山东泰开高压开关有限公司
SHANDONG TAIKAI HIGH VOLTAGE SWITCHGEAR CO.,LTD

Shandong Taikai High Voltage Switchgear Co., Ltd.

ENVIRONMENTAL PRODUCT DECLARATION

Product Name: Circuit breakers:LW30-72.5、LW30-252 (GO)、LW30-252 (IO)、LW-40.5、ZW-40.5、LW30-550 (IO)、LW30-145(IO)、LW30-145(GO)、LW30-170 (GO)、LW30-170 (IO)

Site Plant: Taian, Shangdong Province, China

No. 1888, Longteng Road, High-tech Development Zone, Taian, Shangdong Province, China

in accordance with ISO 14025 and EN 50693: 2019

Program Operator	EPDItaly
Publisher	EPDItaly
Declaration Number	Taikai-00001
Registration Number	EPDITALY0469
Issue Date	2023/10/23
Valid to	2028/10/23

1. General Information

EPD Owner:	Shandong Taikai High Voltage Switchgear Co., Ltd. Address: No. 1888, Longteng Road, High-tech Development Zone, Taian, Shangdong Province, China
Product Name:	Circuit Breakers: LW30-72.5、LW30-252 (GO)、LW30-252 (IO)、LW-40.5、ZW-40.5、LW30-550 (IO)、LW30-145(IO)、LW30-145(GO)、LW30-170 (GO)、LW30-170 (IO)
Production site:	No. 1888, Longteng Road, High-tech Development Zone, Taian, Shangdong Province, China
Field of application:	Circuit Breakers
Program Operator:	EPDITALY (www.epditaly.it) Add: via Gaetano De Castillia n° 10 - 20124 Milano, Italy
CPC Code:	46211 – “Electrical apparatus for switching or protecting electrical circuits, or for making connections to or in electrical circuits, for a voltage exceeding 1000 V”
Company Contact:	Zhang rongqiang (E-mail: taikaimec@sdtaikai.com)
External Audit:	This declaration has been developed referring to EPDItaly, following the General Program Instruction; further information and the document itself are available at: www.epditaly.it. Independent verification of the declaration and data, according to EN ISO 14025:2010. ☐ INTERNAL ☒ EXTERNAL Third party verifier: DANIELE PACE Third party verification carried out by: ICMQ S.p.A., via Gaetano De Castillia n ° 10 - 20124 Milan, Italy. Accredited by Accredia
LCA Consultant:	This life cycle assessment was conducted in accordance with ISO 14044 and the reference PCR by: Ecovane Environmental Co., Ltd (www.1mi1.org/www.ecovane.cc)
Reference PCR and version number:	Core PCR: EPDItaly007 – PCR for Electronic and Electrical Products and Systems, Rev. 3, 2023/01/13. Sub PCR: EPDItaly012 - Electronic and electrical products and systems –Switches, Rev. 0, 2020/03/16.
Other reference documents:	Regulations of the EPDItaly Program rev. 5.2 published on 2022/02/16. EN 50693:2019 - Product category rules for life cycle assessments of electronic and electrical products and systems.
Comparability:	EPDs relating to the same category of products but belonging to different programmes 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. Example of variations: Different LCA software and background LCI datasets may lead to differences results for upstream or downstream of the life cycle stages declared.
Liability:	The owner of the declaration will be responsible for the information and supporting evidence. EPDItaly disclaims any liability regarding the manufacturer's information data.

Reference document:	This declaration is based on the EPDItaly regulation, available on the website www.epditaly.com

2. Company Introduction

Shandong Taikai High Voltage Switchgear Co., Ltd. ("Taikai Switchgear") is a large-scale company wholly owned by Taikai, which is specialized in the professional R&D and production of transmission & distribution products for 1000kV or below application, including outdoor HV SF6 circuit breaker (live tank and dead tank), gas insulated switchgear (GIS), mobile substation, hybrid switchgear and distribution related equipment. Taikai Switchgear also specializes in manufacturing T&D product related components and parts, such as insulators, mechanism, bushing, housing and etc. Taikai Switchgear is one of the top 3 circuit breaker and GIS manufacturers in China with more than 300 national patents registered. It is the leading switchgear manufacturer of 550kV, 245kV, 145kV, 72.5kV and 38kV equipment in China. Taikai Switchgear has been in business without interruption since the year of 2004, when the company was found. But, its stellar history for manufacturing circuit breakers goes back to the year of 1982. With CAD$ 716 Million of total asset, Taikai Switchgear owns two factories integrated with office buildings and manufacturing facilities in Tai'an, China and Vadodara, India. Besides, the company has three North America sales offices.

3. Scope and Type of EPD

3.1. Scope of EPD

The system boundary of the product is from cradle to grave, which include all stages from extraction of raw materials, manufacturing, transportation and installation, maintenance and end-of-life. According to the PCR, the life cycle stage must refer to segmentation in the following three modules:

1. **Upstream module:** which includes extraction of raw materials, including waste recycling processes and the production of semi-finished and ancillary products, and transportation of raw materials to the manufacturing company;
2. **Core module:** which includes manufacturing of the product constituents, including all the stages, product assembly, products packaging and waste recycling processes after the production;
3. **Downstream module:** which includes distribution stage, installation stage, Use & Maintenance stage, and End-of-life stage.

Table 3-1 below shows the various stages that are included in this LCA study. The terms of defining life cycle stages from the core PCR and EN50693 are adopted and shown respectively.

Table 3- 1 Life cycle stages specified in this EPD

Life cycle stages according to PCR	Life cycle stages according to EN50693	-
Upstream module	Manufacturing Stage	X
Core module		
Downstream module	Distribution Stage	X
	Installation Stage	X
	Use Stage	X
	De-installation Stage End-of-life Stage	X

3.2. Type of EPD

This EPD is a product specific EPD. The declaration covers in total 9 series of Ciruit Breakers.

3.3. Geographical scope

The circuit breakers analyzed within this study are manufactured in one factory located in Taian, Shandong Province, China. The geographical coverage of the product is global, a reference market in Italy is used for assessment in this study.

3.4. Time representativeness

All manufacturing data has been collected by Taikai based on their annual production inventory of the year 2021. Datasets have been selected according to the actual processes used by the manufacturer. For generic products where no upstream data was available, such as packaging, manufacturing has been modelled according to current industry practices.

3.5. Database and LCA software used

In this study, generic data for materials, energy as well as waste disposal and transportation were taken from the database Ecoinvent 3.9. LCA-software SimaPro 9.5 was used for the modeling and calculation.

4. Detailed Porduct Description

4.1. Description of the Product

SF6 Live tank circuit breaker, the interrupters are housed in porcelain insulators filled with SF6. 35kV to 145kV circuit breakers are equipped with spring operating mechanism. 252kV circuit breakers are equipped with spring and hydraulic spring operating mechanism. 550kV and 800kV circuit breakers are equipped with hydraulic spring operating mechanism. They all adopt self-energized arc extinguishing principle of "thermo-blast and auto-puffer". The circuit breaker can be used to control and protect and also can be used as contact circuit breakers to switch the capacitor bank.

4.2. Technical parameters

Table 4- 1 technical parameters of different circuit breakers

Circuit breakers	Nominal voltage/kV	Nominal current/A	Number of poles of the switch, P	Nominal short-circuit breaking capacity, kA	Rated peak withstands current (kA)
LW30-72.5	72.5	3150/4000/5000	3	40/50	100
LW30-252 (GO)	252	4000	3	50	125
LW30-252 (IO)	252	4000	3	50	125
LW-40.5	40.5	2500	3	31.5	80
ZW-40.5	40.5	2500	3	31.5	80
LW30-550 (IO)	550	5000	3	63	171
LW30-145(IO)	145(126)	3150/4000	3	40	104(100)
LW30-145(GO)	145(126)	3150/4000	3	40	104(100)
LW30-170 (IO)	170	4000	3	50	125
LW30-170 (GO)	170	4000	3	50	125

Note: IO: Independent operation; GO: gang operation

4.3. Materials compositions

Table 4- 2 Materials compositions of different circuit breakers

Item	Unit	LW30-72.5	LW30-252 (GO)	LW30-252 (IO)	LW-40.5	ZW-40.5	LW30-550(IO)	LW30-145 (IO)	LW30-145 (GO)	LW30-170 (GO)	LW30-170 (IO)
Porcelain	kg	612	3060	3060	276	312	3318	810	810	3060	3060
Steel	kg	732.9	1472.7	1409.5	748.2	728.2	302.9	1301.7	822.9	1472.7	1409.5
Stainless steel	kg	104	212	498	40	40	90	333	104	212	498
Aluminium alloy	kg	155.3	126.2	201.9	71.3	46.4	373	208.8	162.2	126.2	201.9
Copper	kg	23.5	36	44.5	24.25	16	51	53.25	24.25	36	44.5
Plastic	kg	48	48	48	3	0	0	48	48	48	48
Insulator	kg	4.5	4.5	4.5	6	6	0	6	6	4.5	4.5
Rubber	kg	9	9	9	1.8	1.8	0	9	9	9	9
CTY hydraulic mechanism	kg	0	0	0	0	0	3000	0	0	0	0
Other steel components	kg	5.8	41.6	34.60	29.45	40.60	365.106	20.25	83.65	41.6	34.60
Total weight (packaging excluded)	kg	1695	5010	5310	1200	1200	7500	2790	2070	5010	5310

4.4. Description of the production process

Figure 4- 1 is the flowchart depicting the production process of the circuit breaker. The manufacturing of circuit breakers takes place in three workshops, (1) the processing workshop, where the metal raw materials are processed into different components, (2) the shell workshop, where the shell of the circuit breakers are produced, and the (3) final assembly workshop, where all the components and shell are assembled into the circuit breakers.

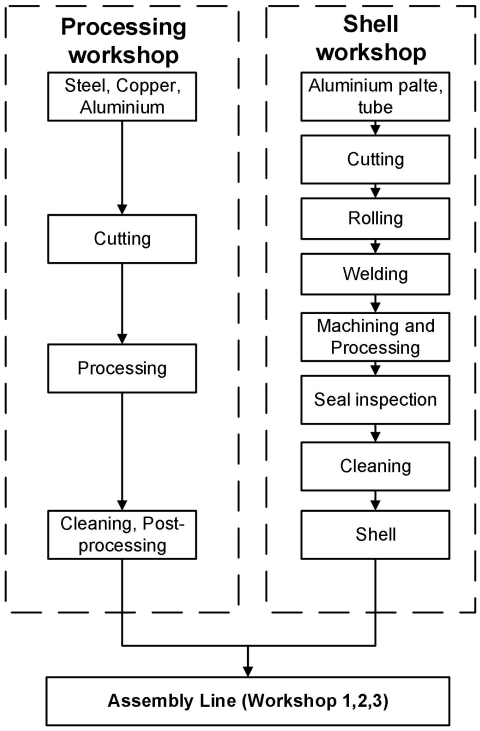

Figure 4- 1 Manufacturing process flow diagram of circuit breaker

5. LCA Results

5.1. Environmental performance

Table 5- 1 Environmental impacts - LW30-72.5

Environmental Impacts	Unit	Manufacturing stage			Distribution	Installation	Use	End-of-life				Total
		Upstream		Core	Downstream							
GWP, t	kg CO2 eq	6.62E+03	2.39E+02	1.26E+03	4.70E+02	1.77E+03	2.66E+04	2.27E+01	6.52E+01	8.70E+01	1.41E+04	5.12E+04
GWP, f	kg CO2 eq	8.09E+03	2.38E+02	1.27E+03	4.69E+02	1.75E+03	2.45E+04	2.04E+01	6.50E+01	8.72E+01	1.41E+04	5.07E+04
GWP, b	kg CO2 eq	-1.48E+03	3.34E-01	-1.12E+01	2.12E-01	1.51E+01	2.02E+03	2.34E+00	1.67E-01	-3.20E-01	6.59E-01	5.49E+02
GWP, luluc	kg CO2 eq	1.55E+01	1.22E-01	4.19E-01	3.14E-01	2.67E-01	3.95E+00	3.14E-03	3.12E-02	1.74E-01	6.50E-03	2.07E+01
ODP	kg CFC-11 eq	1.16E-04	3.07E-06	6.81E-06	5.83E-06	2.73E-06	3.64E-04	3.77E-07	1.14E-06	5.27E-07	2.58E-07	5.01E-04
AP	molc H+ eq	7.90E+01	1.02E+00	6.18E+00	9.22E+00	1.22E+00	7.63E+01	7.16E-02	2.62E-01	4.70E-01	7.48E-02	1.74E+02
EP	kg P eq	4.89E+00	1.89E-02	2.30E-01	2.38E-02	6.40E-02	3.84E+00	3.15E-03	4.47E-03	4.08E-02	3.24E-03	9.12E+00
POCP	kg NMVOC eq	2.75E+01	9.94E-01	3.81E+00	6.45E+00	5.57E-01	3.35E+01	3.48E-02	2.65E-01	2.25E-01	6.55E-02	7.35E+01
ADPE	kg Sb eq	1.93E+00	4.16E-03	2.57E-03	5.96E-03	6.64E-02	6.69E-01	2.03E-04	1.04E-03	2.33E-03	1.82E-04	2.69E+00
ADPF	MJ	8.76E+04	3.30E+03	1.13E+04	5.97E+03	2.35E+03	2.77E+05	3.12E+02	9.04E+02	1.09E+03	2.46E+02	3.90E+05
WDP	m3 water eq	2.23E+03	1.48E+01	1.70E+02	1.92E+01	5.11E+01	1.14E+04	1.25E+01	3.74E+00	1.56E+01	9.19E+00	1.39E+04

Table 5- 2 Environmental impacts - LW30-252 (GO)

Environmental Impacts	Unit	Manufacturing stage			Distribution	Installation	Use	End-of-life				Total
		Upstream		Core	Downstream							
GWP, t	kg CO2 eq	8.51E+03	9.07E+02	1.74E+03	1.39E+03	7.27E+03	6.43E+04	2.27E+01	1.93E+02	2.57E+02	5.88E+04	1.43E+05
GWP, f	kg CO2 eq	1.15E+04	9.05E+02	1.75E+03	1.39E+03	7.24E+03	6.05E+04	2.04E+01	1.92E+02	2.58E+02	5.88E+04	1.43E+05
GWP, b	kg CO2 eq	-3.05E+03	1.27E+00	-1.55E+01	6.28E-01	2.82E+01	3.80E+03	2.34E+00	4.93E-01	-9.45E-01	2.77E+00	7.69E+02
GWP, luluc	kg CO2 eq	2.10E+01	4.65E-01	5.27E-01	9.27E-01	1.10E+00	7.42E+00	3.14E-03	9.23E-02	5.14E-01	3.04E-02	3.21E+01
ODP	kg CFC-11 eq	1.89E-04	1.17E-05	6.73E-06	1.72E-05	9.23E-06	6.85E-04	3.77E-07	3.36E-06	1.56E-06	1.12E-06	9.24E-04
AP	molc H+ eq	9.58E+01	3.89E+00	8.53E+00	2.73E+01	4.87E+00	1.44E+02	7.16E-02	7.75E-01	1.39E+00	3.38E-01	2.86E+02
EP	kg P eq	6.21E+00	7.19E-02	3.18E-01	7.02E-02	2.57E-01	7.22E+00	3.15E-03	1.32E-02	1.21E-01	1.38E-02	1.43E+01

POCP	kg NMVOC eq	3.73E+01	3.78E+00	5.24E+00	1.91E+01	2.22E+00	6.30E+01	3.48E-02	7.83E-01	6.64E-01	2.98E-01	1.32E+02
ADPE	kg Sb eq	2.51E+00	1.58E-02	3.35E-03	1.76E-02	2.76E-01	1.26E+00	2.03E-04	3.06E-03	6.88E-03	8.16E-04	4.10E+00
ADPF	MJ	1.28E+05	1.25E+04	1.55E+04	1.76E+04	8.84E+03	5.21E+05	3.12E+02	2.67E+03	3.21E+03	1.12E+03	7.10E+05
WDP	m3 water eq	3.29E+03	5.61E+01	2.18E+02	5.67E+01	1.71E+02	2.14E+04	1.25E+01	1.10E+01	4.61E+01	4.50E+01	2.53E+04

Table 5- 3 Environmental impacts - LW30-252 (IO)

Environmental Impacts	Unit	Manufacturing stage			Distribution	Installation	Use	End-of-life				Total
		Upstream		Core	Downstream							
GWP, t	kg CO2 eq	1.17E+04	9.89E+02	1.82E+03	1.47E+03	7.20E+03	6.43E+04	2.27E+01	2.04E+02	2.73E+02	5.88E+04	1.47E+05
GWP, f	kg CO2 eq	1.59E+04	9.87E+02	1.83E+03	1.47E+03	7.16E+03	6.05E+04	2.04E+01	2.04E+02	2.73E+02	5.88E+04	1.47E+05
GWP, b	kg CO2 eq	-4.30E+03	1.38E+00	-1.61E+01	6.65E-01	3.92E+01	3.80E+03	2.34E+00	5.22E-01	-1.00E+00	2.78E+00	-4.65E+02
GWP, luluc	kg CO2 eq	2.73E+01	5.07E-01	5.44E-01	9.82E-01	1.06E+00	7.42E+00	3.14E-03	9.79E-02	5.45E-01	3.05E-02	3.85E+01
ODP	kg CFC-11 eq	2.39E-04	1.27E-05	6.85E-06	1.83E-05	7.78E-06	6.85E-04	3.77E-07	3.57E-06	1.65E-06	1.13E-06	9.76E-04
AP	molc H+ eq	1.26E+02	4.24E+00	8.90E+00	2.89E+01	4.54E+00	1.44E+02	7.16E-02	8.22E-01	1.47E+00	3.39E-01	3.19E+02
EP	kg P eq	8.09E+00	7.84E-02	3.32E-01	7.44E-02	2.51E-01	7.22E+00	3.15E-03	1.40E-02	1.28E-01	1.39E-02	1.62E+01
POCP	kg NMVOC eq	5.03E+01	4.12E+00	5.47E+00	2.02E+01	1.88E+00	6.30E+01	3.48E-02	8.29E-01	7.04E-01	2.99E-01	1.47E+02
ADPE	kg Sb eq	3.11E+00	1.72E-02	3.49E-03	1.87E-02	2.75E-01	1.26E+00	2.03E-04	3.25E-03	7.29E-03	8.19E-04	4.69E+00
ADPF	MJ	1.77E+05	1.37E+04	1.62E+04	1.87E+04	7.68E+03	5.21E+05	3.12E+02	2.83E+03	3.40E+03	1.13E+03	7.61E+05
WDP	m3 water eq	4.00E+03	6.12E+01	2.26E+02	6.01E+01	1.66E+02	2.14E+04	1.25E+01	1.17E+01	4.89E+01	4.48E+01	2.61E+04

Table 5- 4 Environmental impacts - LW-40.5

Environmental Impacts	Unit	Manufacturing stage			Distribution	Installation	Use	End-of-life				Total
		Upstream		Core	Downstream							
GWP, t	kg CO2 eq	5.40E+03	1.17E+02	5.64E+02	3.33E+02	3.95E+02	2.26E+04	2.27E+01	4.62E+01	6.16E+01	2.94E+03	3.25E+04
GWP, f	kg CO2 eq	5.90E+03	1.17E+02	5.70E+02	3.32E+02	3.87E+02	2.05E+04	2.04E+01	4.60E+01	6.17E+01	2.94E+03	3.09E+04
GWP, b	kg CO2 eq	-5.05E+02	1.64E-01	-6.49E+00	1.50E-01	7.77E+00	2.12E+03	2.34E+00	1.18E-01	-2.26E-01	1.56E-01	1.62E+03

GWP, luluc	kg CO2 eq	1.09E+01	6.01E-02	4.40E-01	2.22E-01	6.08E-02	4.14E+00	3.14E-03	2.21E-02	1.23E-01	2.87E-03	1.60E+01
ODP	kg CFC-11 eq	9.54E-05	1.51E-06	3.16E-06	4.13E-06	8.63E-07	3.82E-04	3.77E-07	8.06E-07	3.73E-07	9.33E-08	4.89E-04
AP	molc H+ eq	5.01E+01	5.03E-01	2.80E+00	6.53E+00	3.36E-01	8.01E+01	7.16E-02	1.86E-01	3.33E-01	2.97E-02	1.41E+02
EP	kg P eq	3.45E+00	9.30E-03	1.06E-01	1.68E-02	1.62E-02	4.03E+00	3.15E-03	3.16E-03	2.89E-02	1.52E-03	7.67E+00
POCP	kg NMVOC eq	1.90E+01	4.88E-01	1.70E+00	4.57E+00	1.69E-01	3.52E+01	3.48E-02	1.87E-01	1.59E-01	2.75E-02	6.15E+01
ADPE	kg Sb eq	1.15E+00	2.05E-03	1.20E-03	4.22E-03	1.41E-02	7.03E-01	2.03E-04	7.34E-04	1.65E-03	7.23E-05	1.88E+00
ADPF	MJ	6.29E+04	1.62E+03	5.11E+03	4.22E+03	8.20E+02	2.91E+05	3.12E+02	6.40E+02	7.69E+02	9.54E+01	3.67E+05
WDP	m3 water eq	9.60E+02	7.26E+00	1.36E+02	1.36E+01	2.06E+01	1.20E+04	1.25E+01	2.65E+00	1.10E+01	3.08E+00	1.31E+04

Table 5- 5 Environmental impacts- ZW-40.5

Environmental Impacts	**Unit**	**Manufacturing stage**			**Distribution**	**Installation**	**Use**	**End-of-life**				**Total**
		Upstream		Core	Downstream							
GWP, t	kg CO2 eq	4.75E+03	1.20E+02	4.35E+02	3.33E+02	4.36E+01	2.13E+04	2.27E+01	4.62E+01	6.16E+01	4.45E+00	2.71E+04
GWP, f	kg CO2 eq	5.25E+03	1.20E+02	4.39E+02	3.32E+02	3.58E+01	1.92E+04	2.04E+01	4.60E+01	6.17E+01	4.41E+00	2.55E+04
GWP, b	kg CO2 eq	-5.13E+02	1.68E-01	-4.30E+00	1.50E-01	7.73E+00	2.12E+03	2.34E+00	1.18E-01	-2.26E-01	3.68E-02	1.62E+03
GWP, luluc	kg CO2 eq	9.54E+00	6.17E-02	1.67E-01	2.22E-01	1.05E-02	4.14E+00	3.14E-03	2.21E-02	1.23E-01	3.06E-03	1.43E+01
ODP	kg CFC-11 eq	8.82E-05	1.55E-06	3.88E-06	4.13E-06	6.48E-07	3.82E-04	3.77E-07	8.06E-07	3.73E-07	8.22E-08	4.82E-04
AP	molc H+ eq	3.96E+01	5.16E-01	2.14E+00	6.53E+00	1.34E-01	8.01E+01	7.16E-02	1.86E-01	3.33E-01	2.93E-02	1.30E+02
EP	kg P eq	2.84E+00	9.55E-03	8.13E-02	1.68E-02	4.22E-03	4.03E+00	3.15E-03	3.16E-03	2.89E-02	1.47E-03	7.02E+00
POCP	kg NMVOC eq	1.62E+01	5.01E-01	1.31E+00	4.57E+00	9.82E-02	3.52E+01	3.48E-02	1.87E-01	1.59E-01	2.91E-02	5.83E+01
ADPE	kg Sb eq	8.60E-01	2.10E-03	9.56E-04	4.22E-03	4.50E-04	7.03E-01	2.03E-04	7.34E-04	1.65E-03	6.93E-05	1.57E+00
ADPF	MJ	5.63E+04	1.66E+03	4.00E+03	4.22E+03	5.26E+02	2.91E+05	3.12E+02	6.40E+02	7.69E+02	8.97E+01	3.59E+05
WDP	m3 water eq	7.52E+02	7.45E+00	6.70E+01	1.36E+01	1.34E+01	1.20E+04	1.25E+01	2.65E+00	1.10E+01	2.94E+00	1.28E+04

Table 5- 6 Environmental impacts - LW30-550

Environmental Impacts	**Unit**	**Manufacturing stage**		**Distribution**	**Installation**	**Use**	**End-of-life**	**Total**
		Upstream	Core	Downstream				

GWP, t	kg CO2 eq	3.14E+04	1.40E+03	4.08E+03	2.08E+03	7.33E+03	9.00E+04	2.27E+01	2.89E+02	3.85E+02	5.88E+04	1.96E+05
GWP, f	kg CO2 eq	3.60E+04	1.39E+03	4.12E+03	2.08E+03	7.29E+03	8.37E+04	2.04E+01	2.88E+02	3.86E+02	5.88E+04	1.94E+05
GWP, b	kg CO2 eq	-4.68E+03	1.95E+00	-3.51E+01	9.40E-01	4.63E+01	6.37E+03	2.34E+00	7.38E-01	-1.41E+00	2.79E+00	1.71E+03
GWP, luluc	kg CO2 eq	7.03E+01	7.16E-01	1.06E+00	1.39E+00	1.12E+00	1.24E+01	3.14E-03	1.38E-01	7.69E-01	3.22E-02	8.80E+01
ODP	kg CFC-11 eq	5.19E-04	1.79E-05	1.11E-05	2.58E-05	9.35E-06	1.15E-03	3.77E-07	5.04E-06	2.33E-06	1.16E-06	1.74E-03
AP	molc H+ eq	5.03E+02	5.98E+00	2.00E+01	4.08E+01	5.06E+00	2.40E+02	7.16E-02	1.16E+00	2.08E+00	3.55E-01	8.19E+02
EP	kg P eq	3.06E+01	1.11E-01	7.40E-01	1.05E-01	2.60E-01	1.21E+01	3.15E-03	1.98E-02	1.81E-01	1.38E-02	4.42E+01
POCP	kg NMVOC eq	1.42E+02	5.81E+00	1.23E+01	2.85E+01	2.41E+00	1.06E+02	3.48E-02	1.17E+00	9.95E-01	3.14E-01	2.99E+02
ADPE	kg Sb eq	1.44E+01	2.43E-02	7.60E-03	2.64E-02	2.77E-01	2.11E+00	2.03E-04	4.59E-03	1.03E-02	8.52E-04	1.69E+01
ADPF	MJ	3.85E+05	1.93E+04	3.64E+04	2.64E+04	9.47E+03	8.72E+05	3.12E+02	4.00E+03	4.81E+03	1.18E+03	1.36E+06
WDP	m3 water eq	8.96E+03	8.64E+01	4.59E+02	8.49E+01	1.72E+02	3.59E+04	1.25E+01	1.65E+01	6.90E+01	4.84E+01	4.58E+04

Table 5- 7 Environmental impacts - LW30-145 (IO)

Environmental Impacts	**Unit**	**Manufacturing stage**			**Distribution**	**Installation**	**Use**	**End-of-life**				**Total**
		Upstream		Core	Downstream							
GWP, t	kg CO2 eq	1.16E+04	3.57E+02	1.49E+03	7.74E+02	1.76E+03	2.66E+04	2.27E+01	1.07E+02	1.43E+02	1.41E+04	5.70E+04
GWP, f	kg CO2 eq	1.34E+04	3.56E+02	1.50E+03	7.73E+02	1.74E+03	2.45E+04	2.04E+01	1.07E+02	1.43E+02	1.41E+04	5.67E+04
GWP, b	kg CO2 eq	-1.83E+03	4.99E-01	-1.31E+01	3.50E-01	1.93E+01	2.02E+03	2.34E+00	2.74E-01	-5.26E-01	6.84E-01	2.02E+02
GWP, luluc	kg CO2 eq	2.42E+01	1.83E-01	4.71E-01	5.16E-01	2.62E-01	3.95E+00	3.14E-03	5.14E-02	2.86E-01	8.52E-03	2.99E+01
ODP	kg CFC-11 eq	1.95E-04	4.58E-06	7.20E-06	9.60E-06	2.55E-06	3.64E-04	3.77E-07	1.87E-06	8.68E-07	3.13E-07	5.87E-04
AP	molc H+ eq	1.31E+02	1.53E+00	7.30E+00	1.52E+01	1.18E+00	7.63E+01	7.16E-02	4.32E-01	7.74E-01	9.40E-02	2.34E+02
EP	kg P eq	8.34E+00	2.83E-02	2.72E-01	3.91E-02	6.34E-02	3.84E+00	3.15E-03	7.35E-03	6.72E-02	4.36E-03	1.27E+01
POCP	kg NMVOC eq	4.54E+01	1.48E+00	4.50E+00	1.06E+01	5.17E-01	3.35E+01	3.48E-02	4.36E-01	3.70E-01	8.45E-02	9.70E+01
ADPE	kg Sb eq	3.34E+00	6.22E-03	2.97E-03	9.82E-03	6.63E-02	6.69E-01	2.03E-04	1.71E-03	3.83E-03	2.28E-04	4.10E+00
ADPF	MJ	1.45E+05	4.92E+03	1.33E+04	9.82E+03	2.21E+03	2.77E+05	3.12E+02	1.49E+03	1.79E+03	3.05E+02	4.56E+05
WDP	m3 water eq	3.40E+03	2.21E+01	1.93E+02	3.16E+01	5.05E+01	1.14E+04	1.25E+01	6.15E+00	2.57E+01	1.08E+01	1.51E+04

Table 5- 8 Environmental impacts- LW30-145 (GO)

Environmental Impacts	Unit	Manufacturing stage			Distribution	Installation	Use	End-of-life				Total
		Upstream		Core	Downstream							
GWP, t	kg CO2 eq	6.44E+03	2.83E+02	1.30E+03	5.74E+02	1.77E+03	2.66E+04	2.27E+01	7.97E+01	1.06E+02	1.41E+04	5.13E+04
GWP, f	kg CO2 eq	7.46E+03	2.82E+02	1.31E+03	5.73E+02	1.75E+03	2.45E+04	2.04E+01	7.94E+01	1.06E+02	1.41E+04	5.03E+04
GWP, b	kg CO2 eq	-1.04E+03	3.96E-01	-1.16E+01	2.59E-01	1.17E+01	2.02E+03	2.34E+00	2.04E-01	-3.90E-01	6.79E-01	9.89E+02
GWP, luluc	kg CO2 eq	1.38E+01	1.45E-01	4.25E-01	3.83E-01	2.67E-01	3.95E+00	3.14E-03	3.81E-02	2.12E-01	8.24E-03	1.92E+01
ODP	kg CFC-11 eq	1.14E-04	3.63E-06	6.79E-06	7.12E-06	2.75E-06	3.64E-04	3.77E-07	1.39E-06	6.44E-07	3.04E-07	5.01E-04
AP	molc H+ eq	5.91E+01	1.21E+00	6.37E+00	1.13E+01	1.23E+00	7.63E+01	7.16E-02	3.20E-01	5.74E-01	9.16E-02	1.57E+02
EP	kg P eq	3.85E+00	2.24E-02	2.38E-01	2.90E-02	6.41E-02	3.84E+00	3.15E-03	5.45E-03	4.99E-02	3.90E-03	8.10E+00
POCP	kg NMVOC eq	2.35E+01	1.18E+00	3.91E+00	7.88E+00	5.62E-01	3.35E+01	3.48E-02	3.23E-01	2.75E-01	8.22E-02	7.12E+01
ADPE	kg Sb eq	1.33E+00	4.93E-03	2.50E-03	7.28E-03	6.65E-02	6.69E-01	2.03E-04	1.27E-03	2.84E-03	2.20E-04	2.09E+00
ADPF	MJ	8.11E+04	3.90E+03	1.16E+04	7.29E+03	2.37E+03	2.77E+05	3.12E+02	1.10E+03	1.33E+03	2.97E+02	3.86E+05
WDP	m3 water eq	1.95E+03	1.75E+01	1.74E+02	2.34E+01	5.11E+01	1.14E+04	1.25E+01	4.57E+00	1.91E+01	1.13E+01	1.37E+04

Table 5- 9 Environmental impacts - LW30-170 (GO)

Environmental Impacts	Unit	Manufacturing stage			Distribution	Installation	Use	End-of-life				Total
		Upstream		Core	Downstream							
GWP, t	kg CO2 eq	8.51E+03	9.07E+02	1.74E+03	1.39E+03	7.27E+03	6.43E+04	2.27E+01	1.93E+02	2.57E+02	5.88E+04	1.43E+05
GWP, f	kg CO2 eq	1.15E+04	9.05E+02	1.75E+03	1.39E+03	7.24E+03	6.05E+04	2.04E+01	1.92E+02	2.58E+02	5.88E+04	1.43E+05
GWP, b	kg CO2 eq	-3.05E+03	1.27E+00	-1.55E+01	6.28E-01	2.82E+01	3.80E+03	2.34E+00	4.93E-01	-9.45E-01	2.77E+00	7.69E+02
GWP, luluc	kg CO2 eq	2.10E+01	4.65E-01	5.27E-01	9.27E-01	1.10E+00	7.42E+00	3.14E-03	9.23E-02	5.14E-01	3.04E-02	3.21E+01
ODP	kg CFC-11 eq	1.89E-04	1.17E-05	6.73E-06	1.72E-05	9.23E-06	6.85E-04	3.77E-07	3.36E-06	1.56E-06	1.12E-06	9.24E-04
AP	molc H+ eq	9.58E+01	3.89E+00	8.53E+00	2.73E+01	4.87E+00	1.44E+02	7.16E-02	7.75E-01	1.39E+00	3.38E-01	2.86E+02
EP	kg PO4--- eq	6.21E+00	7.19E-02	3.18E-01	7.02E-02	2.57E-01	7.22E+00	3.15E-03	1.32E-02	1.21E-01	1.38E-02	1.43E+01
POCP	kg NMVOC eq	3.73E+01	3.78E+00	5.24E+00	1.91E+01	2.22E+00	6.30E+01	3.48E-02	7.83E-01	6.64E-01	2.98E-01	1.32E+02
ADPE	kg Sb eq	2.51E+00	1.58E-02	3.35E-03	1.76E-02	2.76E-01	1.26E+00	2.03E-04	3.06E-03	6.88E-03	8.16E-04	4.10E+00
ADPF	MJ	1.28E+05	1.25E+04	1.55E+04	1.76E+04	8.84E+03	5.21E+05	3.12E+02	2.67E+03	3.21E+03	1.12E+03	7.10E+05
WDP	m3 water eq	3.29E+03	5.61E+01	2.18E+02	5.67E+01	1.71E+02	2.14E+04	1.25E+01	1.10E+01	4.61E+01	4.50E+01	2.53E+04

Table 5- 10 Environmental impacts - LW30-170 (IO)

Environmental Impacts	Unit	Manufacturing stage			Distribution	Installation	Use	End-of-life				Total
		Upstream		Core	Downstream							
GWP, t	kg CO2 eq	1.17E+04	9.89E+02	1.82E+03	1.47E+03	7.20E+03	6.43E+04	2.27E+01	2.04E+02	2.73E+02	5.88E+04	1.47E+05
GWP, f	kg CO2 eq	1.59E+04	9.87E+02	1.83E+03	1.47E+03	7.16E+03	6.05E+04	2.04E+01	2.04E+02	2.73E+02	5.88E+04	1.47E+05
GWP, b	kg CO2 eq	-4.30E+03	1.38E+00	-1.61E+01	6.65E-01	3.92E+01	3.80E+03	2.34E+00	5.22E-01	-1.00E+00	2.78E+00	-4.65E+02
GWP, luluc	kg CO2 eq	2.73E+01	5.07E-01	5.44E-01	9.82E-01	1.06E+00	7.42E+00	3.14E-03	9.79E-02	5.45E-01	3.05E-02	3.85E+01
ODP	kg CFC-11 eq	2.39E-04	1.27E-05	6.85E-06	1.83E-05	7.78E-06	6.85E-04	3.77E-07	3.57E-06	1.65E-06	1.13E-06	9.76E-04
AP	molc H+ eq	1.26E+02	4.24E+00	8.90E+00	2.89E+01	4.54E+00	1.44E+02	7.16E-02	8.22E-01	1.47E+00	3.39E-01	3.19E+02
EP	kg P eq	8.09E+00	7.84E-02	3.32E-01	7.44E-02	2.51E-01	7.22E+00	3.15E-03	1.40E-02	1.28E-01	1.39E-02	1.62E+01
POCP	kg NMVOC eq	5.03E+01	4.12E+00	5.47E+00	2.02E+01	1.88E+00	6.30E+01	3.48E-02	8.29E-01	7.04E-01	2.99E-01	1.47E+02
ADPE	kg Sb eq	3.11E+00	1.72E-02	3.49E-03	1.87E-02	2.75E-01	1.26E+00	2.03E-04	3.25E-03	7.29E-03	8.19E-04	4.69E+00
ADPF	MJ	1.77E+05	1.37E+04	1.62E+04	1.87E+04	7.68E+03	5.21E+05	3.12E+02	2.83E+03	3.40E+03	1.13E+03	7.61E+05
WDP	m3 water eq	4.00E+03	6.12E+01	2.26E+02	6.01E+01	1.66E+02	2.14E+04	1.25E+01	1.17E+01	4.89E+01	4.48E+01	2.61E+04

Caption:

1E+01 is equal to 1 x 10^1

GWP-total: Global Warming Potential; **GWP-fossil**: Global Warming Potential fossil fuels; **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, Accumulated Exceedance; **EP**: Eutrophication potential; **POCP**: Formation potential of tropospheric ozone; **ADPE**: Abiotic depletion potential for non-fossil resources (minerals and metals); **ADPF**: Abiotic depletion potential for fossil resources; **WDP**: Water deprivation potential, deprivation weighted water consumption

5.2. Resources uses

Table 5- 11 Resource use - LW30-72.5

Environmental Impacts	Unit	Manufacturing stage			Distribution	Installation	Use	End-of-life				Total
		Upstream		Core	Downstream							
PERE	MJ	1.93E+04	4.20E+01	6.20E+02	5.63E+01	2.66E+02	9.21E+04	7.89E+01	1.40E+01	1.46E+02	2.29E+01	1.13E+05
PERM	MJ	1.14E+04	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	1.14E+04
PERT	MJ	3.08E+04	4.20E+01	6.20E+02	5.63E+01	2.66E+02	9.21E+04	7.89E+01	1.40E+01	1.46E+02	2.29E+01	1.24E+05
PENRE	MJ	8.62E+04	3.30E+03	1.13E+04	5.97E+03	2.35E+03	2.77E+05	3.12E+02	9.04E+02	1.09E+03	2.46E+02	3.88E+05
PENRM	MJ	1.44E+03	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	1.44E+03
PENRT	MJ	8.76E+04	3.30E+03	1.13E+04	5.97E+03	2.35E+03	2.77E+05	3.12E+02	9.04E+02	1.09E+03	2.46E+02	3.90E+05
SM	kg	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
RSF	MJ	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
NRSF	MJ	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
FW	m3	6.45E+01	4.70E-01	4.32E+00	6.35E-01	1.48E+00	3.09E+02	3.36E-01	1.29E-01	5.99E-01	2.44E-01	3.82E+02

Table 5- 12 Resource use - LW30-252 (GO)

Environmental Impacts	Unit	Manufacturing stage			Distribution	Installation	Use	End-of-life				Total
		Upstream		Core	Downstream							
PERE	MJ	3.33E+04	1.59E+02	8.53E+02	1.66E+02	8.58E+02	1.73E+05	7.89E+01	4.15E+01	4.30E+02	9.67E+01	2.09E+05
PERM	MJ	2.25E+04	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	2.25E+04
PERT	MJ	5.58E+04	1.59E+02	8.53E+02	1.66E+02	8.58E+02	1.73E+05	7.89E+01	4.15E+01	4.30E+02	9.67E+01	2.32E+05
PENRE	MJ	1.26E+05	1.25E+04	1.55E+04	1.76E+04	8.84E+03	5.21E+05	3.12E+02	2.67E+03	3.21E+03	1.12E+03	7.09E+05
PENRM	MJ	1.44E+03	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	1.44E+03
PENRT	MJ	1.28E+05	1.25E+04	1.55E+04	1.76E+04	8.84E+03	5.21E+05	3.12E+02	2.67E+03	3.21E+03	1.12E+03	7.10E+05
SM	kg	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
RSF	MJ	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
NRSF	MJ	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
FW	m3	9.27E+01	1.79E+00	5.47E+00	1.88E+00	5.04E+00	5.82E+02	3.36E-01	3.81E-01	1.77E+00	1.14E+00	6.92E+02

Table 5- 13 Resource use - LW30-252 (IO)

Environmental Impacts	Unit	Manufacturing stage			Distribution	Installation	Use	End-of-life				Total
		Upstream		Core	Downstream							
PERE	MJ	4.94E+04	1.74E+02	8.89E+02	1.76E+02	8.40E+02	1.73E+05	7.89E+01	4.40E+01	4.56E+02	9.67E+01	2.25E+05
PERM	MJ	3.28E+04	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	3.28E+04
PERT	MJ	8.22E+04	1.74E+02	8.89E+02	1.76E+02	8.40E+02	1.73E+05	7.89E+01	4.40E+01	4.56E+02	9.67E+01	2.58E+05
PENRE	MJ	1.75E+05	1.37E+04	1.62E+04	1.87E+04	7.68E+03	5.21E+05	3.12E+02	2.83E+03	3.40E+03	1.13E+03	7.60E+05
PENRM	MJ	1.44E+03	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	1.44E+03
PENRT	MJ	1.77E+05	1.37E+04	1.62E+04	1.87E+04	7.68E+03	5.21E+05	3.12E+02	2.83E+03	3.40E+03	1.13E+03	7.61E+05
SM	kg	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
RSF	MJ	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
NRSF	MJ	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
FW	m3	1.16E+02	1.95E+00	5.65E+00	1.99E+00	4.88E+00	5.82E+02	3.36E-01	4.04E-01	1.88E+00	1.14E+00	7.16E+02

Table 5- 14 Resource use - LW-40.5

Environmental Impacts	Unit	Manufacturing stage			Distribution	Installation	Use	End-of-life				Total
		Upstream		Core	Downstream							
PERE	MJ	1.09E+04	2.06E+01	3.03E+02	3.99E+01	1.19E+02	9.66E+04	7.89E+01	9.94E+00	1.03E+02	5.53E+00	1.08E+05
PERM	MJ	4.91E+03	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	4.91E+03
PERT	MJ	1.58E+04	2.06E+01	3.03E+02	3.99E+01	1.19E+02	9.66E+04	7.89E+01	9.94E+00	1.03E+02	5.53E+00	1.13E+05
PENRE	MJ	6.29E+04	1.62E+03	5.11E+03	4.22E+03	8.20E+02	2.91E+05	3.12E+02	6.40E+02	7.69E+02	9.54E+01	3.67E+05
PENRM	MJ	9.00E+01	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	9.00E+01
PENRT	MJ	6.29E+04	1.62E+03	5.11E+03	4.22E+03	8.20E+02	2.91E+05	3.12E+02	6.40E+02	7.69E+02	9.54E+01	3.67E+05
SM	kg	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
RSF	MJ	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
NRSF	MJ	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
FW	m3	3.13E+01	2.31E-01	3.86E+00	4.49E-01	5.80E-01	3.25E+02	3.36E-01	9.13E-02	4.24E-01	7.84E-02	3.62E+02

Table 5- 15 Resource use - ZW-40.5

Environmental Impacts	Unit	Manufacturing stage		Distribution	Installation	Use	End-of-life				Total
		Upstream	Core	Downstream							

PERE	MJ	1.01E+04	2.12E+01	2.34E+02	3.99E+01	8.23E+01	9.66E+04	7.89E+01	9.94E+00	1.03E+02	1.57E+00	1.07E+05
PERM	MJ	4.91E+03	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	4.91E+03
PERT	MJ	1.50E+04	2.12E+01	2.34E+02	3.99E+01	8.23E+01	9.66E+04	7.89E+01	9.94E+00	1.03E+02	1.57E+00	1.12E+05
PENRE	MJ	5.63E+04	1.66E+03	4.00E+03	4.22E+03	5.26E+02	2.91E+05	3.12E+02	6.40E+02	7.69E+02	8.97E+01	3.59E+05
PENRM	MJ	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
PENRT	MJ	5.63E+04	1.66E+03	4.00E+03	4.22E+03	5.26E+02	2.91E+05	3.12E+02	6.40E+02	7.69E+02	8.97E+01	3.59E+05
SM	kg	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
RSF	MJ	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
NRSF	MJ	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
FW	m3	2.53E+01	2.37E-01	1.73E+00	4.49E-01	3.67E-01	3.25E+02	3.36E-01	9.13E-02	4.24E-01	7.23E-02	3.54E+02

Table 5- 16 Resource use - LW30-550

Environmental Impacts	Unit	Manufacturing stage			Distribution	Installation	Use	End-of-life				Total
		Upstream		Core	Downstream							
PERE	MJ	7.63E+04	2.45E+02	1.95E+03	2.49E+02	8.66E+02	2.90E+05	7.89E+01	6.21E+01	6.44E+02	9.75E+01	3.70E+05
PERM	MJ	3.90E+04	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	3.90E+04
PERT	MJ	1.15E+05	2.45E+02	1.95E+03	2.49E+02	8.66E+02	2.90E+05	7.89E+01	6.21E+01	6.44E+02	9.75E+01	4.09E+05
PENRE	MJ	3.85E+05	1.93E+04	3.64E+04	2.64E+04	9.47E+03	8.72E+05	3.12E+02	4.00E+03	4.80E+03	1.18E+03	1.36E+06
PENRM	MJ	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
PENRT	MJ	3.85E+05	1.93E+04	3.64E+04	2.64E+04	9.47E+03	8.72E+05	3.12E+02	4.00E+03	4.80E+03	1.18E+03	1.36E+06
SM	kg	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
RSF	MJ	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
NRSF	MJ	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
FW	m3	2.66E+02	2.75E+00	1.12E+01	2.81E+00	5.09E+00	9.74E+02	3.36E-01	5.70E-01	2.65E+00	1.21E+00	1.27E+03

Table 5- 17 Resource use - LW30-145 (IO)

Environmental Impacts	Unit	Manufacturing stage			Distribution	Installation	Use	End-of-life				Total
		Upstream		Core	Downstream							
PERE	MJ	3.07E+04	6.27E+01	7.27E+02	9.27E+01	2.64E+02	9.21E+04	7.89E+01	2.31E+01	2.40E+02	2.39E+01	1.24E+05
PERM	MJ	1.52E+04	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	1.52E+04

PERT	MJ	4.59E+04	6.27E+01	7.27E+02	9.27E+01	2.64E+02	9.21E+04	7.89E+01	2.31E+01	2.40E+02	2.39E+01	1.39E+05
PENRE	MJ	1.44E+05	4.92E+03	1.33E+04	9.82E+03	2.21E+03	2.77E+05	3.12E+02	1.49E+03	1.79E+03	3.05E+02	4.55E+05
PENRM	MJ	1.44E+03	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	1.44E+03
PENRT	MJ	1.45E+05	4.92E+03	1.33E+04	9.82E+03	2.21E+03	2.77E+05	3.12E+02	1.49E+03	1.79E+03	3.05E+02	4.56E+05
SM	kg	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
RSF	MJ	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
NRSF	MJ	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
FW	m3	9.90E+01	7.02E-01	4.88E+00	1.04E+00	1.46E+00	3.09E+02	3.36E-01	2.12E-01	9.86E-01	2.84E-01	4.18E+02

Table 5- 17 Resource use - LW30-145 (GO)

Environmental Impacts	Unit	Manufacturing stage			Distribution	Installation	Use	End-of-life				Total
		Upstream		Core	Downstream							
PERE	MJ	1.57E+04	4.97E+01	6.40E+02	6.88E+01	2.66E+02	9.21E+04	7.89E+01	1.71E+01	1.78E+02	2.37E+01	1.09E+05
PERM	MJ	8.23E+03	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	8.23E+03
PERT	MJ	2.39E+04	4.97E+01	6.40E+02	6.88E+01	2.66E+02	9.21E+04	7.89E+01	1.71E+01	1.78E+02	2.37E+01	1.17E+05
PENRE	MJ	7.97E+04	3.90E+03	1.16E+04	7.29E+03	2.37E+03	2.77E+05	3.12E+02	1.10E+03	1.33E+03	2.97E+02	3.85E+05
PENRM	MJ	1.44E+03	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	1.44E+03
PENRT	MJ	8.11E+04	3.90E+03	1.16E+04	7.29E+03	2.37E+03	2.77E+05	3.12E+02	1.10E+03	1.33E+03	2.97E+02	3.86E+05
SM	kg	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
RSF	MJ	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
NRSF	MJ	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
FW	m3	5.65E+01	5.56E-01	4.41E+00	7.75E-01	1.48E+00	3.09E+02	3.36E-01	1.57E-01	7.32E-01	2.95E-01	3.74E+02

Table 5- 18 Resource use - LW30-170 (GO)

Environmental Impacts	Unit	Manufacturing stage			Distribution	Installation	Use	End-of-life				Total
		Upstream		Core	Downstream							
PERE	MJ	3.33E+04	1.59E+02	8.53E+02	1.66E+02	8.58E+02	1.73E+05	7.89E+01	4.15E+01	4.30E+02	9.67E+01	2.09E+05
PERM	MJ	2.25E+04	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	2.25E+04
PERT	MJ	5.58E+04	1.59E+02	8.53E+02	1.66E+02	8.58E+02	1.73E+05	7.89E+01	4.15E+01	4.30E+02	9.67E+01	2.32E+05
PENRE	MJ	1.26E+05	1.25E+04	1.55E+04	1.76E+04	8.84E+03	5.21E+05	3.12E+02	2.67E+03	3.21E+03	1.12E+03	7.09E+05

PENRM	MJ	1.44E+03	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	1.44E+03
PENRT	MJ	1.28E+05	1.25E+04	1.55E+04	1.76E+04	8.84E+03	5.21E+05	3.12E+02	2.67E+03	3.21E+03	1.12E+03	7.10E+05
SM	kg	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
RSF	MJ	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
NRSF	MJ	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
FW	m3	9.27E+01	1.79E+00	5.47E+00	1.88E+00	5.04E+00	5.82E+02	3.36E-01	3.81E-01	1.77E+00	1.14E+00	6.92E+02

Table 5-20 Resource use - LW30-170 (IO)

Environmental Impacts	Unit	Manufacturing stage			Distribution	Installation	Use	End-of-life				Total
		Upstream		Core	Downstream							
PERE	MJ	4.94E+04	1.74E+02	8.89E+02	1.76E+02	8.40E+02	1.73E+05	7.89E+01	4.40E+01	4.56E+02	9.67E+01	2.25E+05
PERM	MJ	3.28E+04	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	3.28E+04
PERT	MJ	8.22E+04	1.74E+02	8.89E+02	1.76E+02	8.40E+02	1.73E+05	7.89E+01	4.40E+01	4.56E+02	9.67E+01	2.58E+05
PENRE	MJ	1.75E+05	1.37E+04	1.62E+04	1.87E+04	7.68E+03	5.21E+05	3.12E+02	2.83E+03	3.40E+03	1.13E+03	7.60E+05
PENRM	MJ	1.44E+03	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	1.44E+03
PENRT	MJ	1.77E+05	1.37E+04	1.62E+04	1.87E+04	7.68E+03	5.21E+05	3.12E+02	2.83E+03	3.40E+03	1.13E+03	7.61E+05
SM	kg	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
RSF	MJ	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
NRSF	MJ	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
FW	m3	1.16E+02	1.95E+00	5.65E+00	1.99E+00	4.88E+00	5.82E+02	3.36E-01	4.04E-01	1.88E+00	1.14E+00	7.16E+02

Caption:

1E+01 is equal to 1 x 10^1

PENRE: Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials; **PERE**: Use of renewable primary energy excluding renewable primary energy resources used as raw materials; **PENRM**: Use of non-renewable primary energy resources used as raw materials; **PERM**: Use of renewable primary energy resources used as raw materials; **PERT**: Total use of renewable primary energy resources; **PENRT**: Total use of non-renewable primary energy resources; **SM**: Use of secondary materials; **RSF**: Use of renewable secondary fuels**; NRSF**: Use of non-renewable secondary fuels; **FW**: Use of net fresh water

5.3. End-of-life-Waste

Table 5- 21 Waste prodcution - LW30-72.5

Environmental Impacts	Unit	Manufacturing stage			Distribution	Installation	Use	End-of-life				Total
		Upstream		Core	Downstream							
HWD	kg	7.00E+00	2.13E-02	4.34E-03	3.33E-02	8.52E-03	1.21E+00	1.05E-03	5.76E-03	2.17E-03	1.12E-03	8.29E+00
NHWD	kg	2.47E+03	1.60E+02	9.52E+01	1.30E+02	3.55E+01	1.33E+03	9.29E-01	4.42E+01	1.05E+01	6.14E+02	4.89E+03
RWD	kg	8.20E-02	6.67E-04	5.67E-03	8.84E-04	3.76E-03	5.94E-01	6.74E-04	2.94E-04	2.82E-03	2.24E-04	6.91E-01

Table 5- 22 Waste prodcution - LW30-252 (GO)

Environmental Impacts	Unit	Manufacturing stage			Distribution	Installation	Use	End-of-life				Total
		Upstream		Core	Downstream							
HWD	kg	3.06E+01	8.10E-02	5.14E-03	9.86E-02	3.25E-02	2.28E+00	1.05E-03	1.70E-02	6.42E-03	5.10E-03	3.31E+01
NHWD	kg	4.34E+03	6.08E+02	1.26E+02	3.84E+02	1.48E+02	2.50E+03	9.29E-01	1.31E+02	3.11E+01	3.07E+03	1.13E+04
RWD	kg	1.22E-01	2.53E-03	7.81E-03	2.61E-03	1.35E-02	1.12E+00	6.74E-04	8.69E-04	8.33E-03	9.61E-04	1.28E+00

Table 5- 23 Waste prodcution - LW30-252 (IO)

Environmental Impacts	Unit	Manufacturing stage			Distribution	Installation	Use	End-of-life				Total
		Upstream		Core	Downstream							
HWD	kg	3.10E+01	8.83E-02	5.35E-03	1.04E-01	2.52E-02	2.28E+00	1.05E-03	1.80E-02	6.81E-03	5.11E-03	3.35E+01
NHWD	kg	6.57E+03	6.63E+02	1.32E+02	4.07E+02	9.18E+01	2.50E+03	9.29E-01	1.38E+02	3.30E+01	3.07E+03	1.36E+04
RWD	kg	1.83E-01	2.76E-03	8.14E-03	2.77E-03	1.31E-02	1.12E+00	6.74E-04	9.21E-04	8.82E-03	9.62E-04	1.34E+00

Table 5- 24 Waste prodcution - LW-40.5

Environmental Impacts	Unit	Manufacturing stage			Distribution	Installation	Use	End-of-life				Total
		Upstream		Core	Downstream							
HWD	kg	3.27E+00	1.05E-02	1.81E-03	2.36E-02	3.16E-03	1.27E+00	1.05E-03	4.08E-03	1.54E-03	4.54E-04	4.59E+00

NHWD	kg	1.73E+03	7.86E+01	4.10E+01	9.19E+01	1.24E+01	1.40E+03	9.29E-01	3.13E+01	7.46E+00	2.77E+02	3.67E+03
RWD	kg	6.20E-02	3.27E-04	2.59E-03	6.26E-04	1.34E-03	6.24E-01	6.74E-04	2.08E-04	1.99E-03	6.04E-05	6.94E-01

Table 5- 25 Waste prodcution - ZW-40.5

Environmental Impacts	Unit	Manufacturing stage			Distribution	Installation	Use	End-of-life				Total
		Upstream		Core	Downstream							
HWD	kg	3.56E+00	1.07E-02	1.45E-03	2.36E-02	2.42E-03	1.27E+00	1.05E-03	4.08E-03	1.54E-03	4.50E-04	4.88E+00
NHWD	kg	1.61E+03	8.07E+01	3.14E+01	9.19E+01	1.14E+01	1.40E+03	9.29E-01	3.13E+01	7.46E+00	3.22E+02	3.58E+03
RWD	kg	5.56E-02	3.36E-04	2.01E-03	6.26E-04	7.43E-04	6.24E-01	6.74E-04	2.08E-04	1.99E-03	2.84E-05	6.86E-01

Table 5- 26 Waste prodcution - LW30-550

Environmental Impacts	Unit	Manufacturing stage			Distribution	Installation	Use	End-of-life				Total
		Upstream		Core	Downstream							
HWD	kg	3.69E+01	1.25E-01	1.26E-02	1.48E-01	3.67E-02	3.82E+00	1.05E-03	2.55E-02	9.62E-03	5.34E-03	4.11E+01
NHWD	kg	9.40E+03	9.36E+02	3.03E+02	5.74E+02	1.80E+02	4.19E+03	9.29E-01	1.96E+02	4.66E+01	3.33E+03	1.92E+04
RWD	kg	3.94E-01	3.90E-03	1.82E-02	3.91E-03	1.37E-02	1.87E+00	6.74E-04	1.30E-03	1.25E-02	9.78E-04	2.32E+00

Table 5- 27 Waste prodcution - LW30-145 (IO)

Environmental Impacts	Unit	Manufacturing stage			Distribution	Installation	Use	End-of-life				Total
		Upstream		Core	Downstream							
HWD	kg	9.28E+00	3.18E-02	4.98E-03	5.49E-02	7.65E-03	1.21E+00	1.05E-03	9.48E-03	3.58E-03	1.42E-03	1.06E+01
NHWD	kg	5.01E+03	2.39E+02	1.12E+02	2.14E+02	2.88E+01	1.33E+03	9.29E-01	7.28E+01	1.73E+01	8.13E+02	7.83E+03
RWD	kg	1.47E-01	9.95E-04	6.68E-03	1.46E-03	3.71E-03	5.94E-01	6.74E-04	4.84E-04	4.64E-03	2.42E-04	7.60E-01

Table 5- 28 Waste prodcution - LW30-145 (GO)

Environmental Impacts	Unit	Manufacturing stage	Distribution	Installation	Use	End-of-life	Total

		Upstream		Core	Downstream						
HWD	kg	8.70E+00	2.52E-02	3.71E-03	4.07E-02	8.65E-03	1.21E+00	1.05E-03	7.03E-03	2.65E-03	1.38E-03	1.00E+01
NHWD	kg	2.41E+03	1.90E+02	9.28E+01	1.59E+02	3.66E+01	1.33E+03	9.29E-01	5.40E+01	1.29E+01	8.13E+02	5.10E+03
RWD	kg	7.46E-02	7.89E-04	5.85E-03	1.08E-03	3.76E-03	5.94E-01	6.74E-04	3.59E-04	3.44E-03	2.40E-04	6.85E-01

Table 5- 29 Waste prodcution - LW30-170 (GO)

Environmental Impacts	**Unit**	**Manufacturing stage**			**Distribution**	**Installation**	**Use**	**End-of-life**				**Total**
		Upstream		Core	Downstream							
HWD	kg	3.06E+01	8.10E-02	5.14E-03	9.86E-02	3.25E-02	2.28E+00	1.05E-03	1.70E-02	6.42E-03	5.10E-03	3.31E+01
NHWD	kg	4.34E+03	6.08E+02	1.26E+02	3.84E+02	1.48E+02	2.50E+03	9.29E-01	1.31E+02	3.11E+01	3.07E+03	1.13E+04
RWD	kg	1.22E-01	2.53E-03	7.81E-03	2.61E-03	1.35E-02	1.12E+00	6.74E-04	8.69E-04	8.33E-03	9.61E-04	1.28E+00

Table 5- 30 Waste prodcution - LW30-170 (IO)

Environmental Impacts	**Unit**	**Manufacturing stage**			**Distribution**	**Installation**	**Use**	**End-of-life**				**Total**
		Upstream		Core	Downstream							
HWD	kg	3.10E+01	8.83E-02	5.35E-03	1.04E-01	2.52E-02	2.28E+00	1.05E-03	1.80E-02	6.81E-03	5.11E-03	3.35E+01
NHWD	kg	6.57E+03	6.63E+02	1.32E+02	4.07E+02	9.18E+01	2.50E+03	9.29E-01	1.38E+02	3.30E+01	3.07E+03	1.36E+04
RWD	kg	1.83E-01	2.76E-03	8.14E-03	2.77E-03	1.31E-02	1.12E+00	6.74E-04	9.21E-04	8.82E-03	9.62E-04	1.34E+00

Caption:

1E+01 is equal to 1 x 10^1

HWD = Hazardous waste disposed; **NHWD** = Non-hazardous waste disposed; **RWD** = Radioactive waste disposed;

5.4. End-of-life-Output flows

Table 5- 31 Output flows - LW30-72.5

Environmental Impacts	Unit	Manufacturing stage			Distribution	Installation	Use	End-of-life				Total
		Upstream		Core	Downstream							
CRU	kg	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
MFR	kg	0.00E+00	0.00E+00	2.03E+02	0.00E+00	6.12E+02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	9.65E+02	1.78E+03
MER	kg	0.00E+00	0.00E+00	1.89E+00	0.00E+00	2.87E+02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.80E+00	2.94E+02
ETE	MJ	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
EEE	MJ	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

Table 5- 32 Output flows - LW30-252 (GO)

Environmental Impacts	Unit	Manufacturing stage			Distribution	Installation	Use	End-of-life				Total
		Upstream		Core	Downstream							
CRU	kg	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
MFR	kg	0.00E+00	0.00E+00	1.15E+02	0.00E+00	1.21E+03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.75E+03	3.08E+03
MER	kg	0.00E+00	0.00E+00	2.81E+00	0.00E+00	5.69E+02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.80E+00	5.76E+02
ETE	MJ	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
EEE	MJ	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

Table 5- 33 Output flows - LW30-252 (IO)

Environmental Impacts	Unit	Manufacturing stage			Distribution	Installation	Use	End-of-life				Total
		Upstream		Core	Downstream							
CRU	kg	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
MFR	kg	0.00E+00	0.00E+00	1.18E+02	0.00E+00	1.76E+03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.05E+03	3.92E+03
MER	kg	0.00E+00	0.00E+00	2.95E+00	0.00E+00	8.10E+02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.80E+00	8.18E+02
ETE	MJ	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
EEE	MJ	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

Table 5- 34 Output flows - LW-40.5

Environmental Impacts	Unit	Manufacturing stage			Distribution	Installation	Use	End-of-life				Total
		Upstream		Core	Downstream							
CRU	kg	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
MFR	kg	0.00E+00	0.00E+00	5.72E+01	0.00E+00	2.63E+02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.40E+02	1.16E+03
MER	kg	0.00E+00	0.00E+00	9.10E-01	0.00E+00	1.31E+02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.00E-01	1.32E+02
ETE	MJ	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
EEE	MJ	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

Table 5- 35 Output flows - ZW-40.5

Environmental Impacts	Unit	Manufacturing stage			Distribution	Installation	Use	End-of-life				Total
		Upstream		Core	Downstream							
CRU	kg	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
MFR	kg	0.00E+00	0.00E+00	2.91E+01	0.00E+00	2.63E+02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.89E+02	1.08E+03
MER	kg	0.00E+00	0.00E+00	6.94E-01	0.00E+00	1.31E+02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.32E+02
ETE	MJ	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
EEE	MJ	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

Table 5- 36 Output flows - LW30-550

Environmental Impacts	Unit	Manufacturing stage			Distribution	Installation	Use	End-of-life				Total
		Upstream		Core	Downstream							
CRU	kg	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
MFR	kg	0.00E+00	0.00E+00	4.52E+02	0.00E+00	2.09E+03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.76E+02	3.32E+03
MER	kg	0.00E+00	0.00E+00	4.27E+00	0.00E+00	9.96E+02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.00E+03
ETE	MJ	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
EEE	MJ	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

Table 5- 37 Output flows - LW30-145(IO)

Environmental Impacts	Unit	Manufacturing stage			Distribution	Installation	Use	End-of-life				Total
		Upstream		Core	Downstream							
CRU	kg	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
MFR	kg	0.00E+00	0.00E+00	2.04E+02	0.00E+00	8.16E+02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.80E+03	2.82E+03
MER	kg	0.00E+00	0.00E+00	2.32E+00	0.00E+00	3.83E+02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.80E+00	3.90E+02
ETE	MJ	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
EEE	MJ	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

Table 5- 38 Output flows - LW30-145(GO)

Environmental Impacts	Unit	Manufacturing stage			Distribution	Installation	Use	End-of-life				Total
		Upstream		Core	Downstream							
CRU	kg	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
MFR	kg	0.00E+00	0.00E+00	7.10E+01	0.00E+00	4.41E+02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.06E+03	1.57E+03
MER	kg	0.00E+00	0.00E+00	1.37E+00	0.00E+00	2.02E+02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.80E+00	2.09E+02
ETE	MJ	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
EEE	MJ	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

Table 5- 39 Output flows - LW30-170(GO)

Environmental Impacts	Unit	Manufacturing stage			Distribution	Installation	Use	End-of-life				Total
		Upstream		Core	Downstream							
CRU	kg	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
MFR	kg	0.00E+00	0.00E+00	1.15E+02	0.00E+00	1.21E+03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.75E+03	3.08E+03
MER	kg	0.00E+00	0.00E+00	2.81E+00	0.00E+00	5.69E+02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.80E+00	5.76E+02
ETE	MJ	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
EEE	MJ	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

Table 5- 40 Output flows - LW30-170(IO)

Environmental Impacts	Unit	Manufacturing stage			Distribution	Installation	Use	End-of-life				Total
		Upstream		Core	Downstream							
CRU	kg	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
MFR	kg	0.00E+00	0.00E+00	1.18E+02	0.00E+00	1.76E+03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.05E+03	3.92E+03
MER	kg	0.00E+00	0.00E+00	2.95E+00	0.00E+00	8.10E+02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.80E+00	8.18E+02
ETE	MJ	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
EEE	MJ	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

Caption:

1E+01 is equal to 1 x 10^1

CRU = Components for re-use; **MFR** = Materials for recycling; **MER** = Materials for energy recovery; **EEE** = Exported electrical energy; **EET** = Exported thermal energy

6. Calculation rules

6.1. Functional unit

A single unit of the circuit breaker.

6.2. Reference service of life

20 years

6.3. Assumptions

The key assumptions of this LCA study are as follows：

- For missing background data, the substitution of missing data using a similar background data approach was taken to shorten the gap, when this approach is used in this study, it is declared;
- Circuit breakers contain many pieces of components, and the majority of them are made from metals like steel, aluminium alloy, and copper, etc. Thus, the raw materials are categorized and grouped into steel, stainless steel, aluminium alloy, copper, and plastic based on its main constituents;
- During the installation stage, since there is no primary data for energy consumption, an assumption is made by assuming that the high voltage electric equipment is installed by a crane with the power of 50kW for 1 hour, thus the power consumption is 50kWh, a sensitivity analysis is conducted;
- The power consumption of de-installation is assumed to be the same as the installation stage, and the dismantling process of the waste processing stage is modelled by using Ecoinvent waste processing data ‘waste electric and electronic equipment, treatment of, shredding’;
- During the end-of-life stage, the transportation of the waste to treatment facilities including recycling, landfill, or incineration center is assumed to be 200 km for simplification purposes. A sensitivity analysis is conducted.

6.4. Cut-off rules

The following procedures were followed for the inclusion and exclusion of inputs and outputs:

- All inputs and outputs to a (unit) process will be included in the calculation for which data is available. Data gaps may be filled by conservative assumptions with average or generic data. Any assumptions for such choices will be documented;
- According to PCR, data for elementary flows to and from the product system contributing to a minimum of 99% of the declared environmental impacts shall be included. Therefore, the cut-off criteria were set to 1% in this study.

Table 6- 1 Cut-off flows

Flow name	Process stage	Mass %	Criteria to cut-off
Production, use, and disposal of the packaging of components and semi-finished intermediates;	A3	N/A	Specified in PCR
Devices external to the switch itself (e.g. switchboards) required for installation	A5	N/A	Cut-off due to small impact according to PCR
Any extraordinary maintenance done on the switch	B	N/A	Specified in PCR
Total cut-off mass % estimated			<1%

6.5. Data quality

Primary data (such as materials or energy flows that enter and leave the production system) is from Taikai manufacturing facilities in year 2021 (annual average). Generic data related to the life cycle impacts of the material or energy flows that enter and leave the production system is sourced from Ecoinvent 3.9 "allocation, cut-off by allocation - unit" database. SimaPro is one of the world's most widely used LCA software and the data in it comes predominantly from Ecoinvent, the world's most complete and widely used set of data on industrial processes, material production, packaging production, transport, and so on.

6.6. Allocations

Allocation refers to the partitioning of input or output flows of a process or a product system between the product systems under study and one or more other product systems. In this study, there are two types of allocation procedures considered:

Allocation between co-products

In the production of circuit breakers, the energy and water consumption that took place in the processing workshop and shell workshop are allocated based on the economic value of the materials, while the energy consumption in the assembly workshop is allocated based on the total mass of the products. No other by-products are produced from the same production line. Hence there is no need to allocate the energy or water consumption to other products.

Allocation for recovery operations

For the allocation of reuse, recycling and recovery, the polluter pays principle (PPP) is followed in this report. This means that the waste transportation to the treatment site and the waste processing (mainly shredding) is considered in this report, while the benefit, the load from waste treatment for recycling purposes such as de-pollution and crushing, etc., is allocated to the next life cycle of substituted products, but not the primary producers, hence no burden or benefit will be allocated to the primary producer of the electric products (cut-off approach).

6.7. Electricity mix

The manufacturing of circuit breakers occurs in Shandong province, so China's northern medium-voltage electricity mix is used. As for the downstream module, the high voltage equipment’s installation, operation, and end-of-life stage are assumed to take place in Italy, so Italy's average grid medium-voltage electricity mix is used.

7. LCA calculation scenarios

7.1. Distribution

The products are firstly transported from the manufacturing site to Qingdao Port via lorry, the transportation distance is 345km, Then, the products are transported through container ship from Qingdao Port to Italy, Genoa is chosen as the target port. The oceanic transportation distance from Qingdao Port to Genoa is 8896 nautical miles (16475 km). Lastly, the products will be transported from Genoa to the target place, an estimated distance of 200km is assumed in this study.

7.2. Installation

During the installation stage, the products are installed in the substation, where crane is generally assumed for installation, the power output is assumed 50kW, and the installation time is assumed as 1h. Therefore, the electricity consumption during the installation stage is 50kWh, a sensitivity analysis will be conducted further to study the impact of this assumption. SF6 is injected in this stage, and the

consumption of other materials are also considered. As for the waste generated during the installation stage, the waste will be sold to the local company for treatment and recycling, this data is unavailable at this stage, thus only the waste transportation is considered in this study, a transportation distance 200km is assumed in this study. The treatment of the waste wood pallets is modeled as 75% recycling and 25% incineration.

7.3. Use & Maintenance

As specified in the PCR, the following formula is to be used to calculate the electricity consumed during the product's service life:

$$\mathrm{E_{use}[kWh]} = \frac{P_{use} * 8760 * RSL * \alpha}{1000}$$

where: P_{use} is the power consumed by the switch at a given value of current; RSL is the service life of the product, assumed to be 20 years; 8760 is the number of hours in a year; α is a coefficient describing the amount of time in which the switch is requested to operate its function, according to PCR, 30% is selected for high voltage equipment; 1000 is the conversion factor that allows the energy consumed in kWh over the product's service life to be expressed.

The power use during the use phae of circuit breakers considering a three phase system is calculated using the bleow formulla:

$$P_{use} = I_r^2 \times R \times 3$$

where, Ir (s) is the reference current of a given value, which is 50% of the nominal current as specified in the PCR, R (μΩ) is the circuit resistance.

The parameters used for calculation of each product and the electricity consumption are listed in the table below.

Table 4- 3 Power consumption of circuit breakers

Circuit breakers	Rated Current, I (A)	Single phase resistance, R (μΩ)	Puse (W)	Euse (kWh)
LW30-72.5	3150	60	893	46937
LW30-252 (GO)	4000	70	1680	88301
LW30-170 (GO)	4000	70	1680	88301
LW30-252 (IO)	4000	70	1680	88301
LW30-170 (IO)	4000	70	1680	88301
LW-40.5	2500	100	938	49275
ZW-40.5	2500	100	938	49275
LW30-550	5000	75	2813	147825
LW30-145 (IO)	3150	60	893	46937
LW30-145 (GO)	3150	60	893	46937

For the maintenance of the electric products, the Taikai high-voltage electric equipments are designed to be free of maintenance during its service life. The product is proclaimed to have a reliable sealing performance, thus requires no additional recharge of SF6 during its service life. Therefore, no inputs and outputs are taken place in maintenance stage in this study.

7.4. End-of-life

For the end-of-life stage, the De-construction (C1) of the electric products during the end-of-life stage is assumed to use only electricity, and the electricity consumption is assumed to be the same as the construction stage (A5). 200km transportation distance from plant site to waste treatment site (C2) is assumed, and waste processing (C3) stage is modeled using general processing data from Ecoinvent 3.7 database. For the end-of-life disposal process (C4), the existing data of recycling rate and disposal rate for circuit breakers and disconnect switches is missing. Thus, the IEC/TR 62635 guidelines are referred. The recycling rate for steel, stainless steel, aluminum, and copper is 95%, as listed below. Following the end-of-life load and benefit allocation approach, the reuse, recovery and/or recycling potentials not declared in this study. Therefore, 5% of the metal components will end up in the incineration treatment. As for porcelain and bushing, it is assumed that all of them will end up in landfills as they are inert materials, and recycling them has no obvious benefit. A sensitivity analysis is further conducted in section 7 to see the impacts of various disposal scenarios on the final results. The end-of-life treatment of SF6 is modelled by referring to a literature (Shiojiri et al. 2006), where the SF6 is firstly removed by a vacuum pump with a leakage of 3%, then it is purified through a membrane separation process with 0.25% of leakage. And finally, the purified gas is decomposed by a lowtemperature plasma. The leakage and energy consumption of each process is considered in the study.

8. References

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