ENVIRONMENTAL PRODUCT DECLARATION

EFACEC Swithgear FLUOFIX 24 kV [2IS(M)+CIS]

In accordance with ISO 14025 and EN 50693:2019

Program Operator	EPDItaly
Publisher	EPDItaly

Declaration Number	03-2024
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Valid to	07 /08 / 2029

Efacec Energia – Máquinas e Equipamentos Eléctricos S.A. located at Parque Empresarial Arroteia , S, Mamede Infesta 4465-591, Portugal

Efacec India Private Limited located at Plot nº H-155, MIDC Industrial Area, Ambad, Nashik, Maharashtra 422010, Índia

www.epditaly.it

GENERAL INFORMATION

EPD OWNER	
Name of the company	Efacec Energia – Máquinas e Equipamentos Eléctricos S.A. – Switchgear www.efacec.com
Registered office	Parque empresarial Arroteia , S, Mamede Infesta 4465-591
Contacts for information on the EPD	hercilio.santos@efacec.com / josefaria@efacec.com

PROGRAM OPERATOR	
EPDItaly	Via Gaetano De Castillia n° 10 - 20124 Milano, Italy

INFORMATION ON THE EPD	
Product name (s)	FLUOFIX 24kV
Site (s)	Efacec Energia – Máquinas e Equipamentos Eléctricos S.A. located at Parque Empresarial Arroteia , S, Mamede Infesta 4465-591, Portugal Efacec India Private Limited located at Plot nº H-155, MIDC Industrial Area, Ambad, Nashik, Maharashtra 422010, Índia
Other information	Reference period for data collected: March 2022-February 2023
Short description and technical information of the product (s)	Switchgear for secondary distribution. Modular and compact cubicle for indoor installation, with main circuit (medium voltage) insulated in sf6 suitable for medium voltage networks up to 24kV
Field of application of the product (s)	Medium voltage networks up to 24kV
CPC Code (number) https://unstats.un.org/unsd/classifications/Econ	46214

VERIFICATION INFORMATION	
PCR (title, version, date of publication or update)	PCR EPDItaly007 - Electronic and Electrical Products and Systems, revision 3, 13/01/2023 PCR EPDItaly015 – Switchboards, revision 1.5, 23/02/2022
EPDItaly Regulation (version, date of publication or update)	Regulations of the EPDItaly Programme, revision 6.0, 30/10/2023
Independent Verification Statement	The PCR review was performed by the EPD review panel - info@epditaly.it. Independent verification of the declaration and data, carried out according to ISO 14025: 2010. ☐ Internal ☑ External Third party verification carried out by: ICMQ S.p.A., via Gaetano De Castillia n ° 10 - 20124 Milan, Italy. Accredited by Accredia.
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.

OTHER INFORMATION

This is a product specific declaration.

Since the two products correspond to the same Fluofix unit (24 kV, configuration [2IS(M)+CIS], only the destination differs, the "cradle to gate" LCA is the same (manufacturing stage).

Geographic locations: The product is produced in India and in Portugal. The use and the end of life phase occur in Spain and Colombia.

The database used was the Ecoinvent EN 15804 add-on, version 3.10. The database was used to determine the life cycle inventory and impact assessment of upstream and downstream stages and to determine the impact assessment of the core stage.

SCOPE OF THE STUDY

All the stages of the life cycle are included (cradle to grave).

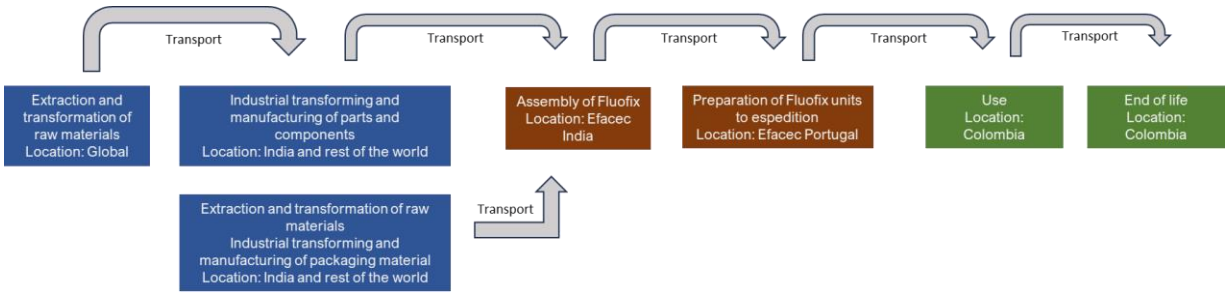


Figure 1 – Schematic representation of the life cycle of the products under study – Destination Colombia

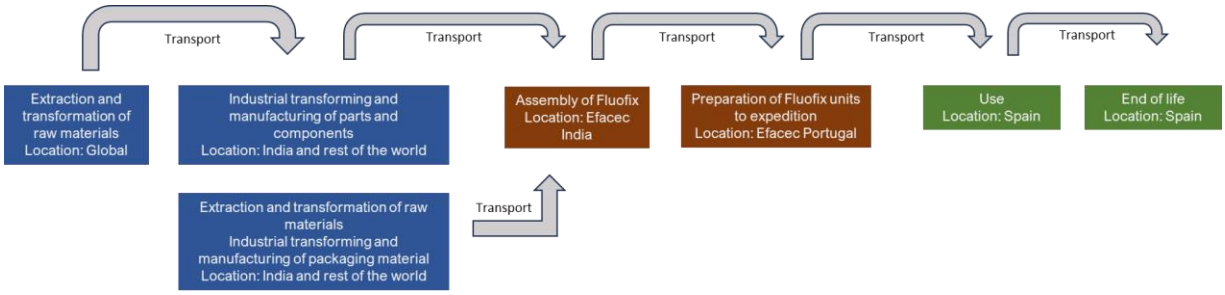


Figure 2 – Schematic representation of the life cycle of the products under study – Destination Spain

ORGANIZATION DESCRIPTION

Efacec develops and provides integrated solutions in the fields of energy, mobility and the environment.

Efacec Power Solutions constitutes a group of companies that brings together all the means of production, technologies and technical and human competences for the development of activities in the fields of Energy, Engineering, Environment, Transport and Electric Mobility solutions, as well as a vast network of subsidiaries, branches and agents spread across four continents.

The organization is audited and certified by the most demanding quality and management standards: ISO 9001, ISO 14001, ISO 45001 and also certified according to the research, development and innovation standard NP 4457. These certifications are an integral part of a policy of continuous, transversal improvement, aimed at customer satisfaction and recognition as preferred partners.

PRODUCT DESCRIPTION

The FLUOFIX GC, from now on designated as Fluofix, is a part of the range of modular and compact cubicles, for indoor installation, with the main circuit (Medium Voltage) insulated in SF6, suitable for Medium Voltage networks up to 24 kV, configuration [2IS(M)+CIS].

The Fluofix tank is constructed from stainless steel and usually filled with SF6 gas with 0.3 bar of relative pressure. This equipment's leak proofness is guaranteed by several routine tests. Its modular and compact construction for easy installation due to its size and weight enables the coupling unit to be extensible, at the installation site, without any handling of gas.

The extendable units are provided with an insulating protective cover for each phase, which should be only withdrawn when the two units are being coupled. The fuse tubes are mounted in a horizontal position, with access from the front. The Fluofix cubicles are insensitive to harsh environmental conditions, they have a long service life and the active parts do not require maintenance due to full gas insulation. Safety, easy operation and reduced dimensions are also aspects that characterize the FLUOFIX as a high-quality product.

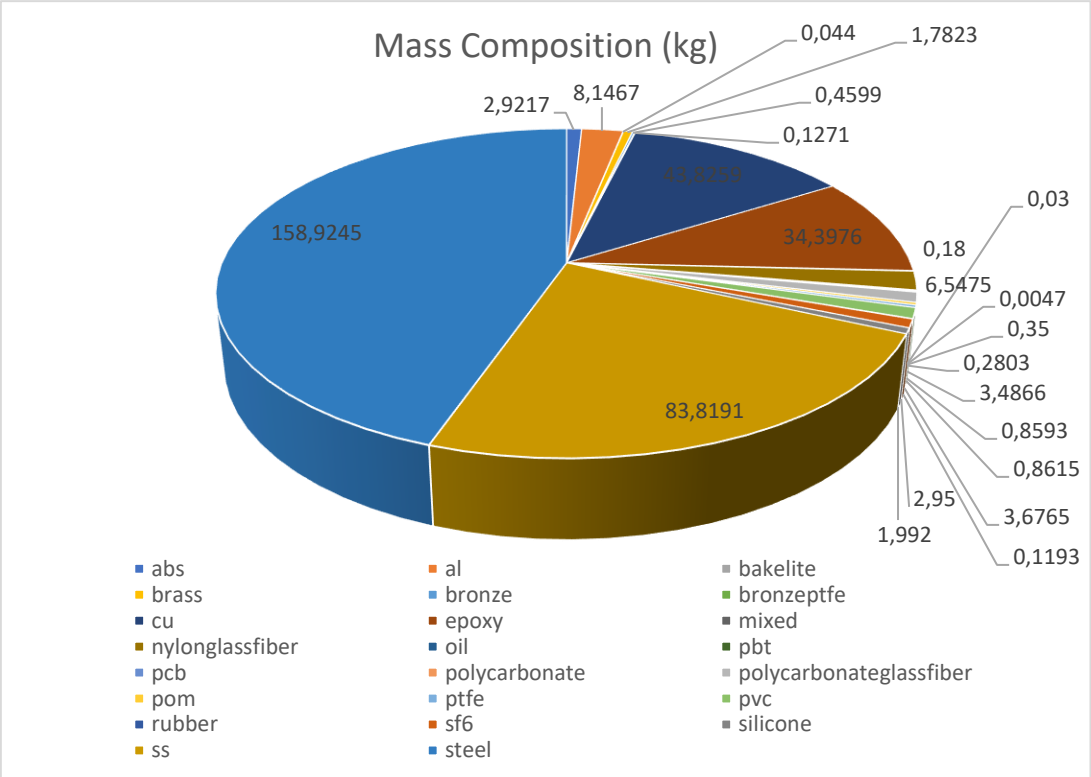
This equipment contains the fluorinated greenhouse gas SF6 covered by the Kyoto Protocol. SF6 shall be recovered and not released into atmosphere.

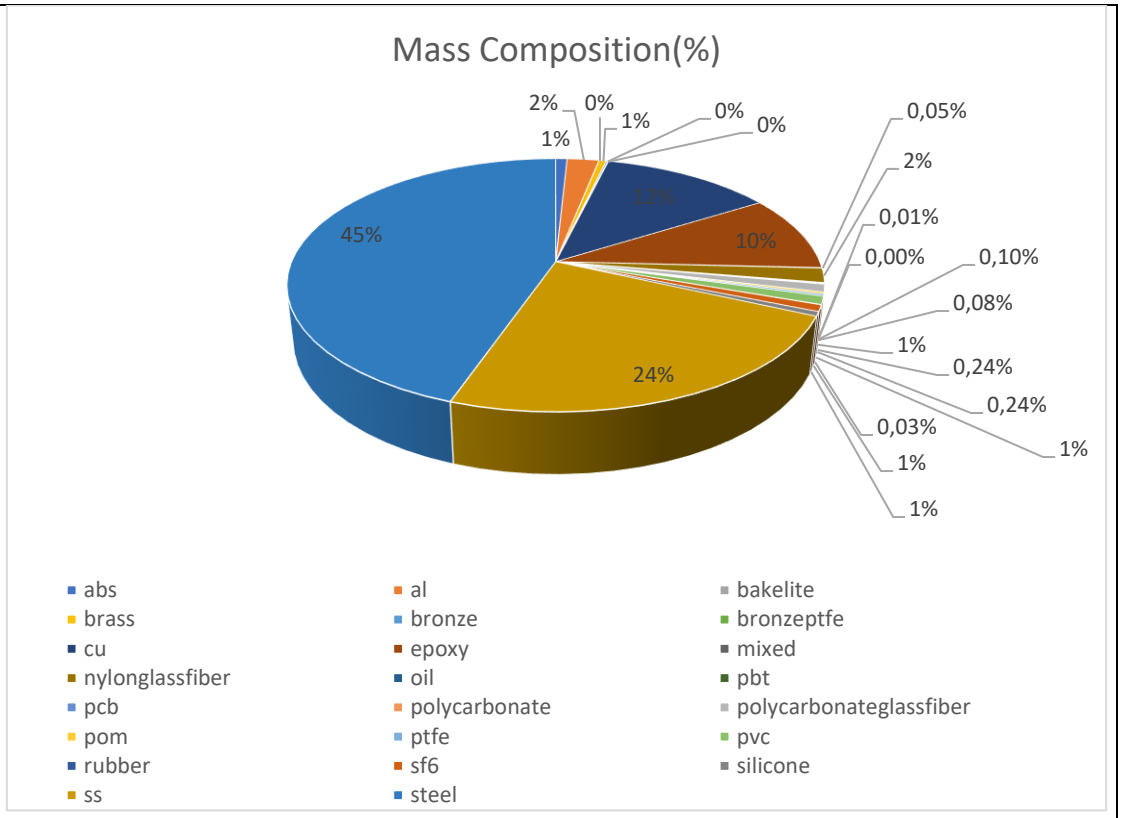
Product/ Characteristic	331180495-01
Ir - Rated Current	630A
IAC - Internal Arc Classification	A-FLR
Icc - Short circuit withstand	20kA/1s
Ur - Rated Voltage	24kV
Ud - Power Frequency	50kV
Up - BIL	125kV

Product Fluofix 24 kV Material Composition

Mass composition of the main materials

Material	Mass (kg)	%
abs	2,9217	1%
al	8,1467	2%
bakelite	0,044	0%
brass	1,7823	1%
bronze	0,4599	0%
bronzeptfe	0,1271	0%
cu	43,8259	12%
epoxy	34,3976	10%
mixed	0,18	0,05%
nylonglassfiber	6,5475	2%
oil	0,03	0,01%
pbt	0,0047	0,00%
pcb	0,35	0,10%
polycarbonate	0,2803	0,08%
polycarbonateglassfiber	3,4866	1%
pom	0,8593	0,24%

	ptfe	0,8615	0,24%
	pvc	3,6765	1%
	rubber	0,1193	0,03%
	sf6	2,95	1%
	silicone	1,992	1%
	ss	83,8191	24%
	steel	158,9245	45%
	Total	355,7865	100%
	Packaging (wood)	12,1611	
Graphic representation (main materials)			



Declared/ Functional Unit: A unit of final product.

Reference Service Life (RSL): Twenty years.

Presence of dangerous substances: No substances of concern or very high concern are present in the final product nor are expected to be released during use phase.

The core module consists of assembling the components and manufacturing the final product.

The Fluofix production process (core module - gate to gate) consists of assembling the final components/sub-assemblies, carrying out quality/ functional tests and packaging/preparing for dispatch.

Assembly involves several stages using hand tools and electrical equipment. Electrical devices and equipment are also used for testing, so only electrical energy is consumed in the core module. There is also no consumption or use of raw materials (other than those included in the BOM (bill of materials), whose production is included in the upstream module) or auxiliaries in the production process in relevant quantities to impact the LCA results.

The next figure represents the flowchart of these assembly processes.

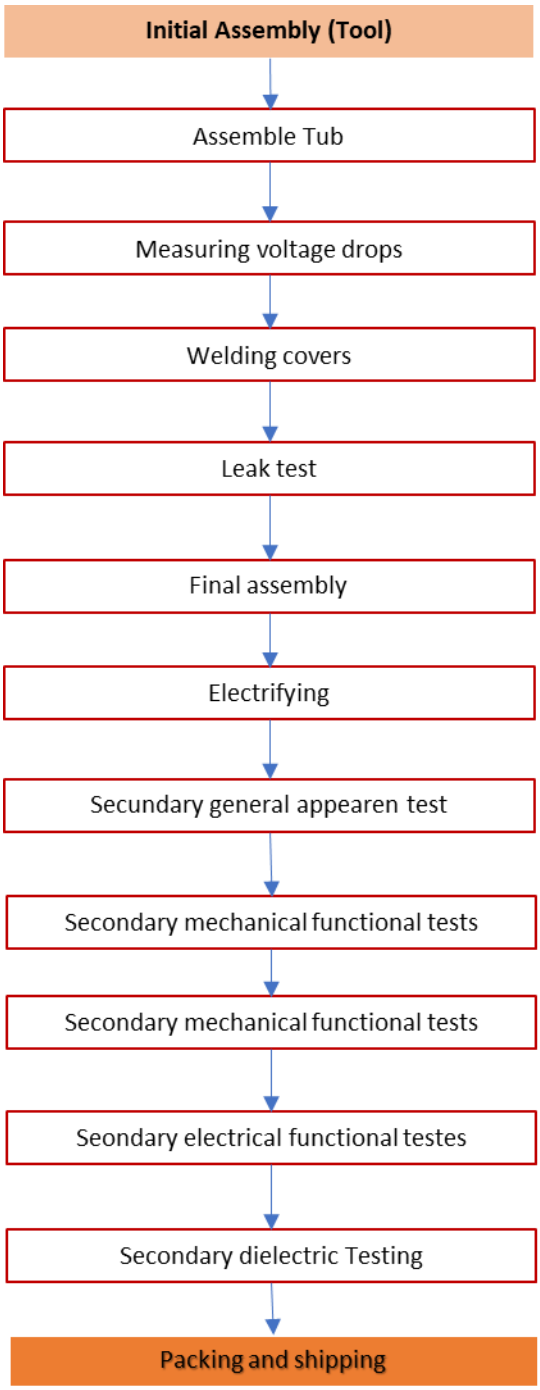


Figure 3 – Fluofix - Assembly at Efacec India - Flowchart

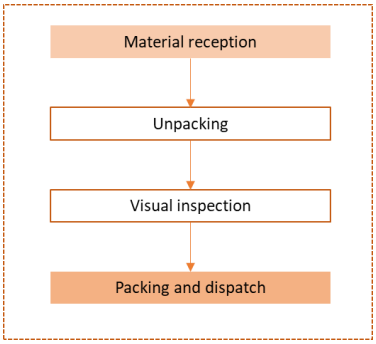


Figure 3 – Fluofix – Activities at Efacec Portugal - Flowchart

LCA RESULTS - ENVIRONMENTAL IMPACT DESCRIPTIVE PARAMETERS – Colombia

Environmental impact indicators	Unit	Manufacturing	Distribution Colombia	Installation Colombia	Use and maintenance Colombia	LCA EoL
Global Warming Potential total (GWPtotal)	kg CO2e	2,624E+03	9,099E+01	2,096E+00	4,208E+04	1,012E+02
Global Warming Potential total (GWPfossil)	kg CO2e	2,583E+03	9,087E+01	2,803E+00	3,501E+04	1,011E+02
Global Warming Potential total (GWPbiogenic)	kg CO2e	3,873E+01	-8,227E-03	6,746E+01	3,962E+03	6,140E-02
Global Warming Potential total (GWPluluc)	kg CO2e	2,024E+00	4,077E-02	1,032E-03	3,071E+03	8,344E-02
Depletion potential of the stratospheric ozone layer (ODP)	kg CFC11ee	3,589E-01	1,351E-06	3,956E-08	2,119E-04	4,964E-07
Acidification potential, Accumulated Exceedance (AP)	moles of H+ equivalents	3,558E+01	1,142E+00	1,607E-02	3,302E+02	1,783E-01
Eutrophication potential, fraction of nutrients reaching freshwater end compartment (EP-freshwater)	kg P eq.	2,749E+00	5,822E-03	4,777E-04	1,055E+01	7,416E-03
Eutrophication potential, fraction of nutrients reaching marine end compartment (EPmarine)	kg N eq.	3,451E+00	3,125E-01	7,073E-03	3,440E+01	1,120E-01
Eutrophication potential, Accumulated Exceedence (EP-terrestrial)	mol N eq.	3,948E+01	3,455E+00	7,206E-02	3,716E+02	5,801E-01
Formation potential of tropospheric ozone (POCP)	Kg NMVOC eq	1,212E+01	1,102E+00	2,170E-02	1,166E+02	1,888E-01
Abiotic Depletion for non-fossil resources potential (ADP-minerals&metals)	Kg Sb eq	3,975E-01	2,228E-04	8,119E-06	7,663E-02	4,428E-04
Abiotic Depletion for non-fossil resources potential (ADP-fossil)	MJ, net calorif value	2,010E+04	1,237E+03	3,617E+01	4,223E+05	4,004E+02
Water deprivation potential, deprivationweighted	m3 eq	8,262E+02	5,051E+00	1,642E+00	2,104E+04	7,857E+00

water consumption (WDP)						

LCA RESULTS - PARAMETERS DESCRIBING RESOURCE USE – Colombia

Parameters describing the resource use	Unit	Manufacturing	Distribution Colombia	Installation Colombia	Use and maintenance Colombia	EoL
Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials (PENRE)	MJ	2,632E+04	1,237E+03	3,617E+01	4,223E+05	-1,665E+03
Use of renewable primary energy excluding renewable primary energy resources used as raw materials (PERE)	MJ	3,837E+03	1,444E+01	5,681E-01	4,545E+05	2,635E+01
Use of non-renewable primary energy resources used as raw materials (PENRM)	MJ	7,624E+02	0,000E+00	0,000E+00	0,000E+00	2,018E+03
Use of renewable primary energy resources used as raw materials (PERM)	MJ	0,000E+00	0,000E+00	2,719E-02	0,000E+00	0,000E+00
Total use of non-renewable primary energy resources (primary energy and primary energy resources used as raw materials (PENRT))	MJ	2,718E+04	1,239E+03	3,624E+01	4,223E+05	4,010E+02
Total use of renewable primary energy resources (primary energy and primary energy resources used as raw materials (PERT))	MJ	4,111E+03	1,444E+01	5,953E-01	4,545E+05	2,635E+01
Net use of fresh water (FW)	m3	2,194E+01	1,453E-01	1,337E-02	4,960E+02	6,110E-02
Use of secondary materials (MS)	kg	1,513E+02	5,617E-01	2,810E-02	7,202E+01	2,716E+01
Use of renewable secondary fuels (RSF)	MJ	6,152E-01	5,285E-03	2,039E-04	2,687E-01	5,812E-03
Use of non-renewable secondary fuels (NRSF)	MJ	ND	ND	0,000E+00	ND	ND

LCA RESULTS - WASTE PRODUCTION DESCRIPTIVE PARAMETERS – Colombia

Parameters describing the waste production	Unit	Manufacturing	Distribution Colombia	Installation Colombia	Use and maintenance Colombia	EoL
Hazardous landfill waste (HWD)	kg	8,577E+02	2,006E+00	3,505E-01	3,701E+03	3,029E+00
Non-hazardous waste disposed (NHWD)	kg	1,400E+04	3,511E+01	4,847E+01	5,206E+04	2,557E+02
Radioactive waste disposed (RWD)	kg	2,547E-02	1,576E-04	6,247E-06	1,331E-02	1,098E-04

Materials for energy recovery (MER)	kg	1,240E-02	5,908E-05	2,633E-06	5,774E-03	3,594E-05
Material for recycling (MFR)	kg	5,711E+01	5,094E-02	2,919E-04	6,926E+01	2,075E+02
Components for reuse (CRU)	kg	ND	ND	ND	ND	ND
Exported thermal energy (ETE)	MJ	2,133E+01	1,163E-01	5,897E-03	1,184E+01	2,119E+00
Exported electricity energy (EEE)	MJ	1,194E+01	8,388E-02	3,057E-03	8,385E+00	5,704E+00

LCA RESULTS - ENVIRONMENTAL IMPACT DESCRIPTIVE PARAMETERS – Spain

Environmental impact indicators	Unit	Manufacturing	Distribution Spain	Installation Spain	Use and maintenance Spain	EoL
Global Warming Potential total (GWPtotal)	kg CO2e	2,624E+03	2,124E+02	2,096E+00	6,265E+04	1,016E+02
Global Warming Potential total (GWPfossil)	kg CO2e	2,583E+03	2,124E+02	2,803E+00	6,265E+04	1,017E+02
Global Warming Potential total (GWPbiogenic)	kg CO2e	3,873E+01	6,527E-03	6,746E+01	-6,787E-01	-2,246E-02
Global Warming Potential total (GWPluluc)	kg CO2e	2,024E+00	8,707E-02	1,032E-03	5,574E+00	1,856E-02
Depletion potential of the stratospheric ozone layer (ODP)	kg CFC11ee	3,589E-01	3,207E-06	3,956E-08	1,130E-03	5,158E-07
Acidification potential, Accumulated Exceedance (AP)	moles of H+ equivalents	3,558E+01	8,791E-01	1,607E-02	1,904E+02	1,753E-01
Eutrophication potential, fraction of nutrients reaching freshwater end compartment (EP-freshwater)	kg P eq.	2,749E+00	1,702E-02	4,777E-04	6,189E+00	7,324E-03
Eutrophication potential, fraction of nutrients reaching marine end compartment (EPmarine)	kg N eq.	3,451E+00	3,179E-01	7,073E-03	4,177E+01	1,122E-01
Eutrophication potential, Accumulated Exceedence (EP-terrestrial)	mol N eq.	3,948E+01	3,474E+00	7,206E-02	4,208E+02	5,812E-01
Formation potential of tropospheric ozone (POCP)	Kg NMVOC eq	1,212E+01	1,236E+00	2,170E-02	1,812E+02	1,901E-01
Abiotic Depletion for non-fossil resources potential (ADP-minerals&metals)	Kg Sb eq	3,975E-01	6,766E-04	8,119E-06	1,092E-01	4,435E-04
Abiotic Depletion for non-fossil resources potential (ADP-fossil)	MJ, net calorif value	2,010E+04	3,031E+03	3,617E+01	1,689E+06	4,272E+02
Water deprivation potential, deprivationweighted water consumption (WDP)	m3 eq	8,262E+02	1,414E+01	1,642E+00	1,176E+04	7,661E+00

LCA RESULTS - PARAMETERS DESCRIBING RESOURCE USE – Spain

Parameters describing the resource use	Unit	Manufacturing	Distribution Spain	Installation Spain	Use and maintenance Spain	EoL
Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials (PENRE)	MJ	2,632E+04	3,031E+03	3,617E+01	1,689E+06	-1,639E+03
Use of renewable primary energy excluding renewable primary energy resources used as raw materials (PERE)	MJ	3,837E+03	4,093E+01	5,681E-01	1,582E+04	1,706E+01
Use of non-renewable primary energy resources used as raw materials (PENRM)	MJ	7,624E+02	0,000E+00	0,000E+00	0,000E+00	2,018E+03
Use of renewable primary energy resources used as raw materials (PERM)	MJ	0,000E+00	0,000E+00	2,719E-02	0,000E+00	0,000E+00
Total use of non-renewable primary energy resources (primary energy and primary energy resources used as raw materials (PENRT))	MJ	2,718E+04	3,038E+03	3,624E+01	1,689E+06	4,278E+02
Total use of renewable primary energy resources (primary energy and primary energy resources used as raw materials (PERT))	MJ	4,111E+03	4,093E+01	5,953E-01	1,582E+04	1,706E+01
Net use of fresh water (FW)	m3	2,194E+01	4,220E-01	1,337E-02	2,810E+02	5,655E-02
Use of secondary materials (MS)	kg	1,513E+02	1,348E+00	2,810E-02	1,361E+02	2,716E+01
Use of renewable secondary fuels (RSF)	MJ	6,152E-01	1,716E-02	2,039E-04	3,102E-01	5,813E-03
Use of non-renewable secondary fuels (NRSF)	MJ	ND	ND	0,000E+00	ND	ND

LCA RESULTS - WASTE PRODUCTION DESCRIPTIVE PARAMETERS – Spain

Parameters describing the waste production	Unit	Manufacturing	Distribution Spain	Installation Spain	Use and maintenance Spain	EoL
Hazardous landfill waste (HWD)	kg	8,577E+02	5,303E+00	3,505E-01	2,488E+03	3,003E+00
Non-hazardous waste disposed (NHWD)	kg	1,400E+04	9,959E+01	4,847E+01	3,547E+04	2,554E+02
Radioactive waste disposed (RWD)	kg	2,547E-02	4,501E-04	6,247E-06	8,553E+00	2,906E-04
Materials for energy recovery (MER)	kg	1,240E-02	1,829E-04	2,633E-06	1,282E-02	3,609E-05
Material for recycling (MFR)	kg	5,711E+01	2,293E-02	2,919E-04	4,223E+01	2,075E+02

Components for reuse (CRU)	kg	ND	ND	ND	ND	ND
Exported thermal energy (ETE)	MJ	2,133E+01	3,657E-01	5,897E-03	1,514E+02	2,122E+00
Exported electricity energy (EEE)	MJ	1,194E+01	2,335E-01	3,057E-03	7,079E+01	5,705E+00

CALCULATION RULES

Relevant aspect for the study	Description
LCI and LCIA	From the Ecoinvent database (add-on EN 15804) we obtained the LCI (life cycle inventory) and the LCA (life cycle assessment) results (indicators and parameters)
System model	Allocation, cut-off, EN15804
LCA assessment method	EN15804 EF 3.1. EN15804
Cut-off and exclusions	Were followed the PCRs indications
Transportation and end of life scenarios	Were followed the PCRs indications For the end-of-life, table G.4 of EN50693:2019 was used as reference
Waste management	Applied the polluters pays principle, adopting the end of waste state based on the definition of EN 15804 and EU's Waste Framework Diretive (European Comission)

SCENARIOS AND ADDITIONAL TECHNICAL INFORMATION

All life cycle stages were included, is a cradle to crave study.

Geographic boundaries:
The manufacture of raw materials and components is carried out globally, with special emphasis on India.
Product assembly starts at Efacec India and ends at Efacec Portugal, where at least customization and final tests are carried out.
The distribution, installation, use and end of life stages are: Colombia and Spain.

Processes/Stages	Description	Aditional information
Production (extraction, treatment, transformation, etc.) of raw materials needed to manufacture the components	This process takes place globally	The composition of each component and constituent part of the product derives from the list of materials prepared in the design/development phase of the product. From there, given the diversity and quantity of raw materials needed to manufacture the components and constituent parts and consequently of the respective suppliers along the upstream chain, we resorted to the use of commercial database. The main material used was classified "low alloyed steel", "market for, GLO" which we found to be the most representative and approximate, taking into account the data availability at Ecoinvent data base.

Processes/Stages	Description	Aditional information
Industrial processes of transformation and manufacture of the various parts, components and semi-finished products	This process takes place specially in India and Portugal, but also in the rest of the world, depending on the market availabilities and conditions	As mentioned, the composition of each component and constituent part of the product derives from the list of materials prepared in the design/development phase of the product. From there, given the diversity and quantity of raw materials needed to manufacture the components and constituent parts and consequently of the respective suppliers along the upstream chain, we resorted to the use of software and commercial database.
Production of finished product packaging, including packaging for distribution in the reference market segment	Similar to what was described in the previous point	Similar to what was described in the previous point It should be noted that the components, parts and semi-finished products are packaged in India, unpacked in Portugal (with non-reusable packaging waste sent for recycling). The product is subject to customization operations, depending on the customer's requirements, and to final tests that ensure the quality control of the finished product, which is then repackaged for distribution to customers.
Transport of raw materials and semi-finished products along the entire supply chain	The environmental impact indicators associated with the transport of raw materials for the manufacture of components and integral parts to direct suppliers (tier 1) are included in their manufacturing process.	Ecoinvent's market activities
Transport of materials, components and sub-assemblies from the supplier's production site to the assembly site(s) and/or packaging site(s)	The average distance between direct suppliers and Efacec India was estimated taking into account the applicable PCRs.	PCRs indications were followed Assumptions
If assembly is to be carried out at several locations in series, consideration should be given to transport between each location	The distance between Efacec India and Efacec Portugal was calculated and the type of transport carried out (maritime and land) was determined	PCRs indications were followed Informatic applications for distance between ports were used

Processes/Stages	Description	Aditional information
Assembly of components	This stage takes place at Efacec Portugal and Efacec India	The activity data is primary data In this process, is mainly consumed electricity Electricity, low voltage, residual mix, Portugal was used for Portugal (GWP total: 6,23E-1 kgCO2e/kWh; GWP fossil: 6,22E-1 kgCO2e/kWh) Market for electricity, low voltage, western India was used for India (GWP total: 1,59 kgCO2e/kWh; GWP fossil: 1,58 kgCO2e/kWh)
Distribution	The distance between Efacec Portugal and the installation site was calculated and the type of transport carried out (maritime and land) was determined	PCRs indications were followed Informatic applications for distance between ports were used
Installation	This stage takes place in Colombia and Spain	It is made mainly manually The packaging waste was considered PCR indications were used
Use and maintenance	This stage takes place in Colombia and Spain	PCR indications were used Market for electricity, medium voltage, Colombia was used for Colombia. Market for electricity, medium voltage, residual mix, Spain was used for Spain.
De-Installation	This stage takes place in Colombia and Spain	It is made mainly manually PCR indications were used
End of life (EoL)	This stage takes place in Colombia and Spain	Table G.4 of EN50693:2019 was used as reference PCR indications were used

REFERENCES

ISO 14067:2018 - Greenhouse gases — Carbon footprint of products — Requirements and guidelines for quantification.

ISO 14025:2006 Environmental labels and declarations — Type III environmental declarations — Principles and procedures

ISO 14026:2017 Environmental labels and declarations — Principles, requirements and guidelines for communication of footprint information

ISO 14040:2006 Environmental management — Life cycle assessment — Principles and framework

ISO 14040:2006/Amd 1:2020 Environmental management — Life cycle assessment — Principles and framework — Amendment 1

ISO 14044:2006 Environmental management — Life cycle assessment — Requirements and guidelines

ISO 14044:2006/Amd 1:2017 Environmental management — Life cycle assessment — Requirements and guidelines — Amendment 1

ISO 14044:2006/Amd 2:2020 Environmental management — Life cycle assessment — Requirements and guidelines — Amendment 2

PCR EPDItaly007 - Electronic and electrical products and systems, revision 3, 2023/01/13

PCR EPDItaly015 – Switchboards, revision 1.5, 2022/02/23

EN 50693:2019 - Product category rules for life cycle assessments of electronic and electrical products and systems

EN 15804:2012+A2:2019 - Sustainability of construction works. Environmental product declarations. Core rules for the product category of construction products.

EN IEC 62474:2019+A1:2021 - Material declaration for products of and for the electrotechnical industry

IEC TR 62635:2012 - Guidelines for end-of-life information provided by manufacturers and recyclers and for recyclability rate calculation of electrical and electronic equipment

LCA (life cycle assessment) Report – EFACEC – FLUOFIX Spain and Colombia, 17/06/2024

GLOSSARY

DIVAC – Vacuum Circuit Breaker

EI – Efacec India

KOMAX – Cabling preparation equipment

SAK – Standard Assembly Kit