COELME
COSTRUZIONI ELETTROMECCANICHE - SPA

EPD ITALY

# ENVIRONMENTAL PRODUCT DECLARATION

EPD according to ISO 14025 and EN 50693:2019

| PRODUCTS | PRODUCTION PLANT |
|---|---|
| TCB-E 170(650)-1250<br>TCB 170(650)-1250<br>TCB-EE 145-3150 | Via Galileo Galilei 1/2<br>30036 Santa Maria di Sala (VE) - Italy |

| | |
|---|---|
| Program Operator | EPDItaly |
| Published by | EPDItaly |
| Declaration number | EPD COELME TCB_1_2023 |
| Registration number | EPDITALY0416 |
| Release Date | 2023-02-02 |
| Valid until | 2028-02-01 |

## GENERAL INFORMATION

| | |
|---|---|
| EPD OWNER | COELME SpA<br>Via Galileo Galilei 1/2 – 30036 Santa Maria di Sala (VE), Italy<br>P.IVA 02699640278 |
| PRODUCTION SITE: | Via Galileo Galilei 1/2 – 30036 Santa Maria di Sala (VE), Italy |
| PROGRAM OPERATOR | EPDItaly; Via Gaetano De Castillia, 10 20124 - MILAN; https://www.epditaly.it/; info@epditaly.it |
| INDEPENDENT VERIFICATION | This EPD was developed following EPDItaly General Program Instruction Rev. 5.2 - 2022/02/16<br>Independent verification of declaration and data carried out according to ISO 14025:2010<br>☐Internal ☒External<br>Third party verification performed by: IMQ SpA - Via Quintiliano 43, 20138 Milan Italy (https://www.imq.it/it) (Certification Body in progress of accreditation) |
| SCOPE | The study was carried out for the following COELME Double-break Disconnectors: TCB-E 170(650)-1250; TCB 170(650 –1250; and TCB-EE 145-3150. The declared unit is a mechanical switching device which provides, in the open position, an isolating distance in accordance with specified requirements, during a service life of 20 years. Primary data collected refer to the year 2021. The scope of the EPD is cradle to grave. |
| UNCPC CODE | 46211 - "Electrical apparatus for switching or protecting electrical circuits, or for making connections to or in electrical circuits, for a voltage exceeding 1000 V" |
| PRODUCT CATEGORY RULES (PCR) | EPDItaly PCR EPDItaly012 – 2020/03/16: Electronic and Electrical Products and Systems – Switches; Rev. 0<br>EPDItaly PCR EPDItaly007 – 2020/10/21: Electronic and Electrical Products and Systems; Rev. 2<br>EN 50693:2019 Product category rules for life cycle assessments of electronic and electrical products and systems; 2019 |
| COMPARABILITY | Environmental claims published within the same product category, though originating from different programmes, may not be comparable. |
| RESPONSIBILITY | COELME relieves EPDItaly from any non-compliance with environmental legislation. The holder of the declaration shall be responsible for the supporting information and evidence; EPDItaly declines all responsibility for the manufacturer's information, data and life cycle assessment results. |
| COMPANY CONTACT | Faoro Giovanni<br>E-mail: giovanni_faoro@coelme.it<br>COELME website: www.coelme-egic.com |
| TECHNICAL SUPPORT | E-Stream, Via Makallè 10 - 35138, Padova (PD)<br>ege@e-stream.it<br>http://e-stream.it/ |

## THE COMPANY

COELME S.p.A. was founded in 1975 around a well-defined industrial project, pooling together some of the best experts in the electromechanical sector with proven knowledge in the fields of High Voltage clamps and medium, high and extra high voltage disconnectors.
The firsts COELME products were High Voltage clamps; subsequently, the Company started to design, produce and sell medium and high voltage disconnectors, achieving continuous growth and diversification of both its product line-up and its sale market.
Over the years, COELME has improved, increased and differentiated its production. Currently COELME offers a wide range of standardized products, whilst keeping the flexibility to design and build special equipment, of which the high voltage disconnectors represent a significant example.
Today, COELME designs and manufactures electromechanical equipment able to meet the most diverse and demanding markets in terms of quality, reliability and performance.
Currently, COELME's range includes:

- medium – high – extra high voltage disconnectors up to over 800 kV – 8000 A, for alternating current and direct current, compliant with IEC standards and ANSI standards, including:
- MV switchgear equipment with vacuum technology
- switchgear equipment with SF6 technology
- switchgear equipment for the railway network

COELME is considered one of the leaders in its sector, not just in Italy (where it is among the few suppliers of products able to comply with the strict specifications of TERNA - ENEL - RFI), but also abroad, thanks to numerous supplies to local electrical utilities companies, carried out directly or through some of the most important players in the generation, transmission and distribution of electricity and railway networks markets.

# SCOPE OF THE STUDY

## System boundaries

This EPD describes the environmental impact of the investigated products according to a "Cradle to grave" life cycle.
The life cycle under study includes:

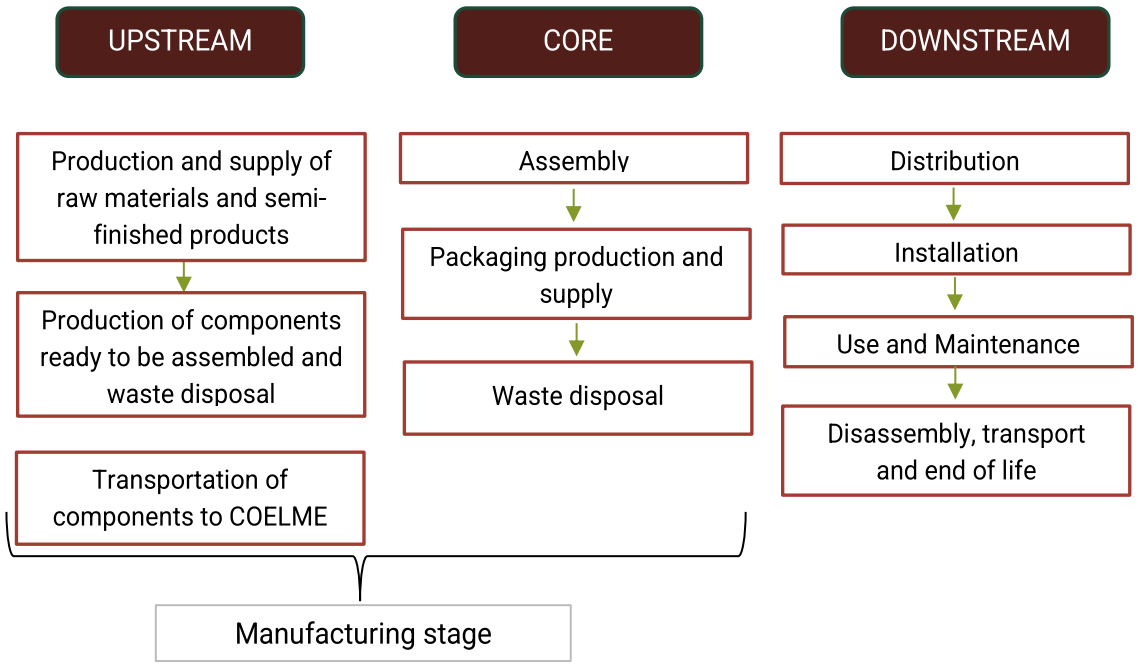
- Manufacturing stage (upstream module e core module)
- Distribution stage (downstream)
- Installation stage (downstream)
- Use & Maintenance Stage (downstream)
- End-of-Life Stage (downstream)

*Table 1: System boundaries2*

| **MANUFACTURING STAGE** | | **DISTRIBUTION STAGE** | **INSTALLATION STAGE** | **USE & MAINTENANCE STAGE** | **END-OF-LIFE STAGE** |
|---|---|---|---|---|---|
| **UPSTREAM MODULE** | **CORE MODULE** | **DOWNSTREAM MODULE** | | | |
| Extraction of raw materials, including waste recycling processes, and production of semi-finished and auxiliary products | Production of the product, including all stages | Transport A: to the distributor / sorting center | Installation | Use | Disassembly |
| | | Reconditioning at the distributor or fulfillment center | Treatment of generated waste | Maintenance | Pick-up and transport |
| | | Transport B: to the place of installation | | Treatment of generated waste | Product treatment (end of life) |
| Transport of raw materials to the company | Product assembly | | | | |
| | Packaging | | | | |
| | Waste disposal and recycling | | | | |

Figure 1 shows the system boundaries of this study. COELME only CORE activity for the investigated products is the assembly of the TCBs. Every component is delivered to COELME ready to be assembled.

*Figure 1: Life Cycle*




## Products description

The products studied are the following double-break disconnectors. The respective tables show their technical specifications, material composition and packaging.

- TCB-E 170(650)–1250:

| | |
|---|---|
| Rated voltage | 170 kV |
| Rated current | 1250 A |
| Number of poles | 3 |
| Rated lightning impulse withstand voltage (common value) | 650 kV |
| Earth blade | 1 |
| Number of control units | 2 |

| **Material** | **Composition %** |
|---|---|
| Aluminum | 10,62% |
| Copper | 1,81% |
| Galvanized steel | 42,86% |
| Acciaio stainless steel | 2,06% |
| Cast iron | 9,75% |
| Fiberglass | 30,25% |
| Plastics and silicones | 1,06% |
| Cables/electronic equipment | 1,60% |
| Silver | 0,00062% |
| **Total mass** | **1,315.11 kg** |

| | | | |
|---|---|---|---|
| **Packaging** | Wood: 650 kg | Steel: 29.6 kg | Plastic: 1kg |

- TCB 170(650)–1250:

| | |
|---|---|
| Rated voltage | 170 kV |
| Rated current | 1250 A |
| Number of poles | 3 |
| Rated lightning impulse withstand voltage (common value) | 650 kV |
| Earth blade | Absent |
| Number of control units | 1 |

| **Material** | **Composition %** |
|---|---|
| Aluminum | 6,88% |
| Copper | 0,92% |
| Galvanized steel | 40,72% |
| Acciaio stainless steel | 1,13% |
| Cast iron | 11,81% |
| Fiberglass | 37,23% |
| Plastics and silicones | 0,56% |
| Cables/electronic equipment | 0,75% |
| Silver | 0,00077% |
| **Total mass** | **1,647.10 kg** |

| | | | |
|---|---|---|---|
| **Packaging** | Wood: 650 kg | Steel: 29.6 kg | Plastic: 1kg |

- TCB-EE 145-3150:

| | |
|---|---|
| Rated voltage: | 145 kV |
| Rated current: | 3150 A |
| Number of poles | 3 |
| Number of control units | 2 |
| Earth blade | 2 |

| **Material** | **Composition %** |
|---|---|
| Aluminum | 11,79% |
| Copper | 2,13% |
| Galvanized steel | 20,00% |
| Acciaio stainless steel | 1,90% |
| Cast iron | 6,37% |
| Ceramics | 56,83% |
| Plastics and silicones | 0,19% |
| Cables/electronic equipment | 0,79% |
| Silver | 0,0037% |
| **Total mass** | **1,647.10 kg** |

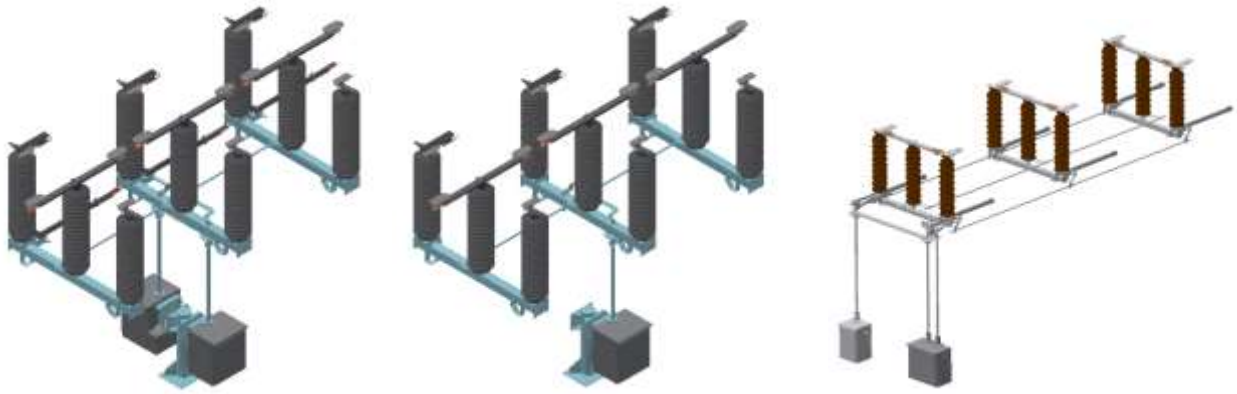
| | | | |
|---|---|---|---|
| **Packaging** | Wood: 120.6 kg | Osb: 59,4 kg | Plastic: 1kg |

TCBs (Double-break Disconnectors) are three-pole devices operated through a mechanical connection by one or more operating mechanism.

Their versatility and resistance to atmospheric agents are highly appreciated: TCBs are installed all over the world and in the most severe environmental conditions, in extremely cold countries or deserts, as well as in the areas with the highest seismic risk on the planet.

The simplicity of the design makes it one of the most widely used disconnectors in the world. Thanks to its three insulators per pole, it is an optimal solution to ensure high load capacity. The horizontal movement and the shape of the contacts allow easy and fast installation and adjustments.

*Figure 2Representative images of: TCB-E 170(650)-1250; TCB 170(650)-1250; TCB-EE 145-3150*



## Production cycle

COELME buys raw materials and semi-finished products from suppliers located in Italy and abroad. The assembly process takes place at COELME's Santa Maria di Sala (VE) plant, and the data collected refer to the year 2021.

## Declared unit and reference flow

The declared unit is a mechanical switching device which provides, in the open position, an isolating distance in accordance with specified requirements, during a reference service life (RSL) of 20 years.
The reference flow is defined by the set of materials, components, and energy flows necessary to produce the declared unit, its functioning during its RSL and its disposal.

## Reference service life

The product has an expected life of 20 years, as defined by the (Sub) PCR EPDItaly012 Rev.0.

## Software and Database used

Simapro, version 9.2.0.2, was used to model the life cycle of the investigated products, alongside the Ecoinvent 3.7.1, ELCD and Industry 2.0 databases.

# RESULTS

The results of the impact assessment provide relative information and cannot predict future impacts based on the final value of an impact category, as well as any exceeding thresholds, margins of safety or risks.

The impacts below refer to a single tripolar disconnector, having a RSL of 20 years.

As required by PCR EPDItaly 012 reRev.0, EN 15804 + A2: 2019 standard was followed for the calculation of the environmental impacts.

For each product studied, the indicators were divided into three groups: environmental impact indicators, resource consumption parameters and parameters of waste production and output flows.

## TCB-E 170(650)–1250

### Environmental impact indicators

| Impact category | Unit | Manufacturing stage | | Distribution stage | Installation stage | Use stage | End of life stage | Total |
|---|---|---|---|---|---|---|---|---|
| | | Upstream | Core | Downstream | | | | |
| GWP - Total | kg CO2 eq | 5,76E+03 | -9,14E+02 | 8,17E+01 | 1,25E+03 | 5,23E+03 | 5,77E+02 | 1,20E+04 |
| GWP-fossil | kg CO2 eq | 5,68E+03 | 2,76E+02 | 8,17E+01 | 4,40E+01 | 5,15E+03 | 5,77E+02 | 1,18E+04 |
| GWP-biogenic | kg CO2 eq | 1,98E+01 | -1,19E+03 | 5,22E-03 | 1,21E+03 | 7,32E+01 | 2,63E-02 | 1,12E+02 |
| GWP-luluc | kg CO2 eq | 5,09E+01 | 9,09E-01 | 6,25E-04 | 6,37E-04 | 5,03E-01 | 3,83E-03 | 5,23E+01 |
| ODP | kg CFC11 eq | 3,42E-04 | 3,36E-05 | 1,91E-05 | 9,37E-06 | 7,22E-04 | 1,33E-05 | 1,14E-03 |
| AP | mol H+ eq | 3,15E+01 | 1,31E+00 | 3,81E-01 | 5,47E-01 | 2,25E+01 | 5,50E-01 | 5,68E+01 |
| EP-freshwater | kg P eq | 2,49E+00 | 5,70E-02 | 3,62E-04 | 4,96E-04 | 1,10E+00 | 1,97E-03 | 3,65E+00 |
| POCP | kg NMVOC eq | 2,51E+01 | 1,44E+00 | 4,05E-01 | 5,18E-01 | 1,06E+01 | 6,98E-01 | 3,88E+01 |
| ADP- M&M* | kg Sb eq | 5,08E-01 | 5,10E-04 | 3,50E-06 | 2,05E-06 | 3,34E-05 | 5,66E-06 | 5,09E-01 |
| ADP-fossil* | MJ | 7,28E+04 | 4,17E+03 | 1,17E+03 | 4,33E+02 | 7,84E+04 | 8,03E+02 | 1,58E+05 |
| WDP* | m3 depriv. | 8,53E+03 | 1,24E+02 | -2,48E-01 | 9,69E-02 | 2,68E+03 | 4,66E+00 | 1,13E+04 |
| *Disclaimer | The results of this environmental impact indicator should be used with caution because the level of uncertainty is high or because experience with the indicator is limited. | | | | | | | |
| Acronyms | GWP-fossil | Global Warming Potential fossil fuels | | | | | | |
| | GWP-biogenic | Global Warming Potential biogenic | | | | | | |
| | GWP-luluc | Global Warming Potential land use and land use change | | | | | | |
| | ODP | Depletion potential of the stratospheric ozone layer | | | | | | |
| | AP | Acidification potential, Accumulated Exceedance | | | | | | |
| | EP-freshwater | Eutrophication potential, fraction of nutrients reaching freshwater end compartment | | | | | | |
| | POCP | Formation potential of tropospheric ozone | | | | | | |
| | ADP-M&M | Abiotic depletion minerals and metals potential (non-fossil resources) | | | | | | |
| | ADP-fossil | Abiotic depletion for fossil resources potential | | | | | | |
| | WDP | Water (user) deprivation potential, deprivation-weighted water consumption | | | | | | |

## Parameters representing resource use

| Indicator | Unit | Manufacturing stage | | Distribution stage | Installation stage | Use stage | End of life stage | Total |
|---|---|---|---|---|---|---|---|---|
| | | Upstream | Core | Downstream | | | | |
| PERE | MJ | 6,09E+03 | 4,96E+03 | 1,72E+00 | 2,17E+00 | 1,61E+04 | 1,17E+01 | 2,71E+04 |
| PERM | MJ | 1,19E+02 | 9,09E+03 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 9,21E+03 |
| PERT | MJ | 6,21E+03 | 1,41E+04 | 1,72E+00 | 2,17E+00 | 1,61E+04 | 1,17E+01 | 3,63E+04 |
| PENRE | MJ | 7,26E+04 | 4,13E+03 | 1,17E+03 | 4,33E+02 | 7,84E+04 | 8,03E+02 | 1,58E+05 |
| PENRM | MJ | 2,61E+02 | 4,23E+01 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 3,04E+02 |
| PENRT | MJ | 7,29E+04 | 4,17E+03 | 1,17E+03 | 4,33E+02 | 7,84E+04 | 8,03E+02 | 1,58E+05 |
| SM | Kg | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 |
| RSF | MJ | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 |
| NRSF | MJ | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 |
| FW | M3 | 2,11E+02 | 3,76E+00 | 1,97E-03 | 1,33E-02 | 7,25E+01 | 1,33E+00 | 2,89E+02 |

| | | |
|---|---|---|
| Acronyms | PERE | Use of renewable primary energy excluding renewable primary energy resources used as raw materials |
| | PERM | Use of renewable primary energy resources used as raw materials |
| | PERT | Total use of renewable primary energy resources |
| | PENRE | Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials |
| | PENRM | Use of non-renewable primary energy resources used as raw materials |
| | PENRT | Total use of non-renewable primary energy re-sources |
| | SM | Use of secondary material |
| | RSF | Use of renewable secondary fuels |
| | NRSF | Use of non-renewable secondary fuels |
| | FW | Use of net fresh water |

## Parameters representing waste generation and output flows

| Indicator | Unit | Manufacturing stage | | Distribution stage | Installation stage | Use stage | End of life stage | Total |
|---|---|---|---|---|---|---|---|---|
| | | Upstream | Core | Downstream | | | | |
| HWD | Kg | 1,78E+00 | 1,64E-01 | 3,10E-03 | 1,53E-03 | 7,34E-02 | 2,95E-03 | 2,02E+00 |
| NHWD | Kg | 3,92E+02 | 6,75E+00 | 6,17E-02 | 2,22E+02 | 3,91E+01 | 4,18E+02 | 1,08E+03 |
| RWD | Kg | 1,49E-01 | 1,48E-02 | 8,47E-03 | 4,16E-03 | 2,00E-01 | 5,47E-03 | 3,82E-01 |
| CRU | Kg | 2,28E+00 | 0,00E+00 | 0,00E+00 | 1,74E+02 | 0,00E+00 | 0,00E+00 | 1,76E+02 |
| MFR | Kg | 7,14E+01 | 2,47E+00 | 0,00E+00 | 2,60E+02 | 0,00E+00 | 7,00E+02 | 1,03E+03 |
| MER | Kg | 2,29E-01 | 0,00E+00 | 0,00E+00 | 1,37E+01 | 0,00E+00 | 2,05E+02 | 2,18E+02 |
| ETE | MJ | 1,20E+00 | 0,00E+00 | 0,00E+00 | 5,08E+01 | 0,00E+00 | 1,62E+03 | 1,67E+03 |
| EEE | MJ | 6,07E-01 | 0,00E+00 | 0,00E+00 | 2,53E+01 | 0,00E+00 | 8,28E+02 | 8,54E+02 |

| | | |
|---|---|---|
| Acronyms | HWD | Hazardous waste disposed |
| | NHWD | Non-hazardous waste disposed |
| | RWD | Radioactive waste disposed |
| | RAW | Components for re-use |
| | MFR | Materials for recycling |
| | MER | Materials for energy recovery |
| | ETE | Exported thermic energy |
| | EEE | Exported electric energy |

TCB 170(650)–1250

## Environmental impact indicators

| Impact category | Unit | Manufacturing stage | | Distribution stage | Installation stage | Use stage | End of life stage | Total |
|---|---|---|---|---|---|---|---|---|
| | | Upstream | Core | Downstream | | | | |
| GWP - Total | kg CO2 eq | 4,42E+03 | -9,14E+02 | 7,16E+01 | 1,25E+03 | 3,71E+03 | 5,53E+02 | 9,10E+03 |
| GWP-fossil | kg CO2 eq | 4,36E+03 | 2,76E+02 | 7,16E+01 | 4,40E+01 | 3,66E+03 | 5,53E+02 | 8,96E+03 |
| GWP-biogenic | kg CO2 eq | 1,23E+01 | -1,19E+03 | 4,58E-03 | 1,21E+03 | 5,20E+01 | 1,88E-02 | 8,34E+01 |
| GWP-luluc | kg CO2 eq | 4,90E+01 | 9,09E-01 | 5,47E-04 | 6,37E-04 | 3,57E-01 | 2,78E-03 | 5,03E+01 |
| ODP | kg CFC11 eq | 2,63E-04 | 3,36E-05 | 1,68E-05 | 9,37E-06 | 5,13E-04 | 1,19E-05 | 8,48E-04 |
| AP | mol H+ eq | 2,34E+01 | 1,31E+00 | 3,34E-01 | 5,47E-01 | 1,60E+01 | 5,23E-01 | 4,21E+01 |
| EP-freshwater | kg P eq | 1,43E+00 | 5,70E-02 | 3,17E-04 | 4,96E-04 | 7,82E-01 | 1,42E-03 | 2,27E+00 |
| POCP | kg NMVOC eq | 2,01E+01 | 1,44E+00 | 3,55E-01 | 5,18E-01 | 7,56E+00 | 6,71E-01 | 3,07E+01 |
| ADP- M&M* | kg Sb eq | 2,08E-01 | 5,10E-04 | 3,07E-06 | 2,05E-06 | 2,38E-05 | 4,48E-06 | 2,09E-01 |
| ADP-fossil* | MJ | 5,63E+04 | 4,17E+03 | 1,02E+03 | 4,33E+02 | 5,57E+04 | 7,31E+02 | 1,18E+05 |
| WDP* | m3 depriv. | 4,33E+03 | 1,24E+02 | -2,17E-01 | 9,69E-02 | 1,90E+03 | 3,34E+00 | 6,36E+03 |
| *Disclaimer | The results of this environmental impact indicator should be used with caution because the level of uncertainty is high or because experience with the indicator is limited. | | | | | | | |
| Acronyms | GWP-fossil | Global Warming Potential fossil fuels | | | | | | |
| | GWP-biogenic | Global Warming Potential biogenic | | | | | | |
| | GWP-luluc | Global Warming Potential land use and land use change | | | | | | |
| | ODP | Depletion potential of the stratospheric ozone layer | | | | | | |
| | AP | Acidification potential, Accumulated Exceedance | | | | | | |
| | EP-freshwater | Eutrophication potential, fraction of nutrients reaching freshwater end compartment | | | | | | |
| | POCP | Formation potential of tropospheric ozone | | | | | | |
| | ADP-M&M | Abiotic depletion minerals and metals potential (non-fossil resources) | | | | | | |
| | ADP-fossil | Abiotic depletion for fossil resources potential | | | | | | |
| | WDP | Water (user) deprivation potential, deprivation-weighted water consumption | | | | | | |

## Parameters representing resource use

| Indicator | Unit | Manufacturing stage | | Distribution stage | Installation stage | Use stage | End of life stage | Total |
|---|---|---|---|---|---|---|---|---|
| | | Upstream | Core | Downstream | | | | |
| PERE | MJ | 4,46E+03 | 4,96E+03 | 1,51E+00 | 2,17E+00 | 1,14E+04 | 8,25E+00 | 2,08E+04 |
| PERM | MJ | 1,19E+02 | 9,09E+03 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 9,21E+03 |
| PERT | MJ | 4,58E+03 | 1,41E+04 | 1,51E+00 | 2,17E+00 | 1,14E+04 | 8,25E+00 | 3,01E+04 |
| PENRE | MJ | 5,62E+04 | 4,13E+03 | 1,02E+03 | 4,33E+02 | 5,57E+04 | 7,31E+02 | 1,18E+05 |
| PENRM | MJ | 1,15E+02 | 4,23E+01 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 1,58E+02 |
| PENRT | MJ | 5,63E+04 | 4,17E+03 | 1,02E+03 | 4,33E+02 | 5,57E+04 | 7,31E+02 | 1,18E+05 |
| SM | Kg | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 |
| RSF | MJ | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 |
| NRSF | MJ | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 |
| FW | M3 | 1,09E+02 | 3,76E+00 | 1,72E-03 | 1,33E-02 | 5,15E+01 | 8,65E-01 | 1,65E+02 |

| | | |
|---|---|---|
| Acronyms | PERE | Use of renewable primary energy excluding renewable primary energy resources used as raw materials |
| | PERM | Use of renewable primary energy resources used as raw materials |
| | PERT | Total use of renewable primary energy resources |
| | PENRE | Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials |
| | PENRM | Use of non-renewable primary energy resources used as raw materials |
| | PENRT | Total use of non-renewable primary energy re-sources |
| | SM | Use of secondary material |
| | RSF | Use of renewable secondary fuels |
| | NRSF | Use of non-renewable secondary fuels |
| | FW | Use of net fresh water |

## Parameters representing waste generation and output flows

| Indicator | Unit | Manufacturing stage | | Distribution stage | Installation stage | Use stage | End of life stage | Total |
|---|---|---|---|---|---|---|---|---|
| | | Upstream | Core | Downstream | | | | |
| HWD | Kg | 8,91E-01 | 1,64E-01 | 2,71E-03 | 1,53E-03 | 5,21E-02 | 2,75E-03 | 1,11E+00 |
| NHWD | Kg | 2,80E+02 | 7,21E+00 | 5,41E-02 | 2,22E+02 | 2,77E+01 | 3,56E+02 | 8,92E+02 |
| RWD | Kg | 1,09E-01 | 1,48E-02 | 7,43E-03 | 4,16E-03 | 1,42E-01 | 4,98E-03 | 2,83E-01 |
| CRU | Kg | 2,28E+00 | 0,00E+00 | 0,00E+00 | 1,74E+02 | 0,00E+00 | 0,00E+00 | 1,76E+02 |
| MFR | Kg | 5,16E+01 | 2,47E+00 | 0,00E+00 | 2,60E+02 | 0,00E+00 | 5,21E+02 | 8,36E+02 |
| MER | Kg | 2,29E-01 | 0,00E+00 | 0,00E+00 | 1,37E+01 | 0,00E+00 | 2,01E+02 | 2,15E+02 |
| ETE | MJ | 1,20E+00 | 0,00E+00 | 0,00E+00 | 5,08E+01 | 0,00E+00 | 1,56E+03 | 1,61E+03 |
| EEE | MJ | 6,07E-01 | 0,00E+00 | 0,00E+00 | 2,53E+01 | 0,00E+00 | 8,00E+02 | 8,26E+02 |

| | | |
|---|---|---|
| Acronyms | HWD | Hazardous waste disposed |
| | NHWD | Non-hazardous waste disposed |
| | RWD | Radioactive waste disposed |
| | RAW | Components for re-use |
| | MFR | Materials for recycling |
| | MER | Materials for energy recovery |
| | ETE | Exported thermic energy |
| | EEE | Exported electric energy |

TCB-EE 145-3150

## Environmental impact indicators

| Impact category | Unit | Manufacturing stage | | Distribution stage | Installation stage | Use stage | End of life stage | Total |
|---|---|---|---|---|---|---|---|---|
| | | Upstream | Core | Downstream | | | | |
| GWP - Total | kg CO2 eq | 3,88E+03 | -2,79E+02 | 2,80E+02 | 3,81E+02 | 1,81E+04 | 7,82E+01 | 2,25E+04 |
| GWP-fossil | kg CO2 eq | 3,86E+03 | 5,03E+01 | 2,80E+02 | 3,63E+01 | 1,81E+04 | 7,81E+01 | 2,24E+04 |
| GWP-biogenic | kg CO2 eq | 1,96E+01 | -3,30E+02 | 1,84E-02 | 3,44E+02 | 5,70E+01 | 1,20E-01 | 9,13E+01 |
| GWP-luluc | kg CO2 eq | 4,37E+00 | 1,72E-01 | 2,84E-03 | 5,62E-04 | 2,71E+01 | 5,35E-03 | 3,16E+01 |
| ODP | kg CFC11 eq | 2,28E-04 | 8,79E-06 | 6,23E-05 | 7,71E-06 | 1,51E-03 | 1,37E-05 | 1,83E-03 |
| AP | mol H+ eq | 2,60E+01 | 2,64E-01 | 4,84E+00 | 3,65E-01 | 9,46E+01 | 5,10E-01 | 1,27E+02 |
| EP-freshwater | kg P eq | 1,75E+00 | 1,06E-02 | 2,26E-03 | 1,42E-03 | 6,64E+00 | 3,43E-03 | 8,41E+00 |
| POCP | kg NMVOC eq | 1,69E+01 | 3,00E-01 | 3,64E+00 | 4,90E-01 | 4,33E+01 | 6,41E-01 | 6,53E+01 |
| ADP- M&M* | kg Sb eq | 4,42E-01 | 1,50E-05 | 8,97E-06 | 1,97E-06 | 8,01E-04 | 4,83E-06 | 4,43E-01 |
| ADP-fossil* | MJ | 4,72E+04 | 8,77E+02 | 3,83E+03 | 4,79E+02 | 2,36E+05 | 8,60E+02 | 2,89E+05 |
| WDP* | m3 depriv. | 8,73E+03 | 2,27E+01 | -3,33E-01 | -1,06E+00 | 1,74E+03 | 1,66E+01 | 1,05E+04 |
| *Disclaimer | The results of this environmental impact indicator should be used with caution because the level of uncertainty is high or because experience with the indicator is limited. | | | | | | | |
| Acronyms | GWP-fossil | Global Warming Potential fossil fuels | | | | | | |
| | GWP-biogenic | Global Warming Potential biogenic | | | | | | |
| | GWP-luluc | Global Warming Potential land use and land use change | | | | | | |
| | ODP | Depletion potential of the stratospheric ozone layer | | | | | | |
| | AP | Acidification potential, Accumulated Exceedance | | | | | | |
| | EP-freshwater | Eutrophication potential, fraction of nutrients reaching freshwater end compartment | | | | | | |
| | POCP | Formation potential of tropospheric ozone | | | | | | |
| | ADP-M&M | Abiotic depletion minerals and metals potential (non-fossil resources) | | | | | | |
| | ADP-fossil | Abiotic depletion for fossil resources potential | | | | | | |
| | WDP | Water (user) deprivation potential, deprivation-weighted water consumption | | | | | | |

## Parameters representing resource use

| Indicator | Unit | Manufacturing stage | | Distribution stage | Installation stage | Use stage | End of life stage | Total |
|---|---|---|---|---|---|---|---|---|
| | | Upstream | Core | Downstream | | | | |
| PERE | MJ | 3,92E+03 | 1,56E+02 | 5,21E+00 | 8,27E-01 | 1,62E+04 | 5,90E+00 | 2,03E+04 |
| PERM | MJ | 1,19E+02 | 2,52E+03 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 2,64E+03 |
| PERT | MJ | 4,04E+03 | 2,67E+03 | 5,21E+00 | 8,27E-01 | 1,62E+04 | 5,90E+00 | 2,30E+04 |
| PENRE | MJ | 4,71E+04 | 8,35E+02 | 3,83E+03 | 4,79E+02 | 2,36E+05 | 8,60E+02 | 2,89E+05 |
| PENRM | MJ | 6,23E+01 | 4,23E+01 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 1,05E+02 |
| PENRT | MJ | 4,72E+04 | 8,78E+02 | 3,83E+03 | 4,79E+02 | 2,36E+05 | 8,60E+02 | 2,89E+05 |
| SM | Kg | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 |
| RSF | MJ | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 |
| NRSF | MJ | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 |
| FW | M3 | 2,12E+02 | 6,56E-01 | 2,89E-02 | -1,50E-02 | 7,81E+01 | 5,19E-01 | 2,92E+02 |

| | | |
|---|---|---|
| Acronyms | PERE | Use of renewable primary energy excluding renewable primary energy resources used as raw materials |
| | PERM | Use of renewable primary energy resources used as raw materials |
| | PERT | Total use of renewable primary energy resources |
| | PENRE | Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials |
| | PENRM | Use of non-renewable primary energy resources used as raw materials |
| | PENRT | Total use of non-renewable primary energy re-sources |
| | SM | Use of secondary material |
| | RSF | Use of renewable secondary fuels |
| | NRSF | Use of non-renewable secondary fuels |
| | FW | Use of net fresh water |

## Parameters representing waste generation and output flows

| Indicator | Unit | Manufacturing stage | | Distribution stage | Installation stage | Use stage | End of life stage | Total |
|---|---|---|---|---|---|---|---|---|
| | | Upstream | Core | Downstream | | | | |
| HWD | Kg | 1,14E+01 | 1,60E-01 | 7,04E-03 | 1,25E-03 | 1,44E-01 | 2,18E-03 | 1,17E+01 |
| NHWD | Kg | 3,87E+02 | 1,32E+00 | 4,22E-01 | 1,07E+00 | 7,58E+02 | 1,11E+03 | 2,25E+03 |
| RWD | Kg | 1,12E-01 | 3,76E-03 | 2,76E-02 | 3,39E-03 | 4,97E-01 | 6,01E-03 | 6,50E-01 |
| CRU | Kg | 2,28E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 2,28E+00 |
| MFR | Kg | 5,52E+01 | 0,00E+00 | 0,00E+00 | 2,00E-01 | 0,00E+00 | 5,37E+02 | 5,92E+02 |
| MER | Kg | 2,29E-01 | 0,00E+00 | 0,00E+00 | 9,04E+01 | 0,00E+00 | 1,24E+00 | 9,19E+01 |
| ETE | MJ | 1,20E+00 | 0,00E+00 | 0,00E+00 | 3,19E+02 | 0,00E+00 | 4,89E+01 | 3,69E+02 |
| EEE | MJ | 6,07E-01 | 0,00E+00 | 0,00E+00 | 1,59E+02 | 0,00E+00 | 2,34E+01 | 1,83E+02 |

| | | |
|---|---|---|
| Acronyms | HWD | Hazardous waste disposed |
| | NHWD | Non-hazardous waste disposed |
| | RWD | Radioactive waste disposed |
| | RAW | Components for re-use |
| | MFR | Materials for recycling |
| | MER | Materials for energy recovery |
| | ETE | Exported thermic energy |
| | EEE | Exported electric energy |

## CONTRIBUTION ANALYSIS

The contribution analysis shows how the processes having the largest impact are, for all three disconnectors, the electricity absorbed and dissipated during the Use stage, the control modules and the metals components.
Metals and control modules partially owe their overall high weighted impact to their contribution to the indicator "Resource use, minerals and metals". EN15804+A2:2019 requires an asterisk to be placed next to such indicator with the following statement "the results of this environmental impact indicator should be used with caution because the level of uncertainty is high or because experience with the indicator is limited".

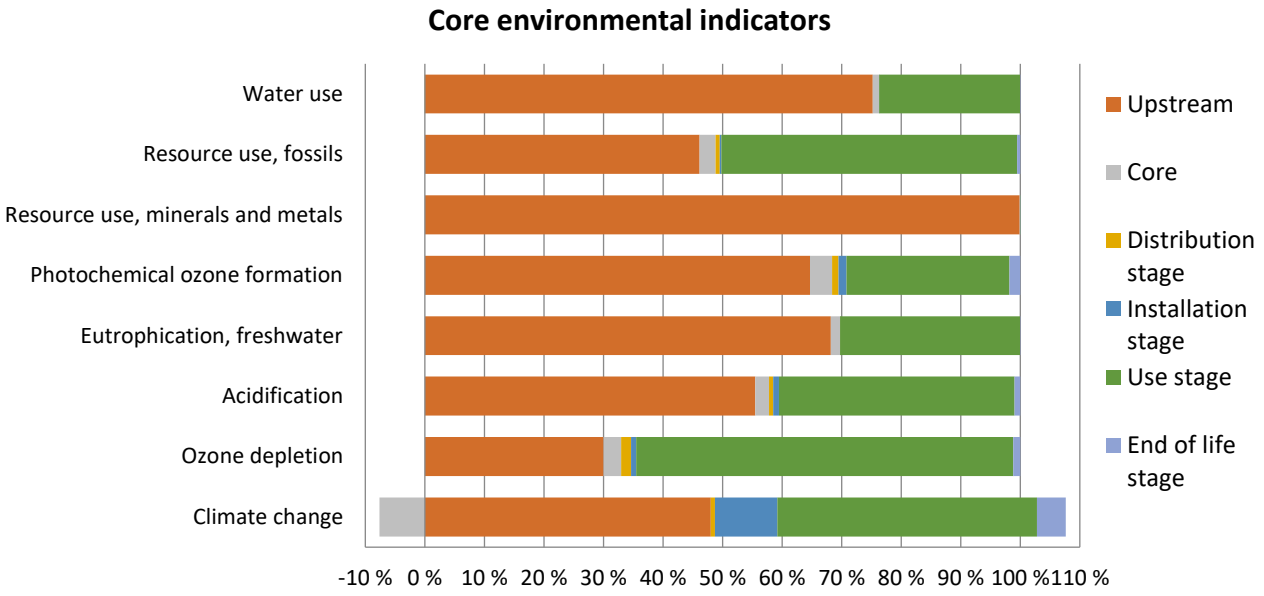
### Global Warming Potential

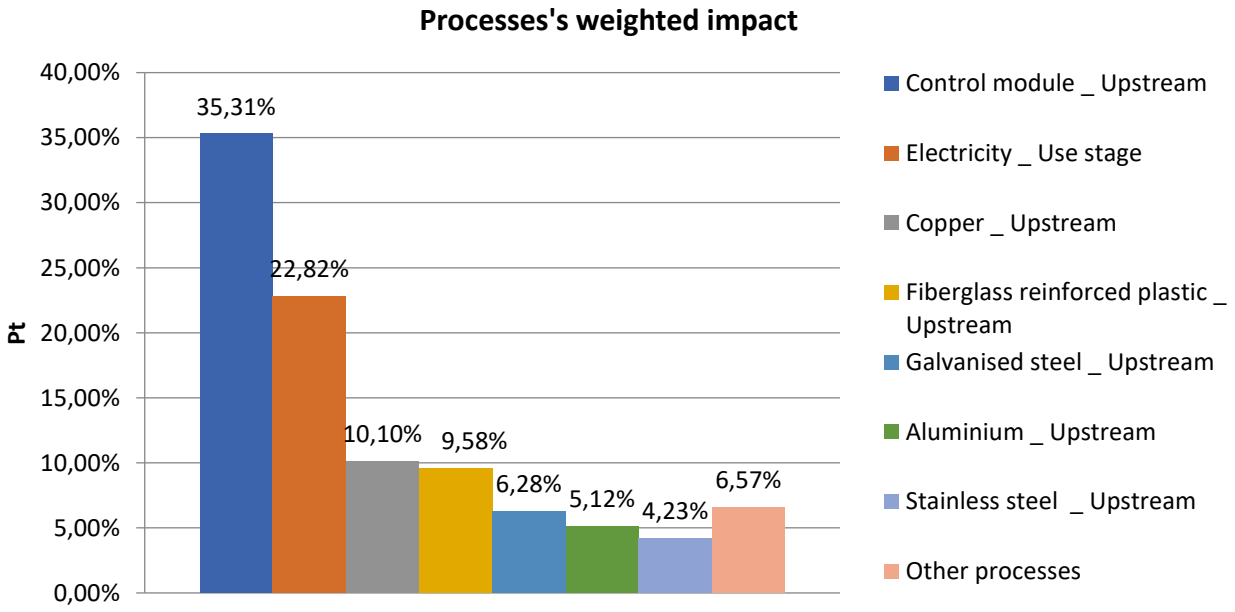
Concerning the estimated impact on Global Warming Potential (GWP total), the Manufacturing stage (covering cradle to gate – Upstream + Core) and the Use stage represent the largest share of impact.
The Use stage has a particularly high impact on the GWP indicator in the case of TCB-EE 145-3150 due to a combination of its higher values of dissipated and absorbed electricity.

*Table 3: GWP Total*

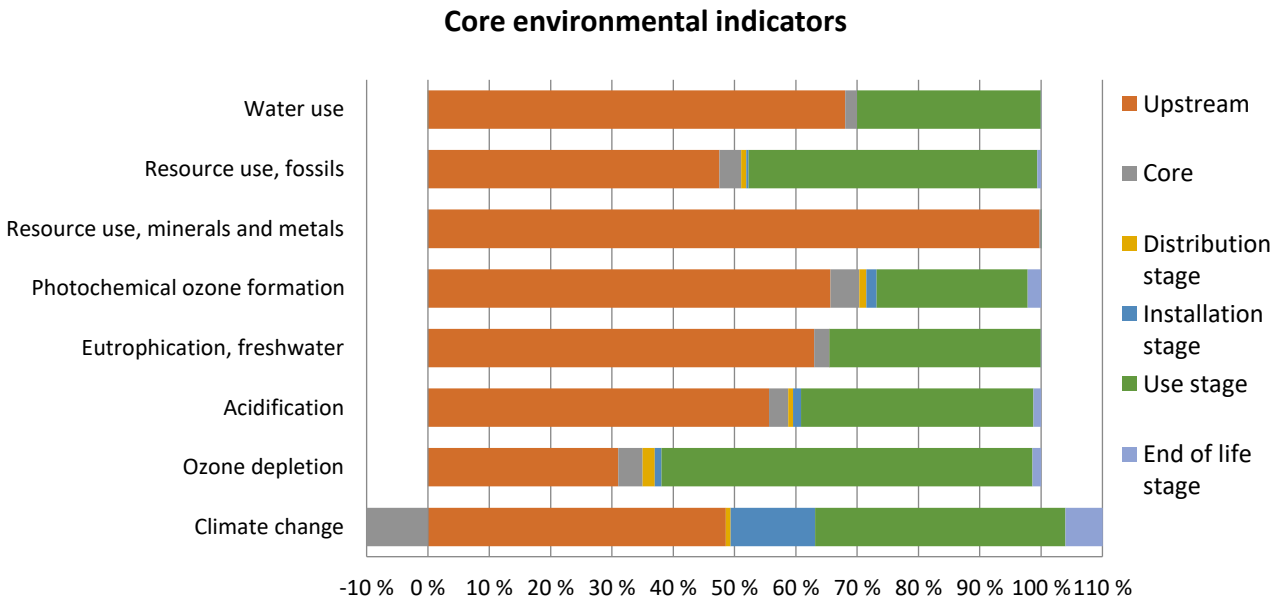
| Disconnector | Manufacturing stage | Use stage | Remaining stages |
|---|---|---|---|
| TCB-E 170(650)-1250 | 4.841,83 kg CO2eq | 5.226,20 kg CO2eq | 1.913,14 kg CO2eq |
| TCB 170(650)-1250 | 3.505,75 kg CO2eq | 3.712,87 kg CO2eq | 1.878,30 kg CO2eq |
| TCB-EE 145-3150 | 3.601,69 kg CO2eq | 18.140,29 kg CO2eq | 538,79 kg CO2eq |

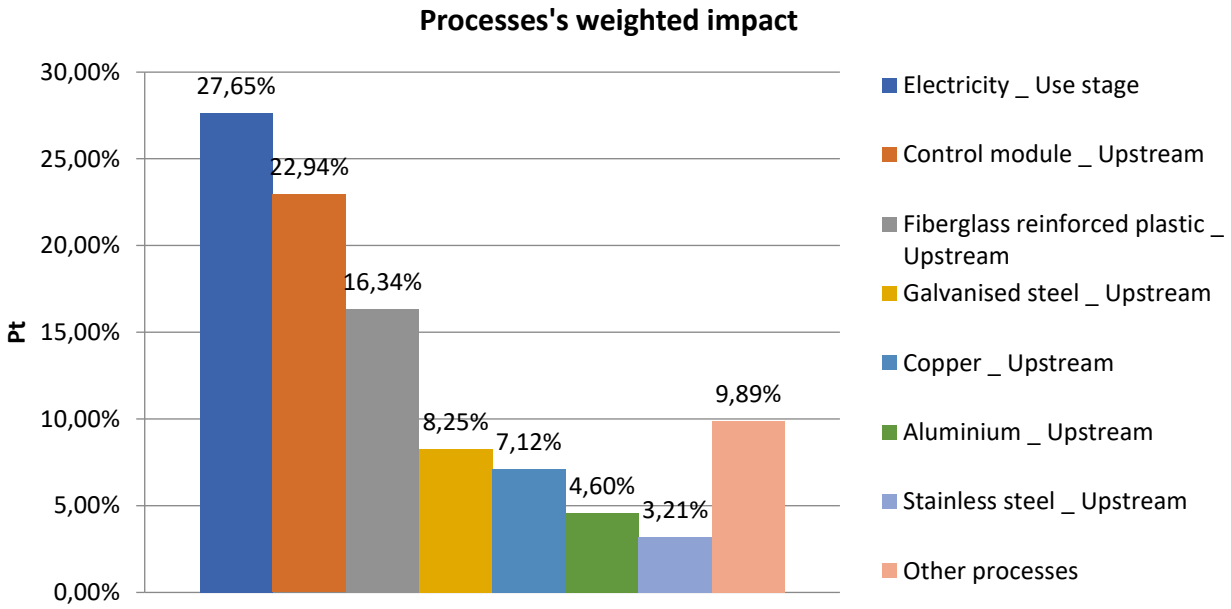
## TCB-E 170(650)-1250 – Contribution analysis



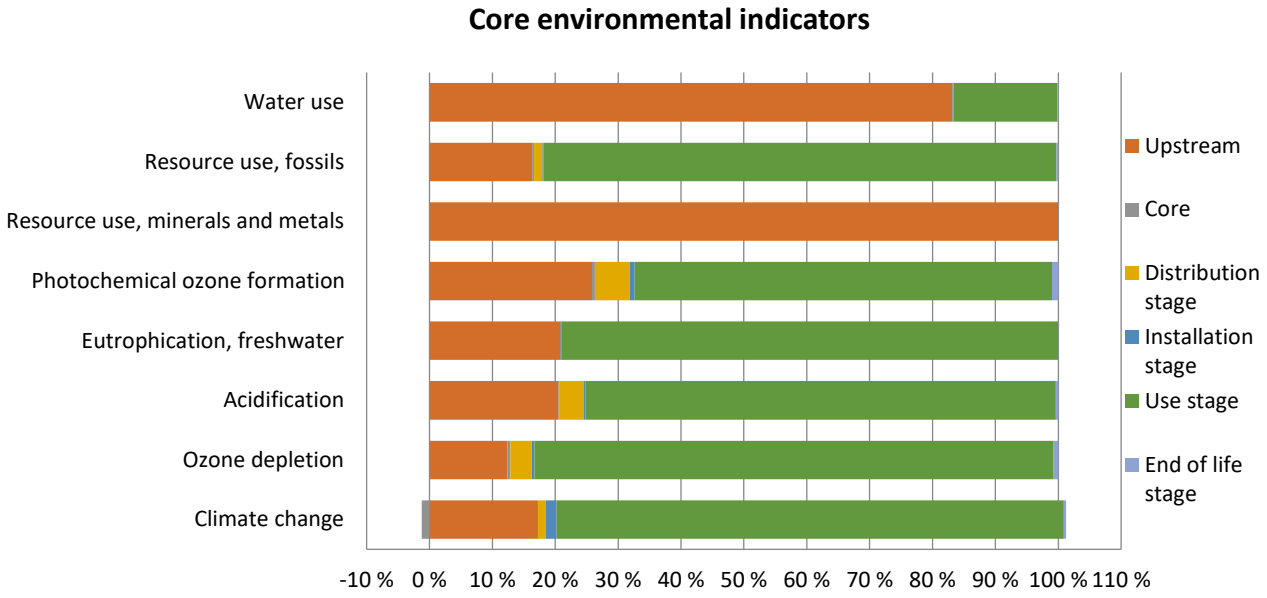



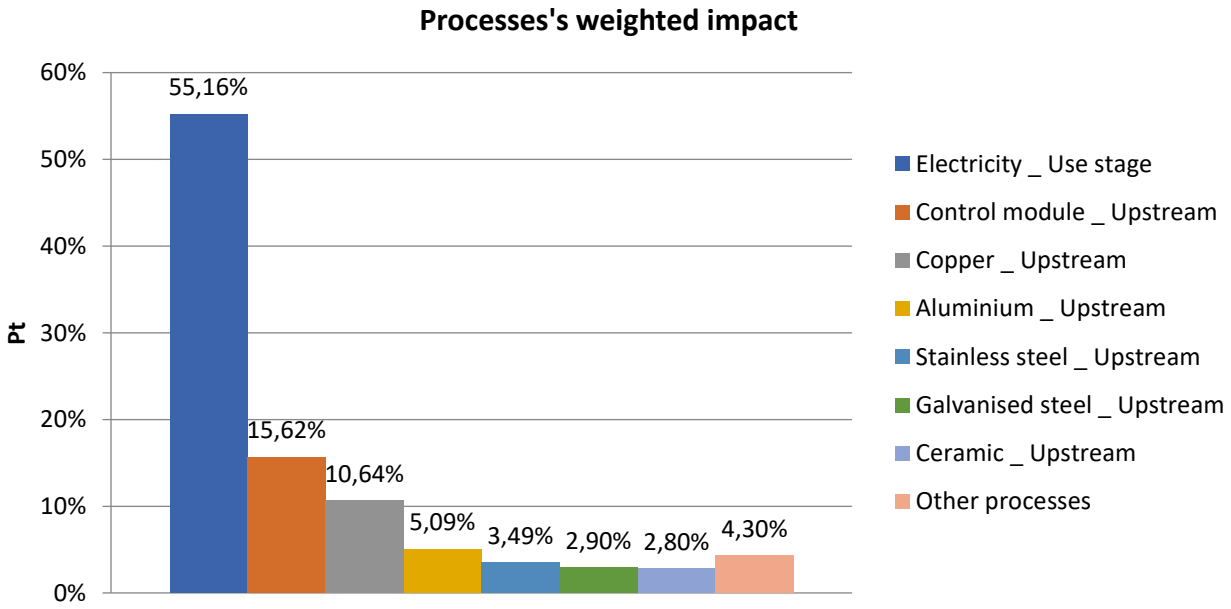
## TCB 170(650)-1250 - Contribution analysis



## TCB-EE 145-3150 - Contribution analysis



## Impact analysis of the Use stage

Given the high impact that the Use stage, estimated following the scenario proposed by the PCR 012 EPDItaly, has on CO2eq emissions, and since the company has no control over this life cycle stage, it might be interesting to evaluate how the GWP indicator would change by modifying the intensity of the reference current from 50% to 30% and 10%.

TCB-E 170(650)–1250

**30% reference current**

| Impact category | Unit | Use Stage | Total | Difference % |
|---|---|---|---|---|
| Climate change | kg CO2 eq | 3,82E+03 | 1,06E+04 | -11,75% |

**10% reference current**

| Impact category | Unit | Use Stage | Total | Difference % |
|---|---|---|---|---|
| Climate change | kg CO2 eq | 3,11E+03 | 9,87E+03 | -17,62% |

TCB 170(650)–1250

**30% reference current**

| Impact category | Unit | Use Stage | Total | Difference % |
|---|---|---|---|---|
| Climate change | kg CO2 eq | 2,31E+03 | 7,69E+03 | -15,47% |

**10% reference current**

| Impact category | Unit | Use Stage | Total | Difference % |
|---|---|---|---|---|
| Climate change | kg CO2 eq | 1,60E+03 | 6,99E+03 | -23,21% |

TCB-EE 145-3150

**30% reference current**

| Impact category | Unit | Use Stage | Total | Difference % |
|---|---|---|---|---|
| Climate change | kg CO2 eq | 1,13E+04 | 1,57E+04 | -30,35% |

**10% reference current**

| Impact category | Unit | Use Stage | Total | Difference % |
|---|---|---|---|---|
| Climate change | kg CO2 eq | 7,91E+03 | 1,22E+04 | -45,52% |

# LIFE CYCLE ASSESSMENT BACKGROUND INFORMATION

This EPD is based on an LCA (Life Cycle Assessment) analysis performed in accordance with ISO 14040 and 14044 standards and in accordance with ISO 14025. The EPDItaly v5.2 regulation, the (Sub) PCR 012 EPDItaly Rev.0 and the PCR 007 EPDItaly Rev.2 were followed. The latter recalls the EN 50693:2019 <<*Product category rules for life cycle assessments of electronic and electrical products and systems*>> at several points, without making additions or changes.
EN 15804+A2:2019 <<*Sustainability of construction works - Environmental product declarations - Core rules for the product category of construction products*>> was followed to calculate the environmental indicators and parameters, as required by PCR 007 EPDItaly Rev.2.

The Polluters Pays Principle was followed.
Extraordinary and ordinary maintenance were not considered, since, according to company indications, the investigated products are not historically affected by malfunctions that require repairing maintenance or replacement of components.

## Cut-off

In accordance with PCR EPDItaly012 Rev. 0, the following activities were not included in the inventory:

- Production, use and disposal of packaging of components and intermediate semi-finished products, i.e. the material flows of the Upstream module
- Any extraordinary maintenance performed on the product
- Devices external to the switch itself (e.g. electrical panels) necessary for installation

Cut-offs were also made of materials that make up the switch itself whose total mass does not exceed 2% of the total weight of the device and of processes that do not exceed 5% of the overall environmental impact of the analyzed product system.

## Data source and quality

Data on raw materials, emissions and waste are specific to the Santa Maria di Sala production site. As far as electricity is concerned, the national energy mix (from the Ecoinvent database) was used. Consumption data is site-specific. All site-specific data cover the year 2021.
Estimates were made for suppliers' electricity consumption.

Supplier and customer distances were estimated using applications such as Google Maps and Serates.com, always based on site-specific purchase and sales data.

Concerning generic data, geographical, technological and system equivalence criteria were applied, as required by the PCR.
The data quality analysis, carried out according to Annex E.1 of EN 15804 + A2: 2019, measured for all three products an average data quality, weighted on the processes having the larger impact (>90% of total environmental impacts), "Fair" or higher.

## Allocations

In this study, the following input and output were allocated between the number of disconnectors produced in the reference year (2021):

- COELME internal electricity consumption for forklifts recharge and workshop lighting
- The waste produced by COELME attributed by the investigated products

## Geographical scope

The investigated products are built with raw materials purchased worldwide, processed in Italy and then assembled at COELME's plant located in Santa Maria di Sala (VE-Italy). The TCB-E 170(650)-1250 and TCB 170(650)-1250 are distributed and installed in Italy, while the TCB-EE 145-3150 is sold worldwide.

# ADDITIONAL TECHNICAL INFORMATION AND SCENARIOS

## Transportation to the installation site

Since the installation site is not known, the scenario proposed by (Sub) PCR 012 EPDItaly Rev.0 of 300 km via Euro 4 truck was followed. For the TCB-EE 145-3150, which is sold worldwide, actual transportation data (via truck and/or ship) to the country of sale were added.

## Electricity dissipated during use

To estimate the electricity dissipated during the Use stage, the scenario proposed by (Sub) PCR 012 EPDItaly Rev.0 was followed.

## End-of-life scenarios

For the end-of-life of the waste of the Manufacturing stage, Italian national statistics were followed.
For the end-of-life of the waste of the Installation stage, Italian national statistics were followed for TCB-E 170(650)-1250 and TCB 170(650)-1250, while Annex G.5 of the EN 50693:2019 standard was followed for TCB-EE 145-3150.
The end-of-life stage of all investigated products followed Annex G.5 of EN 50693:2019.

## Life stages descriptions

### Manufacturing Stage

This module corresponds to a "from cradle to gate" LCA analysis and considers the impacts related to production, starting from raw materials extraction up to the moment in which the product is shipped.

For the investigated products, the manufacturing stage includes material and energy flows related to:

- Extraction and processing of raw materials
- Production of components
- Final assembly operation, carried out internally by COELME
- Production of the packaging used for shipping
- Disposal of waste generated by COELME and of estimated scraps generated by suppliers
- Transport related to the previous points

### Distribution Stage

This module measure impacts of transporting the product to the installation site.

### Installation Stage

This module includes the impacts resulting from the disconnectors installation.
Given the nature of the investigated products and what COELME knows about its installation, this module includes:

- End life of packaging components
- Energy needed for the installation

### Use and Maintenance Stage

This module accounts for the impacts related to the electricity dissipated by the disconnectors during their entire RSL (20 years). No maintenance is needed.

The scenario proposed by (Sub) PCR 012 EPDItaly, Rev. 0 regarding the electricity dissipated during the use stage was followed:

$$E_{use}\ [kWh] = \frac{P_{use} * 8760 * RSL * \alpha}{1000}$$

| Cluster | Switch group | Reference current [%] | a [%] |
|---|---|---|---|
| 3 | High voltage | 50% | 30% |

Furthermore, the electricity used by the resistor placed inside the control module to prevent condensation was also considered.

### End of life Stage

This module spans from the disassembly operations to the actual disposal of the disconnector components.

Given the nature of the investigated products and the disassembly manual issued by COELME, the End-of-life stage includes:

- Power consumption of the disassembly phase
- Transport of the disassembled components to their collection site
- End-of -life of the waste flows. No benefits for recycling of energy recovery were accounted for.

## ADDITIONAL INFORMATION

COELME implements an Environmental Management System (EMS) in compliance with the standard ISO 14001:2015 and a Safety Management System (SMS) in compliance with the standard ISO 45001:2018. COELME's EMS and SMS are certified by IMQ, certificate n. 9191.COE1 and 9192.COEL respectively.

### Release of hazardous substances into air, soil or water

Products covered by this EPD do not contain <<Substances of Very High Concern>> (SVHC) as defined in Article 59 (10) of Regulation (EC) No 1907/2006 (of 2021-07-08), also known as REACH, in a concentration equal to or greater than 0.1% by weight.
The products do not release hazardous substances into air, soil or water during their use and useful life.

## REFERENCES

ISO 14040 (2006): Environmental management - Life cycle assessment - Principles and framework
ISO 14044 (2006): Environmental management - Life cycle assessment - Requirements and guidelines
(Sub) PCR 012 EPDItaly, Rev. 0 – 2020/03/16
PCR 007 EPDItaly, Rev. 2 – 2020/10/21
IN 50693:2019 E, Rev. 0
IN 15804+A2:2019
EPDItaly Regulation, Rev. 5.2 – 2022/02/16
Ecoinvent: Ecoinvent Centre, www.ecoinvent.com
Simapro: Simapro LCA Package, Pré Consultants, the Netherlands, www.pre-sustainability.com
RILEGNO: Specific Prevention Program 2022 RILEGNO
Sustainable Development Foundation: Recycling in Italy 2022