



## ENVIRONMENTAL PRODUCT DECLARATION

**PRODUCT NAME:**

1. TPT2020 Standard
2. TPT2020 Ridotto

**PRODUCTION SITE:**

Via Pindaro, 19, 20128  
Milano (MI)

**in compliance with ISO 14025 and EN 50693**

Program operator	EPDItaly
Publisher	EPDItaly
Declaration number	COL-TW-TPT2020
Registration number	EPDITALY0546
Issue date	10/10/2023
Valid to	10/10/2028



## 1. GENERAL INFORMATION

<b>EPD owner</b>	Col Giovanni Paolo S.p.A. ( <a href="http://www.colgp.it">www.colgp.it</a> ) Via Antonio Chiribiri, 1, 10028 Trofarello (TO)
<b>Reference production site</b>	TW-TeamWare S.r.l. ( <a href="http://www.teamware.it">www.teamware.it</a> ) Via Pindaro, 19, 20128 Milano (MI)
<b>Scope of application</b>	This is a product-specific EPD referring to the two TPT2020 models (standard and ridotto) assembled by TW-TeamWare SRL in 2021, and used as peripheral equipment for remote control and supervision of the primary substations within the Italian territory
<b>Programme operator</b>	EPDItaly – <a href="mailto:info@epditaly.it">info@epditaly.it</a> Via Gaetano De Castillia, 10, 20124 Milano (MI)
<b>Independent verification</b>	This declaration has been developed in accordance with the regulations of EPDItaly; further information and the same regulations are available at: <a href="http://www.epditaly.it">www.epditaly.it</a>  Independent verification of the declaration and data carried out in accordance with ISO 14025: 2010 <input type="checkbox"/> Internal <input checked="" type="checkbox"/> External  Third party verification done by: ICMQ S.p.A. ( <a href="http://www.icmq.it">www.icmq.it</a> ), Via Gaetano De Castillia, 10, 20124 Milano (MI) – Italia. Accredited by ACCREDIA, Accreditation number 002H REV. 19
<b>CPC code</b>	4621 “Electricity distribution or control apparatus”
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<b>PCR – Product Category Rules</b>	Core PCR: EPDItaly007 – PCR for Electronic and Electrical Products and Systems, REV. 3.0 Issue date 13/01/2023
<b>Reference documents</b>	EN ISO 14025:2010, Environmental labels and declarations – Type III environmental declarations – Principles and procedures  EN 50693:2019 - Product category rules for life cycle assessments of electronic and electrical products and systems.  Regulations of the EPDItaly Programme. Revision 5.2. Issue date 16/02/2022
<b>Comparability</b>	EPDs published within the same product category though originating from different programs may not be comparable. Full conformance with a PCR allows EPD comparability only when all stages of a life cycle have been considered. However, variations and deviations are possible.

### Liability

The EPD owner relieves EPDIItaly from any non-compliance with the environmental legislations. The holder of the declaration will be liable for the supporting information and evidence. EPDIItaly disclaims any liability regarding the manufacturer's information, data, and results of the life cycle assessment.

## 2. THE COMPANY

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Col Giovanni Paolo S.p.A. (COL GROUP) is a leading Italian company owned by Oaktree Capital Management, L.P. in the fast-growing global energy transmission and distribution market. It specializes in the development and production of critical components and advanced solutions for smart grid applications in medium and high voltage electrical infrastructure with sustainability at the heart of all its activities. COL GROUP has been working to support the sustainable future of our planet and the long-term success of its customers as well as the company's own business. Testament to that are the ambitions embodied in two of COL GROUP's Strategy 2030 goals i.e., to lead with low-carbon circular economy solutions, and to enhance sustainability across the value chain. The company possesses numerous certifications according to international standards, among which are UNI EN ISO 9001:2015, UNI EN ISO 14001:2015, UNI ISO 45001:2018, UNI EN ISO 50001:2018, and ISO 27001: 2013. Established in 1920, COL GROUP has amassed over 100 years of valuable experience in the electro-technical and plant engineering fields, and it is one of the few authorized suppliers for major utility companies in Europe, Middle East, South America, and Southeast Asia. The company has developed a highly innovative technology portfolio in medium voltage switchgear, substation automation, battery control systems and several other smart grid and high-voltage applications in collaboration with other dominant global utilities and industrial players. Furthermore, COL GROUP acquired TW-TeamWare S.r.l. in 2021 to accelerate its progress towards power quality, cyber security, and electric distribution remote control. The company now has production sites in Torino, Catania, Milano, and Cremona, with over 150 highly skilled, specialized, and efficient employees led by an accomplished management team.

## 3. THE PRODUCT

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The TPT2020 device is a complex Remote Terminal Unit (RTU) expressly designed as per the ENEL technical specification DX1217 (Ed III of March 2008), to be used in High to Medium Voltage substations, and it comes in two models i.e., "standard" and "ridotto" configuration. The device performs control and supervision operations, sampling information from field equipment like breakers, transformers, protection devices, auxiliary services, etc. It can also carry out commands instructed by the central system. The main functionalities of the TPT2020 include digital signals and analogue measurement acquisition, execution of local correlation processing to produce summary virtual events to be sent the central system, stand-alone performing of local automation sequences, commands execution, data storage and events chronological recording management, electrical management, different communication carriers over LAN and/or WAN, as well as self-diagnostic available through a resident Web Server. The TPT2020 (standard

and ridotto) devices manufactured by TW-TeamWare SRL are based on an architecture locally distributed and made up of the following modules: PSU power supply and signalling module, UEL2020 Processing Module, input and output modules (generally MIOx) and all the various modules are suitable for being integrated in a metallic cabinet equipped with a standardized 19" frame. For the most part, the two TPT2020 models are similar however, the main difference between the TPT2020 standard and TPT2020 ridotto is that the latter only has two MIOs (MIO1 and MIO2) whereas the former has four i.e., MIO1, MIO2, MIO3, and MIO4, with the MIO composition indicating TeleSegnale (TS), TeleMisura (TM), TeleComando (TC), and TeleComando Speciale (TCS) as summarized in **Table 1**. The two images on the cover page of this EPD document display each of the fully assembled TPT2020 models i.e., the TPT2020 standard (**left**) and TPT2020 ridotto (**right**).

**Table 1.** Summary of the total composition in the MIOs for each of the two TPT2020 models

TPT2020 Model	Connettori	TS	TM	TC	TCS
Standard (MIO1 to MIO4)	48	1000	72	200	20
Ridotta (MIO1 and MIO2)	24	486	32	102	20

## Technical specifications

The product identification details and technical specifications from the product datasheet are presented in **Table 2**.

**Table 2.** Technical specifications for the TPT2020 standard and ridotto devices

Product identification details	Product model	TPT2020 Standard	TPT2020 Ridotto
	TEAMWARE Product code	079S4500	079S4501
	Matricola ENEL	484102	510037
	Product net weight	137,153 kg	129,509 kg
Product technical specifications	Digital input	1000 galvanically isolated digital inputs	
	Rated current	5A	
	Breaking capacity	0,2A at 110Vdc with L/R = 40msec	
	Relay remote controls	220 relay remote controls	
	72 galvanically isolated analog inputs	± 5mA and 4.2mA	
	Optical ethernet port	100BaseFx	
	Wired ethernet port	100BaseT	
	2 serial ports	V.24	
	1 serial port	RS485 serial port galvanically isolated	
1 port	GPS interface		
Packaging materials	Wooden Pallet	11,3 kg	
	Cardboard box	4,4 kg	

## Material composition

The declaration on the content of materials for the two products was done by the manufacturer in accordance with EN IEC 62474 as recorded in **Table 3** accounting for the packaging materials as well.

**Table 3.** Material composition for each of the fully assembled TPT2020 device models plus its packaging

Material class name	ID	Percentage mass share	
		TPT2020 Standard	TPT2020 Ridotto
Other ferrous alloys, non-stainless steels	M-119	83,9535%	85,8156%
Other unfilled thermoplastics	M-249	0,0467%	0,0271%
Wood	M-340	7,3927%	7,7819%
Paper	M-341	2,8786%	3,0301%
Other	OTHER	5,7286%	3,3453%

## Reference service life

The reference service life (RSL) of each of the two products was set at 10 years

## 4. SCOPE AND TYPE OF EPD

This is a product-specific EPD for the TPT2020 standard and TPT2020 ridotto devices produced at the COL GROUP production site in Milan (TEAMWARE) in compliance with ISO 14025 and EN 50693 under the EPDIItaly program regulations. It is based on a cradle to grave life cycle assessment (LCA) methodology in accordance with the ISO 14040 and 14044 standards, considering the current level of technology worldwide. The spatio-temporal scope considered in this study are summarized in **Table 4**. The LCA results were automatically generated using the excel-based LCA tool “LCA-COL GROUP Tool 2.1” of 01/09/2023., and they were intended for internal R&D, as well as external B2B and B2C communication. Correspondingly, these results facilitated informed business decisions through comparison of the environmental performance of products that have similar functional requirements.

**Table 4.** The spatio-temporal scope of the LCA considering the current global level of technology

Representativeness	Scope
Spatial	Italy
Temporal	2021

## Functional unit

The functional unit (FU) was a fully assembled, tested, and packaged TPT2020 Standard and TPT2020 Ridotto devices produced at TEAMWARE with the technical specifications stated in **Table 2**, transported and installed for use peripheral equipment for remote control and supervision of the primary substations which perform conversion from high voltage to medium voltage within the Italian territory, functioning constantly during a RSL of 10 years.

## System boundary

The system boundary considered in this study covered the entire lifecycle of each of the two products i.e., from cradle to grave as shown in **Table 5** with the life cycle stages grouped into three distinct modules i.e., upstream, core, and downstream with reference to EN 50693. The product life cycle and inventory

analysis for both products describing all the activities, simplifying assumptions, and scenarios used in the LCA model has been comprehensively done under **section 5** of this document.

**Table 5.** Summary of the life cycle stages and modules considered in the system boundary

Manufacturing		Distribution	Installation	Use	End of life
Upstream	Core	Downstream			
✓	✓	✓	✓	✓	✓

✓ = Lifecycle stages and modules considered in the LCA

### Cut-off criteria

The mandatory cut-off for mass and energy flows in this LCA study was set at 1% as defined and modelled in the LCA TOOL "LCA-COL GROUP Tool 2.1" of 01/09/2023. All the material and energy flows within the system boundary known to have potential to cause significant impacts on the LCA results have been accounted for. However, cut-off was applied to the potential impacts that could have resulted from production and disposal of the packaging materials of all the semi-finished products included in the BOMs (e.g., sheets, electronics, screws, etc.) transported to TEAMWARE for processing and later assembling of the final product as it was assumed that such impacts were negligible owing to the reuse agreement for such materials existing between TEAMWARE and the external suppliers. Furthermore, a cut-off was similarly applied to the impacts associated with the skilled labour required during installation before use and dismantling of the two products at their end-of-life. Potential impacts that could have arisen from ordinary or extraordinary maintenance were also ignored since the two products were assumed to be maintenance free for the entire expected service life.

### Allocation rules

The allocation criteria adopted for the LCA model in this study was guided by the PCR of the product being studied. Since many other products are produced at the reference site, the "multi-output" allocation rule was applied to calculate the environmental impact of the two products being studied. The primary on-site data relating to waste generation, water, and energy consumption (petrol, electricity, and natural gas) used was provided for the reference year, and these were allocated based on economic value (revenue generated in millions of euros) using the total annual revenue of the TEAMWARE, annual revenue from selling the each of the products being studied, and the number of the studied product sold in the reference year, to get the corresponding allocation factor for each product.

### Data quality

The most recent and verifiable site-specific data collected from January to December 2021 i.e., reference year, was used in this study, and the International System of Units (SI) was adopted while recording the data. The initial primary data forming the basis for the LCA were the production specifications i.e., BOMs, mechanical drawings, and technical information provided by TEAMWARE to its external suppliers for each component for each of the two final products, and these were analyzed using Microsoft excel. In instances where data was missing for some individual electronic components, approximations were made in the BOMs and proxy data with the nearest equivalence in terms of functionality and mass was used for

modelling such components. The weight and surface area of the structural components for both products were calculated using the Solid Edge software. For the electronic components, information from product datasheets obtained from the websites of Farnell Italia and Mouser Electronics were used, these were complimented with data from Altium and Microarea Mago4 software. Additional primary data used included the water and energy (petrol, electricity, and natural gas) consumption for the activities at TEAMWARE during the reference year, and these were downloaded from the company's reference production site account on the website of the service providers. A similar approach was applied to download annual data for fuel consumption by company vehicles from the Q8 online portal which documents electronic fuel vouchers. In addition to that, the distances from external suppliers to TEAMWARE were evaluated with the aid of Google Maps. The same technique was applied to determine the distributing distance across the various reference installation sites within Italy, and justification was provided for all the simplifying assumptions stated. In terms of secondary data, databases from legitimate sources already embedded in the LCA TOOL "LCA-COL GROUP Tool 2.1" of 01/09/2023 were used to obtain generic data for some up- and down-stream processes in the life cycle of the product.

## 5. PRODUCT LIFE CYCLE AND INVENTORY ANALYSIS

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The life cycle inventory (LCI) lists and quantifies all the flows entering and leaving all the declared life cycle stages of the product within the system boundary considered in relation to the scope of the study. The reference flow for the LCI is 1 piece each of a fully assembled TPT2020 (standard and ridotto) devices and their packaging, weighing about **152,853 kg** and **145,209 kg**, for the TPT2020 standard and TPT2020 ridotto, respectively.

### Manufacturing

This life cycle stage covers all the activities spanning across the upstream and core modules. The supply chain processes commence with the extraction of raw materials to produce intermediate products comprising of electronic and structural components which are constituents of the two final products, and the packaging materials for the two final products. The electronic components are mainly boards on which smaller components are mounted, whereas the structural component consists of galvanized metallic sheets, bolts, and screws. The production of these various components is done by external suppliers all domicile in Italy on their manufacturing sites, and it was assumed that these different components were each transported by road in a 16 - 32 tonne EURO5 lorry to TEAMWARE where the core activities of assembling, testing, and final packaging of the TPT2020 standard and TPT2020 ridotto devices are done. Each of the fully assembled products is then packaged by mounting it on a wooden pallet and then covering it with a long cardboard box to minimize any potential damage during distribution. All but packaging wastes generated from all on-site activities are documented by category in the production site register and declared annually in the MUD "*Modello Unico di Dichiarazione ambientale*" following the applicable regulations and deadlines. Furthermore, these wastes were assumed to be periodically transported in a 16 - 32 tonne ACI mix lorry to a waste treatment plant located **50 km** away.

### Distribution

From here on out till the end of life of each product, all the activities constitute the downstream module. The fully assembled and packaged products are loaded onto a 16 - 32 tonne EURO5 lorry for last mile delivery to the various installation sites throughout the Italian territory. For purposes of simplification, the distribution process was assumed to be solely done by road despite the ferry routes connecting mainland Italy to the islands. All the sites where the two products were distributed and installed during the reference year were used and their distances (in kilometres) from TEAMWARE considering the fastest route were obtained from Google Maps. However, since the distribution of the TPT2020 Standard was not homogeneous across the entire Italian territory, the distances were weighted against the quantity of the product distributed in each of the installation sites, and the sum of the various weighted distances (**633,207 km**) was taken as the distribution distance. The scenario was different for the TPT2020 Ridotto whose distribution was homogeneous because only one piece was produced in the reference year and it was transported to a location within the Italian territory as requested by the sole client, and the distribution distance from TEAMWARE was determined to be **1585 km**.

## Installation

Upon arrival at each of the installation sites, each of the products are unloaded, carefully removed from its packaging, and installed by skilled technicians using spanners to fasten the nuts, bolts, and washers. The entire installation process is overseen by representatives of the client. It is immediately after this process that the packaging materials are returned for reuse as per the reduction of packaging waste agreement signed between TEAMWARE and its external suppliers. Furthermore, at the end of life of the packaging materials, they are assumed to be transported in a 7 - 16 tonne EURO5 lorry to a waste treatment plant located **50 km** away.

## Use

Each of the two perfectly installed TPT2020 devices operate continuously during their **RSL** with the same consumption of electricity (**2190 kWh**) on account of having the same electrical resistance and nominal current, and both were assumed to be maintenance free for the entire expected service life. The electricity consumed by each TPT2020 product during its RSL,  $E_{use}$  was computed using the parameters as in LCA-TOOL "LCA-COL GROUP Tool 2.1" of 01/09/2023, and the formula shown below in **Equation 1**, where;  $P_{use}$  is the power consumed by the TPT2020 device; **RSL** is the service life of the product, assumed to be 10 years; **8760** is the number of hours in a year; and **1000** is the conversion factor that allows the energy consumed in kWh over the product's service life to be expressed. The TPT2020 devices do not use any batteries, instead, it functions on a power supply at the installation site. It was assumed that no periodic or extraordinary maintenance works were required throughout the use phase since the possibility of device failure is seldom, this is on account of the numerous quality control tests performed during and after assembling to ensure robustness. An additional environmental information is that during the installation and use stages, the TPT2020 devices do not emit any pollutants or substances which are dangerous for the environment and health.

$$E_{use}[\text{kWh}] = \frac{P_{use} * 8760 * \text{RSL}}{1000} \quad (1)$$



## End of life

At the end of the RSL of the two TPT2020 products, the dismantling process and separation of the device components is done following guidelines given by the manufacturer, and the resulting wastes were assumed to be transported using a 7,5 - 16 tonne EURO5 lorry to a waste treatment plant located **50 km** away from the installation site.

## 6. LCA RESULTS

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The environmental performance results of the two TPT2020 products i.e., TPT2020 Standard and TPT2020 Ridotto, for the different lifecycle stages per FU accounting for all the mandatory environmental impact indicators (**Tables 6 and 9**), descriptive parameters for resource use (**Tables 7 and 10**), and waste production (**Tables 8 and 11**) computed as per Core PCR: EPDIItaly007, and EN 50693 were automatically generated using the LCA TOOL "LCA-COL GROUP Tool 2.1" of 01/09/2023.

## Environmental impacts for TPT2020 Standard

**Table 6.** LCA results for the environmental impact indicators

Impact categories	Unit of measurement	Manufacturing	Distribution	Installation	Use	End of life	TOTAL
<b>GWP-total</b>	kg CO <sub>2</sub> eq.	9,41E+02	1,51E+01	9,35E-01	8,66E+02	1,32E+02	1,96E+03
<b>GWP-fossil</b>	kg CO <sub>2</sub> eq.	9,37E+02	1,51E+01	2,29E-01	8,53E+02	1,32E+02	1,94E+03
<b>GWP-biogenic</b>	kg CO <sub>2</sub> eq.	2,54E+00	1,10E-03	7,06E-01	1,29E+01	1,85E-02	1,62E+01
<b>GWP-luluc</b>	kg CO <sub>2</sub> eq.	1,60E+00	2,90E-04	2,53E-05	5,81E-02	1,54E-02	1,67E+00
<b>ODP</b>	kg CFC-11 eq.	2,35E-05	3,19E-07	4,36E-09	1,77E-05	1,32E-07	4,17E-05
<b>AP</b>	mol H <sup>+</sup> eq.	8,56E+00	3,85E-02	4,33E-03	2,82E+00	6,59E-02	1,15E+01
<b>EP-freshwater</b>	kg P eq.	1,27E-01	1,16E-05	3,72E-06	1,41E-02	3,39E-04	1,41E-01
<b>EP-marine</b>	kg N eq.	1,23E+00	1,51E-02	2,51E-03	4,45E-01	2,38E-02	1,71E+00
<b>EP-terrestrial</b>	mol N eq.	2,41E+01	1,59E-01	2,31E-02	5,39E+00	2,45E-01	2,99E+01
<b>POCP</b>	kg NMVOC eq.	5,02E+00	6,21E-02	6,06E-03	2,37E+00	6,58E-02	7,52E+00
<b>ADP-min &amp; met</b>	kg Sb eq.	2,69E-01	5,08E-07	3,82E-08	1,27E-05	1,56E-06	2,69E-01
<b>ADP-fossil</b>	MJ	1,47E+04	1,93E+02	2,94E+00	1,52E+04	1,52E+02	3,02E+04
<b>WDP</b>	m <sup>3</sup> eq. deprived	2,19E+02	1,81E-01	1,80E-02	5,35E+02	3,04E+00	7,57E+02

**Caption:** **GWP-total** = Climate change – total; **GWP-fossil** = Climate change – fossil; **GWP-biogenic** = Climate change – biogenic; **GWP-luluc** = Climate change – land use and land use change; **ODP** = Ozone Depletion; **AP** = Acidification; **EP-freshwater** = Eutrophication aquatic freshwater; **EP-marine** = Eutrophication, marine; **EP-terrestrial** = Eutrophication, terrestrial; **POCP** = Photochemical ozone formation; **ADP-min & met** = Depletion of abiotic resources – minerals and metals; **ADP-fossil** = Depletion of abiotic resources – fossil fuels; **WDP** = Water use.

## Resource use for TPT2020 Standard

**Table 7.** LCA results for the environmental parameters describing resource use

Parameters	Unit of measurement	Manufacturing	Distribution	Installation	Use	End of life	TOTAL
PERE	MJ	1,34E+03	5,17E-01	3,32E-01	3,40E+03	1,00E+01	4,75E+03
PERM	MJ	2,26E+02	0,00E+00	0,00E+00	0,00E+00	0,00E+00	2,26E+02
PERT	MJ	1,56E+03	5,17E-01	3,32E-01	3,40E+03	1,00E+01	4,98E+03
PENRE	MJ	1,46E+04	1,99E+02	3,01E+00	1,52E+04	1,54E+02	3,02E+04
PENRM	MJ	2,11E+02	0,00E+00	0,00E+00	0,00E+00	0,00E+00	2,11E+02
PENRT	MJ	1,48E+04	1,99E+02	3,01E+00	1,52E+04	1,54E+02	3,04E+04
MS	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	m <sup>3</sup>	5,21E+04	3,07E+01	2,02E+00	3,07E+05	5,08E+02	3,60E+05

**Caption:** PERE = Use of renewable primary energy excluding renewable primary energy resources used as raw material; PERM = Use of renewable primary energy resources used as raw material; PERT = Total use of renewable primary energy resources (primary energy and primary energy resources used as raw materials); PENRE = Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw material; PENRM = Use of non-renewable primary energy resources used as raw material; PENRT = Total use of non-renewable primary energy resources (primary energy and primary energy resources used as raw materials); MS = Use of secondary materials; RSF = Use of renewable secondary fuels; NRSF = Use of non-renewable secondary fuels; FW = Net use of fresh water

## Waste production for TPT2020 Standard

**Table 8.** LCA results for the environmental parameters describing waste production

Parameters	Unit of measurement	Manufacturing	Distribution	Installation	Use	End of life	TOTAL
HWD	kg	2,76E-01	0,00E+00	0,00E+00	0,00E+00	0,00E+00	2,76E-01
NHWD	kg	0,00E+00	0,00E+00	5,65E+00	0,00E+00	3,23E+01	3,79E+01
RWD	kg	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
CRU	kg	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
MFR	kg	8,04E-01	0,00E+00	9,48E+00	0,00E+00	1,05E+02	1,15E+02
MER	kg	0,00E+00	0,00E+00	6,69E-01	0,00E+00	3,57E-02	7,05E-01
ETE	MJ	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

**Caption:** HWD = Hazardous waste disposed; NHWD = Non-hazardous waste disposed; RWD = Radioactive waste disposed; CRU = Components for reuse; MFR = Material for recycling; MER = Materials for energy recovery; ETE = Exported thermal energy; EEE = Exported electricity energy

## Environmental impacts for TPT2020 Ridotto

**Table 9.** LCA results for the environmental impact indicators

Impact categories	Unit of measurement	Manufacturing	Distribution	Installation	Use	End of life	TOTAL
<b>GWP-total</b>	kg CO <sub>2</sub> eq.	6,74E+02	3,60E+01	9,35E-01	8,66E+02	1,25E+02	1,70E+03
<b>GWP-fossil</b>	kg CO <sub>2</sub> eq.	6,71E+02	3,60E+01	2,29E-01	8,53E+02	1,24E+02	1,68E+03
<b>GWP-biogenic</b>	kg CO <sub>2</sub> eq.	1,86E+00	2,62E-03	7,06E-01	1,29E+01	1,75E-02	1,55E+01
<b>GWP-luluc</b>	kg CO <sub>2</sub> eq.	1,03E+00	6,89E-04	2,53E-05	5,81E-02	1,45E-02	1,11E+00
<b>ODP</b>	kg CFC-11 eq.	1,69E-05	7,59E-07	4,36E-09	1,77E-05	1,25E-07	3,55E-05
<b>AP</b>	mol H <sup>+</sup> eq.	6,51E+00	9,15E-02	4,33E-03	2,82E+00	6,22E-02	9,49E+00
<b>EP-freshwater</b>	kg P eq.	7,84E-02	2,76E-05	3,72E-06	1,41E-02	3,20E-04	9,29E-02
<b>EP-marine</b>	kg N eq.	8,58E-01	3,58E-02	2,51E-03	4,45E-01	2,25E-02	1,36E+00
<b>EP-terrestrial</b>	mol N eq.	1,98E+01	3,79E-01	2,31E-02	5,39E+00	2,31E-01	2,58E+01
<b>POCP</b>	kg NMVOC eq.	3,54E+00	1,48E-01	6,06E-03	2,37E+00	6,21E-02	6,12E+00
<b>ADP-min &amp; met</b>	kg Sb eq.	1,49E-01	1,21E-06	3,82E-08	1,27E-05	1,47E-06	1,49E-01
<b>ADP-fossil</b>	MJ	1,03E+04	4,59E+02	2,94E+00	1,52E+04	1,44E+02	2,61E+04
<b>WDP</b>	m <sup>3</sup> eq. deprived	1,51E+02	4,30E-01	1,80E-02	5,35E+02	2,87E+00	6,89E+02

**Caption:** **GWP-total** = Climate change – total; **GWP-fossil** = Climate change – fossil; **GWP-biogenic** = Climate change – biogenic; **GWP-luluc** = Climate change – land use and land use change; **ODP** = Ozone Depletion; **AP** = Acidification; **EP-freshwater** = Eutrophication aquatic freshwater; **EP-marine** = Eutrophication, marine; **EP-terrestrial** = Eutrophication, terrestrial; **POCP** = Photochemical ozone formation; **ADP-min & met** = Depletion of abiotic resources – minerals and metals; **ADP-fossil** = Depletion of abiotic resources – fossil fuels; **WDP** = Water use.

## Resource use for TPT2020 Ridotto

**Table 10.** LCA results for the environmental parameters describing resource use

Parameters	Unit of measurement	Manufacturing	Distribution	Installation	Use	End of life	TOTAL
PERE	MJ	9,58E+02	1,23E+00	3,32E-01	3,40E+03	9,46E+00	4,37E+03
PERM	MJ	2,26E+02	0,00E+00	0,00E+00	0,00E+00	0,00E+00	2,26E+02
PERT	MJ	1,18E+03	1,23E+00	3,32E-01	3,40E+03	9,46E+00	4,60E+03
PENRE	MJ	1,03E+04	4,72E+02	3,01E+00	1,52E+04	1,45E+02	2,62E+04
PENRM	MJ	1,16E+02	0,00E+00	0,00E+00	0,00E+00	0,00E+00	1,16E+02
PENRT	MJ	1,04E+04	4,72E+02	3,01E+00	1,52E+04	1,45E+02	2,63E+04
MS	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	m <sup>3</sup>	3,89E+04	7,30E+01	2,02E+00	3,07E+05	4,80E+02	3,47E+05

**Caption:** PERE = Use of renewable primary energy excluding renewable primary energy resources used as raw material; PERM = Use of renewable primary energy resources used as raw material; PERT = Total use of renewable primary energy resources (primary energy and primary energy resources used as raw materials); PENRE = Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw material; PENRM = Use of non-renewable primary energy resources used as raw material; PENRT = Total use of non-renewable primary energy resources (primary energy and primary energy resources used as raw materials); MS = Use of secondary materials; RSF = Use of renewable secondary fuels; NRSF = Use of non-renewable secondary fuels; FW = Net use of fresh water

## Waste production for TPT2020 Ridotto

**Table 11.** LCA results for the environmental parameters describing waste production

Parameters	Unit of measurement	Manufacturing	Distribution	Installation	Use	End of life	TOTAL
HWD	kg	2,23E-01	0,00E+00	0,00E+00	0,00E+00	0,00E+00	2,23E-01
NHWD	kg	0,00E+00	0,00E+00	5,65E+00	0,00E+00	2,86E+01	3,42E+01
RWD	kg	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
CRU	kg	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
MFR	kg	6,49E-01	0,00E+00	9,48E+00	0,00E+00	1,01E+02	1,11E+02
MER	kg	0,00E+00	0,00E+00	6,69E-01	0,00E+00	1,97E-02	6,89E-01
ETE	MJ	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

**Caption:** HWD = Hazardous waste disposed; NHWD = Non-hazardous waste disposed; RWD = Radioactive waste disposed; CRU = Components for reuse; MFR = Material for recycling; MER = Materials for energy recovery; ETE = Exported thermal energy; EEE = Exported electricity energy

## 7. REFERENCES

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