PINGGAO GROUP.CO., LTD

ENVIRONMENTAL PRODUCT DECLARATION

Product name:

Pinggao HGIS product

Site plant:

No.22 Nanhuandong Road, Pingdingshan City, Henan Province, P.R. China

In compliance with ISO 14025 and EN 50693

Program Operator	EPDItaly
Publisher	EPDItaly
Declaration Number	*PinggaoHGIS*
Registration Number	EPDItaly0185
Issue Date	19/08/2021
Valid to	19/08/2026

General Information

EPD owner: Pinggao Group Co., Ltd.

Location of production site: No.22 Nanhuandong Road, Pingdingshan City, Henan Province, P.R. China

Company contact: Jun Jiang <jiangjunpg@163.com>

Name of the product: Hybrid Gas Insulated Switchgear: ZHW1B-72.5, ZHW1B-145, ZHW1B-252

CPC code：46211

Applied standards: ISO 14040/44 – Life cycle assessment

ISO 14025 - Environmental labels and declarations - Type III environmental declarations - Principles and procedures

PCR EPDItaly007: for Electronic and electrical products and systems REV. 2 – 2020/10/21

PCR EPDItaly012: for Electronic and electrical products and systems - Switches REV. 0– 2020/03/16

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

Reference EPD system: Regulation of the EPDItaly Programme – rev.5

Program Operator & Publisher： EPDItaly Via G. De Castillia, 10 20124 Milan, *Italy www.epditaly.com*

LCA was performed by： IVL Swedish Environmental Research Institute ,IVL China Department, *www.ivl.se*

Independent verifier: ICMQ Via Gaetano De Castillia, 10 - 20124 Milano Italy, *https://www.icmq.it/* Accredited by ACCREDIA

Liability statement：The Organization relieves EPDItaly from any non-compliance with the environmental legislation self-declared by the producer himself. The owner of the declaration will be responsible for the information and supporting evidence; EPDItaly declines any responsibility regarding the manufacturer's information, data and results of the life cycle assessment.

EPDS relating to the same category of products but belonging to different programmes may not be comparable

Contents

1. Introduction

Company Information

Pinggao Group is a high-tech company awarded by Chinese Academy of Sciences and the Ministry of Science & Technology. Meanwhile, it is one of the three production, research and development centers of high and ultra-high voltage switchgear in China, and has been listed among Chinese top 500 manufacturers. Pinggao's products have passed the type test in KEMA, CESI, Xi'an High Voltage Switchgear Research Institute and etc.

Pinggao is the first company to develop SF6 high voltage switchgear apparatus in China. It has set up a state-level R&D center with strong capability of production, development and technical innovation. Its main products cover:

- 40.5kV~1100 kV circuit breaker
- 40.5kV~1100 kV disconnector and earthing switch
- Hybrid Gas Insulated Switchgear (HGIS) and Gas Insulated Switchgear (GIS)

Pinggao's products have been not only widely used and recommended in China, but also exported to more than 30 countries and areas in Southeast Asia, South Asia, West Asia, South America, Africa, Europe and etc.

Figure 1.1 Location of Pingdingshan City

Product information

Product name:

Hybrid Gas Insulated Switchgear (HGIS)

Product description:

Within this report, in total 3 models of HGIS product from Pinggao Group are analyzed: ZHW1B-72.5(L), ZHW1B-145(L), ZHW1B-252(L).

HGIS is a compact multifunctional combined high-voltage switchgear developed by Pinggao based on decades of accumulated experience in R&D, design and production of high-voltage switchgear. This product combines the advantages of air insulated switchgear and fully enclosed switchgear to develop an advanced combined SF_6 high-voltage switchgear. The product integrates circuit breakers, disconnector and earthing switch, etc. into a module enclosed in a metal tank, and uses conventional AIS (air insulated switchgear) arrangements for buses with a very low probability of accidents. At the same time, it solves the shortcomings of the original conventional AIS equipment such as large area, low reliability, difficult interlocking, and heavy maintenance workload. It is suitable for power transmission and transformation (distribution) systems in power plants, substations, station terminals, large industrial and mining enterprises, etc.

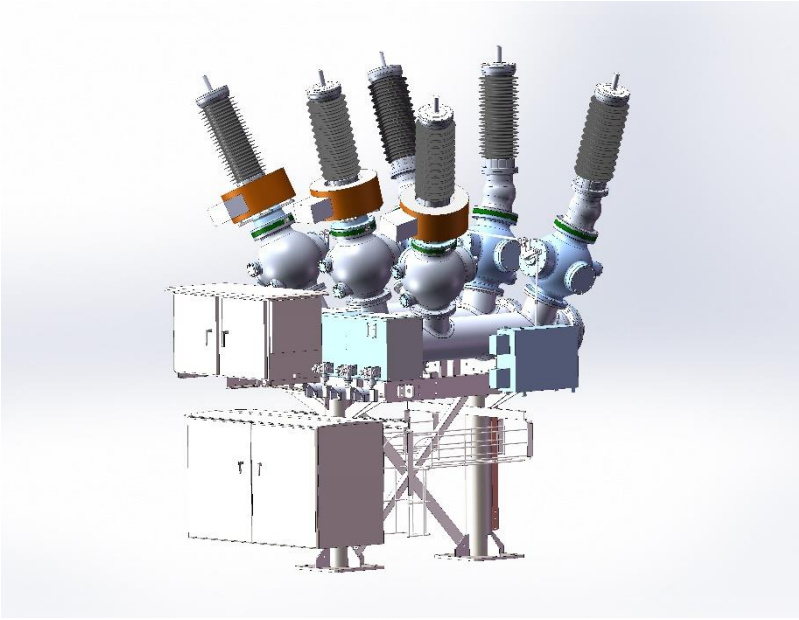

Figure 1.2 Outline drawing of HGIS

Table 1.1 listed the technical information about the product and in Table 1.2 presented the major components weights.

Table 1.1 The mandatory information of the HGIS.

Parameter	Unit	ZHW1B-72.5(L)	ZHW1B-145(L)	ZHW1B-252(L)
Rated voltage	kV	72.5	145	252
Operation mode		three-pole operation	three-pole operation	Single-pole operation
Rated current	A	2000	2000	2000
Rated frequency	Hz	50/60	50/60	50/60
Main loop resistance	μΩ	≤120	≤170	≤180
Mechanical endurance of circuit breaker	Times	10000	10000	10000
Annual leakage of SF6 gas	%	≤ 0.3%	≤ 0.3%	≤ 0.3%

Information above was provided by Pinggao Group from design manual and laboratory test data. The rated current used for this study is 2000 A for HGIS ZHW1B-72.5(L), ZHW1B-145(L) and ZHW1B-252(L). While HGIS products from Pinggao could be designed in higher rated currents to adapt customer requirements.

Table 1.2 Major components weight of the HGIS (unit: kg).

Components	ZHW1B-72.5(L)	ZHW1B-145(L)	ZHW1B-252(L)
Circuit breaker	1048	1185	1650
Three position isolating earthing switch	597	672	1195
Current transformer	358	380	380
Bushing	175	293	1355
Support frame	312	308	242
Control cabinet	362	336	535

Table 1.3 presented raw material groups and each weight percent for HGIS product.

Table 1.3 Major materials groups of the HGIS.

Material group	Weight percent
Aluminium-containing metals	20% ~ 35%
Ferrous metals	55% ~ 65%
Other metals	< 3%
High polymer material	< 10%

There are no substances/materials that might have adverse effects on human health or the environment, at any stage of the life cycle.

2. Specification of methodology

Functional Unit

The product is widely used in power grid, power plant, metallurgy, chemical, mineral, electrical railway and other transmission and distribution system. ZHW1B-72.5(L), ZHW1B-145(L), ZHW1B-252(L) HGIS have been designed to operate under the condition of 72.5 kV, 145 kV and 252 kV respectively.

The functional unit of this LCA study is defined as:

A single HGIS product with packaging as the declared unit, which during a service life of 20 years.

Product system

This study is a cradle-to-grave LCA, assessing the potential environmental impacts associated with the studied product. An overview of the life cycle stages included in the LCA study are presented in Figure

Life Cycle Stages	Module	Processes	
Manufacturing	Upstream	Extraction of raw materials, including waste recycling processes and the production of semi-finished and ancillary products	X
		Transportation of raw materials to the manufacturing company	X
	Core	Manufacturing of the product constituents, including all the stages	X
		Product assembly	X
		Packaging	X
		Waste recycling processes	X
Distribution	Downstream	Distribution	X
Installation		Installation	X
Use & Maintenance		Use & Maintenance	X
End-of-life		End-of-life	X

2.1.

Modules included in the EPD (X).

Figure 2.1 Life cycle stages and modules included in the study

Geographical scope

The study reflects production of Pinggao product in China. The country grid average "*CN: Electricity grid mix 1kV-60kV (China electric power yearbook)*" of electricity applied for the manufacturing and assembling activities. The installation and operation site were chosen as the European country situation. Italy high voltage grid mix "IT: electricity, high voltage, production mix ecoinvent 3.6" was applied to the product use stage.

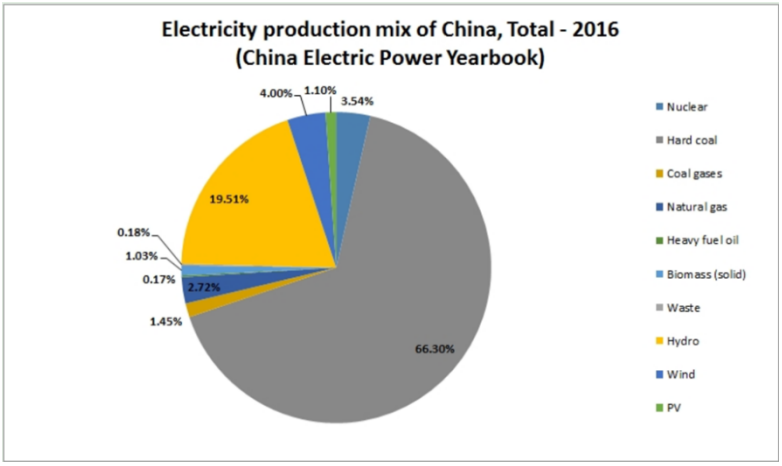

Figure 2.2 Mix of energy sources for electricity production

Figure 2.3 corresponds to the system boundary defined by the PCR. The PCR states that the life cycle stages must refer to segmentation in three modules: Upstream module, Core module and Downstream module.

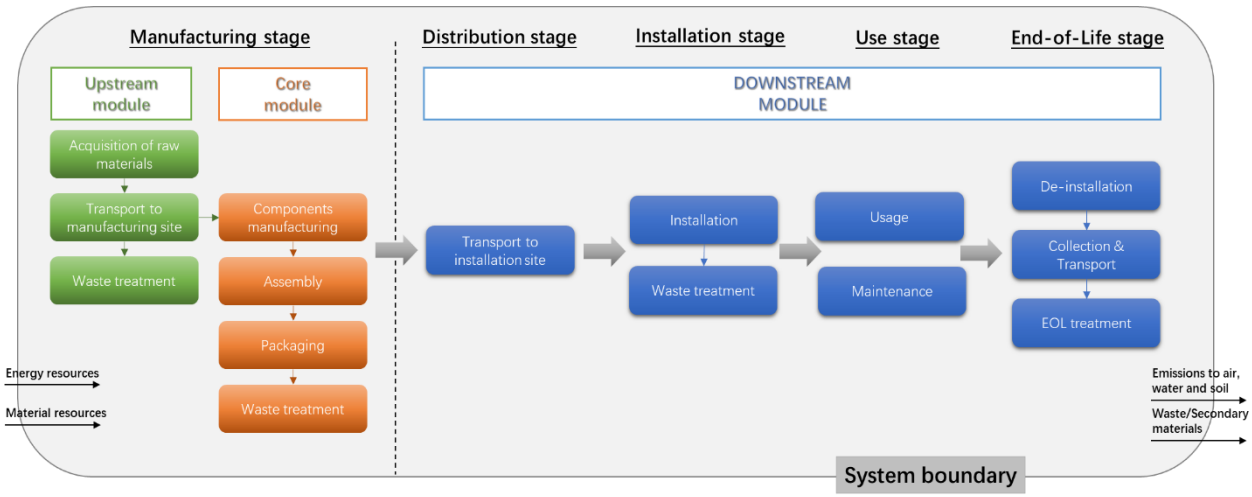

Figure 2.3 The flow chart of the product and product system used for the LCA assessment.

Time representativeness

The reference year for this study is year 2020.

Manufacturing data were collected based on the most representative year for annual through put of product. The data collected in the production process of each HGIS components was based on the average data of factory production in the whole year in 2020.

Database(s) and LCA software used

The LCA-systems are modelled in the Gabi LCA software, Gabi 10, SP 40 with Gabi ts data base and professional Ecoinvent database.

Allocation

The recommended methodology by EPDItaly is, where possible, that allocation must be avoided and apply system expansion prior to allocation for the generated co-products. No co-product allocation has been applied in this study even though allocation is allowed in EPDs. All burdens are allocated to the final analyzed product.

Pinggao produces several models of products and production data were collected at a factory level; Mass allocation was applied to assign the correct production burdens.

Cut-off rules

In this study, the cut-off criteria have been controlled of no more than 2% of materials and energy flows within the system controlled by the EPD holder. It follows the regulation of PCR and EPDItaly system.

3. Environmental performance

In the result table below, it is possible to see the environmental performance of all categories. Each impact category result is presented in tables below.

The results are categorized into “Upstream module”, “Core module”, and “Downstream module”.

The column named “Total” is the sum of each module results.

Environmental impact descriptive parameters

For ZHW1B-72.5(L)

Impact category	Unit	Upstream	Core	Downstream	Total
Climate Change - total	kg CO2 eq	1.62E+04	7.61E+03	6.86E+04	9.24E+04
Climate Change - fossil	kg CO2 eq	1.62E+04	7.61E+03	6.79E+04	9.17E+04
Climate Change - biogenic	kg CO2 eq	7.59E+00	-4.96E+00	6.59E+02	6.62E+02
Climate Change - land use and land use change	kg CO2 eq	1.89E+01	5.16E+00	2.82E+00	2.69E+01
Ozone depletion	kg CFC-11 eq	1.96E-04	2.00E-11	9.88E-04	1.18E-03
Acidification	mole H+ eq	5.96E+01	2.36E+01	5.79E+01	1.41E+02
Eutrophication aquatic freshwater	kg P eq	1.72E+00	3.12E-03	1.40E+00	3.12E+00
Photochemical ozone formation	kg NMVOC eq	3.21E+01	1.65E+01	3.22E+01	8.09E+01
Consumption of abiotic resources - minerals and materials	kg Sb eq	1.89E+00	2.51E-03	3.34E-02	1.92E+00
Consumption of abiotic resources - fossil resources	MJ	1.55E+05	7.84E+04	1.19E+05	3.52E+05
Water consumption	m3	3.98E+04	2.02E+03	4.31E+03	4.61E+04

For ZHW1B-145(L)

Impact category	Unit	Upstream	Core	Downstream	Total
Climate Change - total	kg CO2 eq	2.30E+04	8.67E+03	1.04E+05	1.36E+05
Climate Change - fossil	kg CO2 eq	2.29E+04	8.67E+03	1.03E+05	1.35E+05
Climate Change - biogenic	kg CO2 eq	1.42E+01	-5.41E+00	7.28E+02	7.37E+02
Climate Change - land use and land use change	kg CO2 eq	2.78E+01	6.11E+00	3.07E+00	3.70E+01
Ozone depletion	kg CFC-11 eq	3.55E-04	2.40E-11	1.09E-03	1.45E-03
Acidification	mole H+ eq	7.93E+01	2.73E+01	6.35E+01	1.70E+02
Eutrophication aquatic freshwater	kg P eq	3.11E+00	3.51E-03	1.54E+00	4.65E+00
Photochemical ozone formation	kg NMVOC eq	4.40E+01	1.90E+01	3.53E+01	9.83E+01
Consumption of abiotic resources - minerals and materials	kg Sb eq	3.23E+00	2.58E-03	3.53E-02	3.27E+00
Consumption of abiotic resources - fossil resources	MJ	2.12E+05	8.93E+04	1.30E+05	4.32E+05
Water consumption	m3	4.31E+04	2.38E+03	4.75E+03	5.03E+04

For ZHW1B-252(L)

Impact category	Unit	Upstream	Core	Downstream	Total
Climate Change - total	kg CO2 eq	6.43E+04	1.05E+04	2.52E+05	3.27E+05
Climate Change - fossil	kg CO2 eq	6.41E+04	1.05E+04	2.51E+05	3.26E+05
Climate Change - biogenic	kg CO2 eq	-4.52E+01	-1.69E+01	1.23E+03	1.17E+03
Climate Change - land use and land use change	kg CO2 eq	1.27E+02	7.89E+00	4.80E+00	1.40E+02
Ozone depletion	kg CFC-11 eq	1.40E-03	2.87E-11	1.86E-03	3.25E-03
Acidification	mole H+ eq	2.64E+02	3.32E+01	1.05E+02	4.02E+02
Eutrophication of water	kg P eq	1.25E+01	4.51E-03	2.63E+00	1.51E+01
Photochemical ozone formation	kg NMVOC eq	1.37E+02	2.32E+01	5.78E+01	2.18E+02
Consumption of abiotic resources - minerals and materials	kg Sb eq	2.64E+00	3.25E-03	4.46E-02	2.68E+00
Consumption of abiotic resources - fossil resources	MJ	6.05E+05	1.07E+05	2.19E+05	9.32E+05
Water consumption	m3	3.70E+04	2.86E+03	8.07E+03	4.80E+04

Resource consumption descriptive parameters

For ZHW1B-72.5(L)

Parameters	Unit	Upstream	Core	Downstream	Total
Use of renewable primary energy excluding renewable primary energy resources used as raw material (PERE)	MJ	1.74E+04	1.14E+04	2.26E+04	5.14E+04
Use of renewable primary energy resource used as raw material (PERM) (2)	MJ	INA (3)	INA	INA	INA
Total use of renewable primary energy resources (PERT)	MJ	1.74E+04	1.14E+04	2.26E+04	5.14E+04
Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw material (PENRE)	MJ	1.55E+05	7.84E+04	1.19E+05	3.52E+05
Use of non-renewable primary energy resource used as raw material (PENRM) (2)	MJ	INA	INA	INA	INA
Total use of non-renewable primary energy resources (PENRT)	MJ	1.55E+05	7.84E+04	1.19E+05	3.52E+05
Use of secondary raw material (MS)	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Use of renewable secondary fuels (RSF)	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Use of non renewable secondary fuels (NRSF)	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Net use of fresh water (FW)	m3	9.45E+02	4.86E+01	1.01E+02	1.09E+03

For ZHW1B-145(L)

Parameters	Unit	Upstream	Core	Downstream	Total
Use of renewable primary energy excluding renewable primary energy resources used as raw material (PERE)	MJ	2.10E+04	1.37E+04	2.50E+04	5.96E+04
Use of renewable primary energy resource used as raw material (PERM) (2)	MJ	INA (3)	INA	INA	INA
Total use of renewable primary energy resources (PERT)	MJ	2.10E+04	1.37E+04	2.50E+04	5.96E+04
Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw material (PENRE)	MJ	2.12E+05	8.93E+04	1.30E+05	4.32E+05
Use of non-renewable primary energy resource used as raw material (PENRM) (2)	MJ	INA	INA	INA	INA
Total use of non-renewable primary energy resources (PENRT)	MJ	2.12E+05	8.93E+04	1.30E+05	4.32E+05
Use of secondary raw material (MS)	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Use of renewable secondary fuels (RSF)	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Use of non renewable secondary fuels (NRSF)	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Net use of fresh water (FW)	m3	1.02E+03	5.72E+01	1.12E+02	1.19E+03

For ZHW1B-252(L)

Parameters	Unit	Upstream	Core	Downstream	Total
Use of renewable primary energy excluding renewable primary energy resources used as raw material (PERE)	MJ	5.70E+04	1.66E+04	4.23E+04	1.16E+05
Use of renewable primary energy resource used as raw material (PERM) (2)	MJ	INA (3)	INA	INA	INA
Total use of renewable primary energy resources (PERT)	MJ	5.70E+04	1.66E+04	4.23E+04	1.16E+05
Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw material (PENRE)	MJ	6.06E+05	1.07E+05	2.19E+05	9.32E+05
Use of non-renewable primary energy resource used as raw material (PENRM) (2)	MJ	INA	INA	INA	INA
Total use of non-renewable primary energy resources (PENRT)	MJ	6.06E+05	1.07E+05	2.19E+05	9.32E+05
Use of secondary raw material (MS)	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Use of renewable secondary fuels (RSF)	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Use of non renewable secondary fuels (NRSF)	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Net use of fresh water (FW)	m3	8.89E+02	6.88E+01	1.88E+02	1.15E+03

Waste production descriptive parameters

For ZHW1B-72.5(L)

Impact category	Unit	Upstream	Core	Downstream	Total
Hazardous landfill waste (HWD)	kg	1.72E-01	1.29E-04	1.46E-04	1.72E-01
Non-hazardous waste disposed (NHWD)	kg	6.99E+02	1.43E+02	1.50E+01	8.56E+02
Radioactive waste disposed (RWD)	kg	1.41E+00	9.63E-01	3.21E-02	2.40E+00
Components for reuse (CRU)	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Materials for recycling (MFR)	kg	INA	INA	INA	INA
Material for energy recovery (MER)	kg	INA	INA	INA	INA
Exported electrical energy (EEE)	MJ	INA	INA	INA	INA
Exported thermal energy (ETE)	MJ	INA	INA	INA	INA

For ZHW1B-145(L)

Impact category	Unit	Upstream	Core	Downstream	Total
Hazardous landfill waste (HWD)	kg	1.38E-01	1.48E-04	1.57E-04	1.39E-01
Non-hazardous waste disposed (NHWD)	kg	7.18E+02	1.58E+02	1.51E+01	8.91E+02
Radioactive waste disposed (RWD)	kg	1.27E+00	1.17E+00	3.31E-02	2.47E+00
Components for reuse (CRU)	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Materials for recycling (MFR)	kg	INA	INA	INA	INA
Material for energy recovery (MER)	kg	INA	INA	INA	INA
Exported electrical energy (EEE)	MJ	INA	INA	INA	INA
Exported thermal energy (ETE)	MJ	INA	INA	INA	INA

For ZHW1B-252(L)

Impact category	Unit	Upstream	Core	Downstream	Total
Hazardous landfill waste (HWD)	kg	1.66E-01	2.21E-04	2.42E-04	1.67E-01
Non-hazardous waste disposed (NHWD)	kg	5.75E+02	1.71E+02	1.58E+01	7.61E+02
Radioactive waste disposed (RWD)	kg	2.00E+00	1.39E+00	4.00E-02	3.43E+00
Components for reuse (CRU)	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Materials for recycling (MFR)	kg	INA	INA	INA	INA
Material for energy recovery (MER)	kg	INA	INA	INA	INA
Exported electrical energy (EEE)	MJ	INA	INA	INA	INA
Exported thermal energy (ETE)	MJ	INA	INA	INA	INA

(1) This table presents the impacts value which represented one piece of product as the declared unit.

(2) Input data from databases, trade organizations etc. do NOT distinguish between resources used as material and energy, even though there is a difference in practice. The best example is a polymer, which uses crude oil as a material resource, but some of it is also used as energy, but in the data set this is entirely accounted for as energy and not material.

(3) "INA" represent the indicator has not been evaluated the output.

4. Additional information

Pinggao Group Co., Ltd. is committed to providing customers with safe, reliable, green and intelligent power equipment. It has ISO 9001/2008 quality management system, ISO14001 environmental management system and OHSAS 18001 occupational health and safety system certification.

In order to help China, Europe and other regions to achieve the goals of "carbon peak" and "carbon neutral", Pinggao Group actively develops new technologies, has possessed world-class vacuum breaking technology, and has the ability to manufacture both SF6- insulated and non-fluorinated greenhouse gases high-voltage switchgear, which helps Pinggao provide customers diversified and customized High-voltage switchgear resolutions.

5. References

- *PCR EPDItaly007, issued at 2020-10-21, for Electronic and electrical products and systems [Revision 2, valid until 2025-01-19],*
- *PCR EPDItaly012, issued at 2020-03-16, for Electronic and electrical products and systems - Switches [Revision.0, valid until 2025-03-15];*
- *The EPDItaly system, https://www.epditaly.it*
- *Gabi database. The Gabi database 10 (SP40) was used. SP40 relates to the ServicePak level of the Gabi 2020 database.*
- *Gabi LCA software. The Gabi LCA software and corresponding database are provided by thinkstep in Leinfelden-Echterdingen, Germany. Gabi version 10 was used.*
- *LCA methodology report – ZHW1B-72.5(L)/ ZHW1B-145(L)/ ZHW1B-252(L) HGIS – As the basis for the publication of EPD within the EPDItaly system, Yuqing Zhang, Lin Qiu, IVL Swedish Environmental Research Institute, July 2021.*
- *LCA database published by the ecoinvent association originally known as the ecoinvent Centre, the Swiss Centre for Life Cycle Inventories. Since June 2013 ecoinvent is a not-for-profit association founded by institutes of the ETH Domain and the Swiss Federal Offices. The version 3.6 from 2019, September was used.*
- *ISO (2006a). ISO 14025:2006, Environmental labels and declarations – Type III environmental declarations – Principles and procedures.*
- *ISO (2006b). ISO 14040:2006, Environmental management – Life cycle assessment – Principles and framework.*
- *ISO (2006c). ISO 14044: 2006, Environmental management – Life cycle assessment – Requirements and guidelines.*
- *Thinkstep. The provider of the Gabi LCA software and database.*

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