



ENVIRONMENTAL PRODUCT DECLARATION

ReviWool®
by MANTECO

ReviWool® Fabric by Manteco®

In accordance with ISO 14025:2006

Programme: The International EPD® System - www.environdec.com

Programme Operator: EPD International AB

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An EPD should provide current information and may be updated if conditions change. The stated validity is therefore subject to the continued registration and publication at www.environdec.com

PROGRAMME INFORMATION

Programme: The International EPD® System
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Accountabilities for PCR, LCA and independent, third-party verification

Product category rule (PCR): 2022:04 Fabrics, v. 1.0.1, CPC 266, 267, 268, 2791, 27911, 27912, 27921, 27922, 27994, 27996, 27997, 281, 3625

PCR review was conducted by: Gorka Benito. The Chair of the PCR review can be contacted via the PCR review panel: Technical Committee of the International EPD® System, info@environdec.com

Life Cycle Assessment (LCA): LCA accountability: Life Cycle Assessment (LCA) of ReviWool® fabric, Studio Fieschi & soci Srl

Third party verifier: Independent third-party verification of the declaration and data, according to ISO 14025:2006, via:

EPD verification by individual verifier

Third-party verifier: Chris Foster, EuGeos Srl

Approved by: The International EPD® System

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 of this EPD®.

COMPANY INFORMATION

Owner of the EPD: Manteco S.p.A.
Via della Viaccia 19
59013 Montemurlo, Italy
E-mail: digital@manteco.com

Description of the organisation: Manteco is an Italian leading textile company since 1943. It was first established, in 1941, as a small spinning mill by Enzo Anacleto Mantellassi, who started the production of recycled wool yarns by regenerating old military garments and covers. And as the years passed, it has become a point of reference in the fashion world, thanks to a high level of creativity, constant research, investments, innovations and great textile solutions.

Name and location of production site: Manteco S.p.A. - Via della Viaccia 19, 59013 Montemurlo, Italy

Product-related or management system-related certifications:

- Responsible Wool Standard (RWS) Certified by ICA-RAF-19-444/01B
- Responsible Mohair Standard (RMS) Certified by ICA-RAF-19-444/01B
- Responsible Alpaca Standard (RAS) - Certified by ICA-RAF-19-444/01B
- Global Recycled Standard (GRS) - Certified by ICA-GRS-17-443/02A
- Organic Content Standard (OCS) - Certified by ICA-OCS-20-445/01A-01
- European Flax® - Certified by Bureau Veritas - BVFR11670045

CERTIFICATIONS IN OUR SUPPLY CHAIN



INITIATIVES



PRODUCT INFORMATION

Product name: ReviWool[®] fabrics

Product identification: Woven fabric with fibre content as follows: 75/80% ReviWool[®] fibers and 25/20% Polyamide

Product description: The ReviWool[®] fabric range includes products with a wool/nylon content ranging from 75% wool/25% polyamide to 80% wool/20% polyamide. The polyamide can be either virgin or recycled depending on customers' requests. The thickness of the fabric can also vary, resulting in a heavier or lighter fabric, ranging from 195 g/m² to 435 g/m². This EPD[®] refers to the worst-case product, whose technical characteristics are described in Table 1.

UN CPC code: 2654 Woven fabrics of wool or fine animal hair, containing less than 85% by weight of wool or fine animal hair

Geographical scope: Global

Table 1 – ReviWool[®] fabric: technical specifications

TECHNICAL SPECIFICATION	REFERENCE STANDARD	VALUE
Composition	Regulation (EU) No 1007/2011	80% ReviWool [®] 20% Polyamide
Width and length	EN 1773:1998	Cutable width: Min 120 cm - Max 155 cm Length: Min 20 m - Max 60 m
Surface fuzzing and pilling	ISO 12945-2:2002	Min. 2 Max 4/5
Determination of pH	ISO 3071:2006	4.0 min - 8.5 max
Elasticity	EN 14704-1:2005	N/A No stretch fabrics
Dimensional change to washing for washable styles	ISO 6330:2012 ISO 15797:2017	Warp: -4% max Weft: -4% max

TECHNICAL SPECIFICATION	REFERENCE STANDARD	VALUE
Dimensional stability to drycleaning	ISO 3175-2:2017	Warp: -3% max Weft: -3% max
Colour fastness to artificial light: Xenon arc fading lamp test	ISO 105 B02:2014	Light: Shade change 3 Medium: Shade change 3/4 Dark: Shade change 4 White: Shade change 2
Colour fastness to Water	ISO 105 E01:2013	Shade Change Light Medium Dark 3 3/4 4 Staining Light Medium Dark 3/4 3 2/3
Colour fastness to Dry rubbing	ISO 105-X12:2016	Light: Staining 4 Medium: Staining 3/4 Dark: Staining 3
Colour fastness to Wet rubbing	ISO 105-X12:2016	Light: Staining 3 Medium: Staining 2/3 Dark: Staining 2
Colour fastness to Washing	ISO 105 - C06: 2010	Shade Change Light Medium Dark 3 3/4 4 Staining Light Medium Dark 3/4 3 2/3
Yarn count	ISO 3932:1976	8700 Nm
Weight	ISO 3801-1977	435 g/m ²

The term ReviWool[®] fabrics refers to the reference product of this EPD[®], while the term ReviWool[®] refers to the fibre from which the fabric is made, produced by Manteco[®] selected shorter fibers.

LCA INFORMATION

Functional unit / declared unit: 1 m² of fabric and its packaging.

Reference service life: not applicable.

Time representativeness: 2021-2022

Database(s) and LCA software used: Ecoinvent 3.7 database and SimaPro 9.2 software

System diagram: see figure 1

Description of system boundaries: cradle-to-gate with modules C1-C3 (see Table 2 for details on the processes included)

Excluded lifecycle stages: Forming stage (A4, A5) and Use stage (B1, B2).

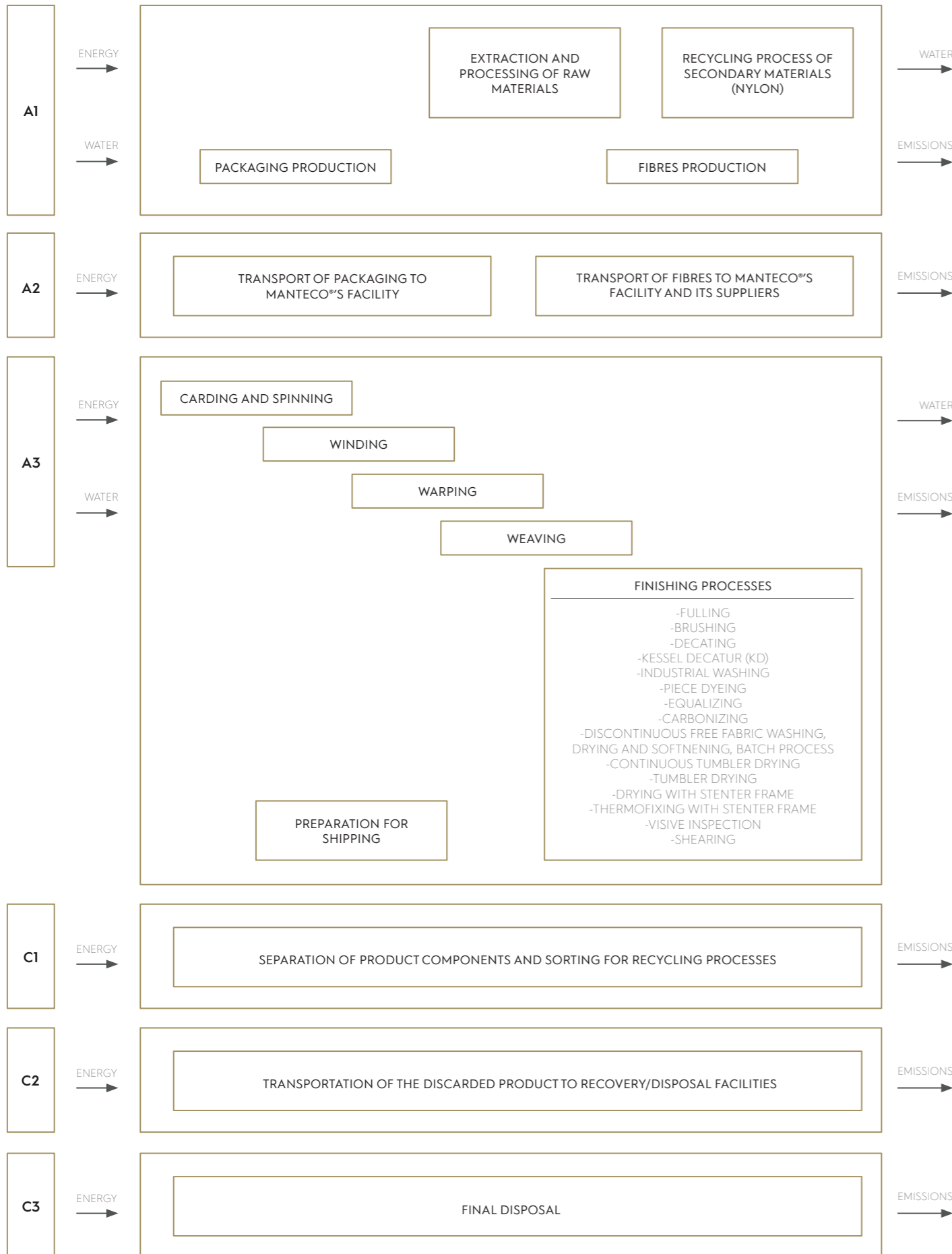
LCA practitioner: Studio Fieschi & soci Srl | C.so Vittorio Emanuele II, 18 10123 Torino, IT | www.studiofieschi.it

Table 2 – System boundaries

LIFE CYCLE STAGE	LIFE CYCLE MODULE	LIFE CYCLE MODULE GROUP	PROCESSES INCLUDED
UPSTREAM	A1) Raw material supply	Product stage	-Extraction and processing of raw materials, including fibres that construct the fabric and chemicals used in the manufacturing -Recycling processes of secondary materials from other product life cycles, -Production of input components, -Transport of raw materials and components along the upstream supply chain to a distribution point, -Production of distribution and consumer packaging, and -Generation of electricity and production of fuels, steam and other energy carriers used in upstream processes.
CORE	A2) Transport		-Transportation of materials and components to Manteco's manufacturing site, and -Generation of electricity and production of fuels, steam and other energy carriers used in transportation
	A3) Manufacturing		-Manufacturing of the ReviWool® fabric, -End-of-life treatment of manufacturing waste, even if carried out by third parties, including transportation, and -Generation of electricity and production of fuels, steam and other energy carriers used in manufacturing.

LIFE CYCLE STAGE	LIFE CYCLE MODULE	LIFE CYCLE MODULE GROUP	PROCESSES INCLUDED
DOWNSTREAM	A4) Transportation of the fabric to retailed	Forming stage	Not included
	A5) Further processing of the fabric		Not included
	B1) Transportation of the fabric to the use phase	Use stage	Not included
	B2) Use of the fabric by the consumer		Not included
	C1) Disassembling / sorting	End of life stage	-Operations for the separation of product components and subsequent sorting, and recycling processes, and -Generation of electricity and production of fuels, steam and other energy carriers used in the disassembling/sorting.
	C2) Transport to recovery/disposal		-Transportation of the discarded product to a recycling site or to final sorting yard or disposal, and -Generation of electricity and production of fuels, steam and other energy carriers used in the transportation to recovery/disposal.
C3) final disposal	- Waste disposal including physical pre-treatment and management of the disposal site		

Figure 1 - ReviWool® fabric: system diagram



Cut-off: packaging of wool purchased by Manteco®

Allocation: Impacts related to sheep co-production of wool and meat follows the protein mass allocation method. Impacts related to wool production processes were allocated according to an economic criterion.

UPSTREAM stage: The grazing, shearing and scouring processes take place in many farms located in different countries (see data quality declaration). The process of wool transformation takes place in Italy and data are referred to Italian companies and/or technical sheets of machineries used by Italian companies.

For these processes, electricity was modelled according to the Italian residual mix, specifically:

- Renewable energy from biomass: 1,73%
- Renewable solar energy: 5,02%
- Renewable energy from wind: 1,75%
- Renewable hydro energy: 1,72%
- Nuclear energy: 11,42%
- Fossil energy from hard coal: 17,40%
- Fossil energy from lignite: 0,54%
- Fossil energy from oil: 3,87%
- Fossil energy from natural gas: 54,43%

CORE stage: ReviWool® purchased in 2022 by Manteco come from sheep farmed mainly in Australia, South Africa, South America, and New Zealand. Electricity is modelled according to the Italian residual mix reported above.

DOWNSTREAM stage: The ReviWool® fabrics are sent to several customers that use the fabric for different final products and sold them all over the world.

For the EoL scenario, the following assumptions were made:

- C1 Disassembling/sorting:

- PE plastic bags and big bales for packaging of used clothes;
- A 100 km distance with a small lorry is assumed to pick clothes from the containers and transport them to the collection centre;
- 5,2 kWh/t is assumed as electricity required for sorting processes.

- C2 Transport to recovery/disposal facilities:

- 200 km by truck for transport to recycling facilities and 50 km by truck for transport to landfill/incineration;

- C3 Final disposal: the following scenario was assumed.

- 25% to recycling
- 54% to unsanitary landfill or open dump
- 10,5% to controlled or sanitary landfill
- 10,5% to incineration

Calculation method, assumptions, and limitations for PERM and PENRM

PERM: Wool LHV = 15,8 MJ/kg¹

PENRM: for plastics, the following parameters are considered:

- LDPE: Oil 68,6% Natural gas 45,3% of the total energy input;²
- Nylon: LHV = 30,2 MJ/kg³

Data quality declaration

- Specific data refer to 2021 with the exception of the origin of wool and polyamide purchased. This information was used for modelling transport from suppliers to Manteco (Module A2);

- PE plastic bags and big bales for packaging of used clothes;
- A 100 km distance with a small lorry is assumed to pick clothes from the containers and transport them to the collection centre;
- 5,2 kWh/t is assumed as electricity required for sorting processes.

- The system model of secondary databases used in the LCA study is cut-off by classification – unit;

- 200 km by truck for transport to recycling facilities and 50 km by truck for transport to landfill/incineration;

- The upstream phase was modelled using generic data from the following sources:

- Sheep greazing and shearing: Wiedemann et al, 2016, Resource use and greenhouse gas emissions from three wool production regions in Australia, Journal of Cleaner Production (2016) 122:121-132
- Scouring: Made Green in Italy, RCP Tessuti in Lana Cardata o peli fini cardati, v. 1.0, Valid until July 7th 2025
- Wool transformation: technical sheets of machineries used by Italian companies

- The use of proxy data contribute to less than 1% of the total GWP

CONTENT DECLARATION

PRODUCT

Product components	kg	%
ReviWool [®]	0,348	80
Polyamide	0,087	20
Total	0,435	100

Environmental/hazardous properties: No substance listed in the Candidate List of Substances of Very High Concern for Authorisation under the REACH Regulations is present in this product, either above the limits for registration with the European Chemicals Agency or in excess of 0,1 weight-% of the product.

PACKAGING

Distribution packaging: The finished ReviWool[®] fabric is packed in cardboard tubes and LDPE film. The weight of each fabric roll shall not exceed 25 kg, i.e. 57 m² of ReviWool[®] fabric.

Consumer packaging: not applicable.

RECYCLED MATERIAL

ReviWool[®] fabrics can be produced by adding either virgin or recycled polyamide upon customer's request. Recycled polyamide is pre-consumer and it is produced in Italy. For the representative product presented in this EPD only virgin material was considered. See additional environmental information for further details on the variation of impacts in case of use of recycled polyamide.

¹ Juanga-Labayen, J.P.; Labayen, I. V.; Yuan, Q., 2022, A Review on Textile Recycling Practices and Challenges, Textiles (2022), 2, 174-188

² PlasticsEurope, Eco-profiles and Environmental Product Declarations of the European Plastics Manufacturers. High-density Polyethylene (HDPE), Low-density Polyethylene (LDPE), Linear Low-density Polyethylene (LLDPE), April 2014, December 2016: update water balance

³ Ioelovich, M., Energy Potential of Natural, Synthetic Polymers and Waste Materials - A Review, Academic Journal of Polymer Science, May 2018, DOI: 10.19080/AJOP.2018.01.555553

RESULTS OF THE ENVIRONMENTAL PERFORMANCE INDICATORS

IMPACT CATEGORY	UNIT	Upstream	Core	Downstream							TOTAL
		Total Upstream	A1	Total Core	A2	A3	Total Downstream	C1	C2	C3	
<i>GWP Total</i>	kg CO ₂ eq.	8,30E+00	8,30E+00	6,00E+00	1,31E-01	5,87E+00	5,65E-01	9,24E-02	7,39E-03	4,66E-01	1,49E+01
<i>GWP Fossil</i>	kg CO ₂ eq.	2,61E+00	2,61E+00	5,79E+00	1,31E-01	5,66E+00	1,97E-01	9,22E-02	7,38E-03	9,74E-02	8,59E+00
<i>GWP-Biogenic</i>	kg CO ₂ eq.	4,66E+00	4,66E+00	1,53E-01	4,28E-05	1,53E-01	3,68E-01	9,12E-05	2,88E-06	3,68E-01	5,19E+00
<i>GWP-luluc</i>	kg CO ₂ eq.	1,02E+00	1,02E+00	5,87E-02	7,15E-05	5,86E-02	6,38E-05	5,87E-05	2,65E-06	2,39E-06	1,08E+00
<i>ODP</i>	kg CFC 11 eq.-	2,85E-07	2,85E-07	6,12E-07	2,76E-08	5,85E-07	1,95E-08	1,66E-08	1,61E-09	1,25E-09	9,17E-07
<i>AP</i>	mol H ⁺ eq.	1,40E-02	1,40E-02	2,37E-02	2,70E-03	2,10E-02	6,61E-04	4,61E-04	3,72E-05	1,63E-04	3,83E-02
<i>EP-Freshwater</i>	kg P eq.	2,82E-04	2,82E-04	3,30E-04	7,98E-07	3,29E-04	1,84E-06	1,44E-06	6,45E-08	3,43E-07	6,14E-04
<i>EP-marine</i>	kg N eq.	5,97E-03	5,97E-03	5,37E-03	6,97E-04	4,67E-03	2,99E-04	1,44E-04	1,26E-05	1,43E-04	1,16E-02
<i>EP-Terrestrial</i>	mol N eq.	3,64E-02	3,64E-02	4,65E-02	7,74E-03	3,88E-02	2,52E-03	1,60E-03	1,39E-04	7,83E-04	8,54E-02
<i>POCP</i>	kg NMVOC eq.	1,14E-02	1,14E-02	1,30E-02	2,04E-03	1,10E-02	8,46E-04	5,12E-04	3,95E-05	2,94E-04	2,53E-02
<i>ADP-Minerals and metals</i>	kg Sb eq.	2,08E-05	2,08E-05	4,20E-05	2,98E-07	4,17E-05	1,34E-06	1,30E-06	2,60E-08	2,34E-08	6,41E-05
<i>ADP-fossil</i>	MJ, net calorific value	3,83E+01	3,83E+01	1,03E+02	1,82E+00	1,01E+02	1,56E+00	1,33E+00	1,10E-01	1,19E-01	1,43E+02
<i>WDP</i>	m ³ world eq. deprived	7,78E+00	7,78E+00	1,54E+00	4,29E-03	1,54E+00	1,28E-02	9,36E-03	3,52E-04	3,09E-03	9,33E+00

RESOURCE USE INDICATORS

IMPACT CATEGORY	UNIT	Upstream	Core	Downstream							TOTAL
		Total Upstream	A1	Total Core	A2	A3	Total Downstream	C1	C2	C3	
<i>PERE</i>	MJ, net calorific value	1,83E+01	1,83E+01	1,25E+01	1,72E-02	1,25E+01	3,87E-02	3,51E-02	1,25E-03	2,38E-03	3,08E+01
<i>PERM</i>	MJ, net calorific value	4,29E+00	4,29E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	4,29E+00
<i>PERT</i>	MJ, net calorific value	2,26E+01	2,26E+01	1,25E+01	1,72E-02	1,25E+01	3,87E-02	3,51E-02	1,25E-03	2,38E-03	3,51E+01
<i>PENRE</i>	MJ, net calorific value	3,87E+01	3,87E+01	1,03E+02	1,82E+00	1,01E+02	1,51E+00	1,28E+00	1,10E-01	1,19E-01	1,43E+02
<i>PENRM</i>	MJ, net calorific value	5,19E+00	5,19E+00	2,41E-02	0,00E+00	2,41E-02	4,89E-02	4,89E-02	0,00E+00	0,00E+00	5,27E+00
<i>PENRT</i>	MJ, net calorific value	4,39E+01	4,39E+01	1,03E+02	1,82E+00	1,01E+02	1,56E+00	1,33E+00	1,10E-01	1,19E-01	1,49E+02

ADDITIONAL ENVIRONMENTAL INFORMATION

Variation of impacts in case of use of recycled Polyamide: As mentioned in the Product description, the Polyamide used in the fabric can originate from pre-consumer recycled materials. The maximum variation of the ReviWool® fabric environmental profile, in case all the polyamide used is from recycled materials, is the following:

IMPACT CATEGORY	UNIT	TOTAL	MAX VARIATION WITH RECYCLED PA
<i>GWP-total</i>	kg CO2 eq.	1,49E+01	-4%
<i>GWP-fossil</i>	kg CO2 eq.	8,59E+00	-6%
<i>GWP-biogenic</i>	kg CO2 eq.	5,19E+00	0%
<i>GWP-luluc</i>	kg CO2 eq.	1,08E+00	0%
<i>ODP</i>	kg CFC 11 eq.	9,17E-07	-5%
<i>AP</i>	mol H+ eq.	3,83E-02	-3%
<i>EP-freshwater</i>	kg P eq.	6,14E-04	-2%
<i>EP-marine</i>	kg N eq.	1,16E-02	-2%
<i>EP-terrestrial</i>	mol N eq.	8,54E-02	-3%
<i>POCP</i>	kg NMVOC eq.	2,53E-02	-3%
<i>ADP-minerals&metals</i>	kg Sb eq.	6,41E-05	0%
<i>ADP-fossil</i>	MJ, net calorific value	1,43E+02	-7%
<i>WDP</i>	m3 world eq. deprived	9,33E+00	-1%

REFERENCES

International EPD System, General Programme Instructions, v4.0

ISO 14025:2010 Environmental labels and declarations – Type III environmental declarations – Principles and procedures

ISO 14040:2006 Environmental management – Life cycle assessment – Principles and framework

ISO 14044:2006 Environmental management – Life cycle assessment – Requirements and guidelines

PCR 2022:04 Fabrics, v. 1.0.1

Other references:

- Bianco I., Blengini G.A., 2022, Life cycle Assessment of Manteco Textiles. Report 2: from yarn to finished fabrics, Politecnico di Torino
- Bianco I., Blengini G.A., 2022, Mapping of co-products in the wool production chain and environmental assessment with LCA methodology, Politecnico di Torino
- Bianco I., Blengini G.A., 2022, Report on the Environmental Product Declaration (EPD) of recycled wool yarn by Manteco SpA, Politecnico di Torino
- Ellen Macarthur foundation, 2017, A new textiles economy: redesigning fashion's future (<http://www.ellenmacarthurfoundation.org/publications>)
- EN 1773:1998 Textiles - fabrics - determination of width and length
- EN 14704-1:2005 Determination of the elasticity of fabrics - Part 1: Strip tests
- EPD S-P-00278 Econyl Nylon textile filament yarns
- EPD S-P-00513 Nurel S.A. Nylon 6 yarns
- International EPD® System, General Programme Instructions, 4.0
- Ioelovich, M., 2022, Energy Potential of Natural, Synthetic Polymers and Waste Materials - A Review, Academic Journal of Polymer Science, DOI: 10.19080/AJOP.2018.01.555553
- ISO 105-B02:2014 Textiles - Tests for colour fastness - Part B02: Colour fastness to artificial light: Xenon arc fading lamp test
- ISO 105-C06:2010 Textiles - Tests for colour fastness - Part C06: Colour fastness to domestic and commercial laundering
- ISO 105-E01:2013 Textiles - Tests for colour fastness - Part E01: Colour fastness to water
- ISO 105-X12:2016 Textiles - Tests for colour fastness - Part X12: Colour fastness to rubbing
- ISO 3071:2006 Textiles - Determination of pH of aqueous extract
- ISO 3175-2:2017 Textiles - Professional care, drycleaning and wetcleaning of fabrics and garments - Part 2: Procedure for testing performance when cleaning and finishing using tetrachloroethene
- ISO 3801-1977 Textiles - Woven fabrics - Determination of mass per unit length and mass per unit area
- ISO 3932:1976 Textiles - Woven fabrics - Measurement of width of pieces
- ISO 6330:2012 Textiles - Domestic washing and drying procedures for textile testing
- ISO 12945-2:2002 Textiles - Determination of fabric propensity to surface pilling, fuzzing or matting - Part 2: Modified Martindale method
- ISO 15797:2017 Textiles - Industrial washing and finishing procedures for testing of workwear
- Juanga-Labayen, J.P.; Labayen, I. V.; Yuan, Q., 2022, A Review on Textile Recycling Practices and Challenges, Textiles (2022), 2, 174-188
- Kaza S., Yao L., et al., 2018, What a waste 2.0. A snapshot of solid waste management to 2050, World Bank Group (<https://openknowledge.worldbank.org/entities/publication/d3f9d45e-115f-559b-b14f-28552410e90a>)
- Made Green in Italy, RCP Tessuti in lana Cardata o peli fini cardati, v. 1.0, valid until July 7th 2025
- PlasticsEurope, Eco-profiles and Environmental Product Declarations of the European Plastics Manufacturers. High-density Polyethylene (HDPE), Low-density Polyethylene (LDPE), Linear Low-density Polyethylene (LLDPE), April 2014, December 2016: update water balance
- Regulation (EU) No 1007/2011 of 27 September 2011 on textile fibre names and related labelling and marking of the fibre composition of textile products
- Wiedemann et al., 2016, Resource use and greenhouse gas emissions from three wool production regions in Australia, Journal of Cleaner Production (2016) 122:121-132
- Wiedemann et al., 2020, Environmental impacts associated with the production, use, and end-of-life of a woollen garment, The International Journal of Life Cycle Assessment (2020) 25:1486-1499

Databases:

Ecoinvent 3.7.1

Eurostat waste database <https://ec.europa.eu/eurostat/web/waste/data/database>