EPD

Environmental Product Declaration

Relion 620 Series of Protection and Control Relays

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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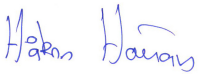
Program operator	The Norwegian EPD Foundation Post Box 5250 Majorstuen, 0303 Oslo, Norway phone: +47 23 08 80 00, email: post@epd-norge.no		
Declared product	Relion 620 Series		
Product description	The Relion 620 series of relays are used in utility, industrial, and transport and infrastructure applications for protection, control, measurement, and supervision of power distribution systems. Specific applications include feeder, transformer, and motor protection and control. The relays are available in ready-made standard configurations but can also be tailored to meet customer-specific requirements.		
Functional unit	To protect a power system against faults such as short circuit and overload, during a service life of 10 years and with a use rate of 100 % in Europe.		
Reference flow	A single Relion 620 series protection and control relay, including related accessories and packaging.		
CPC code	4621 - Electricity distribution or control apparatus.		
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 and PSR	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, 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 2RCA057633.		
EPD type	Specific product		
EPD scope	Cradle-to-grave		
Product RSL	10 years		
Geographical representativeness	Manufacturing (suppliers): Global	Manufacturing (ABB): Finland	Downstream: Europe
Reference year	2021		
LCA software	SimaPro 9.4.0.2 (2023)		
LCI database	Ecoinvent v3.8 (2021)		
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 evidences.		

Contents

Sustainability at ABB

ABB is a leading global technology company that energizes the transformation of society and industry to achieve a more productive, sustainable future. By connecting software to its electrification, robotics, automation and motion portfolio, ABB pushes the boundaries of technology to drive performance to new levels.

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

General Information

The products declared in this Environmental Product Declaration includes the following devices of the Relion 620 series of protection and control relays:

- REF620 – Feeder protection
- RET620 – Transformer protection
- REM620 – Motor protection

The Relion 620 series of relays are used in utility, industrial, and transport and infrastructure applications for protection, control, measurement, and supervision of power distribution systems. Specific applications include feeder, transformer, and motor protection and control. The relays are available in ready-made standard configurations for fast and easy setup but can also be tailored to meet customer-specific requirements.

General technical specifications for all devices belonging to the product series are presented below.

Description		Value
Width	Frame	262,2 mm
	Case	246 mm
Height	Frame	177 mm
	Case	160 mm
Depth		201 mm
Weight (excl. packaging)	Complete relay	max. 5.5 kg
	Plug-in unit only	max. 3.0 kg

	Power supply module 1 (PSM0004)	Power supply module 2 (PSM0003)
Nominal auxiliary voltage Un	100, 110, 120, 220, 240 V AC, 50 and 60 Hz	24, 30, 48, 60 V DC
	48, 60, 110, 125, 220, 250 V DC	
Burden of auxiliary voltage supply under quiescent (Pq) / operating condition	AC < 19.0 W (nominal) / < 23 W (max.)	DC < 18.5 W (nominal) / < 22.5 W (max.)
	DC < 18.0 W (nominal) / < 22.5 W (max.)	

Due to the configurable nature of the product, there is a significant variation within the series in terms of environmental impacts. A representative relay configuration is therefore selected as reference product and declared in this EPD. The reference product is a maximum version in terms of hardware which have all module slots filled; thus, the choice of reference product is conservative. Additionally, the results of the study can be extrapolated for other relay configurations according to EN 50693. The extrapolation rules are provided together with the results.

Slot	Module	Reference product (max. hardware)
X000	Communication	COM0037
X100	Power supply	PSM0004
X105	Optional	BIO0005
X110	Binary I/O	BIO0005
X115	Binary I/O or analogue Input	BIO0005
X120	Analogue input	AIM0016
X130	Sensor or analogue input	AIM0006
XBPL	Backplane	BPL0002
XCPU	CPU	CPU0006
XDIS	Display	DIS0009
Product ID		REF620E_1G
Nominal power, measured average		11.5 W
Weight (excl. packaging)		5.2 kg
Ordering code		NBFNAAAANEA1BNN11G

The Relion 620 series are produced in three different geographical locations: 1) Vaasa, Finland, 2) Vadodara, India, and 3) Nanjing, China. The plant in Vaasa is the main site of production, and these relays are sold globally. The plants in Vadodara and Nanjing instead focus on domestic markets, that is, India and China.

The manufacturing site in Vaasa, Finland, uses 100 % renewable energy for the electricity, more specifically, a 50/50 mix of wind and hydro. The plant is also 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

The manufacturing site in Vadodara, India, uses ca 1,5 % renewable energy from own roof-mounted solar panels. For the rest of the electricity, the national energy mix is used. The plant is also 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

The manufacturing site in Nanjing, China, is a joint venture with Nanjing SAC Power Grid Automation Co Ltd. The plant uses the national energy mix for the electricity. The plant is also 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

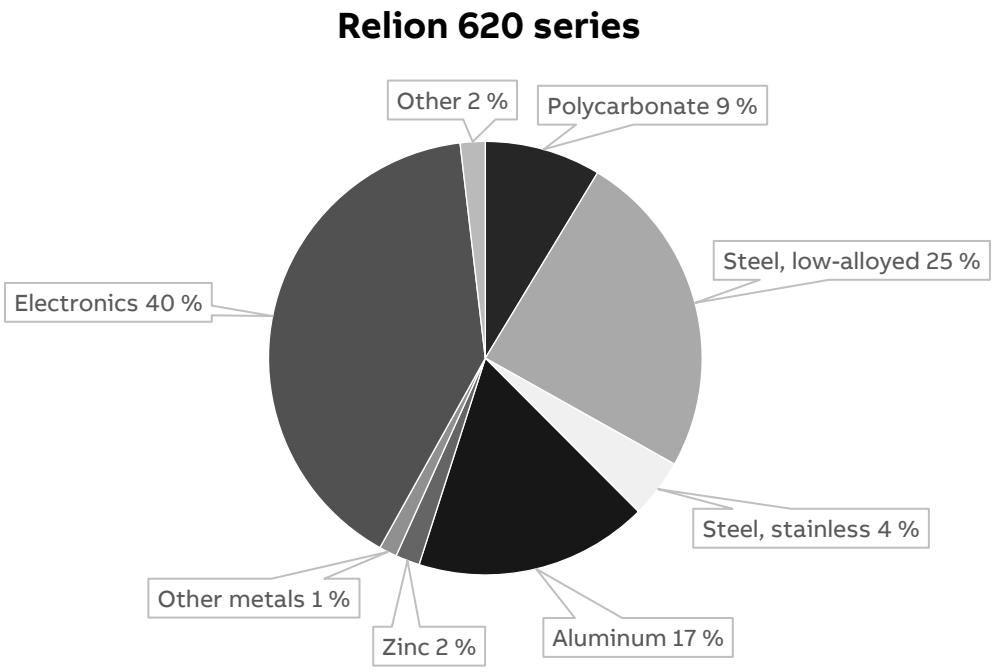
ABB only performs final assembling and testing of the relays. ABB does not manufacture any parts or components themselves. Instead, this is outsourced and purchased from various suppliers globally.

However, in this EPD, only the Relion 620 series manufactured Vaasa, Finland is considered in the main scenario. Additional scenarios are considered in the Sensitivity Analysis chapter, including Relion 620 series manufactured in Vadodara, India, and Nanjing, China.

Constituent Materials

The Relion 620 series reference product weighs 5.2 kg, and the constituent materials are presented below. Stickers have been excluded as they are considered negligible to the overall environmental impacts. Due to the complex nature of the electronics, these are presented as a separate category, which includes printed wiring boards, electronic components, connectors, and cables. Electronics are typically composed of various plastics, copper, and precious metals.

Type	Material	Weight [kg]	%
Plastics	Polycarbonate	0.45	9
Metals	Steel, low-alloyed	1.28	25
	Steel, stainless	0.23	4
	Aluminum	0.91	17
	Zinc	0.09	2
	Other metals	0.07	1
Others	Electronics	2.09	40
	Other	0.10	2
Total		**5.22**	**100**



The packaging materials and accessories of the relay weighs 1.16kg in total, of which 0.46 kg is the packaging of the relay, and 0.70 kg is the bulk packaging per relay (20 relays per pallet). The constituent materials are presented below.

	Description	Material	Weight [g]	Weight %	Secondary material %
Relay	Packaging box	Cardboard	226	19.6	10
	Cushioning	Molded fiber pulp	187	16.2	100
	Self-sealing bags	PE	8	0.7	0
	Documentation	Printed paper	36	3.1	0
	Subtotal		**457**	**39.6**	**46**
Pallet (1/20)	Pallet	Wood	460	39.8	0
	Packaging box	Cardboard	125	10.8	0
	Packaging cover	Cardboard	55	4.8	0
	Protective edges	Cardboard	5	0.4	85
	Cushioning	Kraft paper	50	4.4	100
	Plastic straps	PET	3	0.3	100
	Subtotal		**698**	**60.4**	**8**
Total			**1155**	**100**	**23**

LCA Background Information

Functional Unit

The functional unit of this study is to protect a power system against faults such as short circuit and overload, during a service life of 10 years and with a use rate of 100 % in Europe. The reference flow is a single Relion 620 series protection and control relay, 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 of the Relion 620 series, an EEPS (Electronic and Electrical Products and Systems), is a “from cradle to grave” analysis. The table below shows the stages of the product life cycle and the information stages according to EPDItaly007 for the evaluation of electronic and electrical products and systems.

Manufacturing	Distribution	Installation	Use and maintenance	End-of-life
Acquisition of raw materials Supply chain transports Manufacturing of parts/components Assembly Packaging End-of-life of generated waste	Transport to distributor/ logistic center Reconditioning at distributor/ logistic center Transport to the site of installation	Installation End-of-life of the packaging	Energy consumption Maintenance End-of-life of generated waste	De-Installation Collection and transport End-of-life of the product

In terms of exclusions from the system boundary, the PCR EPDitaly007 refer to chapter 4.2.3.1 in the standard EN 50693 for products that can be easily replaced or recovered. In accordance with EN 50693:2019, capital goods such as machinery, tools, buildings, infrastructure, packaging for internal transports, and administrative activities, which cannot be allocated directly to the production of the reference product, are excluded.

Infrastructures, when present, such as in processes deriving from the ecoinvent database, have not been excluded. Scraps for metal working and plastic processes are also included when already defined in ecoinvent.

Temporal and geographical boundaries

In terms of temporal boundaries, all primary data collected from ABB are from 2021, which is considered a representative production year. Secondary data are provided by ecoinvent v3.8 which was released in 2021.

In terms of geographical boundaries, the materials and components used in the production of the Relion 620 relays are globally sourced. The supply chains are often complex and can extend across multiple countries and continents. Therefore, materials with global representativeness are selected from ecoinvent. Thus, a conservative approach is adopted.

Data quality

Both primary and secondary data are used. The main sources for primary data are the bill of materials and technical drawings, while site specific foreground data are provided by ABB.

For all processes for which primary data are not available, generic data originating from the ecoinvent v3.8 database, “allocation, cut-off by classification”, are used. The LCA software used for the calculations is SimaPro 9.4.0.2.

Environmental impact indicators

The information obtained from the inventory analysis is aggregated according to the effects related to the various environmental issues. 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.

Allocation rules

The utility consumption and waste generation at the ABB manufacturing site is allocated to the production of one relay by using allocation rules. Because the plant is focused on relay production, the total utility consumption and waste generation for 2021 is simply divided by the total output of relays during the same year. Utility and waste deriving from offices and administrative activities are not excluded and thus, a conservative approach is adopted.

For the end-of-life allocation, the “Polluter Pays” principle is adopted according to what is defined in the CEN/TR 16970 standard, as required by the PCR EPDItaly007. This means, waste treatment processes are allocated to the product system that generates the waste until the end-of-waste state is reached. The environmental burdens of recycling and energy recovery processes are therefore allocated to the product system that generates the waste, while the product system that uses the exported energy and recycled materials receives it burden-free. However, the potential benefits and avoided loads from recovery and recycling processes are not considered because it is not required by EPDItaly007.

Cut-off criteria

According to EN 50693, the cut-off criteria can be set to a maximum of 5 % of the overall environmental impacts. In this LCA, stickers and labels as well as the tape and staples used in the packaging have been excluded as their weights are negligible.

Inventory Analysis

Manufacturing stage

Low-alloyed steel and electronics are the most frequently used materials, followed by aluminum and polycarbonate.

Using the ecoinvent database, the steels are mainly modelled with *Steel, low-alloyed [GLO]| market for*, while the aluminum is mainly modelled with a pseudo system of *Aluminium alloy, AlMg3 {GLO}| market for*, with an adjusted alloy composition based on primary data. To account for the production activities of metal and plastic parts, *Metal working, average* and *Injection molding* are the most frequently used processes. Surface treatments are also included, and the most common is *Zinc coat, coils {GLO}| market for*.

For modelling the electronics, the printed wiring boards (PWB) are modelled on a component level. Thus, every single component that is mounted on the PWBs is categorized and grouped into the most corresponding component found in ecoinvent. Furthermore, due to the high impacts of gold, primary data are used to model the specific amounts of gold used in each connector.

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.

For the ABB manufacturing site, utility consumption and waste generation are allocated to the production of one relay according to the defined allocation rules.

Packaging materials and accessories of the product are also included in the study.

Distribution

The transport distance from ABB's plant to the site of installation is assumed to be 3500 km intracontinental transport by lorry, as suggested in EN 50693, and the scenario is representative for Europe.

Installation

Except for commissioning testing, the installation stage only implies manual activities, and no energy is consumed. However, commissioning testing is not considered because the time duration is negligible. Therefore, this phase only considers the end-of-life of the packaging materials.

The end-of-life scenario for packaging materials is based on "Packaging waste by waste management operations" by Eurostat (2020), which is representative for Europe. A transport distance of 100 km by lorry is assumed as actual location of disposal is unknown.

Use

The use stage considers the nominal power consumption over the reference service life of 10 years as defined in the functional unit:

$$E_{use} = 11.5\ \text{W} * 10\ \text{years} * 365\ \text{days} * 24\ \text{hours} = 1007.4\ \text{kWh}$$

A use rate of 100 % is assumed because the relay is always powered on in a normal mode during normal operational circumstances. Additional power consumption from active inputs and outputs, e.g., during trip conditions, is therefore considered negligible. Finally, because this product is sold globally and is not limited to any specific country, the latest energy mix of the European Union is adopted as suggested by the standard EN 50693. The emission factor of the energy mix is presented below.

Energy mix	Source	Amount	Unit
European energy mix; *Electricity, medium voltage {RER}| market group for | Cut-off, S*	Ecoinvent v3.8	0.40	kg CO_2-eq./kWh

Maintenance is not considered because the Relion 620 series does not have any required maintenance within its service life. There is no planned or preventive maintenance for this product. The only maintenance that is performed is corrective maintenance if, for example, something breaks or stops working. However, corrective maintenance is unusual, and thus considered negligible.

End of life

Decommissioning of the product only implies manual activities, and no energy is consumed. Therefore, this phase only considers the end-of-life of the product.

The end-of-life scenario for the product is based on IEC/TR 62635 (Annex D.3), which is representative for Europe. A conservative approach is adopted by using the rates given for materials that go through a separation process, except for electronics for which selective treatment is assumed, and this includes the losses in the separation processes. A transport distance of 100 km by lorry is assumed as actual location of disposal is unknown.

Environmental Indicators

Relion 620 reference product

Product ID: REF620E_1G
Ordering code: NBFNAAAANEA1BNN11G
Hardware: Maximum (all slots filled)
Nominal power: 11.5 W (measured, average)

Impact category	Unit	Total	Manufacturing	Distribution	Installation	Use and maintenance	End-of-life
GWP – total	kg CO2 eq.	5.65E+02	1.54E+02	3.68E+00	4.97E-01	4.02E+02	4.27E+00
GWP – fossil	kg CO2 eq.	5.49E+02	1.53E+02	3.68E+00	3.85E-02	3.89E+02	4.18E+00
GWP – biogenic	kg CO2 eq.	1.43E+01	7.37E-01	3.34E-03	4.59E-01	1.30E+01	8.99E-02
GWP – luluc	kg CO2 eq.	1.24E+00	3.20E-01	1.46E-03	1.39E-05	9.16E-01	3.64E-04
ODP	kg CFC-11 eq.	3.29E-05	1.28E-05	8.58E-07	5.69E-09	1.93E-05	4.14E-08
AP	mol H+ eq.	3.62E+00	1.50E+00	1.86E-02	1.75E-04	2.09E+00	2.65E-03
EP – freshwater	kg P eq.	5.74E-01	1.85E-01	2.39E-04	3.48E-06	3.88E-01	1.26E-04
EP – marine	kg N eq.	6.16E-01	2.45E-01	6.42E-03	2.51E-04	3.62E-01	2.23E-03
EP – terrestrial	mol N eq.	6.26E+00	3.02E+00	7.02E-02	6.73E-04	3.16E+00	9.71E-03
POCP	kg NMVOC eq.	1.58E+00	6.92E-01	2.00E-02	2.23E-04	8.62E-01	2.50E-03
ADP – minerals and metals	kg Sb eq.	5.71E-02	5.62E-02	1.29E-05	9.71E-08	9.22E-04	4.24E-06
ADP – fossil	MJ, net calorific value	1.03E+04	1.94E+03	5.61E+01	4.08E-01	8.31E+03	4.68E+00
WDP	m3 eq.	1.36E+02	4.59E+01	1.69E-01	4.89E-03	9.01E+01	1.13E-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	Manufacturing	Distribution	Installation	Use and maintenance	End-of-life
PENRE	MJ, low cal. value	1.03E+04	1.89E+03	5.61E+01	4.08E-01	8.31E+03	4.68E+00
PERE	MJ, low cal. value	1.76E+03	2.80E+02	7.91E-01	8.00E-03	1.48E+03	3.35E-01
PENRM	MJ, low cal. value	4.62E+01	4.62E+01	0	0	0	0
PERM	MJ, low cal. value	1.85E+01	1.85E+01	0	0	0	0
PENRT	MJ, low cal. value	1.03E+04	1.94E+03	5.61E+01	4.08E-01	8.31E+03	4.68E+00
PERT	MJ, low cal. value	1.78E+03	2.98E+02	7.91E-01	8.00E-03	1.48E+03	3.35E-01
FW	m^3	8.76E+00	1.68E+00	6.25E-03	1.66E-04	7.07E+00	3.97E-03
MS	kg	1.35E+00	1.35E+00	0	0	0	0
RSF	MJ	0	0	0	0	0	0
NRSF	MJ	0	0	0	0	0	0

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	Unit	Total	Manufacturing	Distribution	Installation	Use and maintenance	End-of-life
HWD	kg	2.00E-02	1.69E-02	1.46E-04	9.61E-07	2.95E-03	9.87E-06
NHWD	kg	5.77E+01	2.21E+01	2.89E+00	9.74E-01	2.75E+01	4.18E+00
RWD	kg	6.76E-02	5.92E-03	3.79E-04	2.47E-06	6.13E-02	2.12E-05
MER	kg	2.00E+00	5.45E-01	0	2.02E-01	0	1.26E+00
MFR	kg	5.63E+00	2.19E+00	0	7.12E-01	0	2.72E+00
CRU	kg	0	0	0	0	0	0
ETE	MJ	6.38E+00	1.84E+00	0	8.56E-01	0	3.68E+00
EEE	MJ	3.52E+00	9.96E-01	0	4.75E-01	0	2.05E+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 large variations in environmental impacts present within the series, extrapolation rules are established according to EN 50693. This allows for estimating more precise impacts of other relay configurations. Changes in percentages per hardware module and watt are presented in tables in the following pages, which is based on a sensitivity analysis and linear regression, and the following rules are established:

1. The manufacturing stage, distribution stage, and end-of-life stage can be extrapolated based on the number of hardware modules.
   - Formula: $Value_{\text{refproduct}} * (1 - change\% * n_{\text{emptyslots}})$
   - Range of variation: 0–3 empty slots

2. The use stage can be extrapolated based on the actual, measured nominal power consumption.
   - Formula: $Value_{\text{refproduct}} * (1 - change\% * (11.5 - P_{nominal}))$
   - Range of variation: 6.5–16 W

Example 1: A Relion 620 relay that have 2 hardware module slots empty, and a measured nominal power consumption at 7 W.

- "GWP-total" in manuf. stage = 154 kg CO_2-eq * (1 – 5.6 % * 2) = 137 kg CO_2-eq
- "GWP-total" in use stage = 402 kg CO_2-eq * (1 – 8.7 % * (11.5 – 7)) = 245 kg CO_2-eq

Example 2: A Relion 620 relay that have 1 hardware module slot empty, and a measured nominal power consumption at 13 W.

- "ADP-fossil" in distribution = 56.1 MJ * (1 – 4.6 % * 1) = 53.5 MJ
- "ADP-fossil" in use stage = 831 MJ * (1 – 8.7 % * (11.5 – 13)) = 939 MJ

An Excel tool for the extrapolation rules of the Relion 620 series is available at:
https://search.abb.com/library/Download.aspx?DocumentID=2RCA057634&LanguageCode=en&DocumentPartId=&Action=Launch

Impact category	Change per hardware module					Change per watt
	Manufacturing	Distribution	Installation	Use and maintenance	End-of-life	Use and maintenance
GWP – total	5.6 %	4.6 %	-	-	11.2 %	8.7 %
GWP – fossil	5.7 %	4.6 %	-	-	11.5 %	8.7 %
GWP – biogenic	2.5 %	4.6 %	-	-	-0.8 %	8.7 %
GWP – luluc	3.9 %	4.6 %	-	-	1.6 %	8.7 %
ODP	7.4 %	4.6 %	-	-	5.1 %	8.7 %
AP	6.8 %	4.6 %	-	-	5.9 %	8.7 %
EP – freshwater	3.5 %	4.6 %	-	-	3.3 %	8.7 %
EP – marine	5.0 %	4.6 %	-	-	9.7 %	8.7 %
EP – terrestrial	3.8 %	4.6 %	-	-	7.8 %	8.7 %
POCP	5.4 %	4.6 %	-	-	7.5 %	8.7 %
ADP – minerals and metals	2.9 %	4.6 %	-	-	0.6 %	8.7 %
ADP – fossil	5.8 %	4.6 %	-	-	3.9 %	8.7 %
WDP	7.3 %	4.6 %	-	-	8.3 %	8.7 %

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	Change per hardware module					Change per watt
	Manufacturing	Distribution	Installation	Use and maintenance	End-of-life	Use and maintenance
PENRE	5.6 %	4.6 %	-	-	3.9 %	8.7 %
PERE	4.1 %	4.6 %	-	-	1.3 %	8.7 %
PENRM	12.7 %	-	-	-	-	-
PERM	-	-	-	-	-	-
PENRT	5.8 %	4.6 %	-	-	3.9 %	8.7 %
PERT	3.9 %	4.6 %	-	-	1.3 %	8.7 %
FW	6.3 %	4.6 %	-	-	7.5 %	8.7 %
MS	-0.3 %	-	-	-	-	-
RSF	-	-	-	-	-	-
NRSF	-	-	-	-	-	-

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	Change per hardware module					Change per watt
	Manufacturing	Distribution	Installation	Use and maintenance	End-of-life	Use and maintenance
HWD	4.9 %	4.6 %	-	-	5.7 %	8.7 %
NHWD	5.0 %	4.6 %	-	-	3.7 %	8.7 %
RWD	5.3 %	4.6 %	-	-	3.5 %	8.7 %
MER	-	-	-	-	12.2 %	-
MFR	-0.1 %	-	-	-	0.8 %	-
CRU	-	-	-	-	-	-
ETE	-	-	-	-	12.0 %	-
EEE	-	-	-	-	12.0 %	-

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.

Sensitivity analysis

This chapter presents the results of a sensitivity analysis in different scenarios, to understand how the impact category “GWP – total” varies for the Relion 620 series protection and control relays that are produced and sold in different geographical locations.

The manufacturing stage depends on where the relay is sold, as the plant in Finland sells globally while the plant in China and India sells domestically. In turn, the choice of market affects the supply chain transports, ABB’s utility consumption and waste generation, and the packaging materials used. The downstream stage also depends on the customer location, and the main variable is the energy mix used in the use stage. However, the distribution stage is not modified as the intracontinental transport of 3500 km by lorry remains representative in all scenarios; only the weight of the transport is adjusted as the packaging materials differ. The end-of-life scenarios are neither modified due to the lack of market specific data.

Scenario	Total [kg CO_2 eq.]	Manufacturing	Distribution	Installation	Use and maintenance	End-of-life
Europe (main scenario) Manufacturing site: Finland Use stage: Europe	5.65E+02	1.54E+02	3.68E+00	4.97E-01	4.02E+02	4.27E+00
India Manufacturing site: India Use stage: India	1.58E+03	1.77E+02	4.19E+00	8.56E-01	1.39E+03	4.27E+00
China Manufacturing site: China Use stage: China	1.26E+03	1.88E+02	3.68E+00	6.68E-01	1.06E+03	4.27E+00

Additional Environmental Information

Recyclability potential

The recyclability potential of the Relion 620 series is calculated by dividing “MFR: material for recycling” in the end-of-life stage by the total weight of the product. As a result, the recyclability potentials of the series are presented below:

Hardware configuration	Recyclability potential
Relion 620, full relay (reference product)	52 %
Relion 620, 1 slot empty (extrapolated)	55 %
Relion 620, 2 slots empty (extrapolated)	58 %
Relion 620, 3 slots empty (extrapolated)	61 %

Additional Norwegian Requirements

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	Data source	Amount	Unit
ABB FI energy mix; 50 % wind + 50 % hydro	Ecoinvent v3.8	0.026	kg CO_2-eq/kWh

Dangerous substances

As part of ABB’s values, and in alignment with the Supplier Code of Conduct, we seek to work with companies who contribute to a sustainable development and are ethically, socially, environmentally, and economically responsible.

ABB is responsible for ensuring that our products comply with legal requirements. There are also other sets of environmental requirements not necessarily originating from legislation, but which are of great importance as ABB customers are demanding compliance with them.

ABB Distribution Solutions has contacted suppliers of the Relion 620 series to collect component and material information. This information includes, but is not limited to:

- Full Material Disclosure
- RoHS compliance certificate
- REACH compliance certificate
- Component lifecycle status

Thus, the purpose is to avoid chemicals, materials and substances that

- may represent hazards to the environment, or
- the health of workers, customers, consumers and other stakeholders, or
- could negatively influence end-of-life properties.

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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