



## ENVIRONMENTAL PRODUCT DECLARATION

### PRODUCT NAME:

1. WM-UP2020 L8  
Complete Kit
2. WM-UP2020 L16  
Complete Kit

### 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-UP2020WM
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## 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 WM-UP2020 L8 Complete Kit and WM-UP2020 L16 Complete Kit which are complete UP2020 Lite kits for Indoor application, mounted in the Wall-mounted indoor cabinet container equipped with UE2020 L8 and UE2020 L16 respectively, manufactured as per the ENEL global standards GSTR001/2 Rev. 02 and GSTR002 Rev.02, both of 30.09.2019 by TW-TeamWare SRL in 2021 for use as a the Remote Terminal Unit for telecontrol and supervision of MV/LV substations, within the geographical scope of Italy.
<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 0011PRD REV. 000
<b>CPC code</b>	4621 “Electricity distribution or control apparatus”
<b>Company contact</b>	Massimo BURATTO, Remote control B.U manager e-mail: <a href="mailto:massimo.buratto@teamware.it">massimo.buratto@teamware.it</a>
<b>Technical support</b>	Emmanuel NYERO, Environmental Specialist e-mail: <a href="mailto:emmanuel.nyero@teamware.it">emmanuel.nyero@teamware.it</a>
<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.
<b>Liability</b>	The EPD owner relieves EPDItaly from any non-compliance with the environmental legislations. The holder of the declaration will be liable for the supporting information and evidence. EPDItaly disclaims any liability regarding the manufacturer's information, data, and results of the life cycle assessment.

## 2. THE COMPANY

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. Over the years, COL GROUP has registered significant growth through the acquisition of several companies in the electronic, energy systems, railway, and electromechanical sectors. The ever-expanding company now has contemporary production sites in Torino, Catania, Milano, and Cremona, with over 150 highly skilled, specialized, and efficient employees led by a capable management team.

## 3. THE PRODUCTS

The WM-UP2020 L8 Complete Kit and WM-UP2020 L16 Complete Kit are complete UP2020 Lite kits for Indoor application, mounted in the Wall-mounted indoor cabinet container equipped with UE2020 L8 and UE2020 L16 respectively, manufactured as per the ENEL global standards GSTR001/2 Rev. 02 and GSTR002 Rev.02, both of 30.09.2019. The main functions of the WM-UP2020 L8/L16 Complete Kits are as follows: remote control and automation of 8 secondary substation switchgear, permanent fault detection, and



monitoring of medium voltage power grid. These functions guarantee a high-level reliability of Electric Power Distribution system, reducing the number and the duration of power outages caused by circuit faults. Furthermore, remote control permits optimization of electric power distribution system maintenance and planning policies. The WM-UP2020 L8 Complete Kit **(left)** and WM-UP2020 L16 Complete Kit **(right)** as shown in the photograph on the cover page, are wall mounted for indoor application, and it comprises of two components (i.e., the UE2020 L8/L16 and the PSBC module) that are rack mounted inside a 19" metallic cabinet container rack, accessible from the front, with a height equal to 15U. The UE2020 L8/L16 module is the unit of data acquisition, monitoring, transmission, and processing. The UE2020 L8/L6 is the field interface, and it is completely remote programmable by personal computer. On the other hand, the PSBC module includes a power supply and a battery system with charger circuit. The PSBC supplies the power to UE2020 L8/L6, to communication device called DCE and to motors of Switchgear connected to the UP. The Battery system is made by two Lead-acid rechargeable batteries and the PSBC monitors its functional states. The PSBC is completely programmable from personal computer by local communication port. Other equipment placed into the cabinet are Batteries, Terminal boards for the interface with the switchgears and the RGDAT/RGDM, and the power supply terminal boards, Custom devices, Communication module, and **Table 1** summarizes some of the technical features of the WM-UP2020 L8/L16 Complete Kit and its packaging.

**Table 1.** Technical specifications of the assembled WM-UP2020Lite (L8 and L16) Complete Kits

TEAMWARE Product code		TW143-PFEL-0103-00	TW143-PFEL-0104-00
Client Product code		510021	510020
Product model		WM-UP2020 L8 Complete Kit	WM-UP2020 L16 Complete Kit
Product weight		32,191 kg	34,876 kg
Packaging	Wooden pallet	2,825 kg	2,825 kg
The UE2020 L8/L16 Module		Input/Output Interface:	49/89 Remote signals (TS)
			16/32 Remote commands (TC)
			8/16 Telemetry (TM)
			8/16 Digital Output (UD)
		Communication ports:	1 Ethernet Port 10/100BaseT
			1 serial Port V.24
			1 USB 2.0 device Port
		Power Supply:	Nominal voltage: 24Vcc $\pm$ 20%
		Visual indicators:	Three LED signs
		Mechanical features:	standard rack box 19" 4U
The PSBC Module		Main source voltage:	100/230 VAC (-10% $\div$ +20%), setting up by dedicated selector
		Nominal frequency:	50/60 Hz
		Power:	150 W
		Output of battery charger and load power:	Nominal Voltage: 24VDC set between 23 and 28 VDC balanced also in function of the battery temperature



		Maximum available current (fixed): 5A $\pm$ 5%
		Nominal Voltage: 12 VDC
	Power supply Auxiliary output:	Maximum available current (fixed): 1 A
	Whole efficiency:	$\geq 75\% \pm 3\%$ (calculated at maximum supplied current 5A and at nominal voltage of 24VDC)
	Visual indicators:	Five LED signs
	Mechanical features:	standard rack box 19" 3U

## Material composition

The declaration on the content of materials for the WM-UP2020 L8 and L16 Complete Kits was done by the manufacturer in accordance with EN IEC 62474. The unique ID and percentage mass share of all the materials and declarable substances contained in the fully assembled product plus its packaging are reported in **table 2**.

**Table 2.** Material composition for the fully assembled and packaged WM-UP2020 L8/L16 Complete Kits

Material class name	ID	Percentage mass share (%)	
		WM-UP2020 L8 Complete Kit	WM-UP2020 L16 Complete Kit
Other ferrous alloys, non-stainless steels	M-119	72,8086	73,1579
Aluminium and its alloys	M-120	0,1188	0,1103
Copper and its alloys	M-121	11,2117	10,4133
Other unfilled thermoplastics	M-249	0,3164	0,2939
Unsaturated polyester (UP)	M-301	0,0690	0,0641
Wood	M-340	8,0677	7,4932
Other	OTHER	7,4078	8,4673

## Reference service life

The reference service life (RSL) of the two products was defined as 10 years.

## 4. SCOPE AND TYPE OF EPD

This is a product-specific EPD for the WM-UP2020 L8 Complete Kit and WM-UP2020 L16 Complete Kit which are complete UP2020 Lite kits for Indoor application, mounted in the Wall-mounted indoor cabinet container equipped with UE2020 L8 and UE2020 L16, respectively, produced at the COL GROUP production site in Milano (TEAMWARE), in compliance with ISO 14025 and EN 50693 under the EPDItaly program regulations. It is based on a cradle to grave life cycle assessment (LCA) methodology in accordance with the ISO 14040 and 14044 standards. The spatio-temporal scope for the data used in this study are summarized in **table 3** basing on the current global level of technology. The 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. Accordingly, these results facilitated sustainable operational decisions through comparison of the environmental attributes of products that have similar functional requirements.

**Table 3.** The spatio-temporal scope of the LCA study considering the current global level of technology

Representativeness	Scope
Spatial	Italy
Temporal	January to December, 2021

## Functional unit

The functional unit (FU) was a fully assembled, tested, and packaged WM-UP2020 L8/L16 Complete Kits with the technical specifications stated in **table 1**, distributed to sites within Italy, installed indoors and used as a remote-control Peripheral Unit (UP) for secondary substations and Medium Voltage (MV) power distribution system, during a RSL of 10 years, operating continuously.

## System boundary

The system boundary implemented in this LCA covered the entire lifecycle of the product i.e., from cradle to grave as shown in **table 4** with the life cycle stages for all the major activities involved, grouped into three distinct modules i.e., upstream, core, and downstream with reference to EN 50693. The product life cycle and inventory analysis describing all the activities, simplifying assumptions, and modelling scenarios used in the LCA has been exhaustively conducted under **section 5** of this document.

**Table 4.** The life cycle stages and modules declared in the system boundary

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

✓ = Lifecycle stages and modules declared 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. Furthermore, a cut-off was similarly applied to the impacts associated with the skilled labour required during installation before use and dismantling of the product at its 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 was guided by the PCR of the reference product. Since many other products are produced at the reference site, the “multi-output” allocation rule was applied to calculate the environmental impact of the product being studied. The primary 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 generated from the reference production site of the company, the annual revenue from selling each of the products being studied, and the number of the studied product sold in the reference year, to get the allocation factor for both products.

## Data quality

The most recent and verifiable site-specific data collected in 2021 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 from the client provided by TEAMWARE to its external suppliers for each sub-assembly of the final product, and these were analyzed using Microsoft excel. The weight of the heavier structural components was calculated using the Solid Edge software. For the lighter components, they were manually weighed on the weighing scale and recorded. Additional primary data used included the water and energy (petrol, electricity, and natural gas) consumption for the core activities at TEAMWARE premises 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 that use electronic fuel cards. 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 from TEAMWARE to the reference installation sites in the various regions 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 of a fully assembled and packaged WM-UP2020 L8/L16 Complete Kits, weighing **35,016 kg and 37,701 kg**, respectively.

### Manufacturing

This first 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 sub-assemblies comprising of electronic and structural components i.e., the UE2020\_L8/L16 and the PSBC module that are assembled, and rack mounted inside a metallic cabinet to form the final WM-UP2020 L8/L16 Complete



Kits, and the packaging materials for the final product. The electronic components ordinarily are made of cables and printed circuit boards (PCB) on which smaller components are mounted, whereas the structural component consists of metallic panels, bolts, and screws. The production of these various components was done by external suppliers on their manufacturing sites in Italy in accordance with the ENEL global standards GSTR001/2 Rev. 02 and GSTR002 Rev.02, both of 30.09.2019., and they were assumed to be transported by road in a 16 - 32 tonne EURO5 lorry to TEAMWARE where the core activities of assembling, testing, and final packaging of the WM-UP2020 L8/L16 Complete Kits were done. The fully assembled products were then packaged by loading 4 units on each wooden pallet during distribution. An accessory kit containing connecting cables for the batteries and PSBC are also supplied together with the each of the final products. All the wastes generated on-site from these activities (except packaging) 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 transported periodically in a 16 - 32 tonne ACI mix lorry to a waste treatment plant located **50 km** away.

## Distribution

From this point forth, all the activities are classified under the downstream module. Each of the fully assembled and packaged products are loaded onto a 16 - 32 tonne EURO5 lorry for final 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 products were distributed and installed during the reference year were considered and their distances (in kilometres) from TEAMWARE considering the fastest route were obtained from Google Maps. However, since the distribution of the product was not homogeneous across the entire Italian territory, these distances were weighted against the quantity of each of the products distributed in each of the installation sites, and the sum of the various weighted distances (**520,712 km and 402,509 km**) was taken as the distribution distance for the WM-UP2020 L8 and L16 Complete Kits, respectively.

## Installation

Upon arrival at the client's location, each of the products is unloaded, carefully removed from their packaging, and wall mounted for indoor use by skilled technicians. Furthermore, the two rechargeable batteries (as per GSCB001 specifications) supplied by the client were installed in the battery shelf of the UP2020 complete kits and connected to the PSBC using a short accessory cable (whose power consumption was considered negligible) to be on standby and provide a backup power source in case of power outages while the problem is being resolved. The rechargeable batteries are charged by the PSBC module which forms part of the UP2020 complete kit together with the UE2020 modules. It is immediately after this process that the packaging materials are returned for reuse as per the reduction of packaging waste agreement between TEAMWARE and its external suppliers. 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 **50 km** away.

## Use

The perfectly installed WM-UP2020 L8 Complete Kit and WM-UP2020 L16 Complete Kit consumed **569,4 kWh and 657 kWh** of electricity,  $E_{use}$ , respectively during the **RSL** of 10 years, operating continuously, and this was computed using **Equation 1** with **8760** representing 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 nominal power of the WM-UP2020 (L8 and L16) Complete Kits (in Watts),  $P_{use}$  was obtained by adding the **1,5W** absorbed by the PSBC to the **5 and 6W** nominal power of the UE2020 L8 V2 and UE2020 L16 V2, respectively.

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

During use phase of the WM-UP2020 (L8 and L16) Complete Kits, it was assumed that the power supply was at all times obtained from the PSBC connected to the grid since there was no proper data regarding the occurrence of power blackouts (which would necessitate using the standby batteries) in the various substations throughout Italy to model such scenarios and account for power consumption or loss during battery charging. In addition to that, the batteries were assumed to be replaced after every 2,5 years whether they were used during that period or not i.e., 3 times during the RSL of the products. Furthermore, it was assumed that there were no other periodic or extraordinary maintenance works required throughout the RSL. An additional environmental information is that during the installation and use stages, the device does not emit any pollutants or substances which are dangerous for the environment and health.

## End of life

At the end of the RSL of the product, the dismantling process and separation of the components of both products is done following guidelines in the manual 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 WM-UP2020 L8 Complete Kit and WM-UP2020 L16 Complete Kit for the different lifecycle stages per FU accounting for all the mandatory environmental impact indicators (**Table 5 and 8**) and descriptive parameters for resource use (**Table 6 and 9**) and waste production (**Table 7 and 10**) calculated as per Core PCR: EPDItaly007 and EN 50693 were automatically generated using the LCA TOOL "LCA-COL GROUP Tool 2.1" of 01.09.2023.

## Environmental impacts for WM-UP2020 L8 Complete Kit

**Table 5.** 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.	2,20E+02	2,85E+00	1,59E+02	4,06E+02	5,18E+01	8,40E+02
<b>GWP-fossil</b>	kg CO <sub>2</sub> eq.	2,19E+02	2,85E+00	1,58E+02	4,02E+02	5,16E+01	8,34E+02
<b>GWP-biogenic</b>	kg CO <sub>2</sub> eq.	5,08E-01	2,07E-04	5,79E-01	3,87E+00	5,05E-02	5,01E+00
<b>GWP-luluc</b>	kg CO <sub>2</sub> eq.	3,63E-01	5,46E-05	2,26E-01	2,94E-01	4,01E-02	9,23E-01
<b>ODP</b>	kg CFC-11 eq.	4,73E-06	6,02E-08	6,80E-06	2,15E-05	3,97E-06	3,71E-05
<b>AP</b>	mol H <sup>+</sup> eq.	4,36E+00	7,25E-03	2,05E+00	2,56E+00	1,10E-01	9,08E+00
<b>EP-freshwater</b>	kg P eq.	3,50E-02	2,19E-06	1,00E-02	1,40E-02	1,01E-03	6,01E-02
<b>EP-marine</b>	kg N eq.	3,62E-01	2,84E-03	1,84E-01	3,08E-01	2,39E-02	8,80E-01
<b>EP-terrestrial</b>	mol N eq.	6,68E+00	3,00E-02	2,11E+00	3,58E+00	2,58E-01	1,27E+01
<b>POCP</b>	kg NMVOC eq.	1,48E+00	1,17E-02	6,87E-01	1,31E+00	7,45E-02	3,56E+00
<b>ADP-min &amp; met</b>	kg Sb eq.	8,31E-02	9,57E-08	7,03E-02	5,27E-02	3,01E-06	2,06E-01
<b>ADP-fossil</b>	MJ	3,41E+03	3,63E+01	2,62E+03	6,83E+03	3,41E+02	1,32E+04
<b>WDP</b>	m <sup>3</sup> eq. deprived	8,05E+01	3,40E-02	2,89E+01	1,86E+02	9,23E+00	3,05E+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 WM-UP2020 L8 Complete Kit

**Table 6.** LCA results for the environmental parameters describing resource use

Parameters	Unit of measurement	Manufacturing	Distribution	Installation	Use	End of life	TOTAL
PERE	MJ	3,69E+02	9,73E-02	1,86E+02	1,11E+03	2,95E+01	1,69E+03
PERM	MJ	4,77E+01	0,00E+00	0,00E+00	0,00E+00	0,00E+00	4,77E+01
PERT	MJ	4,16E+02	9,73E-02	1,86E+02	1,11E+03	2,95E+01	1,74E+03
PENRE	MJ	3,40E+03	3,74E+01	2,65E+03	6,87E+03	3,44E+02	1,33E+04
PENRM	MJ	5,08E+01	0,00E+00	3,47E-02	2,61E-02	0,00E+00	5,09E+01
PENRT	MJ	3,45E+03	3,74E+01	2,65E+03	6,87E+03	3,44E+02	1,33E+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>	1,23E+04	5,78E+00	1,16E+04	9,05E+04	7,54E+02	1,15E+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 WM-UP2020 L8 Complete Kit

**Table 7.** LCA results for the environmental parameters describing waste production

Parameters	Unit of measurement	Manufacturing	Distribution	Installation	Use	End of life	TOTAL
HWD	kg	5,00E-02	0,00E+00	0,00E+00	0,00E+00	0,00E+00	5,00E-02
NHWD	kg	0,00E+00	0,00E+00	1,36E+00	8,85E-05	8,69E+00	1,01E+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	1,46E-01	0,00E+00	1,41E+00	4,50E+01	3,84E+01	8,50E+01
MER	kg	0,00E+00	0,00E+00	8,49E-02	1,30E-04	6,75E-02	1,53E-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 WM-UP2020 L16 Complete Kit

**Table 8.** 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.	2,62E+02	2,37E+00	1,59E+02	4,41E+02	5,44E+01	9,19E+02
<b>GWP-fossil</b>	kg CO <sub>2</sub> eq.	2,61E+02	2,37E+00	1,58E+02	4,36E+02	5,42E+01	9,12E+02
<b>GWP-biogenic</b>	kg CO <sub>2</sub> eq.	6,23E-01	1,73E-04	5,79E-01	4,39E+00	5,09E-02	5,64E+00
<b>GWP-luluc</b>	kg CO <sub>2</sub> eq.	4,59E-01	4,54E-05	2,26E-01	2,96E-01	4,04E-02	1,02E+00
<b>ODP</b>	kg CFC-11 eq.	5,56E-06	5,01E-08	6,80E-06	2,22E-05	3,97E-06	3,86E-05
<b>AP</b>	mol H <sup>+</sup> eq.	4,74E+00	6,03E-03	2,05E+00	2,67E+00	1,12E-01	9,58E+00
<b>EP-freshwater</b>	kg P eq.	4,42E-02	1,82E-06	1,00E-02	1,46E-02	1,02E-03	6,98E-02
<b>EP-marine</b>	kg N eq.	4,26E-01	2,36E-03	1,84E-01	3,26E-01	2,44E-02	9,62E-01
<b>EP-terrestrial</b>	mol N eq.	7,61E+00	2,50E-02	2,11E+00	3,80E+00	2,63E-01	1,38E+01
<b>POCP</b>	kg NMVOC eq.	1,69E+00	9,74E-03	6,87E-01	1,40E+00	7,58E-02	3,87E+00
<b>ADP-min &amp; met</b>	kg Sb eq.	1,08E-01	7,97E-08	7,03E-02	5,27E-02	3,04E-06	2,31E-01
<b>ADP-fossil</b>	MJ	4,11E+03	3,03E+01	2,62E+03	7,44E+03	3,43E+02	1,45E+04
<b>WDP</b>	m <sup>3</sup> eq. deprived	9,00E+01	2,83E-02	2,89E+01	2,08E+02	9,29E+00	3,36E+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 WM-UP2020 L16 Complete Kit

**Table 9.** LCA results for the environmental parameters describing resource use

Parameters	Unit of measurement	Manufacturing	Distribution	Installation	Use	End of life	TOTAL
PERE	MJ	4,11E+02	8,10E-02	1,86E+02	1,24E+03	2,97E+01	1,87E+03
PERM	MJ	4,77E+01	0,00E+00	0,00E+00	0,00E+00	0,00E+00	4,77E+01
PERT	MJ	4,59E+02	8,10E-02	1,86E+02	1,24E+03	2,97E+01	1,92E+03
PENRE	MJ	4,08E+03	3,11E+01	2,65E+03	7,48E+03	3,47E+02	1,46E+04
PENRM	MJ	6,55E+01	0,00E+00	3,47E-02	2,61E-02	0,00E+00	6,56E+01
PENRT	MJ	4,15E+03	3,11E+01	2,65E+03	7,48E+03	3,47E+02	1,47E+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>	1,39E+04	4,81E+00	1,16E+04	1,03E+05	7,64E+02	1,29E+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 WM-UP2020 L16 Complete Kit

**Table 10.** LCA results for the environmental parameters describing waste production

Parameters	Unit of measurement	Manufacturing	Distribution	Installation	Use	End of life	TOTAL
HWD	kg	3,23E-02	0,00E+00	0,00E+00	0,00E+00	0,00E+00	3,23E-02
NHWD	kg	0,00E+00	0,00E+00	1,36E+00	8,85E-05	9,56E+00	1,09E+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	9,42E-02	0,00E+00	1,41E+00	4,50E+01	4,02E+01	8,68E+01
MER	kg	0,00E+00	0,00E+00	8,49E-02	1,30E-04	6,75E-02	1,53E-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

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