



ENVIRONMENTAL PRODUCT DECLARATION

PRODUCT:
Transformer
1LPL066403-000

SITE PLANT:
Aleksandrowska 67/93, 91-205 Łódź,
Poland

In compliance with ISO 14025

Program Operator	EPDItaly
Publisher	EPDItaly

Declaration number	EPD-DTRLDZ-0.63MVA-25_0.42kV-01
Registration number	EPDITALY1043

Issue date	18/11/25
Valid to	17/11/30



GENERAL INFORMATION

EPD OWNER	
Name of the company	Hitachi Energy Poland Spa
Location of the production site	Aleksandrowska 67/93, 91-205 Łódź, Poland https://www.hitachienergy.com/
Company Contact	Oleksandr Datsiuk, oleksandr.datsiuk1@hitachienergy.com

PROGRAM OPERATOR	
EPD Italy	EPDItaly – www.epditaly.it Via Gaetano De Castilia 10, 20124 Milan (MI), Italy

PRODUCT	
Declared Product	TNOSCTH 630/25 PNS transformer
CPC code	46121 'Electrical transformers'

VERIFICATION	
Reference PCR	EPDItaly007 – PCR for Electronic and electrical products and systems, Rev. 3.1, valid until 2026/01/19 EPDItaly018 – Electronic and electrical products and systems – Power transformers, Rev. 3.6, 2029/07/01
Reference documents	EN 50693:2019 – Product category rules for life cycle assessment of electronic and electrical products and systems Regolamento del programma EPDItaly rev.6.0 of 26/01/24
Project Report LCA	"LCA Report_HitachiPoland_rev1" Emission date: 31/07/25
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: Italy and other countries around the world according to the conditions of the sales market. Independent verification of the declaration and data carried out according to ISO 14025:2010. ☐ Internal ☒ External Third-party verification carried out by: TÜV Italia srl (Accreditation number 00077VV)
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.

ADDITIONAL INFORMATION	
Technical support	Spin Life s.r.l. Spin-off of University of Padova Via C. Cerato 14 - 35122 Padova T. 049 878 9120 - info@spinlife.it   SPIN-OFF DELL'UNIVERSITÀ DI PADOVA

Additional explanatory material can be obtained by contacting the EPD owner.

“The EPD Owner releases EPDItaly from any noncompliance with environmental legislation. The holder of the declaration will be responsible for the information and supporting evidence”.

COMPANY INFORMATION

The Transformers Factory in Lodz (Poland) is 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.

The production plant is covered by EMS according to ISO 14001.

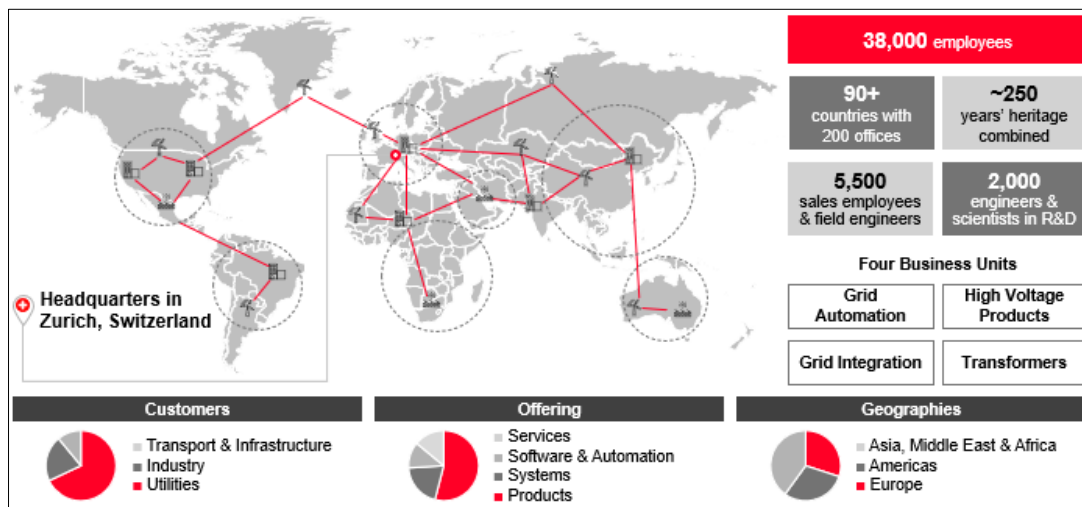


Figure 1 Hitachi Energy global headquarters

PRODUCTS AND PROCESSES

Table 1 Main information about the product

Product ID	1LPL066403-000
Type	TNOSCTH 630/25 PNS
Rated voltage [kV]	25
Rated Power [MVA]	0,63
Frequency [Hz]	50
Classification according to the reference PCR	Electrical transformer
Mass [kg]	2230
Type and quantity of insulating liquid [kg]	mineral oil / 466 kg
Cooling system	ONAN
Area in which transformers are sold and installed (or intended to be installed)	Spain

Table 2 Material composition of the product (in accordance with EN IEC 62474) considered in the analysis. Materials accounting for less than 1% of the total mass was not considered.

Materials	1LPL066403-000		
	Weight [kg]	%	Biogenic Carbon Content
Steel	1370,18	61,5%	/
Aluminium	286,30	12,8%	/
Pressboard	66,74	3,0%	44%
Wood	0,59	0,0%	44%
Cast iron	10,10	0,5%	/
Mineral oil	466,00	20,9%	/
Others	30,09	1,3%	/

The product under study has an additional packaging made in wood, with a weight equal to 11kg (and a biogenic carbon content of 47%).

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 four 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 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.

The objective of this study is to assess the potential environmental impacts from a life-cycle perspective associated with the product under study. A specific EPD for a single product has been created.

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 Poland. The main characteristics of the transformer analysed are described in Table 1.

Product stage			Construction process stage		Use stage							End of life stage			
Raw material supply	Transport	Manufacturing	Transport	Construction installation	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy	Operational water	De-construction	Transport	Waste processing	Disposal
A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4
X	X	X	X	X	ND	X	ND	ND	ND	X	ND	X	X	X	X

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 site, 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.
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. For plant consumption, reference was made to the data related to the Lodz plant (Poland) and referred to the fiscal year 2022 (April 2022-March 2023), considered representative.

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, a Spanish scenario was considered, knowing the exact position of where the transformers will be installed.

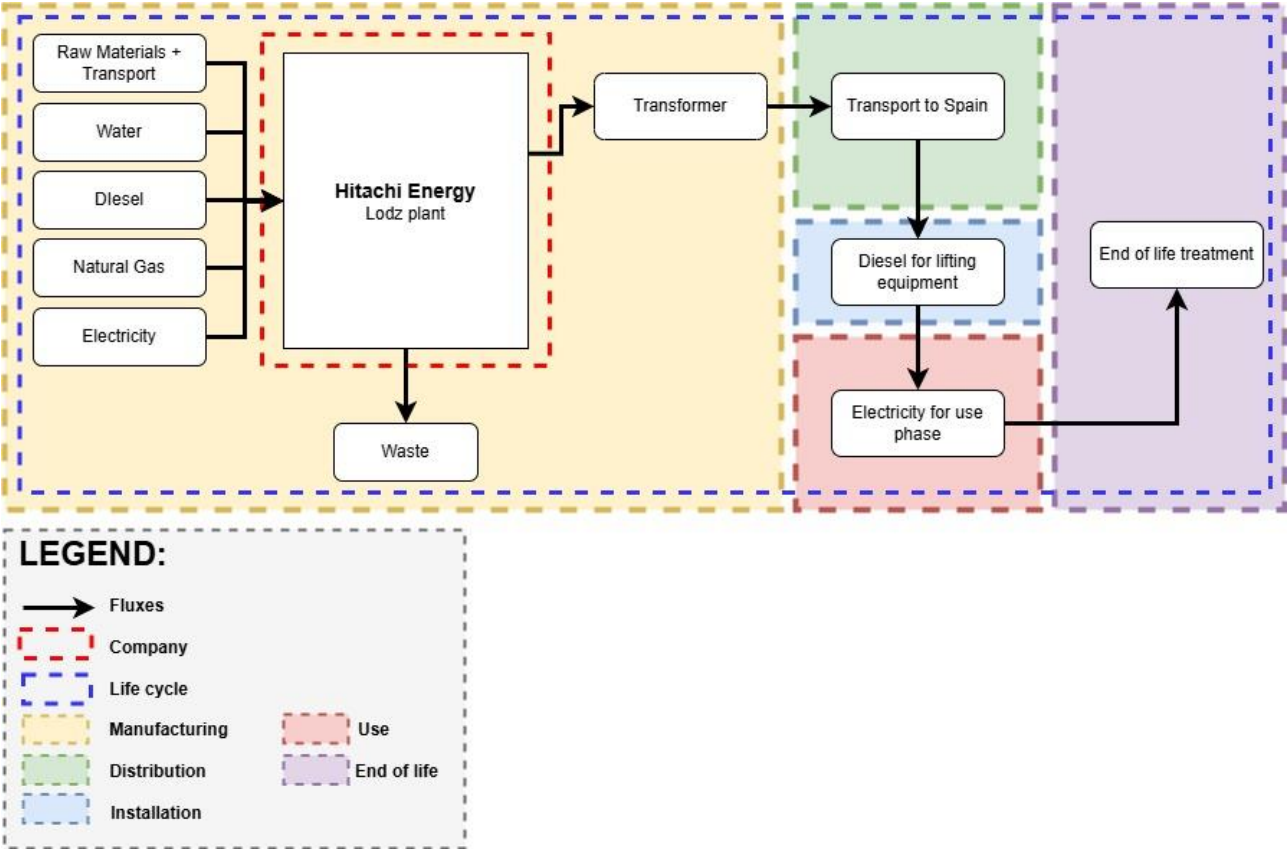


Figure 2 Flux diagram for the product under study

LCA INFORMATION	
Reference year	April 2022– March 2023
Geography	Global
Energy mix	Poland Residual mix
Software	SimaPro version 9.6.0.1
Database	Ecoinvent version 3.10
LCA Method	Cut-off by classification
Characterization factors	Method EN 15804

CALCULATION RULES

Cut-off criteria: The criterion chosen for the initial inclusion of inputs and outputs is based on the definition of a 1% cut-off level, both in terms of mass, energy and environmental significance. This means that a process is considered negligible if it represents less than 1% of the total mass, primary energy and impact.

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.

Allocation principles: In the case under study, allocation of material and energy flows was necessary as much several transformer models are produced in the Polish 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, water consumptions and packaging of the raw material, associated with the processes carried out at the Lodz (Poland) plant.

Data quality: where available, primary data directly provided by the factory have been preferred; secondary data, where used, refer to the most recent available version of the Ecoinvent database.

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 3.10 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 98% by weight of the components. 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, water withdrawal and waste management. For the modeling of electricity, the energy mix was characterized according to the specific Renewable Energy Mix of the certificate of cancellation Guarantees of origin for Hitachi Energy Poland for the year 2022 (22% photovoltaic, 21% wind, 49% biomass and 8% from other resources, which was reportioned between photovoltaic, wind and biomass).
Downstream - Distribution	For the definition of the distribution processes, the actual distances were calculated for the product, as the installation location is known. The product is intended for the Spanish market.
Downstream - Installation	The transformer is shipped already assembled (without any packaging), therefore the only significant activity relevant for the installation phase is the operation of the lifting equipment and the end of life of its packaging.

Life Cycle Stage	Description
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. The electrical energy in this phase was modelled according to the Spanish energy mix (medium voltage): Electricity, medium voltage {ES} market for electricity, medium voltage Cut-off, U, which has an emission factor of 0,201 kgCO₂e/kWh in terms of Global Warming Potential.
Downstream – Maintenance	For the product under study, no ordinary maintenance is required.
Downstream – End of Life	The disassembly phase includes the same operations and consumptions included in the installation phase. Moreover, the dataset Waste electric and electronic equipment {GLO} treatment of waste electric and electronic equipment, shredding Cut-off, U was associated. For the transport to the collection site, a transport of 500 km by lorry>32 ton was assumed. The transformer end-of-life modelling choices were made on the basis of the material destinations provided by the EN 50693: aluminum (70% recycling, 30% landfill), steel (80% recycling, 20% landfill), glass (60% recycling, 40% landfill), oil (70% recycling, 30% landfill), wood (50% recycling, 50% landfill) and paper (100% incineration) .

ENVIRONMENTAL IMPACT ASSESSMENT

The results refer to the declared unit.

Table 3 Results for environmental potential impacts

Impact category	Unit	Total	Manufacturing	Distribution	Installation	Use	End of life
GWP-total	kg CO2 eq	2,01E+05	7,27E+03	1,36E+03	2,14E+01	1,91E+05	7,90E+02
GWP-fossil	kg CO2 eq	1,98E+05	7,34E+03	1,36E+03	2,38E+00	1,88E+05	6,03E+02
GWP-biogenic	kg CO2 eq	6,06E+02	-1,10E+02	2,44E-01	1,90E+01	5,10E+02	1,87E+02
GWP-luluc	kg CO2 eq	2,66E+03	4,10E+01	4,45E-01	2,83E-04	2,62E+03	5,61E-02
ODP	kg CFC11 eq	3,63E-03	1,10E-04	2,71E-05	3,64E-08	3,49E-03	3,27E-06
AP	mol H+ eq	8,48E+02	3,42E+01	4,26E+00	1,18E-02	8,09E+02	5,43E-01
EP-freshwater	kg P eq	2,77E+01	3,01E+00	9,09E-02	1,46E-04	2,46E+01	5,43E-02
EP-marine	kg N eq	1,83E+02	6,70E+00	1,44E+00	5,29E-03	1,75E+02	2,14E-01
EP-terrestrial	mol N eq	1,88E+03	6,94E+01	1,56E+01	5,66E-02	1,80E+03	1,96E+00
POCP	kg NMVOC eq	6,89E+02	2,33E+01	6,68E+00	1,82E-02	6,58E+02	8,16E-01
ADP-minerals&metals	kg Sb eq	6,93E-01	3,70E-02	4,36E-03	1,68E-06	6,52E-01	4,51E-04
ADP-fossil	MJ	4,40E+06	7,74E+04	1,57E+03	1,65E+00	4,32E+06	2,27E+02
WDP	m3 depriv.	1,96E+05	2,37E+03	7,84E+01	1,40E-01	1,93E+05	1,72E+01

Table 4 Results for resource use indicators

Impact category	Unit	Total	Manufacturing	Distribution	Installation	Use	End of life
PERE	MJ	1,82E+06	1,76E+04	3,14E+02	2,39E-01	1,80E+06	4,81E+01
PERM	MJ	8,22E+02	8,22E+02	0,00E+00	0,00E+00	0,00E+00	0,00E+00
PERT	MJ	1,82E+06	1,84E+04	3,14E+02	2,39E-01	1,80E+06	4,81E+01
PENRE	MJ	6,60E+06	9,61E+04	1,91E+04	3,04E+01	6,48E+06	2,22E+03
PENRM	MJ	1,93E+04	1,93E+04	0,00E+00	0,00E+00	0,00E+00	0,00E+00
PENRT	MJ	6,62E+06	1,15E+05	1,91E+04	3,04E+01	6,48E+06	2,22E+03
SM	kg	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
NRSF	MJ	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00

FW	m3	2,92E+03	1,40E+02	2,49E+00	4,24E-03	2,78E+03	5,14E-01
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Table 5 Results for waste indicators

Impact category	Unit	Total	Manufacturing	Distribution	Installation	Use	End of life
HWD	kg	1,67E+01	3,91E+00	1,29E-01	2,08E-04	1,27E+01	2,24E-02
NHWD	kg	1,38E+04	1,12E+03	9,09E+02	3,44E-01	1,13E+04	4,72E+02
RWD	kg	5,58E+01	1,88E-01	6,10E-03	4,23E-06	5,56E+01	1,02E-03
CRU	kg	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
MFR	kg	1,75E+03	1,03E+02	0,00E+00	0,00E+00	0,00E+00	1,64E+03
MER	kg	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
EE	MJ	3,74E-03	3,74E-03	0,00E+00	0,00E+00	0,00E+00	0,00E+00

REFERENCES

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