



MATELEC



ENVIRONMENTAL PRODUCT DECLARATION

Distribution Transformer 630 kVA  
FES0300040 – 111101

Production site: Matelec SAL 59,  
Matelec Sal, Matelec Building,  
Ghorfine, Jbeil Lebanon

In accordance with ISO 14025 and EN 50693:2019

Program Operator	EPDItaly
Publisher	EPDItaly

Declaration Number	<i>EPD-ES-25-008</i>
Registration Number	EPDITALY0934

Issue date	26 / 02 / 2025
Valid to	26 / 02 / 2030



## GENERAL INFORMATION

<b>EPD OWNER</b>	
<b>Name of the company</b>	Matelec SAL
<b>Registered office</b>	Matelec SAL 59, Matelec Sal, Matelec Building, Ghorfine, Jbeil Lebanon
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<b>PROGRAM OPERATOR</b>	
<b>EPDIItaly</b>	Via Gaetano De Castilia n° 10 - 20124 Milano, Italy
<b>INFORMATION ON THE EPD</b>	
<b>Product name (s)</b>	Transformer FES0300040 - 111101
<b>Site (s)</b>	Matelec SAL 59, Matelec Sal, Matelec Building, Ghorfine, Jbeil Lebanon
<b>Short description and technical information of the product (s)</b>	The functional unit for this study refers to the operation of each transformer under ONAN power conditions, over 35 years RSL, 365 days per year, 24 hours per day. The ONAN power values are:  630 kVA transformer
<b>Field of application of the product (s)</b>	Electronic and Electrical Products and Systems
<b>Product (s) reference standards (if any)</b>	Cradle to Grave
<b>CPC Code (number)</b>  <a href="https://unstats.un.org/unsd/classifications/Econ">https://unstats.un.org/unsd/classifications/Econ</a>	46121 – Electrical transformers
<b>VERIFICATION INFORMATION</b>	
<b>PCR (title, version, date of publication or update)</b>	PCR EPDIItaly 007, PCR for electronic and electrical prod-ucts and systems – Rev. 3.1 subPCR: EPDIItaly018 - ELECTRONIC AND ELECTRI-CAL PRODUCTS AND SYSTEMS – POWER TRANS-FORMERS, Rev 3.6, 01/07/2029.
<b>EPDIItaly Regulation (version, date of publication or update)</b>	EPDIItaly Regulations Rev 6.0 PCR EPDIItaly007 v.3.1, man-datory from 20/01/2020
<b>Project Report LCA</b>	Environmental Product Declaration of distribution transformer FES0300040

<b>Independent Verification Statement</b>	<p>Independent verification of the declaration and data, carried out according to ISO 14025: 2010.</p> <p><input type="checkbox"/> Internal <input checked="" type="checkbox"/> External</p> <p>Third party verification carried out by: ICMQ S.p.A., via Gaetano De Castilla n ° 10 - 20124 Milan, Italy. Accredited by Accredia.</p>
<b>Comparability Statement</b>	<p>Environmental statements published within the same product category, but from different programs, may not be comparable.</p>
<b>Liability Statement</b>	<p>The EPD Owner releases EPDIItaly from any non-compliance with environmental legislation. The holder of the declaration will be responsible for the information and supporting evidence.</p> <p>EPDIItaly disclaims any responsibility for the information, data and results provided by the EPD Owner for life cycle assessment.</p>

## 1 COMPANY INFORMATION

Matelec SAL was founded in 1974 to produce distribution transformers and has grown into a diversified electricity business player since then. Matelec enlarged its products offering gear switching, package substations, and control and protection systems within its first decade. In parallel, Matelec expanded into engineering and contracting activities with the realization of complex HV, MV, and LV projects.

Throughout the years, Matelec expanded its manufacturing capabilities in the Mideast, Africa, and Europe with the acquisition or participation in many factories, namely Electrical Equipment Industries Co. (ELICO) in Jordan, International Transformers Matelec (ITM) in Egypt, Transfo Matelec in France, and lately Entreprise algérienne des équipements de transformation et de distribution électrique SPA (EDIEL SPA) in Algeria. Matelec is further exploring other geographic deployments and business ventures across these regions to optimize its global business portfolio.

Matelec employs more than 1000 people in the Mideast, Africa, and Europe.

Matelec guarantees high-quality products and services and provides its customers with technical quality assistance in all project phases. Matelec is part of a multinational industrial group leader in the field of design, development, production, installation, sales and servicing of a range of electrical products and turnkey projects. In order to maintain its leadership, Matelec is committed to implementing a quality management system that meets the requirements of the international standard ISO 9001:2015. The system consists of a set of interacting processes continuously monitored, measured and analyzed. Actions are taken when results do not meet objectives providing a drive for continual improvement. It is the policy of Matelec to deliver error-free products on time. Quality, continual improvement and customer satisfaction are the personal responsibility of each employee. Moreover, Matelec's environmental, safety & health (ES&H) policy ensures that work is performed in a manner that protects the health and safety of employees and the public, preserves the quality of the environment, and prevents property damage. Having the ISO 14001:2015 and ISO 45001:2018, Matelec ensures that priority is given to ES&H issues in the planning and execution of all work activities.

## 2 PRODUCTS DESCRIPTION

Distribution transformers convert high network voltages to medium or low network voltages, so electricity can be transmitted more safely to the final consumers. The FES0300040 Oil immersed, three phase ONAN transform-er 630 KVA 25/0.42 KV.

Geographical scope: The transformer studied will be installed in Spain.

The nominal weight of the transformer is 2260 kg.

**Table 1: Nominal weight of the transformer**

Transformer name	Description	Nominal weight, shown on the plate [kg]
FES0300040	630 KVA 25/0.42 KV	2260

### 3 FUNCTIONAL UNIT

Functional unit is the operation under ONAN power conditions, over 35 years reference service life, 365 days per year, 24 hours per day.

Reference service life:

35 years

Time representativeness:

The data collection for materials in the products is representative of the year 2024.

The data collection for energy and consumables used during manufacturing is representative of 2024.

Geographical representativeness:

The upstream processes for the components and assembly are representative to Lebanon.

The energy consumption during the use stage is representative to Spain.

Allocation:

This EPD considers that the transformer uses the entire given amount of input raw materials for each production process defined. Hence, there is no need to allocate raw materials among different types of transformers. However, the use of energy, infrastructure, and other consumables is shared with other types of transformers during manufacturing in the year of reference 2024. Therefore, since other co-products are generated during the transformers production process, allocation rules are required for the foreground data: calculation of electricity, welding gases, and diesel consumption, on the transformer studied. Modularity and polluter payer principles have been followed.

Cut-off criteria:

The DIN EN 15804+A2 (2019) requires that in case of data gaps or insufficient input data for a unit process, the cut-off criteria shall be 1% of renewable and non-renewable primary energy usage, and 1% of the total mass of this unit process. The total neglected flows from a product stage must be no more than 5% of product inputs by mass or 5% of primary energy contribution.

This assessment involved very comprehensive data collection, and all collected data were modelled; no known flows have been omitted.

The transportation of personnel to the plant: transportation of personnel within the plant, research and development activities & long-term emissions were also excluded in this study.

Database(s) and LCA software:

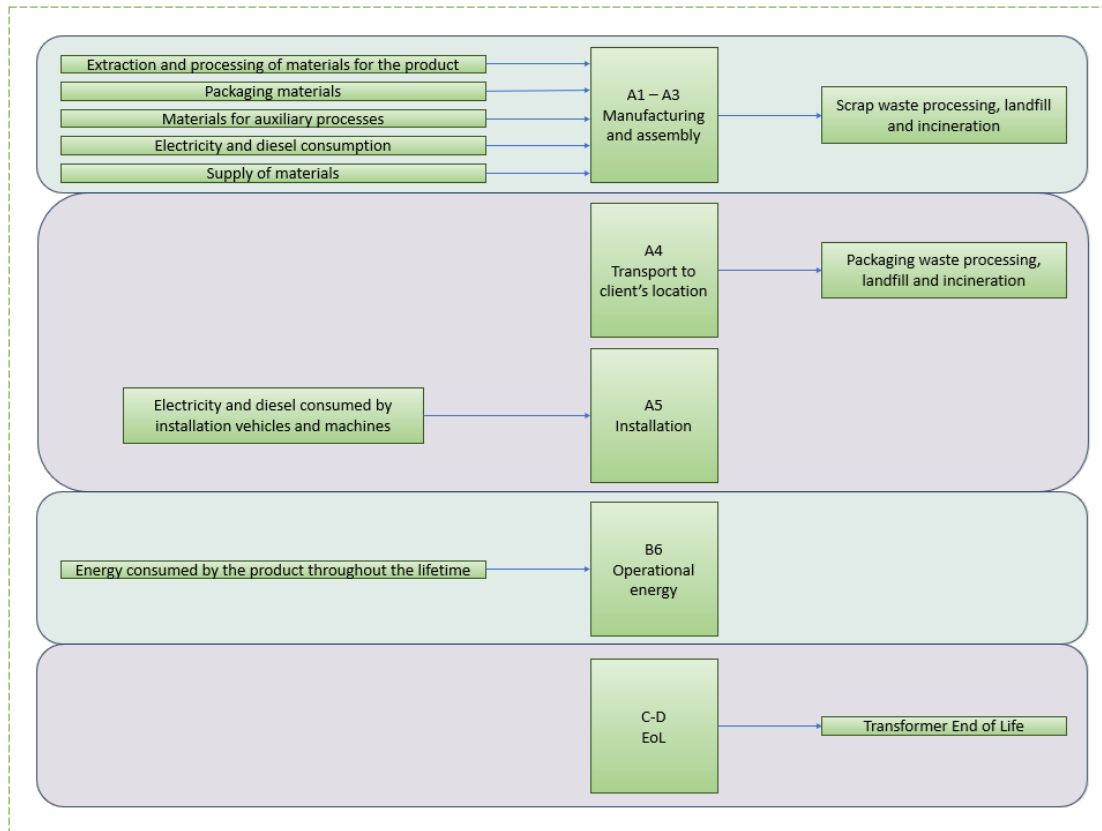
The LCA underlying this EPD has been performed using a dedicated parametric LCA model provided by the external practitioner Sphera Solutions Inc., registered at 130 E Randolph St #2900, Chicago, IL 60601, United States. This parametric model has been developed in 2023 to represent the potential environmental impacts of product produced by Matelec and to produce LCA results that are conform to the requirements of the EPD product category rules of EPDItaly for transformers (Core PCR EPDItaly 007 Electronic and electrical products and systems – Rev3.1, 2026-01-19, Sub-PCR EPDItaly 018 Electronic and electrical products and systems – Power transformers, v3.6, 2029-07-01). The parametric LCA model is made available to Matelec via the software solution licensed by Sphera and named LCA Calculator. This cloud-based software (software as a service) allows users to input parameter values of the LCA model and generate the corresponding LCA results. This software does not allow users to make any amendments to the model itself. More information on the software solution LCA Calculator here.

The LCA model itself has been developed on Sphera's premises using the software solution LCA For Experts Version 10.9 and the Managed LCA Content Database version CUP2023.2. The model has been transferred to the LCA Calculator software environment by Sphera's delivery product delivery services on January 20th, 2025

The parametric LCA model is presented in more detail in section 3 "Parametric LCA model".

## 4 SYSTEM BOUNDARIES

Cradle-to-grave, including Manufacturing, Distribution, Installation, Use & Maintenance, End-of-Life stages, and benefits and loads of the next product system.



Excluded:  
Impacts related to production of machinery, facilities and infrastructure

Figure 1: System boundary of main production processes, transportation, installation, use, and EoL stages.

### 4.1 MODULES DECLARED

Table 2: Modules of the production life cycle included in the EPD according to PCR EDPItaly007 and consistent with EN 50693:2019 (X = declared module; MND = module not declared)

Phases	Manufacturing stage		Distribution stage	Installation stage	Use & maintenance stage	End-Of-Life stage	Benefits & Loads
	Upstream	Core					
Phases declared	X	X	X	X	X	X	MND
Data quality indicator	%	80					

### 4.2 MANUFACTURING

In the manufacturing stage, all processes involved in the production of the transformer have been considered within the study. These include pre-product manufacture, different sources of energy (thermal energy, fuel, and electric power consumption), direct generation of waste from production, as well as relevant emissions data.

### 4.3 DISTRIBUTION

The transportation of the product considers the truck transport from Matelec plant in Ghorfine, Lebanon to the Port of Beirut 40 km away, then 3534 km from the transatlantic distance to Spain & 360 km by truck to Madrid.

## INSTALLATION

The installation stage (A4-A5) of a transformer involves:

- transporting the transformer from the assembly site to its place of installation
- use of machinery (cranes and forklifts) in the installation process.
- packaging disposal and the corresponding waste treatment for each packaging material.

The parametric model allows users to specify the following parameters:

- distance travelled by ship and truck
- Diesel consumed by forklift
- Electricity for operating a 220-tons crane
- Electricity for operating a 5-tons crane
- Electricity for operating an oil treatment machine

The steel is recycled, and the wood is incinerated with energy recovery at a waste incineration

## 4.4 USE

Only the operational energy is considered in the use stage. Maintenance is not required or can be neglected. Throughout their service life of 35 years, the transformers will operate 24 hours a day. No maintenance is considered for the power transformers during their lifetime.

The installation point of the transformer in Spain.

To represent the electricity consumption in this stage, the electricity grid mix from Spain was used.

The study considered the power rates of the transformer when working at partial load with Oil Natural Air Natural (ONAN). Complying with the PCR for transformers, when operating at partial load of 70%, the calculations are adopted with ONAN.

The energy used is calculated following the equation according to PCR EPDIItaly018, 2021:

$$E_d \text{ [kWh]} = [P_{load} * k_{load}^2 + P_{noload}] * t_{year} * RSL + P_{aux} * f_{aux} * t_{year} * RSL$$

Where:

$E_d$  = The energy used by the power transformers for 35 years [kWh]

$P_{load}$  = Load losses of the transformers [kW]

$P_{noload}$  = No-load losses of the transformers [kW]

$k_{load}$  = Average load factor (0.70 for all transformers)

$t_{year}$  = Total number of hours in a year (8760 hours)

$RSL$  = Reference service life (35 years)

$P_{aux}$  = Power loss due to auxiliary activities at no load (zero in all transformers, calculation adopted for ONAN)

$f_{aux}$  = Fraction of time in which ancillary equipment is operating (zero in all transformers, calculation adopted for ONAN)

The parameters of this transformer used in the equation are described below:

**Table 3: Parameters used in the equation for energy use.**

Transformer name	$P_{load}$ [kW]	$k_{load}$	$P_{noload}$ [kW]	$t_{year}$ [h]	$RSL$ [years]	$P_{aux} * f_{aux} * t_{year} * RSL$
FES0300040	5.06	0.7	0.621	8760	35	0

The calculated  $E_d$  value is 950582.64 kWh.



## 4.5 DISASSEMBLY AND EOL

The disassembly of the transformer uses a 75-ton crane. The electricity used by the crane is the only deconstruction process considered in the End-of-Life stage, as the oil is removed from the transformers by gravity with no extra equipment needed.

The transportation of the product from its use location to the disassembly point is assumed by a distance of 500 km by truck.

An additional 500km distance is assumed for the transportation of every disassembled material to their respective waste treatment location.

These modules include waste processing for reuse, recovery and/or recycling, and disposal. Transport, provision of all materials, products and related energy and water use is accounted for the waste treatment processes. The following waste materials are sorted, recycled, and credited as secondary materials as benefits of the next product system:

- Copper
- Steel
- Aluminum
- Stainless steel

The following materials are used for energy recovery processes and credited as secondary materials in thermal energy and electricity processes, the masses of each material going to the waste treatment are described on tables 12 to 16 :

- Plastics
- Oil
- Wood
- Paper
- Carboard

**Table 4: Waste treatment of dismantled products from transformer FES0300040**

Material	Amount [kg]	Waste treatment	Waste treatment percentage [%]
Steel	1428.93	Recycling	100
Oil	420	Incineration	100
Aluminum	359.53	Recycling	100
Cardboard	40.79	Incineration	100
Wood	18.13	Incineration	100
Painting	5.29	Incineration	100

## 5 CONTENT DECLARATION

The transformers produced by Matelec contain the following materials and modules:

- Magnetic steel
- Insulating oil
- Aluminum conductor
- Hot rolled steel sheet
- Other materials
  - Materials or subcomponents made of smaller parts, with no electronic parts

The table 5 below, specify the weight distribution in the FES0300040 transformer.

**Table 5: Material content for transformer FES0300040**

Materials	Mass [kg]	Percentage from total weight
Magnetic steel	1099.7	48.66%
Oil	420	18.58%
Aluminum	359.53	15.91%
Steel	329.23	14.57%
Cardboard	40.79	1.80%
Other	5.46	0.25%
Painting	5.29	0.23%
<b>True weight</b>	<b>2260</b>	<b>100.00%</b>

1 "Other" includes random sub-items that were omitted & do not impact the results as per the allocation rules of the associated PCRs.

No substance in the product greater than 0.10% by weight is present on the "List of Potentially Hazardous Substances" (SVHC in English) candidates for authorization under the REACH legislation.

## 5.1 SUBSTANCES OF VERY HIGH CONCERN (SVHC)

The painting process involves the usage of paintings and coatings that contain the following hazardous substances:

**Table 22: Environmental impact: 1 FES0300040 - 630 KVA 25/0.42 KV transformer over 35 years RSL with 365 days operation**

Hazardous substances	CAS number	Hazardous substances	CAS number
Polyurethane	9009-54-5	Hardener/Cross linker	12451-62-9
Ethyl acrylate	140-88-5	Barium sulfate	7727-43-7
Epoxy resin	25085-99-8	Additives	7631-86-9/119-53-9
Zinc phosphate	7779-90-0	Pigments	1333-86-4
Saturated Carboxylated Polyester resin	1860-26-0	Bisphenol A epichlorhydrin	25036-25-3
Xylene	1330-20-7	2-butoxyethanol	111-76-2
Ethylbenzene	100-41-4	Bisphenol-A-Epichlorhydrinharze	25036-25-3
Xylol	1330-20-7	Hexamethylene-1.6-diisocyanate homopolymer	28182-81-2
2-methoxy-1-methylethyl acetate	108-65-6	hexamethylene-di-isocyanate	822-06-0
2-methylpropan-1-ol	78-83-1	Bisphenol A epichlorhydrin	25036-25-3
1-methoxy-2-propanol	107-98-2	4-hydroxy-2,2,6,6-tetramethyl-1-piperidineethanol	59535-09-0
Toluene	108-88-3		

\*\*\*None of the substances listed above are considered as substances of very high concern (SVHC) on REACH Candidate List published by the European Chemicals Agency.

## 6 ENVIRONMENTAL PERFORMANCE

### 6.1 TRANSFORMER FES0300040

**Table 23: Environmental impact: 1 FES0300040 - 630 KVA 25/0.42 KV transformer over 35 years RSL with 365 days operation**

Parameter	Unit	Manufacturing stage	Distribution stage	Installation stage	Use stage	End-of-life incl. de-installation stage
ADPE	kg Sb eq.	2.71E-02	2.49E-06	2.83E-06	6.37E-02	3.16E-05
ADPF	MJ	1.32E+05	1.08E+03	4.30E+02	5.89E+06	4.73E+03
AP	mole of H <sup>+</sup> -eq.	3.81E+01	1.59E+00	1.91E-01	3.17E+02	2.36E+00
EP - freshwater	kg P eq.	2.57E-01	5.55E-05	1.38E-04	4.58E-01	1.37E-03
EP - marine	kg N eq.	1.02E+01	6.71E-01	9.22E-02	9.64E+01	9.39E-01
EP- terrestrial	mole of N eq.	1.11E+02	7.36E+00	1.03E+00	1.01E+03	1.08E+01
GWP - biogenic	Kg CO2 eq.	-1.55E+02	9.26E-02	2.91E+01	2.22E+02	1.04E+02
GWP - fossil	Kg CO2 eq.	9.79E+03	9.22E+01	3.26E+01	2.32E+05	1.53E+03
GWP - luluc	Kg CO2 eq.	2.66E+01	1.33E-01	5.38E-01	2.78E+01	4.80E+00
GWP - total	Kg CO2 eq.	9.66E+03	9.24E+01	6.22E+01	2.33E+05	1.64E+03
ODP	Kg CFC-11 eq.	6.52E-05	7.58E-12	8.47E-12	5.79E-06	8.59E-10
POCP	kg NMVOC eq.	3.12E+01	1.84E+00	2.49E-01	2.92E+02	1.89E+00
WDP	m <sup>3</sup> world eq.	1.07E+03	2.72E-01	3.76E+00	4.10E+05	1.18E+02
Caption	GWP = Global warming potential; ODP = Depletion potential of the stratospheric ozone layer; AP = Acidification po-tential of land and water; EP = Eutrophication potential; POCP = Formation potential of tropospheric ozone photo-chemical oxidants; ADPE = Abiotic depletion potential for non fossil resources; ADPF = Abiotic depletion potential for fossil resources; WDP=Water user deprivation potential, deprivation-weighted water consumption					

**Table 24: Use of resources of transformer: 1 FES0300040 - 630 KVA 25/0.42 KV transformer over 35 years RSL with 365 days operation**

Parameter	Unit	Manufacturing stage	Distribution stage	Installation stage	Use stage	End-of-life incl. de-installation stage
FW	[m3]	1.26E+02	1.59E-02	1.17E-01	5.58E+03	3.19E+00
PENRE	[MJ]	1.13E+05	1.08E+03	4.30E+02	5.89E+06	4.36E+03
PENRM	[MJ]	1.90E+04	0.00E+00	0.00E+00	0.00E+00	3.65E+02
PENRT	[MJ]	1.32E+05	1.08E+03	4.30E+02	5.89E+06	4.73E+03
PERE	[MJ]	3.06E+04	1.37E+01	3.65E+02	4.82E+06	1.15E+03
PERM	[MJ]	1.06E+03	0.00E+00	-3.26E+02	0.00E+00	-3.14E+02
PERT	[MJ]	3.17E+04	1.37E+01	3.87E+01	4.82E+06	8.31E+02
SM	[kg]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Caption	PERE = Use of renewable primary energy as energy carrier; PERM = Use of renewable primary energy as raw materials; PERT = Total use of renewable primary energy resources; PENRE = Use of Non-Renewable primary energy as energy carrier; PENRM = Use of Non-Renewable primary energy as raw materials; PENRT = Total use of Non-Renewable primary energy resources; SM = Use of secondary material; RSF = Use of renewable secondary fuels; NRSF = Use of Non-Renewable secondary fuels; FW = Use of net fresh water					

Table 25: Output flows and waste categories: 1 FES0300040 - 630 KVA 25/0.42 KV transformer over 35 years RSL with 365 days operation

Parameter	Unit	Manufacturing stage	Distribution stage	Installation stage	Use stage	End-of-life incl. de-installation stage
EEE	[MJ]	5.77E-03	0.00E+00	4.10E+01	0.00E+00	1.08E+02
EET	[MJ]	6.34E-02	0.00E+00	7.39E+01	0.00E+00	1.96E+02
HWD	[kg]	3.59E+00	3.45E-08	2.10E-08	1.43E-02	1.19E-06
MER	[kg]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.54E+01
MFR	[kg]	1.31E+02	0.00E+00	0.00E+00	0.00E+00	1.77E+03
NHWD	[kg]	1.40E+03	1.11E-01	1.30E+01	3.51E+03	4.41E+02
RWD	[kg]	1.64E+00	1.32E-03	1.18E-03	9.71E+02	1.06E-01

Caption	HWD = Hazardous waste disposed; NHWD = Non-hazardous waste disposed; RWD = Radioactive waste disposed; CRU = Components for re-use; MFR = Materials for recycling; MER = Materials for energy recovery; EEE = Exported electrical energy; EET = Exported thermal energy
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## 7 LIFE CYCLE INVENTORY ANALYSIS - CHARACTERIZATION FACTORS AND METHODS USED

For all indicators the characterization factors from EC-JRC (<http://eplca.jrc.ec.europa.eu/LCDN/developerEF.xhtml>) mentioned were applied. All LCIA results are relative expressions and do not predict impacts on category endpoints, the exceeding of thresholds, safety margins or risks.

The environmental parameters apply data based on the LCI describing the use of renewable and non-renewable material resources, renewable and non-renewable primary energy, and water.

The results from the impact assessment are only relative statements which give no information about the endpoint of the impact categories, exceeding threshold values, safety margins or risk.

## 8 REFERENCES

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Managed LCA Content	Life cycle assessment database, by Sphera Solutions GmbH, Leinfelden-Echterdingen, 2022 <a href="https://sphera.com/life-cycle-assessment-lca-database/">https://sphera.com/life-cycle-assessment-lca-database/</a>
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REGOLAMENTO EPDITALY V.6	Regolamento del Programma EPDItaly. Data di emissione: 30/10/2023
LCA REPORT: MATELEC_LCA_FES030 0040-111101	Final version 11/02/2025