

EPD



# Environmental Product Declaration

Medium-voltage gas-insulated switchgear PrimeGear ZX0 feeder-12.12.25

Production site: Xiamen, China



DOCUMENT KIND Environmental Product Declaration	IN COMPLIANCE WITH ISO 14025 and EN 50693			
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<b>EPD Owner</b>	ABB Switzerland Ltd, Group Technology Management				
<b>Organization No.</b>	CHE-101.538.426				
<b>Manufacturer name and address</b>	ABB Xiamen Switchgear Co., Ltd. FangShanXiEr Road, Xiang'an District, Xiamen, Fujian, 361101, P. R. China				
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<b>Program operator</b>	The Norwegian EPD Foundation Post Box 5250 Majorstuen, 0303 Oslo, Norway phone: +47 23 08 80 00, email: post@epd-norge.no				
<b>Declared product</b>	Medium-voltage Gas-insulated Switchgear PrimeGear ZX0 Feeder-12.12.25				
<b>Product description</b>	The PrimeGear ZX0 is a gas-insulated switchgear for the single busbar system which is used to distribute electric power in a variety of demanding applications such as energy supply for public utilities, steel work factories, automobile industry, airports, harbors, or railways.				
<b>Functional unit</b>	To distribute, protect, and control the electricity in a power distribution network, with a nominal voltage of 12 kV, use rate of 100 %, and load rate of 35 %, during a service life of 20 years in China.				
<b>Reference flow</b>	A single PrimeGear ZX0 feeder-12.12.25 switchgear, including related accessories and packaging.				
<b>Independent verification</b>	Independent verification of the declaration and data, according to ISO 14025:2010  <input type="checkbox"/> INTERNAL <input checked="" type="checkbox"/> EXTERNAL  Independent verifier approved by EPD-Norge: Elisabet Amat  Signature: 				
<b>Approved by</b>	Håkon Hauan, CEO EPD-Norge  Signature: 				
<b>Reference PCR</b>	EN 50693:2019 – Product Category Rules for Life Cycle Assessments of Electronic and Electrical Products and Systems. EPDIItaly007 – Electronic and Electrical Products and Systems, Rev. 3.1, 2024/11/12. EPDIItaly015 – Electronic and Electrical Products and Systems – Switchboards, Rev. 2.0, 2024/07/01.				
<b>Program instructions</b>	The Norwegian EPD Foundation/EPD-Norge, General Programme Instructions 2024. Version 4.0 dated 2024.09.18.				
<b>LCA study</b>	This EPD is based on the LCA study described in the LCA report 3XAA054367.				
<b>EPD type</b>	Specific product				
<b>EPD scope</b>	Cradle-to-grave				
<b>Product RSL</b>	20 years				
<b>Geographical representativeness</b>	Manufacturing (suppliers): Global	Manufacturing (ABB): China	Downstream: China		
<b>Reference year</b>	2023				
<b>LCA software</b>	SimaPro 9.5 (2023)				
<b>LCI database</b>	Ecoinvent v3.9.1 (2022)				
<b>Comparability</b>	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.				
<b>Liability</b>	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.				

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## 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.

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](https://global.abb/group/en/sustainability) or scan the QR code.



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## General Information

This Environmental Product Declaration is a “specific product EPD”, and the declared product is the PrimeGear ZX0, including related accessories and packaging.

The PrimeGear ZX0 is a gas-insulated switchgear for the single busbar system which is used to distribute electric power in a variety of demanding applications such as energy supply for public utilities, steel work factories, automobile industry, airports, harbors, or railways.

General technical information of the PrimeGear ZX0 are presented below.

Description		
Config.	Circuit breaker	VD4X0 12.12.25
	Current sensor	KECA 80 C85
	Voltage sensor	KEVA_24_C22c
Size	Width	0.6 m
	Height	2.350 m
	Depth	1.315 m
Ratings	Rated voltage [kV]	12
	Rated power frequency withstand voltage (Ud) [kV]	42
	Rated lightning impulse withstand voltage (Up) [kV]	75
	Rated current [A]	1250
	Rated short-time withstand current (Ik) [kA]	25
	Rated peak withstand current (Ip) [kA]	63
	Rated duration of short-circuit (tk) [s]	4
	Rated frequency (fr) [Hz]	50/60
Insulating gas		Dry air

The product is manufactured by ABB Xiamen Switchgear Co., Ltd. located in Xiamen. The manufacturing site 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

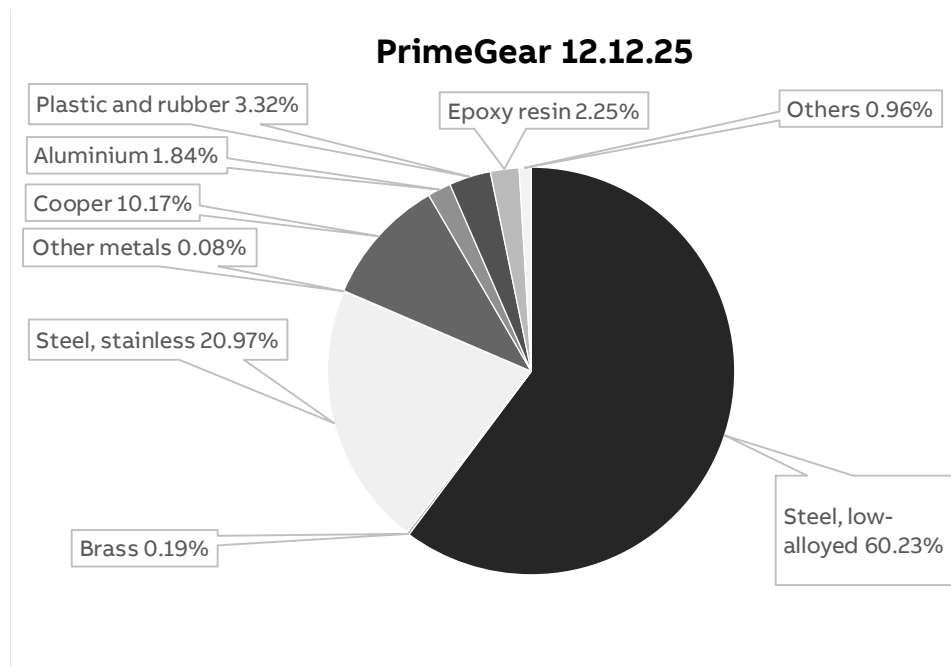
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# Constituent Materials

The constituent materials of PrimeGear ZX0 are presented below.

Type	Material	Weight [kg]	Weight %
<b>Metals</b>	Steel, low-alloyed	312.5	60.23%
	Steel, stainless	108.8	20.97%
	Copper	52.7	10.17%
	Aluminum	9.5	1.84%
	Brass	1.0	0.19%
	Other metals	0.4	0.08%
<b>Plastics</b>	Plastic and Rubber	17.2	3.32%
<b>Others</b>	Epoxy resin	11.7	2.25%
	Others	5.0	0.96%
<b>Total</b>		<b>518.9</b>	<b>100%</b>



The constituent materials of the packaging and accessories are presented below. 1 pcs is assumed per pallet.

Description	Material	Weight [kg]	Weight %
Packaging box	Plywood	70.00	94.11
Fasteners	Steel	0.335	0.45
Plastic bag	PE	0.615	0.83
Packing strips	PET	0.266	0.36
Drying agent	Kaolinite	3.158	4.25
<b>Total</b>		<b>74.374</b>	<b>100</b>



## LCA Background Information

### Functional Unit

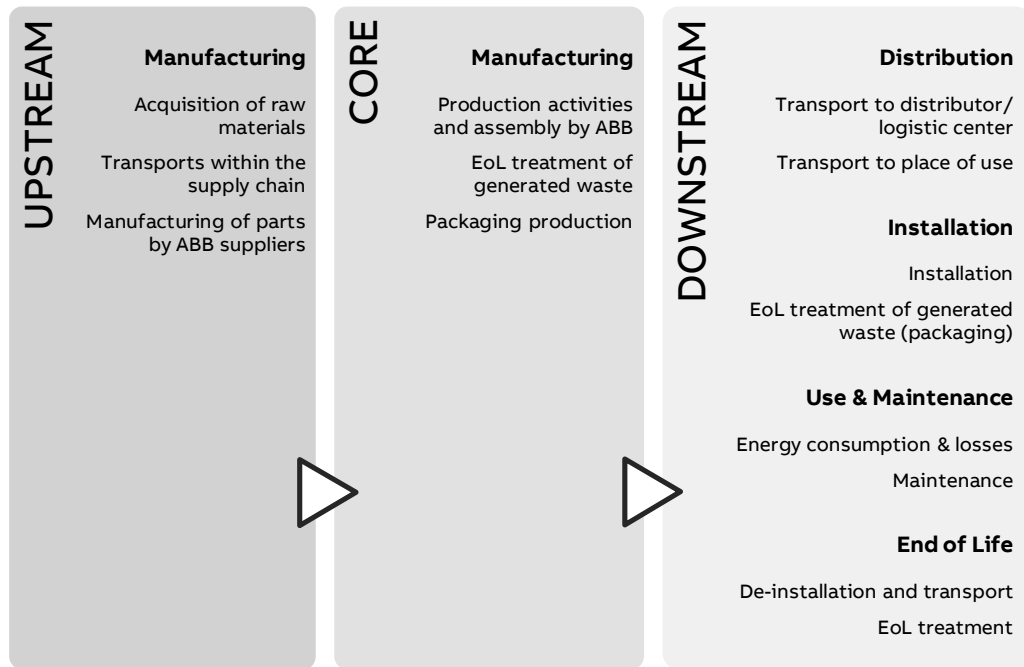
The functional unit of this study is to distribute, protect, and control the electricity in a power distribution network, with a nominal voltage of 12 kV, use rate of 100 %, and load rate of 35 %, during a service life of 20 years in China. The reference flow is a single PrimeGear ZX0 Feeder-12.12.25 device, including related accessories and packaging.

Note, the reference service life (RSL) of 20 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.

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### 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 database Industry Data 2.0 is also used for chemical substance which is not available by ecoinvent. The LCA software used for the calculations is SimaPro 9.5.

### Allocation rules

The utility consumption and waste generation by ABB, in the core manufacturing stage, is allocated to the production of one reference product according to applicable rules. 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

According to EPDIItaly015, the cut-off criteria can be set to a maximum of 2 % of the overall environmental impacts. In this LCA, stickers have been excluded as their weights are negligible. Process of phosphating has also been excluded due to the unavailability of data and complexity of modelling.

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# Inventory Analysis

## Manufacturing Stage (upstream)

The life cycle inventory in the upstream manufacturing stage is based on the primary data available from ABB. 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:

- Epoxy is modelled on a chemical level, i.e., each chemical used is considered and mapped with the most representative dataset available.

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 inecoinvent's "market for"-processes.

## Manufacturing Stage (core)

In the core manufacturing stage, utility consumption and waste generation at the ABB manufacturing site are accounted for. The packaging materials and accessories associated with the product are also considered. Modelling decisions and assumptions that are highly relevant to the results are as following:

- 61% Nuclear power is considered, which is procured by the ABB manufacturing site through a distribution agreement with the local utility. However, due to the lack of life cycle based residual mix data, other electricity mixes in the LCA are not calculated with residual mix.
- The remaining 39% is internally produced from solar panels installed on the roof of the Xiamen manufacturing site.

## Distribution

The transport distance from the ABB manufacturing site to the site of installation is assumed to be 300 km by lorry, as suggested by the PCR EPDIItaly012/015, as the actual distance is unknown. The environmental impacts can be multiplied accordingly if the actual distance is known.

	Dataset	Amount	Unit	Represent.
<b>Transport</b>	<i>Transport, freight, lorry 16-32 metric ton, EURO4 {RoW} market for transport, freight, lorry 16-32 metric ton, EURO4   Cut-off, S</i>	300	km	PCR

## Installation

The installation phase only implies manual activities, and no energy is consumed. Therefore, this phase only considers the end-of-life of the packaging materials used.

	Scenario	Transport	Representation
<b>Packaging End-of-Life</b>	<i>ABB_WS_Packaging Waste Scenario_China literature 2022 - Polluter pays</i>	100 km by lorry (assumption)	China

\* Due to lack of data, 100% energy recovery is assumed for wood, and 100% landfill is assumed for ceramics (e.g., kaolinte)

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## Use

The use stage considers the reference power losses over the reference service life as defined in the functional unit. This is calculated using the following formula, according to PCR EPDItaly015:

$$E_{use} [kWh] = \frac{P_{use} * 8760 * RSL * \alpha}{1000} = \frac{40.17 \text{ W} * 8760 \text{ hours} * 10 \text{ years} * 100 \%}{1000} = 7038.21 \text{ kWh}$$

Where:

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

Energy mix	Source	Amount	Unit
<i>Electricity, medium voltage {CN} market group for   Cut-off, S</i>	Ecoinvent v3.9.1	0.948	kg CO <sub>2</sub> -eq/kWh

Maintenance is not considered because the product is designed as maintenance free product. Even if some maintenance happens during the use stage, from the environmental impacts point of view it can be omitted from the analysis due to negligible energy is consumed.

## 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.

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

\*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. Also, due to the transformer containing parts difficult to process through separation, these are all modelled as 100 % waste to landfill to represent the typical waste streams within China.

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# 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.

## ProductPrimeGear ZX0

Impact category	Unit	Total	Cradle-to-gate					
			Cradle-to-grave					
			UPSTREAM	CORE	DOWNSTREAM			
			Manufacturing	Distribution	Installation	Use and maintenance	End-of-life	
<b>GWP – total</b>	kg CO <sub>2</sub> eq.	1.02E+04	3.39E+03	-4.39E+01	3.44E+01	1.06E+02	6.67E+03	7.16E+01
<b>GWP – fossil</b>	kg CO <sub>2</sub> eq.	1.02E+04	3.30E+03	4.90E+01	3.44E+01	3.44E+00	6.71E+03	5.56E+01
<b>GWP – biogenic</b>	kg CO <sub>2</sub> eq.	7.03E+01	8.34E+01	-9.32E+01	1.20E-02	1.02E+02	-3.84E+01	1.59E+01
<b>GWP – luluc</b>	kg CO <sub>2</sub> eq.	7.36E+00	4.42E+00	2.13E-01	1.79E-02	1.11E-03	2.65E+00	6.97E-02
<b>ODP</b>	kg CFC-11 eq.	9.22E-05	7.33E-05	5.61E-06	5.44E-07	4.24E-08	1.21E-05	6.19E-07
<b>AP</b>	mol H+ eq.	1.01E+02	6.50E+01	4.14E-01	1.51E-01	1.80E-02	3.55E+01	2.60E-01
<b>EP – freshwater</b>	kg P eq.	5.99E+00	4.73E+00	2.62E-02	2.80E-03	6.09E-04	1.21E+00	1.77E-02
<b>EP – marine</b>	kg N eq.	1.32E+01	5.34E+00	1.42E-01	5.54E-02	9.17E-03	7.55E+00	1.08E-01
<b>EP – terrestrial</b>	mol N eq.	1.76E+02	9.32E+01	1.48E+00	5.93E-01	8.40E-02	8.04E+01	6.91E-01
<b>POCP</b>	kg NMVOC eq.	4.15E+01	1.94E+01	4.63E-01	2.03E-01	2.37E-02	2.12E+01	2.18E-01
<b>ADP – minerals and metals</b>	kg Sb eq.	6.99E-01	6.93E-01	6.73E-04	1.11E-04	6.93E-06	4.28E-03	4.72E-04
<b>ADP – fossil</b>	MJ, net calorific value	1.10E+05	4.12E+04	2.36E+03	4.87E+02	3.05E+01	6.52E+04	6.34E+02
<b>WDP</b>	m <sup>3</sup> eq.	1.75E+03	9.48E+02	7.57E+01	2.15E+00	-7.12E-01	7.21E+02	7.75E+00

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.

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ENVIRONMENTAL PRODUCT DECLARATION

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	1.09E+05	4.06E+04	2.33E+03	4.87E+02	3.05E+01	6.52E+04	6.34E+02
PERE	MJ, low cal. value	1.50E+04	6.40E+03	1.60E+03	6.19E+00	5.48E-01	6.95E+03	6.18E+01
PENRM	MJ, low cal. value	5.66E+02	5.34E+02	3.22E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PERM	MJ, low cal. value	1.02E+03	2.60E+01	9.94E+02	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PENRT	MJ, low cal. value	1.10E+05	4.12E+04	2.36E+03	4.87E+02	3.05E+01	6.52E+04	6.34E+02
PERT	MJ, low cal. value	1.60E+04	6.43E+03	2.60E+03	6.19E+00	5.48E-01	6.95E+03	6.18E+01
FW	m <sup>3</sup>	5.07E+01	3.05E+01	2.15E+00	6.94E-02	-1.20E-02	1.77E+01	2.99E-01
MS	kg	1.87E+02	1.87E+02	1.07E-01	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	5.55E-01	5.10E-01	5.64E-03	3.15E-03	1.81E-04	3.36E-02	2.40E-03
NHWD	kg	1.99E+03	1.37E+03	1.04E+01	2.36E+01	2.18E+00	4.94E+02	8.81E+01
RWD	kg	1.78E-01	8.58E-02	2.15E-02	9.83E-05	8.01E-06	6.90E-02	1.25E-03
MER	kg	7.30E+01	3.58E-01	9.19E-01	0.00E+00	7.03E+01	0.00E+00	1.45E+00
MFR	kg	6.08E+02	1.04E+02	4.69E+01	0.00E+00	5.26E-01	0.00E+00	4.56E+02
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	2.97E+02	1.87E+00	4.00E+00	0.00E+00	2.82E+02	0.00E+00	9.30E+00
EEE	MJ	1.65E+02	9.49E-01	2.22E+00	0.00E+00	1.57E+02	0.00E+00	5.17E+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.

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## Sensitivity analysis

This chapter presents the results of a sensitivity analysis, to understand how the impact category “GWP – total” varies for PrimeGear ZX0 with the emission factor from latest IEA energy mix for China in use stage.

Emission factor for the IEA energy mix used in the use stage

Energy mix	Source	Amount	Unit
<i>Electricity, medium voltage {CN} market group for / Cut-off, S</i>	IEA 2021	0.7428	kg CO <sub>2</sub> -eq/kWh

Sensitivity analysis for impact category “GWP – total” [kg CO<sub>2</sub>-eq]

Scenario	Total	UPSTREAM	CORE	DOWNSTREAM			
		Manufacturing	Distribution	Installation	Use and maintenance	End-of-life	
<b>Declared scenario</b>							
Use stage: Energy mix source from Ecoinvent v3.9.1	1.02E+04	3.39E+03	-4.39E+01	3.44E+01	1.06E+02	6.67E+03	7.16E+01
<b>IEA 2021</b>							
Use stage: Energy mix source from IEA 2021	8.79E+03	3.39E+03	-4.39E+01	3.44E+01	1.06E+02	5.23E+03	7.16E+01



## Additional Environmental Information

### Circularity Values

The recyclability potential of the product (excluding packaging) 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 potential of the product is 87.8 % presented below.

Recyclability potential	
<b>PrimeGear ZX0 12.12.25</b>	87.8 %

### 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
<i>ABB_Electricity mix Xiamen Factory {CN}_ Nuclear 61.16%-Solar 38.84%_2023 / System</i>	Ecoinvent v3.9.1	0.0467	kg CO <sub>2</sub> -eq/kWh

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### 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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