 35131 Padova T. 049 878 9120 - info@spinlife.it
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

The Monselice Transformers Factory is part of Hitachi Energy Italy Spa, which is in turn part of Hitachi Energy (a subsidiary of Hitachi corporation).

Hitachi Energy is a technology and market global leader in electrical power grids. The company provides engineering services for grid infrastructures, grid automation solutions, high voltage products, and transformers.

Hitachi Energy is advancing the world's energy system to be more sustainable, flexible, and secure. As the pioneering technology leader, the company collaborates with customers and partners to enable a sustainable energy future for today's generations and those to come.

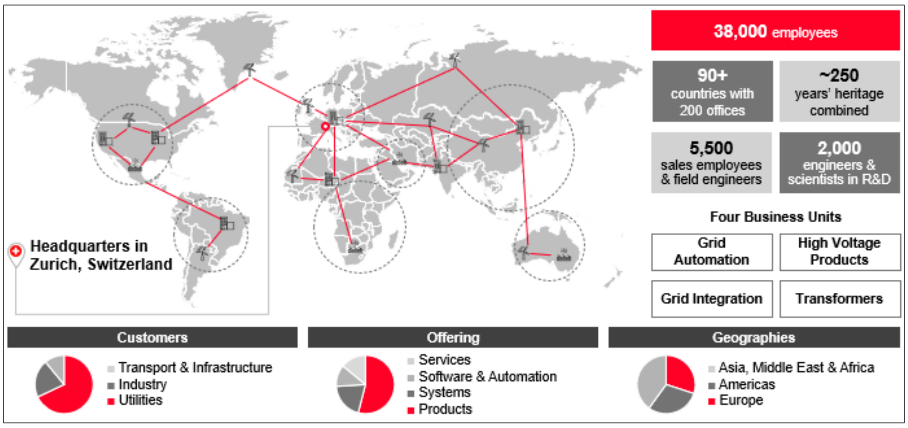

Figure 1 Hitachi Energy global headquarters

The Monselice local unit is part of the Transformers business unit. Monselice hosts all transformers related expertise from R&D and engineering to manufacturing and testing to commissioning and service.

The factory in Monselice is a leading center for product and process development. Over the years, it has acquired international recognition, especially for its product and process excellence.

The factory's history goes back a long way. In 1952 the Scarpa company set up INDELVE (Industria Elettrotecnica Veneta) S.p.A., which dealt in distribution transformers. In 1988 ABB took over INDELVE and after two decades decided to transfer the production to the current facility that was completed and became operative in 2009. In 2020, the facility was transferred to Hitachi ABB Power Grids (Hitachi Energy since Oct. 2021), when the joint venture between Hitachi and ABB was established.

The Monselice local unit quality, environment, health and safety management system is certified ISO 9001 (since 1994 – Certification number: CERT-00049-93-AQ-MIL-SINCERT), ISO 14001 (since 2002 – Certification number: CERT-474-2002-AE-MIL-SINCERT)) and ISO 45001 (since 2004 with OHSAS18001 standard - Certification number: CERT-049-2004-AHSO-MIL-SINCERT).

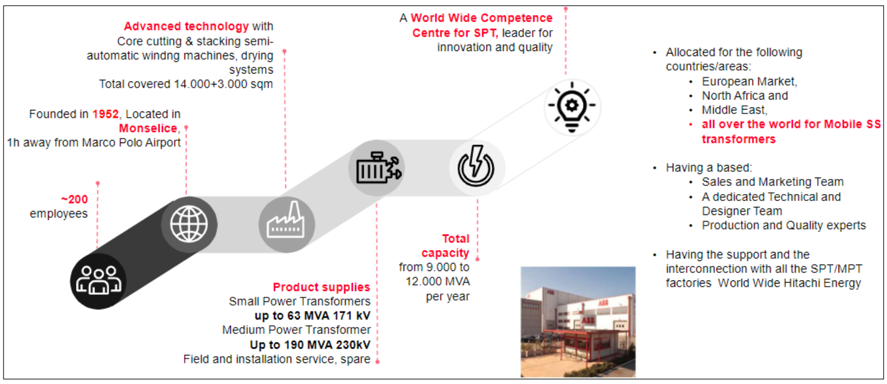

Figure 2 The Hitachi Energy Monselice local unit

2. Product Information

Power transformers are used in the power grids for transferring power from one system to another one by step-up or by step-down the main voltage with the same frequency. The transformers are a fundamental component of the power grids infrastructures as they enable the transport of AC electricity at High Voltage reducing energy losses and minimizing material usage for cables. Then transformers, stepping down at Medium and Low Voltage, can supply the final user at a desired and stable voltage for a safer and more efficient use of electricity.

The four power transformers considered in this EPD have a rated power of 40 MVA and mineral or bio-based insulating liquid. They are used in the Italian power grid “Primary substations”, where high voltage level is lowered to medium voltage level.

The 40 MVA Monselice transformers are designed, manufactured and tested in accordance with the customer and IEC60076 international standard.

Transformer active part is made by core (electrical steel for magnetic flux circulation) and copper windings (High Voltage, Medium Voltage and Regulation windings for voltage transformation).

The active part of the transformer is confined in a steel tank and immersed in insulating oil. The tank is equipped with radiators to cool the oil and an expansion tank (called conservator) to allow the oil expansion. These transformers have a natural air convection cooling system so neither oil pumps nor air fans are present to force flows. The steel tank ensure also reduction of electrical, noise and electromagnetic risks. Each transformer has an on-load tap changer that adjust the output voltage. The OLTC is controlled by an automatic device that allows to keep the MV voltage constant as the load absorbed by the network and the voltage on the HV side vary.

The connection of the transformer is made by three HV silicone bushing and four MV silicone bushing.

The designed transformers are equipped with other accessories: level gauge for oil conservator, filling and drain valves, oil sampling device, earthing terminals, lifting lugs, jacking packs, maintenance-free dehydrating breather, Buchholz relay and oil thermometers.

The transformers are designed to have a minimum of 30 years of life use. Hitachi Energy Monselice can also provide the service to maintain the transformers efficiency and reliability during all its operative lifetime. Minimum ordinary service activities are:

- periodical electrical measurements
- inspections on transformer’s components integrity
- OLTC oil change.

The designed transformers materials are valuable and can be 99% reused and/or recycled ensuring a high level of circularity for transformers. In Italy (where all these40 MVA transformers are installed) authorized companies, specialized in power grids equipment waste management, recover most of transformer materials: copper, electrical steel, steel and oil. Hitachi Energy Monselice collaborates with these expertise suppliers, ensuring the transformer materials reusage and recycle.

Please refer to the company contacts for additional material.

Table 1 Main information about the products

Product ID	**GST002-40MVA-HV132-MV15,6 ONAN**	**GST002-40MVA-HV150-M20,8 ONAN**	**GST002-40MVA-HV132-MV15,6 KNAN**	**GST002-40MVA-HV150-MV20,8 KNAN**
Type	Three-phase transformer for outdoor use	Three-phase transformer for out-door use	Three-phase transformer for outdoor use	Three-phase transformer for outdoor use
Rated voltage [kV]	132/15.6	150/20.8	132/15.6	150/20.8
Rated Power [MVA]	40	40	40	40
Frequency [Hz]	50	50	50	50
Classification according to the reference PCR	Medium	Medium	Medium	Medium
Mass [kg]	57’380	60’030	63’209	69’739
Type and quantity of insulating liquid [kg]	13’500 (mineral oil)	15’250 (mineral oil)	16’050 (natural ester oil)	18’800 (natural ester oil)
Cooling system	ONAN	ONAN	KNAN	KNAN
Area in which transform-ers are sold and in-stalled (or intended to be installed)	Italy	Italy	Italy	Italy

Table 2 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.

	Materials	**GST002-40MVA-HV132-MV15,6 ONAN**		**GST002-40MVA-HV150-M20,8 ONAN**		**GST002-40MVA-HV132-MV15,6 KNAN**		**GST002-40MVA-HV150-MV20,8 KNAN**	
		Weight [kg]	%	Weight [kg]	%	Weight [kg]	%	Weight [kg]	%
Metals	Steel (M-100)	36573,53	63,8%	37340	62,3%	38981	61,8%	42856	61,5%
	Copper (M-121)	5796,00	10,1%	5854	9,8%	6420	10,2%	6270	9,0%
	Other metals	515,00	0,9%	518	0,9%	542	0,9%	474	0,7%
Others	Mineral Oil (M-410)	13500,00	23,5%	15250	25,4%	-	-	-	-
	Natural ester oil	-	-	-	-	16050	25,4%	18800	27,0%
	Pressboard (M-341)	306,54	0,5%	331	0,6%	377	0,6%	416	0,6%
	Wood (M-340)	363,37	0,6%	362	0,6%	398	0,6%	464	0,7%
	Bakelite (M-319)	23,16	0,0%	28	0,0%	34	0,1%	39	0,1%
	Other	263,86	0,5%	267	0,4%	266	0,4%	335	0,5%

3. Life Cycle Assessment Information

Life Cycle Assessment (LCA) is an analytical tool that captures the overall potential environmental impacts of a product, process or human activity from raw material extraction, through production and use, to end of life. LCA studies are structured in 4 phases. The *Goal and scope definition* phase clarifies the objective of the study and determines the main methodological boundaries, as well as the life cycle processes to be included in the analysis (also referred to as system boundaries). Another fundamental step of this phase is the definition of the so-called functional unit which is the measuring unit that quantifies the function of the product under study. The *Inventory analysis* phase includes data collection and modelling of all of the input and outputs of material, energy, and other elementary flows that can cause potential environmental impacts. In the *Life cycle impact assessment* phase, inventory data are characterized into potential environmental impacts. Finally, in the *Interpretation* phase the validity of the results with respect to the purpose and scope of the study are commented and the most impactful stages of the life cycle are identified.

3.1. Declared unit

The declared unit is defined as a single unit of transformer operating for 35 years. The reference flow is defined as a single unit of transformer produced by Hitachi Energy Italy Spa. The main characteristics of the power grid transformers analysed are described in Table 1.

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:

1. **Manufacturing stage**. This phase includes the upstream and core modules described previously (raw material transformation, transportation of raw materials and semi-finished products, production of the finished product packaging, generation of process waste including its transportation to the disposal sire, energy and material consumption associated to plant operations);
2. **Distribution stage**. This module includes the impacts related to the distribution of the product at the installation site;
3. **Installation stage**. This module includes the end of life of packaging, the energy consumption associated to installation and setup, scrap and waste generated during the installation stage;
4. **Use & Maintenance Stage.** This module includes the energy consumed by the transformer to operate during its entire reference service life, ordinary scheduled maintenance and extraordinary scheduled maintenance.
5. **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 recycling 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 production began in 2021 (reference year). For plant consumption, reference was made to the data related to the Monselice plant (PD) and referred to the year 2020 (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 all over the world. Where possible, the specific origin of the raw material has been investigated and characterized accordingly. For the downstream phases, an Italian scenario was considered, knowing the exact position of where the transformers will be installed.

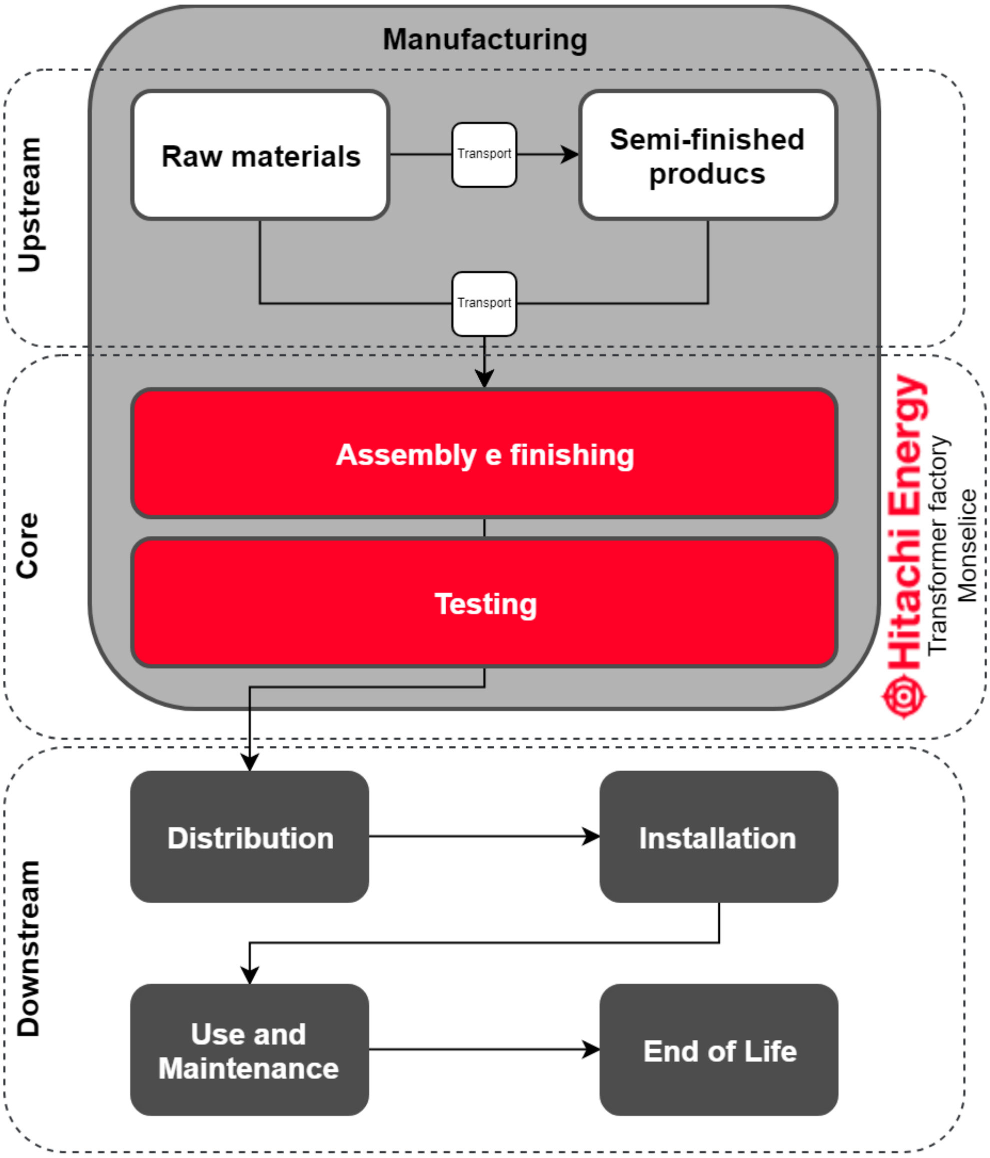

Figure 3 Processes included in the EPD

Upstream

- **Manufacturing**
  - Acquisition of raw materilas
  - Manufacturing of semifinished products
  - Transport to manufacturing site

Core

- **Manufacturing**
  - Manufacturing of the produc constituents
  - Product assembly
  - Process waste management

Downstream

- **Distribution**
- **Installation**
- **Use**
  - Energy lossess
  - Ordinary and extraordinary maintenance
- **End of life**
  - Transport
  - End of life treatment

Figure 4 Phases and processes included in the EPD

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:

- **Climate change** (kg CO_2 equiv). Climate change can have adverse effects on ecosystem health, human health and material well-being. Climate change is linked to greenhouse gas emissions into the air. The characterization model used is that developed by the Intergovernmental Panel on Climate Change (IPCC). The characterization factors are expressed as global warming potential for 100 years (GWP100), in kg of carbon dioxide / kg of emissions. The geographical scope of this indicator is on a global scale. The GWP was also reported as GWP-fossil, GWP-biogenic and GWP-luluc. As required by the Standard EN 15804 + A2:2019, the temporary biogenic carbon storage due, for example, to the recycling of materials, was not taken into account. The biogenic carbon content of recycled materials was treated as an emission of biogenic CO_2 from the technosphere to nature.
- **Ozone depletion** (kg CFC-11 equiv). This category concerns the depletion of stratospheric ozone, which can have adverse effects on human health, animal health, terrestrial and aquatic ecosystems, biochemical cycles and materials. The characterization model used is that developed by the Meteorological Organization (WMO) which defines the ozone reduction potential of different gases (kg CFC-11 equivalent / kg of emission). The geographical scope of this indicator is on a global scale.
- **Acidification** (mol H^+ equiv). This impact category covers acidifying substances that cause a wide range of impacts on soil, groundwater, surface water, organisms, ecosystems and materials (buildings). The acidification potential (AP) for emissions is calculated as reported in Seppälä et al. 2006 and Posch et al, 2008. AP is expressed in mol H + equivalents / kg of emissions.
- **Eutrophication aquatic freshwater** (kg PO_4^{3-} equiv). Eutrophication includes all impacts due to excessive levels of macronutrients in the environment caused by emissions of nutrients to water.
- **Photochemical ozone formation** (kg NMVOC eq.). Photo-oxidant formation is the formation of reactive substances (mainly ozone) which are harmful to human health and ecosystems and which can also damage crops. This problem is also referred to as "summer smog". Winter smog does not fall within this category. The photochemical ozone creation potential (POCP) for the emission of substances into the air is calculated according to what reported in Van Zelm et al. (2008) and expressed in equivalent kg of NMVOC / kg of emissions.
- **Depletion of abiotic resources-mineral and metals** (kg Sb equiv) and **Depletion of abiotic resources-fossil fuels** (MJ). These impact categories relate to the protection of human well-being, human health and ecosystem health and the extraction of minerals and fossil fuels. The abiotic depletion factor is determined for each mineral and fossil fuel extraction (kg of antimony equivalents / kg of extraction) on the basis of reserves and the de-accumulation rate. The geographical scope of this indicator is on a global scale[1].
- **Water use** (m^3 world eq. deprived). The indicator measures the Relative Available WAter REmaining (AWARE), or the amount of water remaining in a basin, after the demand for water resources for human and ecosystem activities has been met (Boulay et al. 2018). This indicator evaluates the potential for deprivation of water resources, both for humans and ecosystems, starting from the assumption that the less water is available, the more likely it is that a further user, be it a human or an ecosystem, will be deprived of it (Boulay et al., 2016).[1]

[1] The results of these environmental impact indicators shall be used with care as the uncertainties on these results are high or as there is limited experienced with the indicator.

3.4. Cut-off

The criterion chosen for the initial inclusion of inputs and outputs is based on the definition of a 5% cut-off level (according to EN 50693:2019), both in terms of mass, energy and environmental significance. This means that a process is considered negligible if it represents less than 5% of the total mass, primary energy and impact. However, all processes for which data are available were considered, even if they contribute less than 1%. According with the reference sub-PCR (§3.2.3.9) the following flows were neglected:

- Production and use 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. The cut-off approach was applied in the modelling of transformer components, where some minor contributions were neglected (auxiliary components like plates and screws). However, it is emphasized that at least 99.5% by weight (compared to the BOM value) was modelled. Considering, therefore, that the contribution of raw materials to the overall impact is less than 5%, it can be deduced that the inclusion of 0.5% by weight of the processor in the cut-off results in a neglection of environmental impacts of well below 1%.
- Material and energy flows related to dismantling phase, because it is reasonable to assume that dismantling is performed by adopting manual tools (e.g. screwdrivers, hammers, etc.). This threshold also includes disassembly consumption (electricity), the significance of which in terms of environmental impacts was assessed through a significance analysis (confirming the validity of the assumption).
- Devices external to the product itself required for installation.

3.5. Allocation Principles

In the case under study allocation of material and energy flows was necessary inasmuch several transformer models are produced in the Monselice (PD) plant. The allocation principle chosen is based on a physical property of transformers that is considered representative, namely their apparent power (measured in MVA).

The allocation was applied in the following cases: consumption of electricity, methane gas, diesel fuel, dry air, nitrogen, resin, air emissions associated with the processes carried out at the Monselice (PD) plant.

3.6. Limitation and Assumption

For transformers produced in 2021, the plant consumptions in 2020 was assumed to be representative. This assumption was found to be appropriate in view of the modest contribution (less than 1%) of factory consumption to the total impact (see §5). The analysis of the plant environmental data for the period January 2021 - December 2021 does not show any changes such that the values for the year 2020 cannot be considered representative. At the beginning of 2022, the production of one transformer was already completed.

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 v3.6 database (Frischknecht R. 2005) 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, and emissions in the various environmental compartments for the products analyzed, using the analysis of the transformers' executive projects, as well as analyzing the test reports and the equipment's use and maintenance manuals. The data collection sheet was verified and checked by mass balances and reporting any inconsistencies that were clarified and resolved.

The software used is SimaPro update 9.1.1.

Table 3 Description of the main characteristics of the inventory analysis

Life Cycle Stage	Description
Upstream – Manufacturing stage	For the characterization of raw materials and semi-finished products entering the plant, reference was made to Ecoinvent 3.6 datasets, where possible suitably modified in order to make them more representative of the specific country of origin. The origin of the raw materials, and the consequent transport process, was modeled in a punctual manner for at least 95% by weight of the components, adopting an average scenario of 100 km for the remaining materials. The distances were calculated using web tools such as Google Maps and Ecotransit.
Core – Manufacturing stage	The production process at the plant has been characterized by considering the following inventory flows: consumption of electricity, combustion of methane gas and diesel fuel, water withdrawal and discharge, consumption of technical gases and resin, waste management and air emissions. For the modeling of electricity, reference was made to the specific Renewable Energy Mix according to the certificate of cancellation guarantees of origin (100% hydroelectricity). Next, the energy mix was reconstructed using the processes contained in the Ecoinvent 3.6 database. Once the high voltage electricity was characterized, the medium voltage conversion process found in Ecoinvent 3.6 was applied.
Downstream - Distribution	For the definition of the distribution processes, the actual distances were calculated for each product, as the installation locations are known. All products are intended for the Italian market.
Downstream - Installation	The transformers are shipped already assembled (without any packaging), therefore no significant activities are foreseen for the installation phase
Downstream – Use	Quantification of losses during the use phase was performed in accordance with the reference PCR by applying the following equation: $$E_d[kWh] = (P_{load} \cdot k_{load}^2 + P_{noload}) \cdot t_{year} \cdot RSL + P_{aux} \cdot f_{aux} \cdot t_{year} \cdot RSL$$ Where: P_{load} is the load loss of the transformer at 75 °C reference temperature at nominal power. It is expressed in kW; K_{load} represents an average load factor for the equipment. For calculations based on this PCR, 70% of nominal power shall be adopted; P_{noload} is the power dissipated in case no losses shall occur. It is expressed in kW; P_{aux} is the power loss due to auxiliary activities at no load (such as cooling). It is expressed in kW; f_{aux} represents the fraction of time in which ancillary equipment is operating. It is expressed in % over 1 year; t_{year} is the total amount of hours during a year. For this calculation, 8 760 hours shall be considered; RSL represents the Reference Service Life, defined as 35 years for EPDs based on the PCR. For the definition of the values associated with the parameters P_{load} and P_{noload}, reference was made to internal test reports. The electrical energy in this phase was modelled according to the residual mix (high voltage). The electrical energy in this phase was modelled according to the residual mix (high voltage) for the Italian market proposed by AIB - Association of issuing bodies in the report '*European Residual Mixes - Results of the calculation of residual mixes for the calendar year 2020'*.

Life Cycle Stage	Description
Downstream – Maintenance	In accordance with the reference PCR, in addition to losses, ordinary and extraordinary maintenance operations are also associated with the use phase. The maintenance scenarios have been defined according to the indications of the company departments responsible for the service, and can be summarized as follows: ▪ 1400 kg of mineral oil replacements (including transport and disposal) were considered for ordinary maintenance; ▪ For the extraordinary maintenance, the replacement of the insulators and the main electrical equipment, i.e. the switchboard (also considering their transport and disposal) was considered.
Downstream – End of Life	The transformer end-of-life modelling choices were made on the basis of what is reported in the operating manual written by the company., in "Part 1: Environment and Safety", and considering average disposal scenarios. In accordance with the reference PCR, the consumption associated with transformer disassembly activities was not considered in the model according to cut-off. For steel, aluminum, and copper waste, in accordance with the scenarios for special ferrous and non-ferrous metal waste (ISPRA 2018), it was assumed that 99% of the material is destined for recovery activities. For dielectric mineral and natural ester dielectric oil a recycling scenario was assumed. For other materials, a disposal scenario was considered.

5. Environmental Impact Assessment

5.1. Power transformer GST002-40MVA-HV132-MV15,6 ONAN

Environmental impact descriptive parameters

Table 4

Impact category	Unit	Total	Upstream	Core	Downstream			
			Manufacturing		Distribution	Installation	Use	End of Life
GWP-fossil	kg CO_2eq.	2,11E+07	1,43E+05	5,38E+03	1,97E+03	0,00E+00	2,09E+07	5,48E+02
GWP-biogenic	kg CO_2eq.	3,91E+05	-1,31E+03	5,14E+01	1,44E+00	0,00E+00	3,91E+05	1,28E+03
GWP-luluc	kg CO_2eq.	1,69E+03	1,61E+02	5,33E-01	5,78E-01	0,00E+00	1,53E+03	1,99E-01
GWP-total	kg CO_2eq.	2,15E+07	1,42E+05	5,43E+03	1,97E+03	0,00E+00	2,13E+07	1,82E+03
ODP	kg CFC-11 eq.	3,08E+00	1,89E-02	5,36E-04	4,66E-04	0,00E+00	3,06E+00	1,25E-04
AP	mol H^+ eq.	9,03E+04	1,45E+03	1,06E+01	1,00E+01	0,00E+00	8,89E+04	2,83E+00
EP-freshwater	kgPO_4^{3-}eq	1,41E+04	4,76E+02	1,00E+00	4,31E-01	0,00E+00	1,36E+04	1,57E-01
POCP	kg NMVOC eq.	4,53E+04	1,15E+03	9,36E+00	1,12E+01	0,00E+00	4,41E+04	3,07E+00
ADP-minerals and metals	kg Sb eq.	3,09E+01	1,45E+01	1,74E-02	3,38E-02	0,00E+00	1,63E+01	9,75E-03
ADP-fossil	MJ, net cal. value	3,35E+08	2,29E+06	7,25E+04	3,08E+04	0,00E+00	3,33E+08	8,54E+03
WDP	m^3eq.	5,50E+06	5,10E+04	1,24E+04	1,00E+02	0,00E+00	5,44E+06	3,24E+01

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 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.

Parameters describing resource use

Table 5

Parameters	Unit	Total	Upstream	Core	Downstream			
			Manufacturing		Distribution	Installation	Use	End of Life
PENRE	MJ, lower cal. value	3,35E+08	1,66E+06	7,25E+04	3,08E+04	0,00E+00	3,33E+08	8,54E+03
PERE	MJ, lower cal. value	9,72E+06	1,93E+05	5,58E+04	3,88E+02	0,00E+00	9,47E+06	1,43E+02
PENRM	MJ, lower cal. value	6,95E+05	6,30E+05	0,00E+00	0,00E+00	0,00E+00	6,53E+04	0,00E+00
PERM	MJ, lower cal. value	1,73E+04	1,73E+04	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
PENRT	MJ, lower cal. value	3,35E+08	2,29E+06	7,25E+04	3,08E+04	0,00E+00	3,33E+08	8,54E+03
PERT	MJ, lower cal. value	9,74E+06	2,10E+05	5,58E+04	3,88E+02	0,00E+00	9,47E+06	1,43E+02
FW	m^3	1,39E+05	1,46E+03	2,79E+02	3,51E+00	0,00E+00	1,38E+05	1,16E+00
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 6

Parameters	Unit	Total	Upstream	Core	Downstream			
			Manufacturing		Distribution	Installation	Use	End of Life
HWD	kg	4,15E+02	1,01E+02	9,78E-02	7,47E-02	0,00E+00	3,14E+02	2,01E-02
NHWD	kg	6,10E+05	4,23E+04	6,96E+02	2,68E+03	0,00E+00	5,63E+05	1,13E+03
RWD	kg	1,03E+03	8,68E+00	4,66E-02	2,10E-01	0,00E+00	1,02E+03	5,71E-02
MER	kg	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
MFR	kg	6,07E+04	0,00E+00	3,50E+03	0,00E+00	0,00E+00	1,40E+03	5,58E+04
CRU	kg	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
ETE	MJ	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
EEE	MJ	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00

HWD = Hazardous waste disposed; N**HWD =** Non-hazardous waste disposed; **RWD =** Radioactive waste disposed; **MER =** Material for energy recover; **MFR =** Material for recycling; **CRU =** Component for reuse; **ETE =** Exported thermal energy; **EEE =** Exported electricity energy. 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.

5.2. Power transformer GST002-40MVA-HV150-MV20,8 ONAN

Environmental impact descriptive parameters

Table 7

Impact category	Unit	Total	Upstream	Core	Downstream			
			Manufacturing		Distribution	Installation	Use	End of Life
GWP-fossil	kg CO_2eq.	2,03E+07	1,49E+05	5,38E+03	4,74E+03	0,00E+00	2,01E+07	5,71E+02
GWP-biogenic	kg CO_2eq.	3,75E+05	-1,32E+03	5,14E+01	3,46E+00	0,00E+00	3,75E+05	1,27E+03
GWP-luluc	kg CO_2eq.	1,65E+03	1,80E+02	5,33E-01	1,40E+00	0,00E+00	1,47E+03	2,06E-01
GWP-total	kg CO_2eq.	2,06E+07	1,47E+05	5,43E+03	4,74E+03	0,00E+00	2,05E+07	1,84E+03
ODP	kg CFC-11 eq.	2,95E+00	2,06E-02	5,36E-04	1,12E-03	0,00E+00	2,93E+00	1,31E-04
AP	mol H^+ eq.	8,67E+04	1,49E+03	1,06E+01	2,43E+01	0,00E+00	8,52E+04	2,95E+00
EP-freshwater	kgPO_4^{3-}eq	1,35E+04	4,87E+02	1,00E+00	1,04E+00	0,00E+00	1,30E+04	1,63E-01
POCP	kg NMVOC eq.	4,36E+04	1,21E+03	9,36E+00	2,72E+01	0,00E+00	4,23E+04	3,20E+00
ADP-minerals and metals	kg Sb eq.	3,06E+01	1,49E+01	1,74E-02	8,15E-02	0,00E+00	1,56E+01	1,02E-02
ADP-fossil	MJ, net cal. value	3,22E+08	2,43E+06	7,25E+04	7,43E+04	0,00E+00	3,19E+08	8,91E+03
WDP	m^3eq.	5,28E+06	5,27E+04	1,24E+04	2,41E+02	0,00E+00	5,22E+06	3,37E+01

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 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.

Parameters describing resource use

Table 8

Parameters	Unit	Total	Upstream	Core	Downstream			
			Manufacturing		Distribution	Installation	Use	End of Life
PENRE	MJ, lower cal. value	3,21E+08	1,72E+06	7,25E+04	7,43E+04	0,00E+00	3,19E+08	8,91E+03
PERE	MJ, lower cal. value	9,34E+06	2,03E+05	5,58E+04	9,35E+02	0,00E+00	9,08E+06	1,48E+02
PENRM	MJ, lower cal. value	7,77E+05	7,11E+05	0,00E+00	0,00E+00	0,00E+00	6,53E+04	0,00E+00
PERM	MJ, lower cal. value	1,73E+04	1,73E+04	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
PENRT	MJ, lower cal. value	3,22E+08	2,43E+06	7,25E+04	7,43E+04	0,00E+00	3,19E+08	8,91E+03
PERT	MJ, lower cal. value	9,36E+06	2,20E+05	5,58E+04	9,35E+02	0,00E+00	9,08E+06	1,48E+02
FW	m^3	1,34E+05	1,51E+03	2,79E+02	8,46E+00	0,00E+00	1,32E+05	1,20E+00
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 9

Parameters	Unit	Total	Upstream	Core	Downstream			
			Manufacturing		Distribution	Installation	Use	End of Life
HWD	kg	4,05E+02	1,04E+02	9,78E-02	1,80E-01	0,00E+00	3,01E+02	2,10E-02
NHWD	kg	5,93E+05	4,42E+04	6,96E+02	6,46E+03	0,00E+00	5,40E+05	1,17E+03
RWD	kg	9,89E+02	9,47E+00	4,66E-02	5,07E-01	0,00E+00	9,79E+02	5,96E-02
MER	kg	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
MFR	kg	6,32E+04	0,00E+00	3,50E+03	0,00E+00	0,00E+00	1,40E+03	5,83E+04
CRU	kg	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
ETE	MJ	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
EEE	MJ	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00

HWD = Hazardous waste disposed; N**HWD =** Non-hazardous waste disposed; **RWD =** Radioactive waste disposed; **MER =** Material for energy recover; **MFR =** Material for recycling; **CRU =** Component for reuse; **ETE =** Exported thermal energy; **EEE =** Exported electricity energy. 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.

5.3. Power transformer GST002-40MVA-HV132-MV15,6 KNAN

Environmental impact descriptive parameters

Table 10

Impact category	Unit	Total	Upstream	Core	Downstream			
			Manufacturing		Distribution	Installation	Use	End of Life
GWP-fossil	kg CO_2eq.	2,06E+07	1,58E+05	5,38E+03	2,12E+03	0,00E+00	2,04E+07	6,00E+02
GWP-biogenic	kg CO_2eq.	3,81E+05	-4,52E+04	5,14E+01	1,55E+00	0,00E+00	3,81E+05	4,52E+04
GWP-luluc	kg CO_2eq.	4,46E+04	3,97E+04	5,33E-01	6,24E-01	0,00E+00	4,93E+03	2,15E-01
GWP-total	kg CO_2eq.	2,10E+07	1,53E+05	5,43E+03	2,12E+03	0,00E+00	2,08E+07	4,58E+04
ODP	kg CFC-11 eq.	2,99E+00	1,19E-02	5,36E-04	5,02E-04	0,00E+00	2,97E+00	1,38E-04
AP	mol H^+ eq.	8,82E+04	1,65E+03	1,06E+01	1,08E+01	0,00E+00	8,65E+04	3,09E+00
EP-freshwater	kgPO_4^{3-}eq	1,38E+04	5,39E+02	1,00E+00	4,64E-01	0,00E+00	1,32E+04	1,69E-01
POCP	kg NMVOC eq.	4,40E+04	1,02E+03	9,36E+00	1,21E+01	0,00E+00	4,29E+04	3,37E+00
ADP-minerals and metals	kg Sb eq.	3,10E+01	1,52E+01	1,74E-02	3,65E-02	0,00E+00	1,58E+01	1,07E-02
ADP-fossil	MJ, net cal. value	3,26E+08	1,81E+06	7,25E+04	3,32E+04	0,00E+00	3,24E+08	9,36E+03
WDP	m^3eq.	5,36E+06	5,50E+04	1,24E+04	1,08E+02	0,00E+00	5,30E+06	3,52E+01

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 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.

Parameters describing resource use

Table 11

Parameters	Unit	Total	Upstream	Core	Downstream			
			Manufacturing		Distribution	Installation	Use	End of Life
PENRE	MJ, lower cal. value	3,26E+08	1,96E+06	7,25E+04	3,32E+04	0,00E+00	3,24E+08	9,36E+03
PERE	MJ, lower cal. value	9,55E+06	2,64E+05	5,58E+04	4,18E+02	0,00E+00	9,22E+06	1,54E+02
PENRM	MJ, lower cal. value	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
PERM	MJ, lower cal. value	6,26E+05	5,77E+05	0,00E+00	0,00E+00	0,00E+00	4,87E+04	0,00E+00
PENRT	MJ, lower cal. value	3,26E+08	1,81E+06	7,25E+04	3,32E+04	0,00E+00	3,24E+08	9,36E+03
PERT	MJ, lower cal. value	1,02E+07	8,42E+05	5,58E+04	4,18E+02	0,00E+00	9,27E+06	1,54E+02
FW	m^3	1,36E+05	1,57E+03	2,79E+02	3,78E+00	0,00E+00	1,34E+05	1,25E+00
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 12

Parameters	Unit	Total	Upstream	Core	Downstream			
			Manufacturing		Distribution	Installation	Use	End of Life
HWD	kg	4,16E+02	1,11E+02	9,78E-02	8,05E-02	0,00E+00	3,05E+02	2,21E-02
NHWD	kg	6,02E+05	4,88E+04	6,96E+02	2,89E+03	0,00E+00	5,49E+05	1,23E+03
RWD	kg	9,99E+02	4,84E+00	4,66E-02	2,27E-01	0,00E+00	9,94E+02	6,26E-02
MER	kg	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
MFR	kg	6,62E+04	0,00E+00	3,50E+03	0,00E+00	0,00E+00	1,40E+03	6,13E+04
CRU	kg	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
ETE	MJ	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
EEE	MJ	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00

HWD = Hazardous waste disposed; N**HWD =** Non-hazardous waste disposed; **RWD =** Radioactive waste disposed; **MER =** Material for energy recover; **MFR =** Material for recycling; **CRU =** Component for reuse; **ETE =** Exported thermal energy; **EEE =** Exported electricity energy. 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.

5.4. Power transformer GST002- 40MVA-HV150-MV20,8 KNAN

Environmental impact descriptive parameters

Table 13

Impact category	Unit	Total	Upstream	Core	Downstream			
			Manufacturing		Distribution	Installation	Use	End of Life
GWP-fossil	kg CO_2eq.	2,05E+07	1,72E+05	5,38E+03	4,06E+03	0,00E+00	2,04E+07	6,60E+02
GWP-biogenic	kg CO_2eq.	3,80E+05	-5,29E+04	5,14E+01	2,97E+00	0,00E+00	3,80E+05	5,29E+04
GWP-luluc	kg CO_2eq.	5,14E+04	4,64E+04	5,33E-01	1,20E+00	0,00E+00	4,93E+03	2,33E-01
GWP-total	kg CO_2eq.	2,10E+07	1,65E+05	5,43E+03	4,06E+03	0,00E+00	2,08E+07	5,35E+04
ODP	kg CFC-11 eq.	2,98E+00	1,29E-02	5,36E-04	9,62E-04	0,00E+00	2,97E+00	1,52E-04
AP	mol H^+ eq.	8,82E+04	1,74E+03	1,06E+01	2,08E+01	0,00E+00	8,64E+04	3,40E+00
EP-freshwater	kgPO_4^{3-}eq	1,38E+04	5,56E+02	1,00E+00	8,90E-01	0,00E+00	1,32E+04	1,83E-01
POCP	kg NMVOC eq.	4,40E+04	1,11E+03	9,36E+00	2,32E+01	0,00E+00	4,29E+04	3,71E+00
ADP-minerals and metals	kg Sb eq.	3,11E+01	1,52E+01	1,74E-02	6,98E-02	0,00E+00	1,58E+01	1,17E-02
ADP-fossil	MJ, net cal. value	3,26E+08	1,97E+06	7,25E+04	6,36E+04	0,00E+00	3,24E+08	1,03E+04
WDP	m^3eq.	5,36E+06	5,89E+04	1,24E+04	2,07E+02	0,00E+00	5,29E+06	3,85E+01

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 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.

Parameters describing resource use

Table 14

Parameters	Unit	Total	Upstream	Core	Downstream			
			Manufacturing		Distribution	Installation	Use	End of Life
PENRE	MJ, lower cal. value	3,26E+08	2,14E+06	7,25E+04	6,36E+04	0,00E+00	3,24E+08	1,03E+04
PERE	MJ, lower cal. value	9,56E+06	2,85E+05	5,58E+04	8,01E+02	0,00E+00	9,21E+06	1,66E+02
PENRM	MJ, lower cal. value	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
PERM	MJ, lower cal. value	7,25E+05	6,76E+05	0,00E+00	0,00E+00	0,00E+00	4,87E+04	0,00E+00
PENRT	MJ, lower cal. value	3,26E+08	1,97E+06	7,25E+04	6,36E+04	0,00E+00	3,24E+08	1,03E+04
PERT	MJ, lower cal. value	1,03E+07	9,61E+05	5,58E+04	8,01E+02	0,00E+00	9,26E+06	1,66E+02
FW	m^3	1,36E+05	1,68E+03	2,79E+02	7,25E+00	0,00E+00	1,34E+05	1,37E+00
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 15

Parameters	Unit	Total	Upstream	Core	Downstream			
			Manufacturing		Distribution	Installation	Use	End of Life
HWD	kg	4,14E+02	1,09E+02	9,78E-02	1,54E-01	0,00E+00	3,05E+02	2,44E-02
NHWD	kg	6,06E+05	5,03E+04	6,96E+02	5,54E+03	0,00E+00	5,48E+05	1,35E+03
RWD	kg	9,98E+02	5,18E+00	4,66E-02	4,34E-01	0,00E+00	9,92E+02	6,90E-02
MER	kg	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
MFR	kg	7,26E+04	0,00E+00	3,50E+03	0,00E+00	0,00E+00	1,40E+03	6,77E+04
CRU	kg	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
ETE	MJ	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
EEE	MJ	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00

HWD = Hazardous waste disposed; N**HWD =** Non-hazardous waste disposed; **RWD =** Radioactive waste disposed; **MER =** Material for energy recover; **MFR =** Material for recycling; **CRU =** Component for reuse; **ETE =** Exported thermal energy; **EEE =** Exported electricity energy. 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.

5.5. Contribution analysis

In order to ensure a more complete interpretation of the results, an analysis of the contributions in graphic form is proposed below. Graphs are presented for the GWP total and the ADP-minerals and metals categories, divided into the following life cycle phases: manufacturing, distribution, use and end of life (the installation phase is omitted as no impacts are associated with it). In the other categories the contribution analysis is comparable to that of the GWP. For both the mineral and the natural oil transformers the energy losses during the use phase are the main source of impact in the GWP category. In the ADP-minerals and metals category the contribution of the manufacturing phase is relevant, being equals to 47.9%.

The contributions reported below refer to the average environmental profiles of the two mineral oil transformer and the two natural oil transformers presented in this EPD.

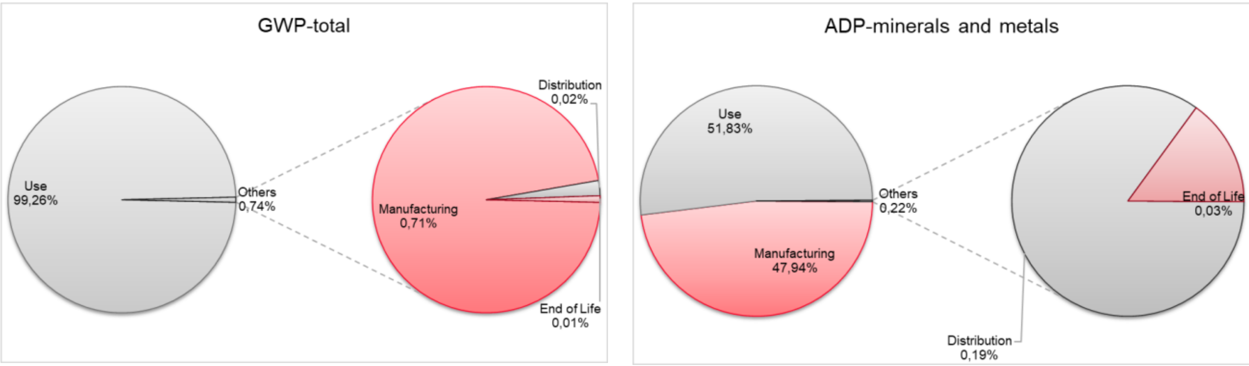

Figure 5 Contribution analysis for the average mineral oil transformer

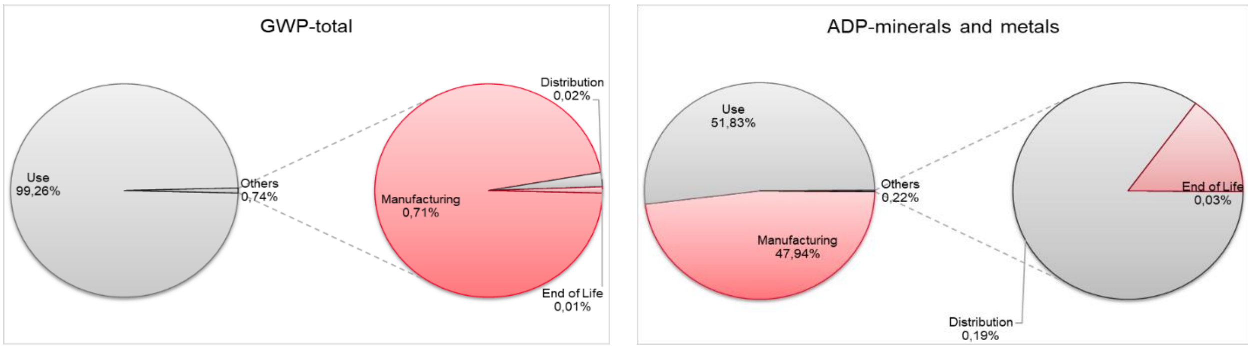

Figure 6 Contribution analysis for the average natural ester oil transformer

6. Additional environmental information

6.1. Results expressed for 1 MVA and 1 year

In order to ensure greater usability of the data, the following are the values of environmental impact and resource consumption, expressed for 1 year and normalized with respect to 1 MVA.

Environmental impact descriptive parameters

Table 16

Impact category	Unit	GST002-40MVA-HV132-MV15,6 ONAN	GST002-40MVA-HV150-MV20,8 ONAN	GST002-40MVA-HV132-MV15,6 KNAN	GST002-40MVA-HV150-MV20,8 KNAN
GWP-fossil	kg CO_2eq.	1,51E+04	1,45E+04	1,47E+04	1,47E+04
GWP-biogenic	kg CO_2eq.	2,79E+02	2,68E+02	2,72E+02	2,72E+02
GWP-luluc	kg CO_2eq.	1,21E+00	1,18E+00	3,19E+01	3,67E+01
GWP-total	kg CO_2eq.	1,54E+04	1,47E+04	1,50E+04	1,50E+04
ODP	kg CFC-11 eq.	2,20E-03	2,11E-03	2,13E-03	2,13E-03
AP	mol H^+ eq.	6,45E+01	6,20E+01	6,30E+01	6,30E+01
EP-freshwater	kgPO_4^{3-}eq	1,01E+01	9,66E+00	9,84E+00	9,84E+00
POCP	kg NMVOC eq.	3,23E+01	3,11E+01	3,14E+01	3,14E+01
ADP-minerals and metals	kg Sb eq.	2,20E-02	2,19E-02	2,22E-02	2,22E-02
ADP-fossil	MJ, net cal. value	2,39E+05	2,30E+05	2,33E+05	2,33E+05
WDP	m^3eq.	3,93E+03	3,77E+03	3,83E+03	3,83E+03

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

Parameters describing resource use

Table 17

Parameters	Unit	GST002-40MVA-HV132-MV15,6 ONAN	GST002-40MVA-HV150-MV20,8 ONAN	GST002-40MVA-HV132-MV15,6 KNAN	GST002-40MVA-HV150-MV20,8 KNAN
PENRE	MJ, lower cal. value	2,39E+05	2,29E+05	2,33E+05	2,33E+05
PERE	MJ, lower cal. value	6,94E+03	6,67E+03	6,82E+03	6,83E+03
PENRM	MJ, lower cal. value	4,97E+02	5,55E+02	0,00E+00	0,00E+00
PERM	MJ, lower cal. value	1,24E+01	1,23E+01	4,47E+02	5,18E+02
PENRT	MJ, lower cal. value	2,39E+05	2,30E+05	2,33E+05	2,33E+05
PERT	MJ, lower cal. value	6,96E+03	6,69E+03	7,27E+03	7,34E+03
FW	m^3	9,95E+01	9,55E+01	9,70E+01	9,69E+01
MS	kg	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
NRSF	MJ	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.

Waste production descriptive parameters

Table 18

Parameters	Unit	GST002-40MVA-HV132-MV15,6 ONAN	GST002-40MVA-HV150-MV20,8 ONAN	GST002-40MVA-HV132-MV15,6 KNAN	GST002-40MVA-HV150-MV20,8 KNAN
HWD	kg	2,96E-01	2,89E-01	2,97E-01	2,96E-01
NHWD	kg	4,36E+02	4,23E+02	4,30E+02	4,33E+02
RWD	kg	7,36E-01	7,07E-01	7,13E-01	7,13E-01
MER	kg	0,00E+00	0,00E+00	0,00E+00	0,00E+00
MFR	kg	4,33E+01	4,52E+01	4,73E+01	5,19E+01
CRU	kg	0,00E+00	0,00E+00	0,00E+00	0,00E+00
ETE	MJ	0,00E+00	0,00E+00	0,00E+00	0,00E+00
EEE	MJ	0,00E+00	0,00E+00	0,00E+00	0,00E+00

HWD = Hazardous waste disposed; N**HWD =** Non-hazardous waste disposed; **RWD =** Radioactive waste disposed; **MER =** Material for energy recover; **MFR =** Material for recycling; **CRU =** Component for reuse; **ETE =** Exported thermal energy; **EEE =** Exported electricity energy

6.2. End of life management

Inside the manual of use and management of the power transformer are available the indications for the correct management at the end of life of the components, as well as information on the constituent materials, in order to maximize the potential for recycling.

6.3. Other certifications

The Monselice local unit quality, environment, health and safety management system is certified ISO 9001 (since 1994 – Certification number: CERT-11274-2002-AQ-VEN-SINCERT), ISO 14001 (since 2002 – Certification number: CERT-474-2002-AE-MIL-SINCERT) and ISO 45001 (since 2004 with OHSAS18001 standard - Certification number: CERT-049-2004-AHSO-MIL-SINCERT).

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