

ENVIRONMENTAL PRODUCT DECLARATION

in accordance with ISO 14025:2006.

RENYCLE® S T203K 3030BK

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Programme

The International EPD® System

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Accountabilities for PCR, LCA and independent, third-party verification

Product Category Rules (PCR):

PCR 2010:16 Plastic in Primary Forms, version 3.0.2 UN CPC 347.

PCR review conducted by:

The International EPD® System Technical Committee
Chair: Paola Borla
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Independent third-party verification of the declaration and data, according to ISO 14025:2006, via:

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Anna Bortoluzzi

Third-party verification:

CERTIQUALITY S.r.l. - Istituto di Certificazione della qualità - Milan, Italy

Third-party verifier is accredited by:

ACCREDIA - Accreditation No.: 0008PRD

Procedure for follow-up of data during EPD validity involves third-party verifier:

Yes No

The EPD owner has the sole ownership, liability, and responsibility for the EPD.

EPDs within the same product category but registered in different EPD programmes, or not compliant with EN 15804, may not be comparable. For two EPDs to be comparable, they must be based on the same PCR (including the same version number) or be based on fully-aligned PCRs or versions of PCRs; cover products with identical functions, technical performances and use (e.g. identical declared/functional units); have equivalent system boundaries and descriptions of data; apply equivalent data quality requirements, methods of data collection, and allocation methods; apply identical cut-off rules and impact assessment methods (including the same version of characterisation factors); have equivalent content declarations; and be valid at the time of comparison. For further information about comparability, see EN 15804 and ISO 14025.

The Group

Radici Novacips SpA is the headquarters of the **RadiciGroup** High Performance Polymers Business Area – a multinational organization with the capacity **to manufacture and supply engineering polymers** (based on polyamide, polyester and other materials) around the globe, with the backing of a production and sales network across all continents, as well as research and development increasingly focused on high-performance polymers.


With eight production plants – strategically located in Italy, Germany, Brazil, the USA, Mexico, China and India – and a worldwide sales network, RadiciGroup High Performance Polymers provides high-quality product standards on a global scale, besides offering state-of-the-art support in research & development and processing technologies. Through its Computer Aided Engineering services, RadiciGroup can provide customers with technological support in applications development and in the design of products with greater environmental sustainability.

RadiciGroup High Performance Polymers is a vertically integrated compounder, whose strengths range from the independent management of its whole production chain **upstream and downstream of the product**, including the recovery of process waste and scrap from other RadiciGroup companies, to research and development activities specifically targeted at industrial-grade products, allowing it to offer a complete range of second-generation engineering polymers **for automotive, electrical/electronics and consumer/industrial applications**. Based on this experience, the company now offers a new sustainability-oriented range of materials marketed under the Renycle® brand.

In the area of engineering polymers, RadiciGroup offers a complete portfolio of products including: **polyamides (Radilon®, Renycle®, Radistrong® and Torzen®), polyesters (Raditer®), polyacetals (Heraform®) and thermoplastic elastomers (Heraflex®)**.

Production sites

RadiciGroup High Performance Polymers has production sites in:



- **ITALY**
RADICI NOVACIPS SpA Villa d'Ogna
RADICI NOVACIPS SpA Chignolo d'Isola
- **GERMANY**
RADICI PLASTICS GmbH
- **BRAZIL**
RADICI PLASTICS Ltda.
- **The USA**
RADICI PLASTICS USA Inc.
- **MEXICO**
RADICI PLASTICS MEXICO S. de R.L. de C.V.
- **CHINA**
RADICI PLASTICS (Suzhou) Co., Ltd.
- **INDIA**
RADICI PLASTICS INDIA PVT. LTD.

The products covered in this Environmental Product Declaration (EPD) are manufactured at the Radici Novacips SpA - Via Bedeschi, 20 - 24040 Chignolo d'Isola (BG) - Italy plant.

Management system-related certifications and social responsibility

In 2003 RadiciGroup and Radici Novacips started their journey towards process and product sustainability by joining the **voluntary Responsible Care® protocol**. In 2004, RadiciGroup published its first Social Report prepared along the guidelines of the Study Group for Social Reporting Standards (Gruppo di Studio del Bilancio Sociale, or GBS).

In 2010, RadiciGroup's sustainability efforts accelerated with the launch of the project named "RadiciGroup for Sustainability". This activity, today fully active, encompasses initiatives targeted at the development and continual improvement of Group products based on the Life Cycle Assessment method, as well as the improvement of Group information quality with the adoption of the Global Reporting Initiative (GRI) framework for the preparation of the RadiciGroup Sustainability Report. The first Sustainability Report was published in 2011 and received external assurance.

Radici Novacips is equipped with strong systems for Environmental Management (ISO 14001-certified since 2006), Safety Management (OHSAS 18001-certified since 2010, now ISO 45001-certified) and Quality Management (ISO 9001-certified since 1993 and, only Villa d'Ogna plant IATF 16949-certified). HPP has also signed the Operation Clean Sweep® voluntary protocol, undertaking to prevent possible plastic material loss in the environment. Supported by strong Research and Development and Application Marketing departments with a high rate of product innovation, the company has decided to charge its qualified staff with the task of formulating products with the highest sustainability and designing ways to measure the environmental impact of the products. Methods, people, training, research and transparent communication are the cornerstones of the Radici Novacips sustainability project.

Radici Novacips' decision to use LCAs to develop and prepare **EPDs** for its products, including the most innovative ones, reflects its commitment to support collaborative endeavours with its customers in order to develop products more in tune with the most recent trends in international markets, all the while keeping an eye on the **sustainability of its economic development** through the optimization of waste and scraps recovery from Radici's polymerization and spinning plants, the production of recyclate and recyclable products, and **the use of 100% renewable energy** supplied by Geogreen SpA, a Radici company and producer of hydroelectric energy.

The Radici Novacips Chignolo d'Isola facility started operating in 1980 as a very small plant, which RadiciGroup had decided to create to make the best use of all the waste and scrap generated by upstream processes, such as polymerization and spinning. The Group began waste recovery in the firm belief that even polyamide scrap could and should be used in a useful way, in the spirit of the zero-waste philosophy. Moreover, Radici Novacips could exercise maximum control over all process stages, even when work was outsourced to qualified external suppliers. Radici Novacips Chignolo d'Isola began its waste recovery activity in a market that knew little of recycled polymers and appreciated them even less.

Over the years, the Group has constantly increased its investments in recovery competence, materials selection and the research and development of specific solutions for engineering plastics. The efforts have been directed at adopting the best technologies for the treatment of materials, while, at the same time, staying committed to the environmental adequacy of the facilities and the safety of the plants. Radici Novacips takes full advantage of convenient access to the quality post-industrial waste and scrap produced by RadiciGroup's upstream processes and has recently integrated post-consumer waste recycling into its well-established industrial waste recycling activity. Polyamides represent a marginal share of plastic waste, and all the knowledge of the application sectors was necessary – together with a close collaboration with the downstream market – to identify and select the sources of polyamide waste suitable for recovery and recycling in applications that require high technical performance. These materials are carefully sorted and then pre-treated using "simple", high-yield, additive-free technologies such as mechanical recycling. The pre-treatment phase, supervised by Radici Novacips, is more complex, however, because post-consumer waste must be cleaned of the substances with which it may have been in contact during its useful life. RadiciGroup High Performance Polymers' production activities are part of RadiciGroup's vertically integrated production chain: polyamide 66 polymer (PA66) from Radici Chimica and polyamide 6 polymer (PA6) from RadiciFil and Radici Yarn are the inputs for the production of the Radilon® product range, while waste and scrap from polymerization, spinning and compounding are also used to manufacture the Renycle® range.

Replacing primary with secondary raw materials, a declared objective promoted by European authorities, is a challenge that Radici Novacips is ready to pursue with the utmost transparency. Indeed, it has certified the EPD relating to its Polyamide Scrap Recovery Service (EPD No. S-P-00708) to provide greater disclosure on its activities by supplying quantifiable and credible information both on its recovery process and its products, which are realized using its flexible and versatile technologies and taking advantage of its specific expertise.

The product

Renycle® is the trade name for a range of partially and fully recycled PA6 and PA66 products manufactured using secondary raw materials and intended for injection moulding and extrusion for automotive, electrical/electronics and industrial applications.

The Renycle® product range comprises PA6 and PA66 plastic compounds made mostly from secondary raw materials selected from the industrial waste and scrap produced by RadiciGroup polymerization and compounding plants. Thus, the products are engineering plastics targeted at optimizing the technical performance to environmental impact ratio. The aim is for Renycle® products to achieve the best possible balance among the different polymeric sources (virgin, post-consumer and post-industrial), so as to reduce the environmental impact of the materials and limit the performance loss compared to prime grades. The analysis of unknown substances in materials intended for uses subject to voluntary restrictions (i.e., the GADSL list) is becoming more and more important, especially with the implementation of recycled materials whose composition and possible risks are not exactly known. Given the different chemical nature of such materials, "ad hoc" analytical techniques are necessary to identify volatile, semi-volatile, and non-volatile, polar and non-polar compounds, in line with the internationally recognized analytical and scientific principles of risk assessment. At the Food Contact Center, which HPP has commissioned to carry out the testing, the screening of polar and non-volatile substances is based on the use of an exclusive database -- currently containing about 12.000 molecules -- developed over the years, also through collaboration with SCIEX, the University / CNR of Pisa and the University of Florence. The testing performed in the HPP internal R&D and Quality Labs and at external labs ensures that all the required technical and safety documentation can be provided for all the products.

The Renycle® product range is proof that it is possible to integrate environmental commitment with the manufacture of PA6 and PA66 thermoplastic compounds. Renycle® products possess unique characteristics that make them suitable for the manufacture of plastic components for use in a variety of different industries, from electronics to automotive.

The product grade covered by this Environmental Product Declaration (EPD) is **Renycle® S T203K 3030BK, black PA6** compound.

The geographical scope of the EPD® is Europe.

Information on use and end of life management

The product is used in industries such as automotive, furnishings and electrical/electronics and is recyclable at end of life.

Environmental performance assessment

Product environmental performance was assessed using the Life Cycle Assessment (LCA) method, from the extraction of the raw materials to the distribution of the finished product. The study was conducted in accordance with the ISO 14040 standard and the product category rules set forth in PCR 2010:16 PLASTICS IN PRIMARY FORMS, approved by the International EPD® System technical committee. The environmental impact indicators are in accordance with EF 3.1 and EN15804 (version 2.0 of the default list of indicators).

Declared unit

The declared unit is 1 kg of compound in granular form, including average packaging (the weight of the packaging is not included in this 1 kg).

General system boundaries

The system boundaries are illustrated in the figure below and include the production phase of the primary raw materials (upstream processes) and the production phase of the compound (core processes), from cradle to gate. According to the PCR, the recycling processes are also considered within the core phase. The finished product distribution phase is included as part of the post-production phase (downstream processes).

The definition of the system boundaries follows the rules established in the relevant PCR document.

The pre-production phase (upstream processes) comprises:

- Extraction and processing of virgin raw materials
- Polymer production
- Production of additives and other input materials (mineral fills, pigments, etc.)
- Maintenance material and packaging production

The production phase (core processes) comprises:

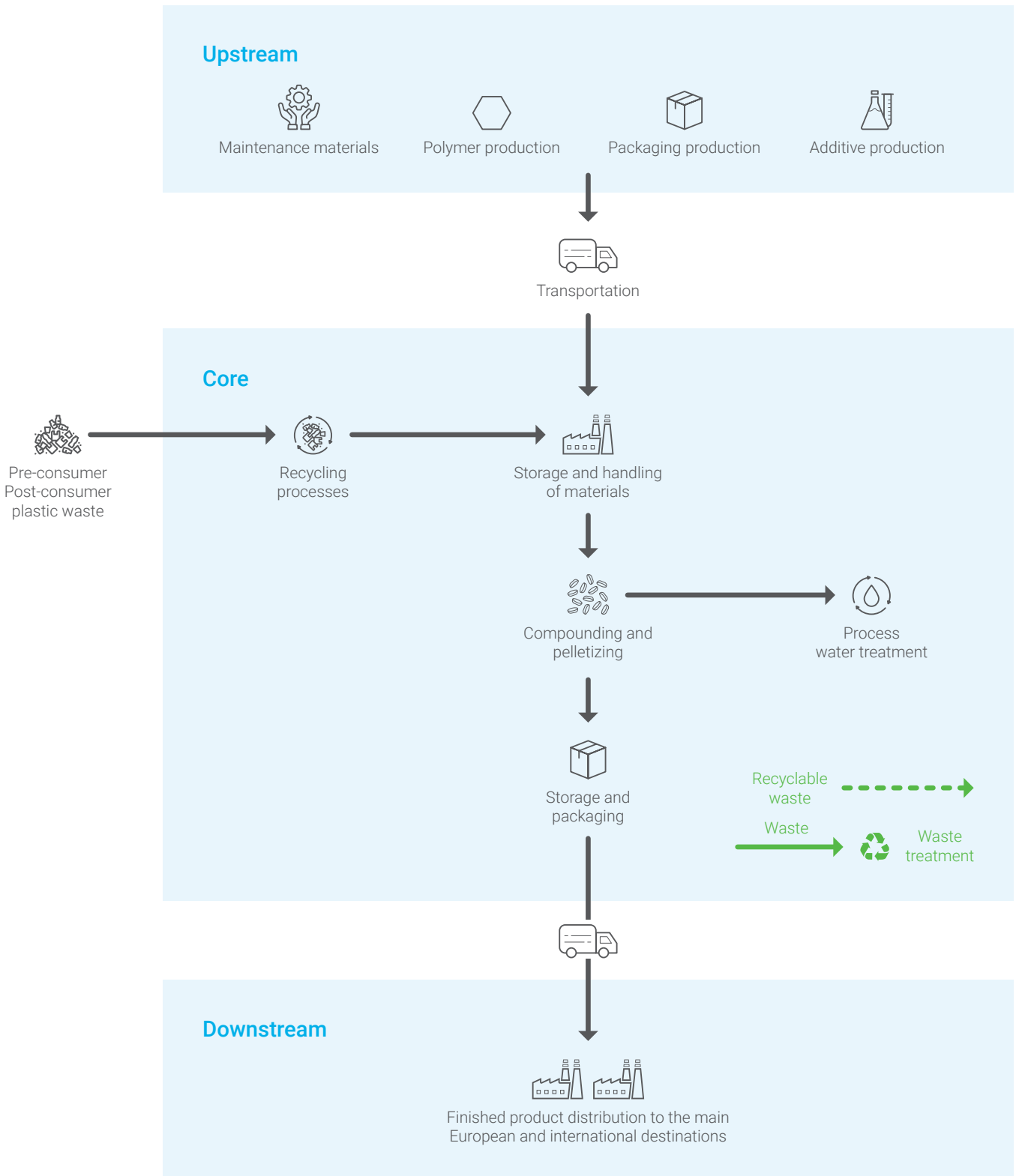
- Transportation of all input virgin raw materials to the production plant for the production phase
- Plastic waste and scrap recovery processes
- Storage and internal handling of materials
- Compounding and pelletizing
- Storage and packaging
- Treatment of process waters
- Transportation and treatment of waste generated in the various phases

Post-production processes (downstream processes) comprise:

- Weighted average distribution of finished product to the main European and international destinations

- Product and packaging end-of-life have been excluded

System boundaries



Cut-off rules

Data for elementary flows to and from the product system contributing to a minimum of 99% of the declared environmental impacts were included.

Data quality

The data quality rules followed for this EPD are those defined in the relevant PCR document. In accordance with said rules, use was made of both specific data gathered directly from the production sites during the year 2022 and generic data extracted from the **Ecoinvent 3.9.1 database and Industry data 2.0 in Simapro v.9.5.0.1**.

Product environmental profile

Below are reported the product characteristics and product environmental profile for **Renycle® S T203K 3030BK**. The data reported are for 1 kg of compound, and are broken down into the following phases: pre-production (upstream processes), production (core processes) and post-production (downstream processes).

Environmental profile Renycle® S T203K 3030BK

Content declaration

Renycle® S T203K 3030BK

Injection moulding grade PA6, black colour. The product is packaged in bags or octabins and distributed on wooden pallets.

Product composition:

PA6 88%;
Additives and master 12%;
Recycled content: 88%
(35% pre-consumer, 53% post-consumer).

TRADE NAME	STANDARD	Renycle® S T203K 3030BK
ISO code	ISO 1043	PA6
IUPAC name		Poly (hexamethylene adipamide)
CAS number		32131-17-2
GHS classification		N.A.

TECHNICAL DESCRIPTION		
Density	ISO 1183	1120 kg/m ³
MFR	ISO 1133	ND
Tensile stress at break	ISO 527	65 MPa
Melting T	ISO 11357	220°C
HDT @ 1.8 MPa	ISO 75f	60°C
Charpy impact notched	ISO 179:2010	16 kJ/m ² (+23°C)
Flame behaviour	UL 94	HB (0.8 mm thickness)

Environmental impacts

IMPACT CATEGORY		UNIT	TOTAL	UPSTREAM	CORE	DOWNSTREAM
Global warming (GWP100a)	Fossil	kg CO ₂ eq.	1.07E+00	3.05E-01	6.45E-01	1.23E-01
	Biogenic	kg CO ₂ eq.	7.83E-03	9.73E-04	6.82E-03	3.92E-05
	Land use and land use change	kg CO ₂ eq.	8.20E-03	2.37E-04	7.91E-03	5.98E-05
	TOTAL	kg CO ₂ eq.	1.09E+00	3.06E-01	6.59E-01	1.23E-01
Acidification potential (AP)		mol H ⁺ eq.	3.86E-03	9.66E-04	2.50E-03	4.02E-04
Eutrophication potential (EP)	Freshwater	kg P eq.	1.95E-04	4.84E-05	1.38E-04	8.62E-06
	Marine	kg N eq.	1.27E-03	2.31E-04	8.98E-04	1.38E-04
	Terrestrial	mol N eq.	1.04E-02	2.33E-03	6.57E-03	1.46E-03
Photochemical ozone creation potential (POCP)		kg NMVOC eq.	3.83E-03	9.95E-04	2.24E-03	6.00E-04
Ozone depletion potential (ODP)		kg CFC 11 eq.	4.34E-08	7.62E-09	3.31E-08	2.68E-09
Abiotic depletion potential (ADP)*	Minerals and metals	kg Sb eq.	2.89E-06	6.14E-07	1.88E-06	3.95E-07
	Fossils resources	MJ	2.06E+01	9.01E+00	9.83E+00	1.75E+00
Water depletion potential (ODP)*		m ³ world eq. deprived	1.41E+01	3.41E-01	1.37E+01	7.11E-03

* Disclaimer: the results of this environmental impact indicator shall be used with care as the uncertainties of these results are high or as there is limited experience with the indicator.

Use of resources and other indicators

PARAMETER		UNIT	TOTAL	UPSTREAM	CORE	DOWNSTREAM
Renewable energy resources	Used as energy	MJ	4.93E+00	8.51E-01	4.05E+00	2.71E-02
	Used as raw material	MJ	1.22E+00	5.10E-01	7.01E-01	5.25E-03
	TOTAL	MJ	6.14E+00	1.36E+00	4.75E+00	3.23E-02
Non-renewable energy resources	Used as energy	MJ	2.18E+01	9.31E+00	1.07E+01	1.86E+00
	Used as raw material	MJ	3.29E-01	3.29E-01	0.00E+00	0.00E+00
	TOTAL	MJ	2.22E+01	9.64E+00	1.07E+01	1.86E+00
Secondary material		kg	9.06E-01	0.00E+00	9.06E-01	0.00E+00
Renewable secondary fuels		MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Non-renewable secondary fuels		MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Water consumption		m ³	3.32E-01	1.05E-02	3.21E-01	2.33E-04

Waste production

WASTE	UNIT	TOTAL	UPSTREAM	CORE	DOWNSTREAM
Non-hazardous waste disposed	kg	2.38E-01	1.95E-02	1.34E-01	8.53E-02
Hazardous waste disposed	kg	5.38E-05	5.42E-06	3.73E-05	1.11E-05
Radioactive waste* disposed	kg	1.48E-05	4.04E-06	1.02E-05	5.67E-07

* RadiciGroup DOES NOT use radioactive materials or additives, and DOES NOT manage processes that could, directly or indirectly, produce radioactivity or radioactive leftovers. The item reported is attributable EXCLUSIVELY to the share of waste allocated to the nuclear part of the national electricity energy mix, used for processes absolutely independent of RadiciGroup production and that of its suppliers.

Output flows

PARAMETER	UNIT	TOTAL	UPSTREAM	CORE	DOWNSTREAM
Components for reuse	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Materials for recycling	kg	5.39E-02	0.00E+00	5.39E-02	0.00E+00
Materials for energy recovery	kg	2.61E-03	0.00E+00	2.61E-03	0.00E+00
Exported energy, electricity	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Exported energy, thermal	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Other environmental indicators

The recycled content in the compound is declared according to ISO 14021 definition.

Recycling technologies used: mechanical volume reduction, extrusion. Recovery process yield (process upstream of compounding): 98%.

Destination of non-recovered waste fraction: recycling/energy recovery.

The energy content of the compound, in the case of material subject to end-of-life energy recovery, is 30 MJ.

The primary energy demand, differentiated between Non-renewable primary energy resources and Renewable primary energy resources, is already accounted for among the main environmental indicators and measured in MJ.

Differences versus to the previous version

This version is published considering the update of the Database to Ecoinvent 3.9.1 and the update of the specific data (2022). The environmental impact indicator are in accordance with EF 3.1 and EN15804 (version 2.0 of the default list of indicators).

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