EPD

Environmental Product Declaration

REA 10_ Arc Fault Protection System

Production site: Vaasa, Finland

DOCUMENT KIND Environmental Product Declaration	IN COMPLIANCE WITH ISO 14025 and EN 50693			
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EPD Owner	ABB Switzerland Ltd, Group Technology Management
Organization No.	CHE-101.538.426
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Declared product	REA 10_ Arc Fault Protection System
Product description	The REA system is a fast and selective arc fault protection system for air-insulated low voltage and medium voltage switchgear which is a natural constituent of modern switchgear panels and a safety and security investment for older switchgear panels to protect human lives and prevent or reduce material damage.
Functional unit	To protect an air insulated switchgear of a power system against arc faults, using an auxiliary voltage of 110 V DC, during a service life of 10 years and with a use rate of 100 % in Europe.
Reference flow	REA 101 main module, including related connectors and packaging.
Independent verification	Independent verification of the declaration and data, according to ISO 14025:2010 ☐ INTERNAL ☒ EXTERNAL Independent verifier approved by EPD-Norge: Elisabet Amat Signature: 
Approved by	Håkon Hauan, CEO EPD-Norge Signature: 
Reference PCR	EN 50693:2019 – Product Category Rules for Life Cycle Assessments of Electronic and Electrical Products and Systems. EPDItaly007 – Electronic and Electrical Products and Systems, Rev. 3.0, 2023/01/13.
Program instructions	The Norwegian EPD Foundation/EPD-Norge, General Programme Instructions 2019, Version 3.0, 2019/04/24.
LCA study	This EPD is based on the LCA study described in the LCA report 2NGA002384.
EPD type	Specific product with extrapolation rules
EPD scope	Cradle-to-grave
Product RSL	10 years
Geographical representativeness	Manufacturing (suppliers): Global Manufacturing (ABB): Finland Downstream: Europe
Reference year	2023
LCA software	SimaPro 9.5 (2023)
LCI database	Ecoinvent v3.9.1 (2022)
Comparability	EPDs published within the same product category, though originating from different programs, may not be comparable. Full conformance with a PCR allows EPD comparability only when all stages of a life cycle have been considered. However, variations and deviations are possible.
Liability	The owner of the declaration shall be liable for the underlying information and evidence. EPD-Norge shall not be liable with respect to manufacturer, life cycle assessment data, and evidence.

Contents

Sustainability at ABB

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At ABB, we actively contribute to a more sustainable world, leading by example in our own operations and partnering with customers and suppliers to enable a low-carbon society, preserve resources, and promote social progress.

Learn more on our website global.abb/group/en/sustainability or scan the QR code.

General Information

This Environmental Product Declaration is a “specific product EPD” with extrapolation rules. A single REA 101 main module is declared as reference product, and the results can be extrapolated for different extension module combinations according to the provided extrapolation rules. The EPD covers all combinations of REA 10_, including related connectors and packaging.

The REA system is a fast and selective arc fault protection system for air-insulated low voltage and medium voltage switchgear which is a natural constituent of modern switchgear panels and a safety and security investment for older switchgear panels to protect human lives and prevent or reduce material damage.

The REA system offers one main module and three extension modules. The main module REA 101 can operate as a stand-alone device or in combination with other REA 101 modules, and with the REA 103, REA 105 or REA 107 extension modules. The extension modules REA 103 and REA 107 allow the number of sensor fibers and/or lens-type sensors to be increased to extend the area of protection. The use of the extension module REA 105 including fast trip outputs will allow protection schemes with increased selectivity to be created.

General technical specifications of the REA reference product are presented below.

Description		REA 101 main module
Size	Width (frame)	148.8 mm
	Width (housing)	130.8 mm
	Height (frame)	265.9 mm
	Height (housing)	255.8 mm
	Depth (without rear plate protective cover)	235.0 mm
	Depth (with rear plate protective cover)	245.1 mm
	Weight	4.8 kg
Ratings	Nominal auxiliary voltage U_n	100, 110, 120, 220, 240 V AC, 50 and 60 Hz 60, 110, 125, 220, 250 V DC
	Measured nominal power @ 110 V DC	6.3 W

ABB does not manufacture or assembly the product itself. Instead, it is outsourced and purchased from supplier as a ready product. The REA products are stored for re-distribution at ABB in Vaasa, Finland. The manufacturing site uses 100 % renewable energy for the electricity (50/50 wind and hydro) and for heating (bioenergy) and is certified according to the following standards:

- ISO 9001:2015 – Quality Management Systems
- ISO 14001:2015 – Environmental Management Systems
- ISO 45001:2018 – Occupational Health and Safety Management Systems
- ISO 50001:2018 – Energy management systems

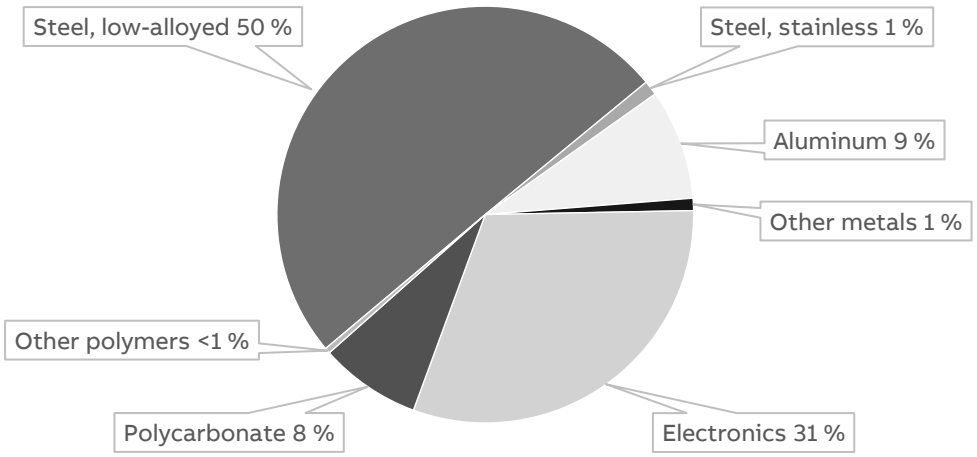
Constituent Materials

The constituent materials of the REA Reference Product are presented below.

Type	Material	Weight [kg]	Weight %
Metals	Steel, low-alloyed	2.40	50
	Steel, stainless	0.05	1
	Aluminum	0.41	9
	Other metals	0.05	1
Plastics	Polycarbonate	0.38	8
	Other polymers	0.02	<1
Others	Electronics	1.48	31
Total		**4.79**	**100**

The extension modules weight range is 1.1 – 1.2 kg the same constituent materials are utilized.

REA 101 Reference Product



The constituent materials of the packaging are presented below. Both primary packaging (unit) and secondary packaging (bulk) are considered. Per pallet, 12 pcs are assumed for the REA 101.

	Description	Material	Weight [kg]	Weight %
Unit (1st)	Packaging box	Cardboard	0.716	26
	Interior	Cardboard	0.684	25
	Documentation	Printed paper*	0.077	3
	Subtotal		**1.477**	**54**
Bulk (2nd)	Pallet	Wood*	0.883	32
	Packaging box	Cardboard*	0.092	3
	Packaging cover	Cardboard*	0.208	8
	Protective edges	Cardboard	0.009	<1
	Cushioning	Kraft paper	0.084	3
	Plastic straps	PET	0.006	<1
	Subtotal		**1.282**	**46**
	Total		**2.759**	**100**

*FSC- or PEFC-certified
Extension module packaging weighs 0.320 kg with the same packaging materials

LCA Background Information

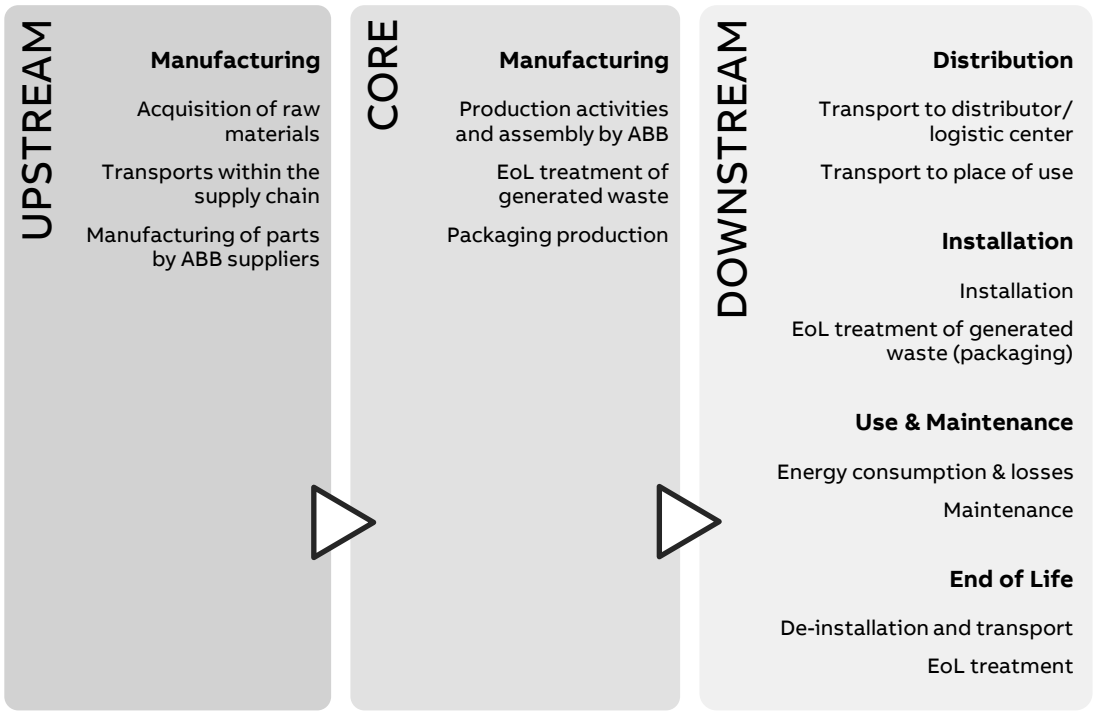
Functional Unit

The functional unit of this study is to protect an air insulated switchgear of a power system against arc faults, using an auxiliary voltage of 110 V DC, during a service life of 10 years and with a use rate of 100 % in Europe. The reference flow is a single REA 101 main module, including related accessories and packaging.

Note, the reference service life (RSL) of 10 years is a theoretical period selected for calculation purposes only – this is not representative for the minimum, average, nor actual service life of the product.

System Boundaries

The life cycle assessment is a “cradle-to-grave” analysis, and the system boundaries are defined according to EN 50693, as required by the PCR. For transparency reasons, the manufacturing stage is further divided into an upstream and core stage.



Data quality

Both primary and secondary data are used. The main sources for primary data are the bill of materials (BOM), CAD-files, technical drawings, and site-specific foreground data provided by ABB.

For all processes for which primary data are not available, generic background data originating from the ecoinvent v3.9.1 database, with system model “allocation, cut-off by classification”, are used. The LCA software used for the calculations is SimaPro 9.5.

Allocation rules

ABB does not manufacture or assembly the product itself, and the REA products are only stored for re-distribution at ABB in Vaasa, Finland. The energy consumption for storage is considered negligible. Therefore, no utility consumption and waste generation by ABB in the core manufacturing stage are allocated to the product. Thus, mass balance is not considered either.

For the end-of-life allocation, the “Polluter Pays” principle is adopted according to what is defined in the CEN/TR 16970 standard. However, the potential benefits and avoided loads from recovery and recycling processes are not considered because it is not required by the PCR.

Cut-off criteria

The PCR EPDItaly007 does not provide any details about cut-off criteria; it refers to chapter 4.2.3.3 in the standard EN 50693. According to EN 50693, the cut-off criteria can be set to a maximum of 5 % of the overall environmental impacts. In this LCA, labels as well as the tape and staples used in the packaging have been excluded as their weights are negligible.

Inventory Analysis

Manufacturing Stage (upstream)

The life cycle inventory in the upstream manufacturing stage is based on the primary data available from ABB and background data from ecoinvent. Datasets are applied accordingly, to the best of our knowledge, to represent each material, manufacturing process, and surface treatment. Modelling decisions and assumptions that are highly relevant to the results are as following:

- Secondary raw materials content is considered when selecting datasets.
- Printed wiring boards are modelled on a component level, i.e., each component is considered and mapped with the most representative dataset available.
- The amount of gold used in each connector is considered, due to its high impact.

Additionally, supply chain transports are added as far as data is available between ABB, the suppliers, and sub-suppliers. Only primary suppliers are considered. The rest of the transports are assumed to already be included in ecoinvent's "market for"-processes.

Manufacturing Stage (core)

ABB does not manufacture or assembly the product itself, and the REA products are only stored for re-distribution at ABB in Vaasa, Finland. The energy consumption for storage is considered negligible. Therefore, no utility consumption and waste generation by ABB in the core manufacturing stage are allocated to the product. Thus, mass balance is not considered either. The packaging materials also considered.

Modelling decisions and assumptions that are highly relevant to the results are as following:

- 100% renewable electricity and district heating is considered, which is procured by the ABB manufacturing site through Guarantees of Origins (GO's). In the use stage electricity is not calculated according to residual mix, but according to location-based approach.

Distribution

The transport distance from the ABB manufacturing site to the site of installation is assumed to be 300 km by lorry, as the actual distance is unknown. The environmental impacts can be multiplied accordingly if the actual distance is known.

	Dataset	Amount	Unit	Represent.
Transport	*Transport, freight, lorry 16-32 metric ton, EURO4 {RER}*	300	km	Assumption

Installation

The installation phase only implies manual activities, and the energy consumed is negligible. Therefore, this phase only considers the end-of-life of the packaging materials used.

	Scenario	Transport	Representation
Packaging End-of-Life	*Packaging waste by waste management operations* (Eurostat, 2021)	100 km by lorry (assumption)	Europe

Use

The use stage considers the measured nominal power consumption at 110 V DC over the reference service life of 10 years over the reference service life as defined in the functional unit. This is calculated using the following formula:

$$E_{use}[kWh] = \frac{P_{use} * 8760 * RSL * \alpha}{1000} = \frac{6.3\ \text{W} * 8760\ \text{hours} * 10\ \text{years} * 100\ \%}{1000} = 551.9\ kWh$$

Where:

- E_{use} = Total energy use over the reference service life
- P_{use} = Reference power consumption in watts
- RSL = Reference Service Life in years
- α = Use time rate
- 8760 is the number of hours in a year
- 1000 is the conversion factor from W to kW

The energy mix of the European Union is adopted to represent an average European downstream scenario.

	Dataset	Amount	Unit	Represent.
Energy	*Electricity, medium voltage {RER}| market group for | Cut-off, S*	0.36	kg CO_2-eq./kWh	Europe

Maintenance is not considered because the REA does not have any required, planned, or preventive maintenance within its service life. Possible corrective maintenance is unusual, and thus considered negligible.

End of life

Decommissioning of the product only implies manual activities, and the energy consumed is negligible. Therefore, this phase only considers the end-of-life of the product.

	Scenario	Transport	Representation
Product End-of-Life	IEC/TR 62635 (Annex D.3)*	100 km by lorry (assumption)	Europe

*A conservative approach is adopted by considering all parts as either: requiring selective treatment, difficult to process, or going through a separation process; no individual part is considered as a single recyclable material.

Environmental Indicators

In accordance with the PCR EPDItaly007, the environmental impact indicators are determined by using the characterization factors and impact assessment methods specified in EN 15804:2012+A2:2019.

REA 101 Reference Product

			Cradle-to-gate		Cradle-to-grave			
Impact category	Unit	Total	UPSTREAM	CORE	DOWNSTREAM			
			Manufacturing		Distribution	Installation	Use and maintenance	End-of-life
GWP – total	kg CO_2 eq.	2,96E+02	9,19E+01	4,52E-01	4,24E-01	1,06E+00	2,00E+02	2,53E+00
GWP – fossil	kg CO_2 eq.	2,88E+02	9,12E+01	2,24E+00	4,23E-01	7,59E-02	1,92E+02	2,44E+00
GWP – biogenic	kg CO_2 eq.	6,95E+00	6,11E-01	-1,82E+00	3,85E-04	9,89E-01	7,08E+00	9,20E-02
GWP – luluc	kg CO_2 eq.	6,79E-01	1,67E-01	3,06E-02	2,07E-04	3,62E-05	4,80E-01	6,19E-04
ODP	kg CFC-11 eq.	7,27E-06	3,64E-06	1,55E-07	9,27E-09	1,58E-09	3,45E-06	6,23E-09
AP	mol H+ eq.	1,86E+00	8,77E-01	1,18E-02	1,75E-03	3,75E-04	9,64E-01	2,79E-03
EP – freshwater	kg P eq.	2,79E-01	1,03E-01	1,23E-03	2,98E-05	8,07E-06	1,75E-01	1,64E-04
EP – marine	kg N eq.	3,10E-01	1,29E-01	6,02E-03	6,69E-04	5,63E-04	1,71E-01	1,74E-03
EP – terrestrial	mol N eq.	3,20E+00	1,64E+00	3,75E-02	7,14E-03	1,51E-03	1,51E+00	8,80E-03
POCP	kg NMVOC eq.	9,53E-01	4,49E-01	1,14E-02	2,57E-03	5,85E-04	4,87E-01	2,51E-03
ADP – minerals and metals	kg Sb eq.	2,39E-02	2,35E-02	8,75E-06	1,37E-06	2,07E-07	3,82E-04	3,90E-06
ADP – fossil	MJ, net calorific value	5,64E+03	1,17E+03	3,21E+01	6,04E+00	9,65E-01	4,42E+03	5,82E+00
WDP	m^3 eq.	6,83E+01	2,19E+01	1,10E+00	2,45E-02	1,09E-02	4,52E+01	1,00E-01

GWP-fossil: Global Warming Potential fossil; 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; EP-freshwater: Eutrophication potential-freshwater compartment; EP-marine: Eutrophication potential-marine compartment; EP-terrestrial: Eutrophication potential-accumulated exceedance; POCP: Formation potential of tropospheric ozone; ADP-minerals & metals: Abiotic Depletion for non-fossil resources potential; ADP-fossil: Abiotic Depletion for fossil resources potential; WDP: Water deprivation potential.

Resource use parameters	Unit	Total	Cradle-to-gate		Cradle-to-grave			
			UPSTREAM	CORE	DOWNSTREAM			
			Manufacturing		Distribution	Installation	Use and maintenance	End-of-life
PENRE	MJ, low cal. value	5,61E+03	1,15E+03	3,20E+01	6,04E+00	9,65E-01	4,42E+03	5,82E+00
PERE	MJ, low cal. value	9,83E+02	1,31E+02	3,04E+00	9,37E-02	1,93E-02	8,48E+02	5,62E-01
PENRM	MJ, low cal. value	2,80E+01	2,79E+01	1,35E-01	0,00E+00	0,00E+00	0,00E+00	0,00E+00
PERM	MJ, low cal. value	3,62E+01	7,06E-02	3,61E+01	0,00E+00	0,00E+00	0,00E+00	0,00E+00
PENRT	MJ, low cal. value	5,64E+03	1,17E+03	3,21E+01	6,04E+00	9,65E-01	4,42E+03	5,82E+00
PERT	MJ, low cal. value	1,02E+03	1,31E+02	3,91E+01	9,37E-02	1,93E-02	8,48E+02	5,62E-01
FW	m^3	4,31E+00	8,15E-01	3,38E-02	8,61E-04	3,76E-04	3,45E+00	3,63E-03
MS	kg	2,80E+00	1,55E+00	1,25E+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

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

System output indicators	Unit	Total	Cradle-to-gate		Cradle-to-grave			
			UPSTREAM	CORE	DOWNSTREAM			
			Manufacturing		Distribution	Installation	Use and maintenance	End-of-life
HWD	kg	1,81E-02	1,22E-02	1,59E-04	3,85E-05	5,75E-06	5,60E-03	2,38E-05
NHWD	kg	2,72E+01	1,23E+01	6,44E-01	2,95E-01	5,41E-01	1,21E+01	1,38E+00
RWD	kg	3,46E-02	2,39E-03	5,82E-05	1,96E-06	3,71E-07	3,22E-02	1,05E-05
MER	kg	1,08E+00	0,00E+00	0,00E+00	0,00E+00	4,34E-01	0,00E+00	6,50E-01
MFR	kg	5,13E+00	3,35E-01	0,00E+00	0,00E+00	1,83E+00	0,00E+00	2,97E+00
CRU	kg	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
ETE	MJ	3,73E+00	0,00E+00	0,00E+00	0,00E+00	1,82E+00	0,00E+00	1,92E+00
EEE	MJ	2,07E+00	0,00E+00	0,00E+00	0,00E+00	1,01E+00	0,00E+00	1,06E+00

HWD: hazardous waste disposed; NHWD: non-hazardous waste disposed; RWD: radioactive waste disposed; MER: materials for energy recovery; MFR: material for recycling; CRU: components for reuse; ETE: exported thermal energy; EEE: exported electricity energy.

Extrapolation rules

Due to the possibilities of extending the REA 101 with different module combinations, extrapolation rules are established according to EN 50693. This allows for estimating more precise impacts of other various combinations. Also, the extrapolation rules have been tested with various REA combinations to ensure an accuracy of within ± 10% of the total environmental impacts. As a result, the following rules are established:

- The upstream manufacturing stage, core stage, distribution stage, use and maintenance stage, and end-of-life stage can be extrapolated, based on the type and number of extension module, using the following formula:

$$Impact = Impact_{ref} + (a_1 * n_1 + a_2 * n_2 + a_3 * n_3)$$

where
- *Impact* is the extrapolated value for any impact category
- $Impact_{ref}$ is the impact value of the reference product
- *a* is the impact value of extension module type
- *n* is the number of used extension module type

- The use stage is proportional to the actual, measured power consumption and can be extrapolated using the following formula:

$$Impact = Impact_{ref} * (\frac{P_{actual}}{6.3\ \mathrm{W}})$$

where
- *Impact* is the extrapolated value for any impact category
- $Impact_{ref}$ is the impact value of the reference product
- P_{actual} is the actual, measured power consumption
- *6.3 W* is the nominal power consumption at 110 V DC

Example 1: REA 101 + REA 105, and a measured power consumption at 8.9 W.
- "GWP-total" in upstream = 91.9 kg CO2-eq + (35.2 * 1) = 127 kg CO2-eq
- "GWP-total" in use stage = 200 kg CO2-eq * (8.9 W / 6.3 W) = 282 kg CO2-eq

Example 2: REA 101 + 2 x REA 103 + 2 x REA 105, and a theoretical power consumption at 14.9 W.
- "ADP-fossil" in distribution = 6.04 MJ + (1.13 * 2 + 1.18 * 2) = 10.7 MJ
- "ADP-fossil" in use stage = 4420 MJ * (14.9 W / 6.3 W) = 10 454 MJ

An Excel tool for the extrapolation rules of REA is available at:
https://search.abb.com/library/Download.aspx?DocumentID=2NGA002397&LanguageCode=en&DocumentPartId=&Action=Launch

Impact category	Upstream			Core	Distribution			Install	End-of-life		
	a_1 (103)	a_2 (105)	a_3 (107)	a_1 a_2 a_3	a_1 (103)	a_2 (105)	a_3 (107)	a_1 a_2 a_3	a_1 (103)	a_2 (105)	a_3 (107)
GWP – total	2,28E+01	3,52E+01	2,07E+01	2,00E-02	7,92E-02	8,27E-02	8,76E-02	1,27E-01	3,78E-01	4,48E-01	4,15E-01
GWP – fossil	2,25E+01	3,48E+01	2,04E+01	2,83E-01	7,91E-02	8,26E-02	8,75E-02	9,20E-03	3,49E-01	4,18E-01	3,82E-01
GWP – biogenic	2,68E-01	3,28E-01	2,45E-01	-2,66E-01	7,20E-05	7,52E-05	7,97E-05	1,18E-01	2,85E-02	2,89E-02	3,28E-02
GWP – luluc	3,89E-02	6,34E-02	3,51E-02	2,75E-03	3,87E-05	4,04E-05	4,28E-05	4,27E-06	1,43E-04	1,51E-04	1,64E-04
ODP	7,43E-07	1,38E-06	9,33E-07	2,09E-08	1,73E-09	1,81E-09	1,92E-09	1,83E-10	1,36E-09	1,46E-09	1,57E-09
AP	1,69E-01	2,77E-01	1,60E-01	1,51E-03	3,27E-04	3,42E-04	3,62E-04	4,47E-05	5,95E-04	6,40E-04	6,76E-04
EP – freshwater	2,28E-02	4,02E-02	2,32E-02	1,45E-04	5,57E-06	5,82E-06	6,17E-06	1,02E-06	3,76E-05	3,98E-05	4,28E-05
EP – marine	3,13E-02	4,82E-02	2,88E-02	6,28E-04	1,25E-04	1,30E-04	1,38E-04	6,70E-05	2,16E-04	2,33E-04	2,47E-04
EP – terrestrial	3,31E-01	5,16E-01	3,06E-01	4,43E-03	1,33E-03	1,39E-03	1,48E-03	1,83E-04	1,75E-03	1,92E-03	1,98E-03
POCP	9,84E-02	1,62E-01	9,31E-02	1,39E-03	4,79E-04	5,01E-04	5,30E-04	6,87E-05	5,19E-04	5,62E-04	5,88E-04
ADP – minerals and metals	5,49E-03	9,87E-03	5,92E-03	1,07E-06	2,56E-07	2,67E-07	2,83E-07	2,44E-08	9,60E-07	1,01E-06	1,10E-06
ADP – fossil	2,85E+02	4,42E+02	2,57E+02	4,09E+00	1,13E+00	1,18E+00	1,25E+00	1,15E-01	1,33E+00	1,40E+00	1,51E+00
WDP	4,36E+00	6,97E+00	3,60E+00	1,38E-01	4,58E-03	4,78E-03	5,07E-03	1,08E-03	1,89E-02	2,08E-02	2,26E-02

GWP-fossil: Global Warming Potential fossil; 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; EP-freshwater: Eutrophication potential-freshwater compartment; EP-marine: Eutrophication potential-marine compartment; EP-terrestrial: Eutrophication potential-accumulated exceedance; POCP: Formation potential of tropospheric ozone; ADP-minerals & metals: Abiotic Depletion for non-fossil resources potential; ADP-fossil: Abiotic Depletion for fossil resources potential; WDP: Water deprivation potential.

Resource use parameters	Upstream			Core	Distribution			Install	End-of-life		
	a_1 (103)	a_2 (105)	a_3 (107)	a_1 a_2 a_3	a_1 (103)	a_2 (105)	a_3 (107)	a_1 a_2 a_3	a_1 (103)	a_2 (105)	a_3 (107)
PENRE	2,82E+02	4,40E+02	2,54E+02	4,07E+00	1,13E+00	1,18E+00	1,25E+00	1,15E-01	1,33E+00	1,40E+00	1,51E+00
PERE	3,19E+01	5,12E+01	2,84E+01	1,18E+00	1,75E-02	1,83E-02	1,94E-02	2,26E-03	1,30E-01	1,37E-01	1,48E-01
PENRM	2,27E+00	2,85E+00	2,79E+00	2,02E-02	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
PERM	0,00E+00	0,00E+00	0,00E+00	4,24E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
PENRT	2,85E+02	4,42E+02	2,57E+02	4,09E+00	1,13E+00	1,18E+00	1,25E+00	1,15E-01	1,33E+00	1,40E+00	1,51E+00
PERT	3,19E+01	5,12E+01	2,84E+01	5,42E+00	1,75E-02	1,83E-02	1,94E-02	2,26E-03	1,30E-01	1,37E-01	1,48E-01
FW	1,79E-01	2,88E-01	1,55E-01	4,15E-03	1,61E-04	1,68E-04	1,78E-04	3,82E-05	7,12E-04	7,76E-04	8,44E-04
MS	2,92E-01	3,01E-01	3,32E-01	9,07E-02	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00

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

Waste production indicators	Upstream			Core	Distribution			Install	End-of-life		
	a_1 (103)	a_2 (105)	a_3 (107)	a_1 a_2 a_3	a_1 (103)	a_2 (105)	a_3 (107)	a_1 a_2 a_3	a_1 (103)	a_2 (105)	a_3 (107)
HWD	2,31E-03	2,81E-03	2,31E-03	2,57E-05	7,19E-06	7,50E-06	7,95E-06	6,84E-07	5,26E-06	5,62E-06	6,00E-06
NHWD	2,81E+00	3,87E+00	2,90E+00	7,16E-02	5,52E-02	5,76E-02	6,10E-02	7,17E-02	1,88E-01	2,12E-01	2,18E-01
RWD	6,07E-04	9,88E-04	5,31E-04	7,42E-06	3,67E-07	3,83E-07	4,06E-07	4,34E-08	2,52E-06	2,65E-06	2,89E-06
MER	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	5,67E-02	8,01E-02	1,01E-01	8,58E-02
MFR	2,05E-01	2,07E-01	2,34E-01	0,00E+00	0,00E+00	0,00E+00	0,00E+00	1,97E-01	8,70E-01	8,92E-01	9,97E-01
CRU	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
ETE	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	2,34E-01	2,25E-01	2,83E-01	2,42E-01
EEE	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	1,30E-01	1,25E-01	1,57E-01	1,35E-01

HWD: hazardous waste disposed; NHWD: non-hazardous waste disposed; RWD: radioactive waste disposed; MER: materials for energy recovery; MFR: material for recycling; CRU: components for reuse; ETE: exported thermal energy; EEE: exported electricity energy.

Additional Environmental Information

Circularity Values

The recycled content and recyclability potential of the product is calculated by dividing “MFR: material for recycling” in the end-of-life stage by the total weight of the product. The result is representative for Europe according to IEC/TR 62635 and are presented below.

	Recyclability potential
REA 101 (reference)	62 %

The recycled content and recyclability potential of the packaging is calculated by dividing "MS: Use of secondary materials" in the core manufacturing stage and “MFR: material for recycling” in the installation stage by the total weight of the packaging. The recycled content is based on primary data, and the recyclability potential is representative for Europe according to Eurostat (2021). The results are presented below.

	Recycled content	Recyclability potential
Packaging materials REA 101 (reference)	45 %	66 %

Greenhouse gas emissions from the use of electricity in the manufacturing phase

Production mix from import, medium voltage (production of transmission lines, in addition to direct emissions and losses in grid) of applied electricity for the manufacturing process.

Energy mix	Source	Amount	Unit
ABB FI custom energy mix; 50 % wind + 50 % hydro	Ecoinvent v3.9.1	0.028	kg CO_2-eq/kWh

Dangerous substances

The product complies with REACH and RoHS directive requirements and does not contain any of the listed materials in excess of the authorized proportions. For further information about REACH and RoHS, please visit the ABB webpage:
https://new.abb.com/contact/form

Indoor environment

The product meets the requirements for low emissions.

Carbon footprint

Carbon footprint has not been worked out for the product.

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