OEMB – OFFICINE ELETTROMECCANICHE BONOMI

ENVIRONMENTAL PRODUCT DECLARATION (EPD) FOR

ELECTRIC SWITCHBOARD
RMU-AR1-I006 - 3I 24KV-16KA

EPD in accordance with ISO 14025 and EN 50693:2019

Program Operator	**EPDItaly**
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SOMMARIO

1. GENERAL INFORMATION

The Environmental Product Declaration (EPD) for the ELECTRIC SWITCHBOARD RMU-AR1-I006 - 3I 24KV-16KA produced in OEMB in 2024 for the Global market is prepared according to ISO 14025 standard. The functional unit is 1 finished RMU-AR1-i006-3i 24kV-16kA packed and ready to be transported from OEMB's site to its clients. The nominal voltage of the functional unit is 24 kV. The Reference Service Life (RSL) of the product is 20 years. The technical description of the products is reported in the following paragraphs.

The EPD is product specific.

It complies with the product category rules PCR EPD Italy 007 Electronic and electrical products and systems and PRC EPD Italy 015 Switchboards. The results are based on the Life cycle assessment (LCA) report conducted in accordance with the EN ISO 14040 and EN ISO 14044 standards. The switchboards covered by this EPD are devices used to monitor and measure electricity consumption with a service life of 20 years and are not defined as construction products, therefore EN 50693 is applied.

General Information	
Epd Owner	
Name of the company	Officine elettromeccaniche Bonomi
Address	Registered office: Via A. Mercanti 17, 25018, Montichiari (BS), Italy Operative office: Via Italo Calvino 6, 25018, Montichiari (BS), Italy
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Program Operator	
EPDItaly	Via Gaetano De Castilia n. 10 – 20124 Milano, Italy
Information on the EPD	
Product name	RMU-AR1-I006 - 3I 24KV-16KA
Site	Registered office: Via A. Mercanti 17, 25018, Montichiari (BS), Italy Operative office: Via Italo Calvino 6, 25018, Montichiari (BS), Italy
Short description and technical information of the product	The RMU switchboards of the Bonomi Group, insulated in gas, allow the connection, power supply and protection of transformers for open or radial ring networks.
Field of application of the product	Ring main unit used by clients in primary distribution substations
EPD's type	
CPC code	CPC 46214 Boards, consoles, cabinets and other bases, equipped with electrical switching etc. apparatus, for electric control or the distribution of electricity, for a voltage exceeding 1000 V
Verification information	
PCR (title, version, date of publication or update)	PCR EPDItaly 007 Electronic and electrical products and systems (Rev.3.1 12/11/2024). Sub-PCR EPDItaly 015 Electronic and electrical products and systems – Switchboards (Rev.2.0 01/07/2024)
EPDItaly Regulation (version, date of publication or update)	General Program Instructions of EPDItaly REV 6.0 of 30/10/2023

Project report LCA	LCA STUDY OF RMU-AR1-I006 - 3I 24KV-16KA PRODUCED BY GRUPPO OEMB
Review statement	This declaration has been developed in accordance with the regulations of EPDItaly; further information and the same regulations are available at: www.epditaly.it . Independent verification of the declaration and data carried out in accordance with ISO 14025: 2010 ☐ Internal ☒ External External Third-party verification carried out by: SGS ICS Italia srl, Accredited by Accredia, accreditation number 02242.
Comparability statement	Environmental statements published within the same product category, but from different programs, may not be comparable.
Liability statement	The EPD Owner releases EPDItaly from any non compliance with environmental legislation. The holder of the declaration will be responsible for the information and supporting evidence. EPDItaly disclaims any responsibility for the information, data and results provided by the EPD Owner for life cycle assessment.

Additional information	
EPD owner	Officine Elettromeccaniche Bonomi
Company contact	Riccardo Bonomi, riccardo.bonomi@gruppo-bonomi.com
Technical support	Martina Cimatti, Francesca Reale *Ecoinnovazione S.r.l. – spin-off ENEA* *Via della Liberazione 6, 40128, Bologna, Italy* ecoinnovazione spin off ENEA www.ecoinnovazione.it

2. PRODUCT RELATED INFORMATION

2.1 THE COMPANY

Since 1928 Bonomi's production units are specialised in the engineering and production of solutions to support electrical conductivity and insulation. The group's expertise lies in the railway, energy and custom sectors. Over the last 10 years' Bonomi has broadened its product base and expertise by acquisition, establishing itself as an international market leader. OEMB is part of the Bonomi Group and was founded in 1961 in Brendola (VI).

2.2 THE PRODUCT

The medium-voltage switchgear RMU, functional unit of this study, is intended for installation in secondary substations, where electrical energy is converted from medium voltage to low voltage. The term "RMU" stands for Ring Main Unit and refers to a specific type of compact switchgear insulated with SF_6 gas. It integrates all MV functions required for the connection, supply, and protection of one or more MV/LV transformers installed on a network. The electrical characteristics are the following:

- Rated Voltage (Un): 24 kV
- Rated Current (In): 630 A
- Short-Circuit Current (Ik): 16 kA
- Peak Current (Ip): 40 kA

The RMU switchboards of the Bonomi Group, insulated in gas, allows the connection, power supply and protection of transformers for open or radial ring networks.

The production processes of the product covered by the present EPD is schematized in Table 1.

The reference CPC code is 46214 "Boards, consoles, cabinets and other bases, equipped with electrical switching etc. apparatus, for electric control or the distribution of electricity, for a voltage exceeding 1000 V".

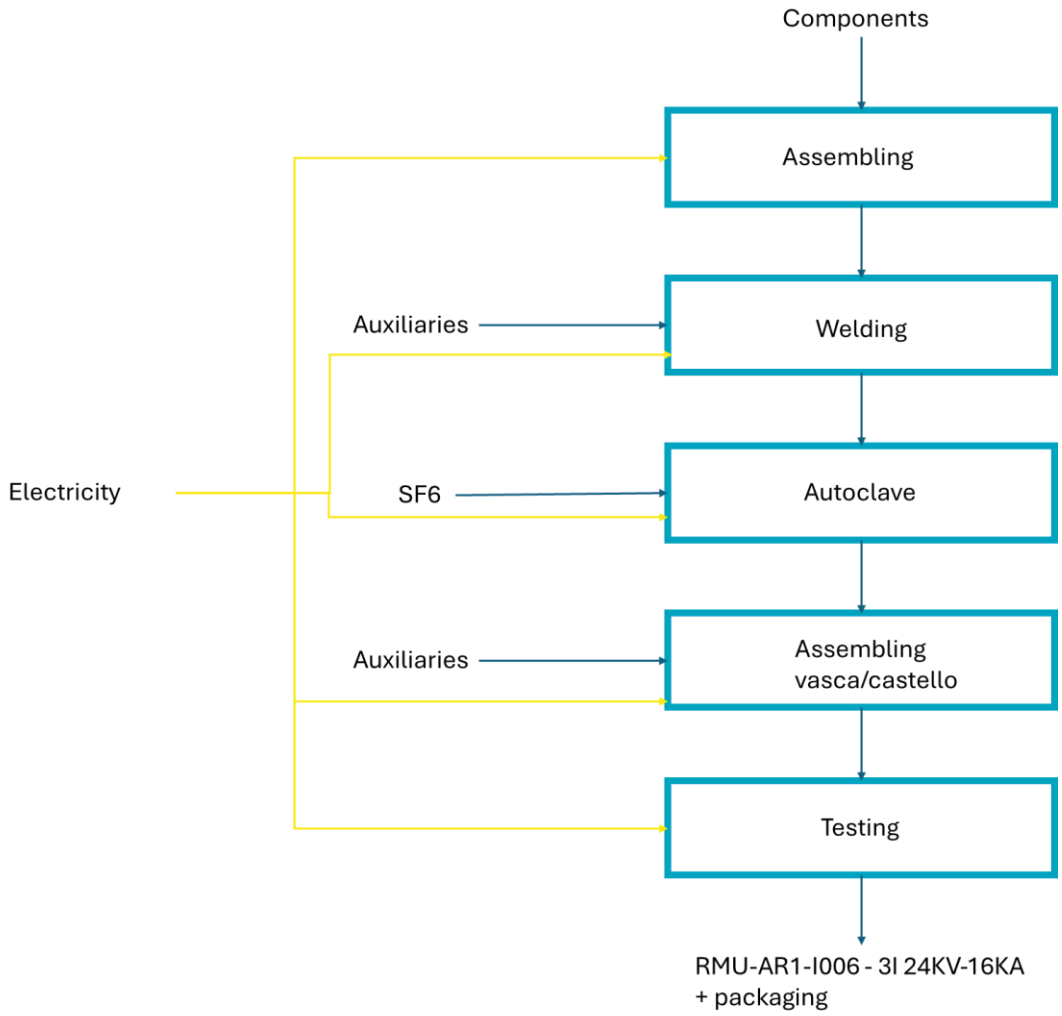

Table 1: Production process

2.2.1 PRODUCT COMPOSITION

The composition of the product is reported in Table 2 while

Table 3 reports information about the packaging.

Table 2: Product composition.

Macro categories	Material	Weight [kg]	Relevance wt [%]	Note
Steel	Steel	**483,5**	**76,30%**	Tinplates/Bolts/Tongs/Assembly (steel parts forged)/Semifinished components/Assiemi (mix of differents components in steel)
Other metals	Mix copper semifinished components	**29,53**	**4,66%**	Different components as contacts/bar/support

	Mix aluminium semifinished components	**13,74**	**2,17%**	Bolts and bars
	Iron bolts	**20,16**	**3,18%**	Bolts
	Brass electric material	**14,4**	**2,26%**	Tyco/wire/contacts/bolts
Plastic	Plastic support	**20**	**3,16%**	Plastic support
	Epoxy resin components	**31,8**	**5,02%**	Epoxy resin insulator/panel
	PPS GF – thermoplastic glass fiber	**3,29**	**0,52%**	Plastic support
Other materials	Electronic material (power outlets)	**0,795**	**0,13%**	Power outlets
	Ceramic material	**9,48**	**1,50%**	Ampolla, mix of ceramic, copper and steel
Gas	SF6	**7**	**1,10%**	Insulator gas
	TOT.	**634**	**100%**	

Table 3: Packaging material.

Packaging material	Amount per product [kg]
Wood pallet	32
Steel strap	0,1
Plastic film	1

2.2.2 PRODUCT REFERENCE SERVICE LIFE

The use and maintenance stage includes the energy consumed by the product and all maintenance activities that may occur throughout its entire service life (20 years of RSL, as defined in sub-PCR 0015, section 4.2.3.5). The company has confirmed that no maintenance is expected during the 20-year lifespan of the product; therefore, only energy consumption has been considered.

3. ENVIRONMENTAL PRODUCT DECLARATION

3.1 METHODOLOGY

The study has been performed according to the state of art of the LCA methodology, in accordance with the following standards and guidelines:

- EN ISO 14040:2006+A1:2020 Environmental management -- Life cycle assessment -- Principles and framework.
- EN ISO 14044:2006+A2:2020 Environmental management -- Life cycle assessment -- Requirements and guidelines.
- ISO EN 50693:2019 Product category rules for life cycle assessments of electronic and electrical products and systems
- Regolamento EPD Italy, revisione 6.0
- PCR EPDItaly007 per prodotti e sistemi elettronici ed elettrici Rev.3.1
- Sub-PCR EPDItaly015 per quadri elettrici Rev.2

The assessment of the potential environmental impacts of the products and components under study has been performed with the support of LCA software LCA for Experts version 10.9.1.19, by Sphera and the use of the implemented database (version 2025.2). Results presented and discussed in the study are calculated according to the Life Cycle Impact Assessment (LCIA) method required by the 4.4 section of the PCR 007, i.e. the EN15804:2012+A2:2019. Standard EN 15804:2012+A2:2019 (Sustainability of construction works - Environmental product declarations - Core rules for the product category of construction product) used for characterization factors calculation. Results presented and discussed in the study are calculated according to the Life Cycle Impact Assessment (LCIA) method mandatory for EN15804:2012+A2:2019, which is the method prescribed by the PCR 007 and which is based on the LCIA method EF3.1.

3.2 FUNCTIONAL UNIT

The functional unit is 1 finished RMU-AR1-i006-3i 24kV-16kA packed and ready to be transported from OEMB's site to its clients. The nominal voltage of the functional unit is 24 kV. The Reference Service Life (RSL) of the product is 20 years. The technical description of the products is reported in the following paragraphs.

3.3 SYSTEM BOUNDARY

The identification of the life cycle stages follows the modular approach adopted by the standard EN 50693. The system boundaries are, as in 4.2.3.1 of PCR EPDItaly 007 and according to Section 1.3, refer to 4.2.3.1 of EN 50693 are divided in modules that are represented in Table 4.

Table 4: Modules declared, from "cradle to grave".

MANUFACTURING STAGE	DISTRIBUTION STAGE	INSTALLATION STAGE	USE AND MAINTENANCE STAGE	END-OF-LIFE STAGE	BENEFIT AND LOADS*
Components Supply Transport Manufacturing	Transport	Waste packaging treatment	Energy used by the product during its service life	Deconstruction/demolition, waste processing, disposal	Reuse, Recovery, recycling potential
X	X	X	X	X	OPTIONAL (MND)

MND = Module not declared.

The following stages are included in the study:

- *Manufacturing stage*
  - Production of the materials and components making up the reference product, including the final packaging
  - Industrial processes used to assemble the reference product and packaging components.
- *Distribution stage*
  - Transportation of the product in its packaging from the manufacturer's last logistics platform to the distributor and from the distributor to the place of installation and/or operation.
- *Installation stage*
  - Management of the waste generated at the installation place (collection and treatment up to its final treatment (e.g. material recovery, energy recovery, disposal):
    - Packaging
- *Use and maintenance stage*

  - Energy consumption and other flows (emissions, water, etc.) of the product during its use over the RSL.

End-of-life stage and de-installation

  - De-installation, Collection, transport, storage (Transportation by the user to the collection point may be excluded), it includes:
    - Fractions separation and preparation (e.g.: dismantling, crushing, shredding, sorting processes)

- Material recovery processes (e.g.: without benefit)
- Disposal (e.g.: incineration without energy recovery, landfill)

End-of-life stage follows the polluter pays principal.

The reference year of the study is **2024.**

3.4 MAIN ASSUMPTIONS, CUT-OFFS, BACKGROUND DATA INFORMATION AND SCENARIOS

3.4.1 ENERGY

The modelling of the electricity in the production process in Montichiari reflects the specific mix purchased by the company, i.e. hydropower. The GWPtot of the energy is 0,01 $kgCO_2eq/kW$.

3.4.2 ALLOCATION

Energy consumption, resources used for production (water and ancillary), packaging of final product together with waste of the production process are allocated to the product production based on the mass.

3.4.3 CUT-OFFS CRITERIA

- Various materials were excluded mainly due to due to the lack of information. They overall weight 0,6 kg, i.e. 0,0004% of the whole bill of components. The environmental impact of this material, calculated as proxy, is less than 5% of the total (1,13 kgCO2eq).
- Machinery waste (i.e. machinery waste that can be considered part of capital goods) are not considered, They overall weight 800kg, 0,009% of the total waste. Machinery are not used only for the product studied but are considered part of the capital goods, the impact of this good lowered during the years.

3.4.4 BACKGROUND DATA INFORMATION

For all the input material a European dataset has been used, this choice was made due to lack of dataset from Italy and information from suppliers of suppliers. When the European dataset is not available a German dataset as been used as replacement, this is due to similarity of data from European and German, and availability.

Electricity and thermal energy from natural gas have been modelled using national (Italian) datasets.

For raw materials, auxiliaries, packaging and waste a road transport is assumed on a truck Euro 4 (24,7 t) with a utilisation ratio of 61% (standard data from Sphera dataset).

3.4.5 SCENARIOS FOR STAGES

Distribution stage:

A weighted average distance is considered, based on client's location in the reference period. It results in 1002,20 km by ship, and 654,48 km by truck.

Installation stage:

For the installation phase, only the disposal of the packaging of the finished product is considered. In this case, the packaging consists of 32 kg of wooden pallets, 0,1 kg of metal straps, and 1 kg of plastic film. Average EoL rates are applied, based on European data. To this regard, for waste plastic packaging, EoL treatment rates as reported by PlasticsEurope (2021) for Italy are adopted. Such rates are referred to 2020. For waste cardboard packaging, the End-of-life treatment rates from COMIECO (2018) are applied, whose reference year is 2017. For waste wood packaging, End-of-life treatment rates retrieved from CONAI are applied, whose reference year is 2017. EoL rates considered for packaging waste are reported in Table 5, together with distance to collection/treatment site.

Table 5: EoL rates applied for packaging waste and transport distance

Waste packaging	EoL treatment rates	Transport distance
Waste paper/cardboard packaging	79,8% recycling 20,2% incineration	100
Waste wood packaging	61% recycling 36% incineration 3% landfill	100
Waste plastic packaging	34,6% recycling 42% incineration 23,4% landfill	100

Use and maintenance stage:

The electricity consumed for 20 years of life span is considered. If one panel at 20°C consumes 204 W per day, 1460 kWh is the consumption in after 20 years ($Euse$ $[kWh]$= ($Puse*$ 8760$*RSL$)/1000).

The Italian grid mix has been considered, since 84% of the switchboard are sold in Italy.

End of life:

For the end-of-life stage an Italian scenario has been considered, since 84% of RMU are sold in Italy and the study is conducted for an Italian tender.

The end-of-life stage considered all the phases from the de-installation, shredding, transport to the facilities and then recycling, recovery, landfill.

The de-installation phase has not be considered as there is lack of information about it, the model starts with the deconstruction phase where it has been considered a 10% of the total lost during the dismantling process. That is a conservative assumption. The SF6 gas has been taken from the switchboard during this phase, it is assumed totally recovered without any leakage of it.

After the dismantling, the material undergoes a shredding process and sorted fraction is sent to remelting for the metals. To simplify the model 3 categories of waste are treated: metals, plastic and gas.

SF6 gas is assumed to be totally recovered, metals with all follow the assumption of aluminium (from European Aluminium rates,95% recycled, 5% to landfill) and plastic will follow Eurostat rate from 2015 (31,3% to landfill, 61,8% recovery and 3% incineration).

As assumption the distance between demolition site and shredding site is 200 km, demolition site to landfill is 50 km. From shredding site to landfill is 50 km as well.

For the shredding process of both metals and plastic an electricity consumption of 0,2 MJ per kg of material to be sorted is considered. Such consumption reflects the electricity consumption of a car shredder based on Sphera database (Car shredding dataset). Metals not recovered is landfilled. Collection and processing efficiency are reported in Table 6. As a conservative approach, a share of shredded metals is considered to not enter the recycling process. This is aligned with the study [1] performed by Ecoinnovazione for the European Aluminium, with no other assumption for metals has been made we considered this share for each type of metals.

Table 6: Applied collection and waste processing efficiency for the End-of-life.

End-of-life - collection and processing efficiency	
Collection efficiency - %	
Material collected	90
Material lost at the collection site	10
Processing efficiency (shredding) - %	
Metals sent to recycling after shredding	95
Metals lost in the shredding	5
Gas SF6 recovered before shredding	100
Plastic sent to incineration after shredding	68
Plastic lost in shredding	32

[1] Ecoinnovazione (2019), confidential.

3.5 PARAMETERS DESCRIBING THE ENVIRONMENTAL IMPACT ACCORDING EN15804+A2

The estimated impact results are only relative statements which do not indicate the end points of the impact categories, exceeding threshold values, safety margins or risks.

Table 7: Impacts of RMU per declared unit (1 piece) according to EN 15804:2012+A2:2019.

Core impact indicators	Manufacturing Stage	Distribution Stage	Installation Stage	Use and maintenance Stage	End of Life Stage
Climate Change - total [kg CO2 eq.]	2,70E+03	4,71E+01	2,18E+01	5,70E+02	6,63E+01
Climate Change, fossil [kg CO2 eq.]	2,69E+03	4,64E+01	1,67E+00	5,60E+02	6,59E+01
Climate Change, biogenic [kg CO2 eq.]	1,15E+01	2,13E-01	2,01E+01	7,57E+00	2,23E-01
Climate Change, land use and land use change [kg CO2 eq.]	3,20E+00	4,22E-01	3,81E-03	1,51E+00	1,84E-01
Ozone depletion [kg CFC-11 eq.]	4,84E-07	5,50E-12	1,74E-13	1,30E-08	2,85E-10
Acidification [Mole of H+ eq.]	6,82E+00	4,10E-01	5,40E-03	1,25E+00	1,31E-01
Eutrophication, freshwater [kg P eq.]	9,06E-03	1,12E-04	7,19E-06	1,73E-03	4,79E-04
Eutrophication, marine [kg N eq.]	1,16E+00	1,83E-01	2,02E-03	2,52E-01	5,29E-02
Eutrophication, terrestrial [Mole of N eq.]	1,25E+01	1,99E+00	2,51E-02	3,18E+00	5,92E-01
Photochemical ozone formation, human health [kg NMVOC eq.]	3,79E+00	3,94E-01	5,28E-03	6,08E-01	1,08E-01
Resource use, mineral and metals [kg Sb eq.]*	1,28E-01	2,89E-06	2,77E-08	1,10E-04	3,41E-06
Resource use, fossils [MJ]*	2,11E+04	6,05E+02	5,29E+00	8,18E+03	3,92E+02
Water use [m^3 world equiv.]*	2,38E+02	1,77E-01	2,16E+00	2,34E+02	8,83E+00

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

3.6 INDICATORS OF RESOURCES USE, WASTE AND OUTPUT FLOWS, BIOGENIC CONTENT

Table 8: Impacts of RMU per declared unit (1 piece) according to EN 15804:2012+A2:2019.

Resource use indicators	Manufacturing Stage***	Distribution Stage	Installation Stage	Use and maintenance Stage	End of Life Stage
Use of renewable primary energy (PERE) [MJ]	4,37E+03	3,88E+01	1,49E-01	7,90E+03	1,86E+02
Primary energy resources used as raw materials (PERM) [MJ]*	5,24E+02	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Total use of renewable primary energy resources (PERT) [MJ]	4,90E+03	3,88E+01	1,49E-01	7,90E+03	1,86E+02
Use of non-renewable primary energy (PENRE) [MJ]	2,10E+04	6,05E+02	5,29E+00	8,18E+03	3,92E+02
Non-renewable primary energy resources used as raw materials (PENRM) [MJ]**	2,19E+02	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Total use of non-renewable primary energy resources (PENRT) [MJ]	2,12E+04	6,05E+02	5,29E+00	8,18E+03	3,92E+02
Input of secondary material (SM) [kg]	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Use of renewable secondary fuels (RSF) [MJ]	9,93E-04	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Use of non renewable secondary fuels (NRSF) [MJ]	9,52E-02	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Use of net fresh water (FW) [m3]	7,16E+00	1,90E-02	5,04E-02	6,20E+00	2,30E-01
Output flows and waste categories	**Manufacturing Stage*** **	**Distribution Stage**	**Installation Stage**	**Use and maintenance Stage**	**End of Life Stage**
Hazardous waste disposed (HWD) [kg]	2,00E+01	2,18E-08	-2,57E-10	7,76E-06	1,82E-07
Non-hazardous waste disposed (NHWD) [kg]	1,43E+02	7,53E-02	1,28E+00	8,49E+00	1,16E+02
Radioactive waste disposed (RWD) [kg]	2,71E-01	7,85E-04	-7,44E-05	3,16E-01	7,73E-03
Components for re-use (CRU) [kg]	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Materials for Recycling (MFR) [kg]	1,09E+01	0,00E+00	1,99E+01	0,00E+00	4,90E+02
Material for Energy Recovery (MER) [kg]	2,18E+00	0,00E+00	3,00E-01	0,00E+00	0,00E+00
Exported electrical energy (EEE) [MJ]	4,95E+00	0,00E+00	1,36E+00	0,00E+00	0,00E+00
Exported thermal energy (EET) [MJ]	8,76E+00	0,00E+00	2,43E+00	0,00E+00	0,00E+00
Biogenic carbon content	**Manufacturing Stage*** **	**Distribution Stage**	**Installation Stage**	**Use and maintenance Stage**	**End of Life Stage**
Biogenic carbon content in packaging [kg]***	2,02E+01	0,00E+00	0,00E+00	0,00E+00	0,00E+00

* Due to the presence of the wood bars, the calorific value of the wood chips was considered as 12,2 MJ/kg. (AIEL 2009)

** The calorific value of plastic was considered at 43 MJ MJ/kg. This is the value attributed to Polypropylene granulate (PP) mix by LCA FE dataset.

*** 1 kg biogenic carbon is equivalent to 44/12 kg CO2.

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