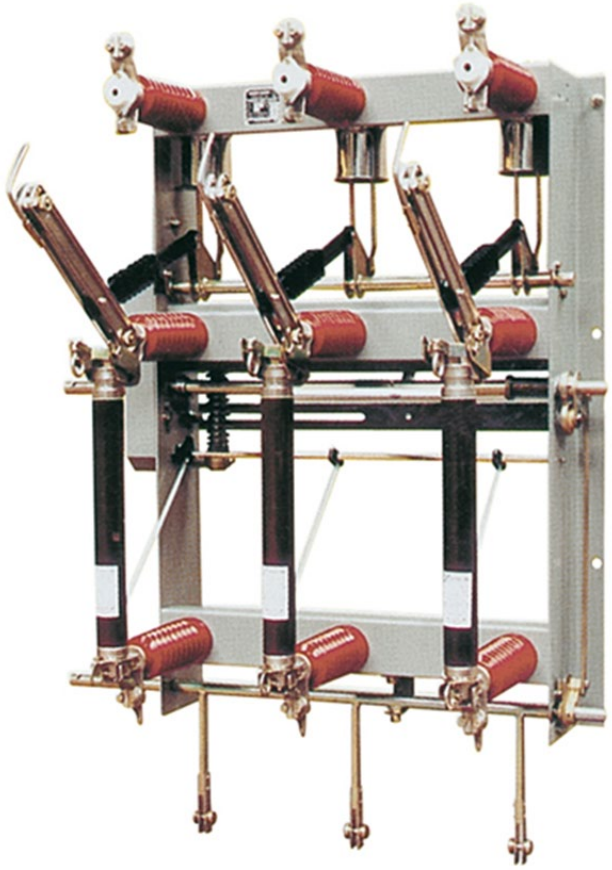
ENVIRONMENTAL PRODUCT DECLARATION

In compliance with ISO 14025 and EN 50693:2019



Load-break switches (LBS) DY 515/1, DY 515/2 and DY 516/2

Site Plant: Via Provinciale, 568 - 24059 Urgnano (BG), Italy

Program operator	EPDItaly
Publisher	EPDItaly
Declaration number	IME01
Registration number	EPDITALY0471
Issue date	31/05/2023
Valid to	30/05/2028

GENERAL INFORMATION

EPD owner	**IMEQUADRI DUESTELLE SpA.** Via Provinciale, 568 - 24059 Urgnano (BG), Italy
Production site	**IMEQUADRI DUESTELLE SpA.** Via Provinciale, 568 - 24059 Urgnano (BG), Italy
Reference product	Load-break switches (LBS) DY 515/1, DY 515/2 and DY 516/2 produced by Imequadri Duestelle S.p.A.
Program operator	EPDItaly https://www.epditaly.it/; info@epditaly.it
Third-party verification	Independent verification of the declaration and data, in compliance with ISO 14025:2010. ☐ Internal ☒ External Verification conducted by: SGS Italia SpA Via Caldera 21, 20153 Milano (www.sgs.com) (Accredited by Accredia. Accreditation n.006H)
CPC Code	46211 – "Electrical apparatus for switching or protecting electrical circuits, for making connections to or in electrical circuits, for a voltage exceeding 1000 V"
Reference PCR	Core-PCR EPDItaly007 "Electronic and electrical products and systems", rev. 3, 2023/01/13 [PCR Committee: ICMQ S.p.A. – Via G. De Castillia, 10. Eng. Elena Neri, Indaco2. Moderator: Ing. Ugo Pannuti, ICMQ Spa] Sub-PCR EPDItaly012 "Switches" REV. 0 – 2020/03/16 [PCR Committee: Bticino S.p.A., CESI S.p.A., ECAMRICERT, Take Care International, ENEL S.p.A.; Moderator: Stefano Rossi, Life Cycle Engineering]
Other reference documents	Regulation of the EPDItaly Programme – rev. 5.2 EN 50693:2019 "Product category rules for life cycle assessments of electronic and electrical products and systems".
Company contact	Antonio Rota antonio.rota@imequadriduestelle.it
Study developed by	Valentina Castellani, Sustainability consultant
Declaration of responsibility	The owner of the declaration will be responsible for the information and supporting evidence. EPDItaly disclaims any liability regarding the manufacturer's information data.
Comparability	EPDs relating to the same category of products but belonging to different programmes may not be comparable.
Type of the EPD	Product EPD

COMPANY INFORMATION

IME Group operates on the market of electrical switchgears and other products and systems for the generation, transmission and distribution of electricity. Giulio Primavesi founded the company in the '20s. At the beginning, in a laboratory of 40 sqm in Milan, they build frames and electrical equipment for industrial use. Soon, the artisan workshop turned into a company with 60 employees. After World War II, the company continued its growth, with a new settlement in Monza, and in 1962 with the foundation of IME S.p.A. in Urgnano, became what is today a well-know, highly qualified and specialized group, grown also through acquisitions of other companies, as Elettromeccanica Duestelle in Castellanza at the beginning of the '90s. Over 50 years of activity, IME Group today is a reference point on the market of medium and low voltage electrical switchgears and electromechanical installations. The Group operates with four companies:

- Imequadri Duestelle S.p.A., which designs and produces a wide range of Medium and Low Voltage Electrical Swicthgears, Motor controlgears, Panelboards, Busducts, Containerized package units as well as specific MV components for OEM's re-sales market.
- Imemont S.r.l., whose operation range includes engineering, installation testing and commissioning of electrical and electro-instrumental plants and substations up to 380 KV for industrial facilities and energy users.
- Enneci S.r.l., with a core business focused on the realization of renewable energies power plants, especially solar parks.
- Imeromelectrica S.r.l., which is a technical and commercial branch, based in Bucarest, Romania.

SCR-SGV series products are manufactured by Imequadri Duestelle S.p.A. The manufacturing activity of Imequadri Duestelle is based in Urgnano (BG), with a factory of more than 25,000 sqm (16,000 sqm indoor). The site includes financial, sales, and technical offices and production plants with workshop, mounting, wiring departments, prototypes laboratories and testing rooms.
Imequadri highly regards innovation as one of the key-factors for business success and customer satisfaction; consequently, a dedicated "Research & Development" team of skillful engineers has always been considered by the company something to be proud of. Thanks to this team, on a yearly basis, new products and solutions are carefully designed and created in line with market's requirements and expectations.
The Production is organized in the following Business Divisions:

- The Switchgear Division designs and manufactures Medium and Low Voltage switchgears & panel units, complying with company quality standards or with specific customer's requirements.
- The MV Equipment Division designs and manufactures indoor MV Switches, Load Break Switches, Disconnectors (Air or SF6 gas-insulated), and Earthing Switches for panel/wall mounting solutions.

Imequadri Duestelle has obtained ISO 9001:2015, ISO 14001:2015, and ISO 45001:2018 certifications.

LIFE CYCLE ASSESSMENT INFORMATION

The company undertook the LCA study having as main goal to obtain EPDItaly certification of the environmental impact generated by the product during its life cycle, to be communicated to its clients. Other potential uses of the study include the identification of hotspots in the product life cycle, in support to the definition of improvement measures, and the monitoring of results over time.

The scope of the EPD is "from cradle to grave". It includes the modules illustrated in Table 3, according to EN 50639:2019.

Table 1 – Modules included in the EPD

Manufacturing		Distribution	Installation	Use & Maintenance	End-of-Life
Upstream module	Core module	Downstream module			
Extraction of raw materials, and production of LBS components Transportation of raw materials and components to the manufacturing company	Metalworking (cutting and shaping of laminated steel; turning and milling of metal parts) Assembly of the LBS Testing Product packaging	Transport of product to the site of installation	Installation of product and disposal of packaging materials	Energy consumption during the service life	De-installation of product and EoL of product materials

Geographical scope: the geographical scope of the study is Italy.

Temporal scope: The temporal scope of the study is 2022-2023, and the following 20 years assumed as service life of the product (starting from the year of production and installation, i.e. 2023). The temporal scope associated to the inventory data collected is 2022, which is the last calendar year for which a full set of records regarding electricity, natural gas and water use was available at the time of the study.

Database and LCA software used: the LCI of the system has been modelled in SimaPro software, version 9.4, using ecoinvent 3.8 LCI library.

Cut-off and exclusions: Following the PCR EPDItaly 007, the following flows and operation has been cut-off: production, use and disposal of the packaging of components and semi-finished intermediates; any extraordinary maintenance done on the LBS; Materials and energy flows related to the dismantling phase, because it is assumed that it is performed by adopting manual tools. In addition, cut-off is applied to scraps deriving from manufacturing activities of Imequadri Duestelle's suppliers, because data were not available.

Allocation: Commodities use (electricity, natural gas and water) related to the activities performed in Imequadri Duestelle production site (in Urgnano) have been estimated by allocation of the total consumption of the production site in one year to the production of the products under study. Allocation has been performed by multiplying the hourly consumption by the number of working hours dedicated to the production of one piece of the products under study.

Declared unit: a single LBS that establishes or interrupts the electrical continuity of the circuit to witch is applied, during a service life of 20 years**.** The associated reference flow is 1 piece of each of the products analyzed.

System boundary: see description of production process and inventory assumptions and scenarios.

PRODUCT SYSTEMS ANALYZED

The product systems analyzed correspond to three products belonging to the SCR-SGV product family: DY 515/1, DY 515/2 and DY 516/2 load-break switches (LBS) produced by Imequadri Duestelle S.p.A.

The SCR switches are designed for indoor installation and are intended to be fixed to wall in substations. They are called “hinge” type as the movable contacts perform closing and opening from the fixed contacts by acting precisely on a hinge on which rotation of contacts occurs.

These devices are intended to ensure the flow of current in closed position, the isolation of the circuit in open position, and are also capable of breaking the rated current and establishing any short-circuit currents. The extinction of the arc is due by the puff of the air generated by three cylinders with self-blowing pistons (one per phase). The products comply with IEC / IEC 62271-103 and IEC /CEI EN 62271-1 and equipped with all the type tests required.

The expected lifetime of the products is 20 years. Main technical specifications of the switches analyzed are detailed in Table 2.

Table 2 – Technical specifications of SCR-SGV load-break switches

Property	Unit	DY 515/1	DY 515/2	DY 516/2
Nominal voltage	kV	24	24	24
Nominal current intensity	A	400	400	40
Rated mainly active load breaking current	A	400	400	40
Rated short-circuit current for 1”	kA	12.5	12.5	12.5
Rated short-circuit making current	kA	31.5	31.5	31.5
Number of poles of the switch	nr	3	3	3
Resistance of the pole	μΩ	132	132	55500
Nominal short-circuit breaking capacity	-	N.A.*	N.A.*	N.A.*

* The parameter is not applicable because this kind of products are not designed for breaking short-circuit current

The following table illustrate the material content of the LBS. The products are compliant to the requirements of the European directive "2011/65/EU ROHS 2 - Restriction of dangerous substances in electrical and electronical equipment".

Table 3 – Material content

Material		DY 515/1		DY 515/2		DY 516/2	
		kg	%	kg	%	kg	%
Metals	Steel	82.23	*79,5%*	55.89	*72,5%*	63.28	*72,8%*
	Aluminium	0.02	*0,0%*	0.02	*0,0%*	0.02	*0,0%*
	Brass	4.92	*4,8%*	4.92	*6,4%*	7.74	*8,9%*
	Bronze	0.00	*0,0%*	0.00	*0,0%*	0.23	*0,3%*
	Copper	7.16	*6,9%*	7.16	*9,3%*	5.62	*6,5%*
Plastics	Glass reinforced plastic	0.00	*0,0%*	0.00	*0,0%*	0.08	*0,1%*
	Nylon	0.51	*0,5%*	0.51	*0,7%*	0.66	*0,8%*
	Polycarbonate	1.11	*1,1%*	1.11	*1,4%*	0.56	*0,6%*
	Polystyrene	0.00	*0,0%*	0.05	*0,1%*	0.00	*0,0%*
	Rubber	1.04	*1,0%*	1.04	*1,3%*	0.00	*0,0%*
	Epoxy resin	5.70	*5,5%*	5.70	*7,4%*	8.70	*10,0%*
Other	Electronics	0.70	*0,7%*	0.70	*0,9%*	0.00	*0,0%*
	Total	**103.37**	*100%*	**77.08**	*100%*	**86.88**	*100%*

PRODUCTION PROCESS AND INVENTORY ANALYSIS

The study is cradle-to-grave, i.e. it includes all the life cycle phases of the product under investigation, from the extraction of raw materials to the dismantling and End of Life (EoL) of the product. The life cycle phases of the system under study are illustrated in Figure 1.

Figure 1 – Life cycle of LBS DY 515/1, DY 515/2 and DY 516/2

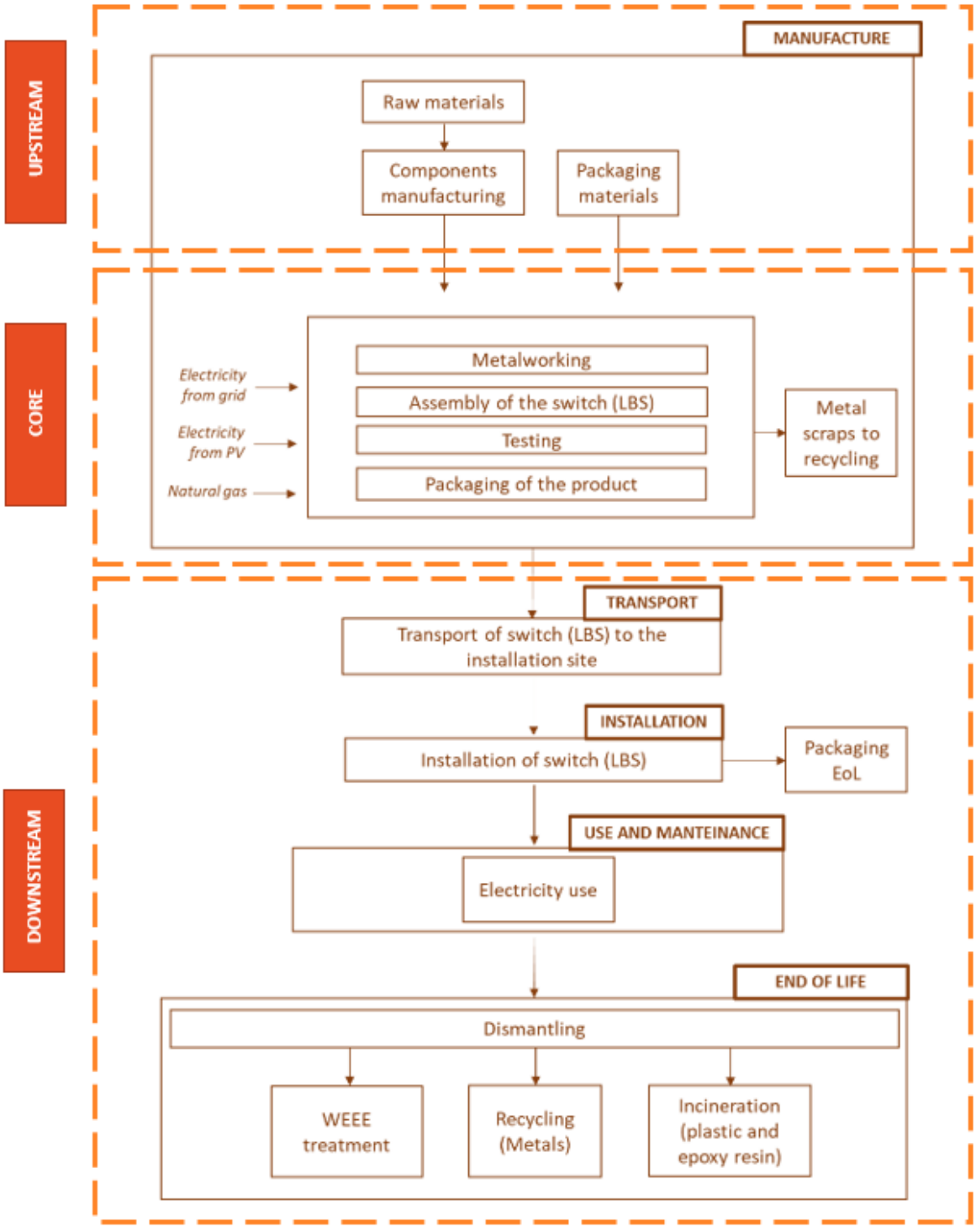


Table 4 – Main characteristics of the inventory analysis

<table>
<tr><th>Life cycle stage</th><th>Description and assumptions</th></tr>
<tr><td>Upstream</td><td>Manufacture of components is modelled based on project documents (materials and weight, including scraps) and considering the transport distance from the supplier to Imequadri Duestelle production site (calculated using Google maps).</td></tr>
<tr><td>Core</td><td>Production of the LBSs implies the use of electricity, natural gas and water. These inputs were calculated considering the hourly consumption of the production plant in 2022 and the hours worked for the manufacture of one piece of each of the products under study.

Electricity use in Urgnano production site is modelled considering the share from the local PV panel system and from the national grid. Electricity from the grid is certified as 100% from renewable sources by the electricity supplier, through certificates of orgin issued by the national competent body, and it is modelled using a dataset representing the renewable share of medium voltage residual electricity mix in Italy, which was created following the information reported in the document “European Residual Mixes 2021”, by the Association of Issuing Bodies.</td></tr>
<tr><td>Distribution</td><td>The LBSs will be installed in Italy, but the exact site is unknown, so the distribution scenario provided by the reference PCR (PCR EPDItaly012) has been used. It corresponds to a transport by EURO4 truck for 300km.</td></tr>
<tr><td>Installation</td><td>Installation is done manually, so this phase includes only the End of Life (EoL) of the product packaging (board box and wood pallet). The packaging materials are recycled.</td></tr>
<tr><td>Use and maintenance</td><td>The electricity consumed during the product’s service life is calculated through the following formula, provided by PCR EPDItaly012:

$$Euse\ [kWh] = Puse * 8760 * RSL * \alpha\ /\ 1000$$

The parameters considered for the three products under study, and the resulting electricity consumption are reported in the table below.
<table>
<tr><th>Product</th><th>N_{poles}</th><th>R (μΩ)</th><th>In (A)</th><th>Rerefence current (%)</th><th>P_{use}(W)</th><th>RSL</th><th>α</th><th>E_{use} (kWh)</th></tr>
<tr><td>DY 515/1</td><td>3</td><td>132</td><td>400</td><td>50%</td><td>15.84</td><td>20</td><td>30%</td><td>832.55</td></tr>
<tr><td>DY 515/2</td><td>3</td><td>132</td><td>400</td><td>50%</td><td>15.84</td><td>20</td><td>30%</td><td>832.55</td></tr>
<tr><td>DY 516/2</td><td>3</td><td>55 500</td><td>40</td><td>50%</td><td>66.6</td><td>20</td><td>30%</td><td>3500.50</td></tr>
</table></td></tr>
<tr><td>End of Life (EoL)</td><td>The EoL scenario for the materials in the LBSs assumes: recycling of metals, incineration of plastics and treatment of WEEE in a dedicated waste flow.</td></tr>
</table>

ENVIRONMENTAL PERFORMANCE

The following tables report the results of environmental indicators, resource use indicators, and waste production indicators, expressed with reference to the declared unit of the study (D.U.), i.e. one piece of LBS with a service life of 20 years, for the three products analyzed.

Table 5. Results of indicators describing environmental impacts per D.U. of DY 515/1

			Upstream	Core		Downstream							
Impact category	**Unit**	**Total**	**Manufacturing**			**Distribution**		**Installation**		**Use and maintenance**		**EoL**	
Climate change	kg CO2 eq	**8.85E+02**	4.59E+02	1.13E+01	*53%*	5.96E+00	*1%*	2.49E+01	*3%*	3.62E+02	*41%*	2.14E+01	*2%*
Climate change - Fossil	kg CO2 eq	**8.44E+02**	4.73E+02	1.12E+01	*57%*	5.95E+00	*1%*	1.40E-01	*0%*	3.32E+02	*39%*	2.14E+01	*3%*
Climate change - Biogenic	kg CO2 eq	**4.01E+01**	-1.50E+01	1.04E-01	*-37%*	5.40E-03	*0%*	2.48E+01	*62%*	3.02E+01	*75%*	3.40E-03	*0%*
Climate change - Land use and LU change	kg CO2 eq	**6.47E-01**	5.99E-01	1.86E-03	*93%*	2.36E-03	*0%*	5.55E-05	*0%*	4.31E-02	*7%*	7.60E-04	*0%*
Ozone depletion	kg CFC11 eq	**8.48E-05**	3.57E-05	1.40E-06	*44%*	1.39E-06	*2%*	3.27E-08	*0%*	4.58E-05	*54%*	3.89E-07	*0%*
Acidification	mol H+ eq	**1.32E+01**	1.16E+01	2.74E-02	*88%*	3.01E-02	*0%*	7.10E-04	*0%*	1.53E+00	*12%*	1.24E-02	*0%*
Eutrophication, freshwater	kg P eq	**7.62E-01**	6.83E-01	1.31E-03	*90%*	3.87E-04	*0%*	9.10E-06	*0%*	7.67E-02	*10%*	1.57E-04	*0%*
Photochemical ozone formation	kg NMVOCeq	**3.67E+00**	2.87E+00	1.74E-02	*79%*	3.24E-02	*1%*	7.62E-04	*0%*	7.29E-01	*20%*	1.40E-02	*0%*
Resource use, minerals and metals	kg Sb eq	**2.35E-01**	2.34E-01	5.95E-05	*100%*	2.09E-05	*0%*	4.91E-07	*0%*	7.28E-04	*0%*	6.49E-06	*0%*
Resource use, fossils	MJ	**1.16E+04**	6.21E+03	1.67E+02	*55%*	9.07E+01	*1%*	2.13E+00	*0%*	5.10E+03	*44%*	2.63E+01	*0%*
Water use	m3 depriv.	**5.24E+02**	2.88E+02	9.71E+00	*57%*	2.72E-01	*0%*	6.40E-03	*0%*	2.24E+02	*43%*	1.01E+00	*0%*

Table 6. Results of indicators describing environmental impacts per D.U. of DY 515/2

			Upstream	Core		Downstream							
Impact category	**Unit**	**Total**	**Manufacturing**			**Distribution**		**Installation**		**Use and maintenance**		**EoL**	
Climate change	kg CO2 eq	**7.82E+02**	3.57E+02	1.13E+01	*47%*	4.66E+00	*1%*	2.49E+01	*3%*	3.62E+02	*46%*	2.11E+01	*3%*
Climate change - Fossil	kg CO2 eq	**7.44E+02**	3.75E+02	1.12E+01	*52%*	4.65E+00	*1%*	1.40E-01	*0%*	3.32E+02	*45%*	2.11E+01	*3%*
Climate change - Biogenic	kg CO2 eq	**3.66E+01**	-1.85E+01	1.04E-01	*-50%*	4.22E-03	*0%*	2.48E+01	*68%*	3.02E+01	*83%*	3.05E-03	*0%*
Climate change - Land use and LU change	kg CO2 eq	**5.50E-01**	5.02E-01	1.86E-03	*92%*	1.84E-03	*0%*	5.55E-05	*0%*	4.31E-02	*8%*	6.05E-04	*0%*
Ozone depletion	kg CFC11 eq	**7.74E-05**	2.87E-05	1.40E-06	*39%*	1.08E-06	*1%*	3.27E-08	*0%*	4.58E-05	*59%*	2.98E-07	*0%*
Acidification	mol H+ eq	**1.22E+01**	1.06E+01	2.74E-02	*87%*	2.36E-02	*0%*	7.10E-04	*0%*	1.53E+00	*13%*	1.04E-02	*0%*
Eutrophication, freshwater	kg P eq	**7.12E-01**	6.34E-01	1.31E-03	*89%*	3.02E-04	*0%*	9.10E-06	*0%*	7.67E-02	*11%*	1.31E-04	*0%*
Photochemical ozone formation	kg NMVOCeq	**3.27E+00**	2.49E+00	1.74E-02	*77%*	2.53E-02	*1%*	7.62E-04	*0%*	7.29E-01	*22%*	1.17E-02	*0%*
Resource use, minerals and metals	kg Sb eq	**2.32E-01**	2.31E-01	5.95E-05	*100%*	1.63E-05	*0%*	4.91E-07	*0%*	7.28E-04	*0%*	5.15E-06	*0%*
Resource use, fossils	MJ	**1.03E+04**	4.98E+03	1.67E+02	*50%*	7.09E+01	*1%*	2.13E+00	*0%*	5.10E+03	*49%*	2.03E+01	*0%*
Water use	m3 depriv.	**4.87E+02**	2.52E+02	9.71E+00	*54%*	2.12E-01	*0%*	6.40E-03	*0%*	2.24E+02	*46%*	1.00E+00	*0%*

Table 7. Results of indicators describing environmental impacts per D.U. of DY 516/2

			Upstream	Core		Downstream							
Impact category	**Unit**	**Total**	**Manufacturing**			**Distribution**		**Installation**		**Use and maintenance**		**EoL**	
Climate change	kg CO2 eq	**1.97E+03**	3.66E+02	8.04E+00	*19%*	5.73E+00	*0%*	4.18E+01	*2%*	1.52E+03	*77%*	2.50E+01	*1%*
Climate change - Fossil	kg CO2 eq	**1.83E+03**	3.99E+02	7.96E+00	*22%*	5.73E+00	*0%*	2.39E-01	*0%*	1.40E+03	*76%*	2.50E+01	*1%*
Climate change - Biogenic	kg CO2 eq	**1.35E+02**	-3.35E+01	7.44E-02	*-25%*	5.20E-03	*0%*	4.16E+01	*31%*	1.27E+02	*94%*	3.55E-03	*0%*
Climate change - Land use and LU change	kg CO2 eq	**7.17E-01**	5.32E-01	1.33E-03	*74%*	2.27E-03	*0%*	9.46E-05	*0%*	1.81E-01	*25%*	6.91E-04	*0%*
Ozone depletion	kg CFC11 eq	**2.27E-04**	3.18E-05	1.00E-06	*14%*	1.34E-06	*1%*	5.57E-08	*0%*	1.93E-04	*85%*	3.37E-07	*0%*
Acidification	mol H+ eq	**1.72E+01**	1.07E+01	1.96E-02	*62%*	2.90E-02	*0%*	1.21E-03	*0%*	6.45E+00	*37%*	1.20E-02	*0%*
Eutrophication, freshwater	kg P eq	**9.93E-01**	6.69E-01	9.35E-04	*67%*	3.72E-04	*0%*	1.55E-05	*0%*	3.23E-01	*32%*	1.51E-04	*0%*
Photochemical ozone formation	kg NMVOCeq	**5.73E+00**	2.60E+00	1.24E-02	*46%*	3.12E-02	*1%*	1.30E-03	*0%*	3.06E+00	*54%*	1.35E-02	*0%*
Resource use, minerals and metals	kg Sb eq	**2.27E-01**	2.24E-01	4.25E-05	*99%*	2.01E-05	*0%*	8.38E-07	*0%*	3.06E-03	*1%*	5.88E-06	*0%*
Resource use, fossils	MJ	**2.71E+04**	5.41E+03	1.19E+02	*20%*	8.73E+01	*0%*	3.64E+00	*0%*	2.14E+04	*79%*	2.31E+01	*0%*
Water use	m3 depriv.	**1.21E+03**	2.64E+02	6.94E+00	*22%*	2.62E-01	*0%*	1.09E-02	*0%*	9.42E+02	*78%*	1.19E+00	*0%*

Table 8. Results of parameters describing resource use, referred to the D.U. of DY 515/1

Indicator	Unit	Total	Manufacturing		Distribution	Installation	Use and Maintenance	EoL
			Upstream	Core	Downstream			
Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw material (PENRE)	MJ	**1.13E+04**	5.94E+03	1.67E+02	9.07E+01	2.13E+00	5.10E+03	2.63E+01
Use of renewable primary energy excluding renewable primary energy resources used as raw material (PERE)	MJ	**2.23E+03**	8.81E+02	2.62E+01	1.28E+00	3.01E-02	1.32E+03	4.66E-01
Use of non-renewable primary energy resources used as raw material (PENRM)	MJ	**2.76E+02**	2.76E+02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Use of renewable primary energy resources used as raw material (PERM)	MJ	**3.10E+02**	3.10E+02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Total use of non-renewable primary energy resources (primary energy and primary energy resources used as raw materials) (PENRT)	MJ	**1.16E+04**	6.21E+03	1.67E+02	9.07E+01	2.13E+00	5.10E+03	2.63E+01
Total use of renewable primary energy resources (primary energy and primary energy resources used as raw materials) (PERT)	MJ	**2.54E+03**	1.19E+03	2.62E+01	1.28E+00	3.01E-02	1.32E+03	4.66E-01
Net use of fresh water (FW)	m^3	**1.43E+01**	8.01E+00	2.41E-01	1.15E-02	2.70E-04	6.00E+00	3.24E-02
Use of secondary materials (MS)	kg	**0.00E+00**	0.00E+00	0.00E+00	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	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	0.00E+00	0.00E+00	0.00E+00

Table 9. Results of parameters describing resource use, referred to the D.U. of DY 515/2

Indicator	Unit	Total	Manufacturing		Distribution	Installation	Use and Maintenance	EoL
			Upstream	Core	Downstream			
Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw material (PENRE)	MJ	**1.00E+04**	4.71E+03	1.67E+02	7.09E+01	2.13E+00	5.10E+03	2.04E+01
Use of renewable primary energy excluding renewable primary energy resources used as raw material (PERE)	MJ	**2.10E+03**	7.53E+02	2.62E+01	9.99E-01	3.01E-02	1.32E+03	3.82E-01
Use of non-renewable primary energy resources used as raw material (PENRM)	MJ	**2.78E+02**	2.78E+02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Use of renewable primary energy resources used as raw material (PERM)	MJ	**3.10E+02**	3.10E+02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Total use of non-renewable primary energy resources (primary energy and primary energy resources used as raw materials) (PENRT)	MJ	**1.03E+04**	4.98E+03	1.67E+02	7.09E+01	2.13E+00	5.10E+03	2.04E+01
Total use of renewable primary energy resources (primary energy and primary energy resources used as raw materials) (PERT)	MJ	**2.41E+03**	1.06E+03	2.62E+01	9.99E-01	3.01E-02	1.32E+03	3.82E-01
Net use of fresh water (FW)	m^3	**1.31E+01**	6.83E+00	2.41E-01	8.95E-03	2.70E-04	6.00E+00	3.18E-02
Use of secondary materials (MS)	kg	**0.00E+00**	0.00E+00	0.00E+00	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	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	0.00E+00	0.00E+00	0.00E+00

Table 10. Results of parameters describing resource use, referred to the D.U. of DY 516/2

Indicator	Unit	Total	Manufacturing		Distribution	Installation	Use and Maintenance	EoL
			Upstream	Core	Downstream			
Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw material (PENRE)	MJ	**2.67E+04**	5.11E+03	1.19E+02	8.73E+01	3.64E+00	2.14E+04	2.31E+01
Use of renewable primary energy excluding renewable primary energy resources used as raw material (PERE)	MJ	**6.43E+03**	8.50E+02	1.87E+01	1.23E+00	5.13E-02	5.56E+03	4.38E-01
Use of non-renewable primary energy resources used as raw material (PENRM)	MJ	**3.05E+02**	3.05E+02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Use of renewable primary energy resources used as raw material (PERM)	MJ	**5.28E+02**	5.28E+02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Total use of non-renewable primary energy resources (primary energy and primary energy resources used as raw materials) (PENRT)	MJ	**2.71E+04**	5.41E+03	1.19E+02	8.73E+01	3.64E+00	2.14E+04	2.31E+01
Total use of renewable primary energy resources (primary energy and primary energy resources used as raw materials) (PERT)	MJ	**6.96E+03**	1.38E+03	1.87E+01	1.23E+00	5.13E-02	5.56E+03	4.38E-01
Net use of fresh water (FW)	m^3	**3.26E+01**	7.22E+00	1.73E-01	1.10E-02	4.60E-04	2.52E+01	3.76E-02
Use of secondary materials (MS)	kg	**0.00E+00**	0.00E+00	0.00E+00	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	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	0.00E+00	0.00E+00	0.00E+00

Table 11. Results of waste production descriptive parameters, referred to the D.U. of DY 515/1

Indicator	Unit	Total	Manufacturing		Distribution	Installation	Use and Maintenance	EoL
			Upstream	Core	Downstream			
Hazardous waste disposed (HWD)	kg	**6.17E-02**	5.59E-02	4.72E-04	2.37E-04	5.58E-06	5.10E-03	7.04E-05
Non-hazardous waste disposed (NHWD)	kg	**1.79E+02**	1.58E+02	2.60E-01	4.67E+00	1.10E-01	1.60E+01	1.85E+00
Radioactive waste disposed (RWD)	kg	**4.85E-02**	3.30E-02	2.40E-04	6.13E-04	1.44E-05	1.47E-02	1.61E-04
Materials for energy recovery (MER)	kg	**8.36E+00**	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.36E+00
Material for recycling (MFR)	kg	**1.13E+02**	0.00E+00	8.35E-01	0.00E+00	1.70E+01	0.00E+00	9.50E+01
Components for reuse (CRU)	kg	**0.00E+00**	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Exported thermal energy (ETE)	MJ	**0.00E+00**	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Exported electricity energy (EEE)	MJ	**0.00E+00**	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Table 12. Results of waste production descriptive parameters, referred to the D.U. of DY 515/2

Indicator	Unit	Total	Manufacturing		Distribution	Installation	Use and Maintenance	EoL
			Upstream	Core	Downstream			
Hazardous waste disposed (HWD)	kg	**4.66E-02**	4.09E-02	4.72E-04	1.85E-04	5.58E-06	5.10E-03	5.51E-05
Non-hazardous waste disposed (NHWD)	kg	**1.44E+02**	1.24E+02	2.60E-01	3.65E+00	1.10E-01	1.60E+01	1.50E+00
Radioactive waste disposed (RWD)	kg	**4.39E-02**	2.85E-02	2.40E-04	4.79E-04	1.44E-05	1.47E-02	1.21E-04
Materials for energy recovery (MER)	kg	**8.41E+00**	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.41E+00
Material for recycling (MFR)	kg	**8.65E+01**	0.00E+00	8.35E-01	0.00E+00	1.70E+01	0.00E+00	6.87E+01
Components for reuse (CRU)	kg	**0.00E+00**	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Exported thermal energy (ETE)	MJ	**0.00E+00**	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Exported electricity energy (EEE)	MJ	**0.00E+00**	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Table 13. Results of waste production descriptive parameters, referred to the D.U. of DY 516/2

Indicator	Unit	Total	Manufacturing		Distribution	Installation	Use and Maintenance	EoL
			Upstream	Core	Downstream			
Hazardous waste disposed (HWD)	kg	**7.12E-02**	4.91E-02	3.37E-04	2.28E-04	9.51E-06	2.15E-02	6.27E-05
Non-hazardous waste disposed (NHWD)	kg	**2.08E+02**	1.36E+02	1.89E-01	4.50E+00	1.88E-01	6.72E+01	1.72E+00
Radioactive waste disposed (RWD)	kg	**7.99E-02**	1.75E-02	1.72E-04	5.90E-04	2.46E-05	6.16E-02	1.36E-04
Materials for energy recovery (MER)	kg	**9.99E+00**	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	9.99E+00
Material for recycling (MFR)	kg	**1.07E+02**	0.00E+00	1.10E+00	0.00E+00	2.90E+01	0.00E+00	7.69E+01
Components for reuse (CRU)	kg	**0.00E+00**	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Exported thermal energy (ETE)	MJ	**0.00E+00**	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Exported electricity energy (EEE)	MJ	**0.00E+00**	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

REFERENCES

1. Castellani V., Life Cycle Assessment of Load-break switches (LBS) DY 515/1, DY 515/2 and DY 516/2 produced by Imequadri Duestelle S.p.A. Study report v.02, released 25/05/2023.
2. ISO 14040:2006. Environmental management — Life cycle assessment — Principles and framework.
3. 14044:2006+A2:2020. Environmental management — Life cycle assessment — Requirements and guidelines
4. ISO 14025:2006. Environmental labels and declarations –Type III environmental declarations – Principles and procedures.
5. EN 50693:2019 Product category rules for life cycle assessments of electronic and electrical products and systems.
6. EPDItaly Regulation, Rev. 5.2 published 2022/02/16.
7. Core-PCR EPDItaly007 “Electronic and electrical products and systems”, rev. 3, 2023/01/13.
8. Sub- PCR EPDItaly012 – “Switches”, rev. 0 – 2020/03/16.