ENVIRONMENTAL PRODUCT DECLARATION

EPD REGISTRATION NUMBER: S-P-01164

MERINO WOOL ATHLEISURE KNIT FABRIC FIRST LAYER

IN ACCORDANCE WITH ISO 14025 & ISO 14040/14044

Programme operator: EPD Australasia Limited

Date of publication (issue): 2019-04-12

Date of validity: 2024-04-12

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

AUSTRALASIA EPD®
ENVIRONMENTAL PRODUCT DECLARATION

1865 REDA

NEW ZEALAND merino™

ZQ

PROGRAMME RELATED INFORMATION
ENVIRONMENTAL PRODUCT DECLARATION

Merino wool athleisure knit fabric - first layer

EPD Australasia Limited
www.epd-australasia.com

How to use this EPD

This EPD covers the following product group: Merino wool athleisure knit fabric - first layer in accordance with ISO 14025. CPC Code: 28190 Other knitted or crocheted fabrics. EPDs within the same product category but from different programmes may not be comparable.

This is one of two EPDs produced in 2019 by Successori Reda S.p.A. in cooperation with The New Zealand Merino Company Ltd. EPD transparency complements Reda's tradition of locally produced, high quality and environmentally sustainable products.

The EPDs are intended to be used in business-to-business communication for two fabric brands; Reda 1865 (worsted suiting fabric) and Reda Active (first layer). Note, finished apparel are not covered within the EPDs, only the fabric component.

This EPD only covers fabric made from merino wool sourced from New Zealand. Reda's merino wool athleisure knit fabric - first layer is purely made from ZQ accredited New Zealand merino wool, no other wool is used.

AUSTRALASIA EPD®
ENVIRONMENTAL PRODUCT DECLARATION

PROGRAMME RELATED INFORMATION	For further information about this EPD or its content please contact Dave Maslen at *dave.maslen@nzmerino.co.nz* or Francesco Botto at *francescobotto@reda.it*
Programme	EPD Australasia Limited www.epd-australasia.com
Programme operator	EPD Australasia Limited
EPD registration number	S-P-01164
Publication date	2019-04-12
Validity date	2024-04-12
Geographical scope	Production scope: New Zealand and Italy Application scope: International
Manufacturer	Successori Reda S.p.A., Biella, Italy
Product Category Rule (PCR)	Woven, knitted and crocheted fabrics of naturals fibres (except silk), for apparel sector (Version 1.01, 2018-10-06)
EPD Type	Cradle to factory gate (fabric)
LCA Study conducted by	thinkstep Australasia
EPD Owner	Successori Reda S.p.A.
EPD Verification by	Kimberly Robertson, Catalyst Ltd.

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PRODUCT INFORMATION

Merino Wool
Athleisure Knit Fabric - First Layer

Overview

This cradle to gate (fabric) Environmental Product Declaration (EPD) is valid for a declared unit of 1 m^2 of merino wool athleisure knit fabric - first layer produced at Reda's mill and selected external facilities located in Biella, Italy from New Zealand sourced ZQ accredited merino wool.

MERINO WOOL
ATHLEISURE KNIT FABRIC
FIRST LAYER

Declared unit: 1m^2 of fabric

Intended use: fabric to be used in the production of mens and womens athleisure apparel

Approx 1.3m^2 of fabric required for one t-shirt

FABRIC SPECIFICATIONS

Fabric type	**Weight per m^2**	**Composition**	**Reference standard**
Athleisure knit fabric - first layer	**146 g/m^2 ± 5%**	**100% wool**	**EU Reg No 1007/2011**
Content declaration	**Percentage**	**Details**	
Natural fibre	**99.9%**	**New Zealand sourced merino wool**	
Synthetic or man-made cellulosic fibre	**0.00%**	**N/A**	
Chemical residues Pigments, Dye Stuff, organic and inorganic chemicals	**<0.01%**	**Reda complies with the limits enforced by the Guidelines for eco-toxicological requirements for clothing, leather goods, footwear and accessories of the National Chamber of Italian Fashion, supported by ISO 14001 certification and Associazione Tessile e Salute auditing.**	**Reg.(UE) 1907/2006 e compliance**
Production volume	**Tonnes**		
Atheleisure knit fabric - first layer produced by Reda in 2016	**97.5**		
Other fabric specifications	**Unit**	**Result**	
Minimum useable width	cm	**≥ 126**	**UNI EN 1773**
Pilling (14400 revolutions)	grado	**Face 4/5**	**UNI EN ISO 12945-1**
pH-value water extract	pH	**4.0 ÷ 8.5**	**UNI EN ISO 3071**
Dimensional stability - machine washing (1X4N soap ECE drying C)	%	**Length ≤ 5.0, Width ≤ 6.0**	**UNI EN ISO 6330**
Dimensional stability - spirality after washing	%	**18**	**UNI EN ISO 16322-2**
Colour fastness - light	Grade	**Dark colours 4/5, Light colours 3/4**	**UNI EN ISO 105-B02**
Colour fastness to water	Change in colour	**Dark colours 3/4, Light colours 4**	**UNI EN ISO 105-E01**
Colour fastness - dry rubbing	Grade	**Dark colours 5, Light colours 5**	**UNI EN ISO 105-X12**
Colour fastness - wet rubbing	Grade	**Dark colours 3/4, Light colours 4/5**	**UNI EN ISO 105-X12**

THE CONSCIOUS CHOICE
OF TRANSPARENCY

REDA HISTORY

Since 1865

Today: 2019 — **LCA and EPD of fabrics**

2015 — SustainaWOOL standard in Australia

2013 — Supply chain traceability

2012 — Reduction of dangerous chemicals

2009 - Current — Specific Contracts

2009 — ZQ standard in New Zealand

2007 — Safety management system

2004 — Environmental Management Audit Scheme

2000 — The new factory

1993-2002 — REDA buys 3 farms and 30,000 sheep in New Zealand

1865: REDA ESTABLISHED

REDA

VISION
LEGACY

HISTORY & SUSTAINABILITY

History of Reda

1865. This is the year our long history began from the starting point of Carlo Reda's passion for wool and entrepreneurial ability.

It all began at a mill in Valle Mosso, Biella, which was transformed into a specialist wool factory and was progressively grown by succeeding generations until Albino and Francesco Botto Poala took over the enterprise in 1919. Since then, investment in people and technology has been central to Reda's success.

Reda has long supported the traditional craftsmanship of local workers in the production of quality merino fabrics. These were cherished for their sophisticated elegance, tending towards purity of weave. For example, the style expressed in these early designs featured minimal weaving variation and were light to the touch.

In 1968, a flood destroyed the Valle Mosso factory, but this did not stop Reda, Instead the company took advantage of the rebuild to focus on technological innovation. The next few decades saw large scale export development in international markets attracted by luxury and 'Made in Italy' quality. Today Reda exports to countries around the world but continues to maintain a strong bond with the Biella hills.

A new factory was opened in 1998 in Valle Mosso, where the Reda story began almost 150 years ago. It was the first wool factory in the world to take completely on board the new 'compact' spinning technology. Reda remains a vertically integrated business and alongside worsted suiting fabrics, it also produces athleisure knit fabric.

Reda's business is now well established in Europe, Japan and North America. We are also looking towards new markets such as Russia, China, India and South America with growing interest.




Reda sustainability initiatives

Factory

The company became the world's first vertical mill to be certified by EMAS and ISO 14001 in 2004[1]. Investment in sustainability projects and initiatives has led to a significant improvement in our environmental performance over the years. Reda developed a formal health and safety management system and obtained the BS OHSAS 18001 certification[2] in 2007. Furthermore, Reda is committed to the conscious purchasing of the raw material and complete traceability of its supply chain. The company achieved Unionfiliere Traceability & Fashion certification in 2013[3].

Farm

Reda is committed to raising awareness among its farmers. In 2009, an agreement was reached for the exclusive purchase of raw materials from farms in possession of the ZQ Merino certification, known as "Ethical wool", through The New Zealand Merino Company. This certification, so far unique in the world, combines the natural performances of the fibre with a program aimed at ensuring respect for the environment, economic development and social responsibility, combined with animal welfare and full traceability of wool's path from the farm to the mill.

Through New England Wool, Reda launched its accreditation scheme SustainaWOOL[4] for Australian breeders in March 2015. The basic philosophy is to promote the production of the best wool through a sustainable management of physical and natural resources, respecting the welfare of animals and tracing the entire path of wool. After only two years, more than 600 farms have received the certification.

Product

In order to reduce its impact on the product and on the consumer in terms of eco-toxicological substances, Reda has been certified by the Textile & Health Association[5]. This certification guarantees compliance with the strict limits of chemical that may be present on the finished product, and also pursues the future goal of the complete elimination of hazardous substances from the production cycle. To ensure compliance with the aforementioned limits, the company carries out tests on its own articles, monitoring the families of dangerous compounds.

The combination of all these efforts allows Reda to approach sustainability issues starting from the source of its product, continuing along the entire production chain, down to the finished fabric. EPD transparency complements Reda's tradition of locally produced, high quality and environmentally sustainable products.

Note: Reference for certifications mentioned:

1. http://ec.europa.eu/environment/emas/index_en.htm
1. https://www.dnvgl.com/services/iso-14001-environmental-management-system-3360
2. https://www.dnvgl.com/services/iso-45001-ohsas-18001-occupational-health-safety-113791
3. http://www.tfashion.camcom.it/P42A0C0S160/Il-sistema-di-tracciabilita.htm
4. https://www.newenglandwool.com.au/sustainability-animal-welfare/
5. https://www.tessileesalute.it/en/

THE NEW ZEALAND MERINO COMPANY & ZQ

VISION
LEGACY

VALUES & LEADERSHIP

The New Zealand Merino Company

The New Zealand Merino Company Limited (NZM) is an integrated sales, marketing, and innovation company headquartered in Christchurch in New Zealand's South Island.

The organisation was started in 1995 by Merino growers who wanted to lift New Zealand's Merino wool out of the commodity basket through marketing and differentiation.

Through an innovative forward contract mechanism, NZM growers now have greater price stability that allows them to more effectively manage their farms and make important capital investment decisions. In exchange, NZM's brand partners receive sustainable pricing, guaranteed supply, consistency of supply, traceability, and fit-for-purpose processing consignments.

The ZQ Accreditation Programme[1] was launched by NZM in 2006 and is well established as a world leading ethical wool sourcing standard. In addition to addressing animal welfare and land management, ZQ also addresses social responsibility, fibre quality, education, and has a significant portfolio of research to continue to refine and improve standards over time.

ZQ Accreditation Programme

Overview

ZQ wool is sourced directly through handpicked growers who are committed to continually improving product performance, farm management practices, animal health and welfare, environmental, economic and social values. ZQ Merino and ZQ Premium Wool brands cover fine wool and strong wool micron types respectively.

ZQ accredited wool is available exclusively through NZM and selected supply chain partners. It is sourced through direct supply contracts and is priced to ensure the economic sustainability of growers, supply chain partners and the retail brand.

Note: Reference for NZM ZQ programme:
http://www.jas-anz.org/accredited-bodies/organisation/db2e4c9d-c9b3-e411-be4f-005056b24e56/schemes-standards?search=all

Independent accreditation

Independent third party auditing is undertaken by Asure Quality (www.asurequality.co.nz), an internationally recognised assurance organisation, to ensure that production systems meet the highest standards. The maintenance of ZQ Merino accreditation is dependent on ongoing compliance.

This is determined through a programme of ongoing auditing, including self-assessments and on farm auditing which involves visual inspection of sheep, farms and facilities to ensure standards are met. All ZQ Merino accredited farms are audited every 3-5 years and in addition a random selection of properties are audited annually to ensure that the integrity of the programme is maintained. Some of these audits are conducted by a veterinarian focusing specifically on the animal welfare and health components of the programme.

Animal Welfare and Health

ZQ sheep graze on pastures in 'free range' extensive farming conditions. The ZQ accreditation programme ensures healthy animals by providing the five key freedoms (summary below), and does not permit mulesing or live shipping.

Environmental Sustainability

Healthy animals are reliant on a healthy environment, both of which are consistent with productive and profitable farming. To ensure this environment is maintained for future productivity, our ZQ accredited growers undertake active positive management that results in the production of premium quality fibre in harmony with environmental sustainability. All growers must have, and be adhering to, an approved and documented environmental management plan to manage the environmental impacts associated with their farming system.

Social Responsibility

Sustainable farming is closely linked with the social and economic welfare of farmers, farm workers and the local communities. The ZQ accreditation programme encourages the continuation of the culture of robustness and resilience and the health and safety of those living, working and visiting ZQ accredited farms.

Consistent fibre quality

Each ZQ fleece is individually hand classed and selected to brand specifications. ZQ wool is available in a wide range of microns, from fine Merino (12-24 micron) through to strong wool (25-40 micron). Working with selected growers whose farming systems consistently meet quality parameters, ZQ accredited wool is renowned for its outstanding processing and performance attributes which include:

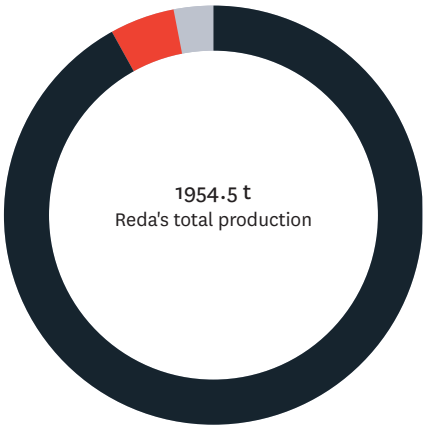
- Superior whiteness
- Superior strength
- Low coefficient of variation of fibre diameter
- Low vegetable matter
- Low levels of contamination

Traceability to fibre origin

ZQ wool is fully traceable to the individual farm, connecting the garment to the grower and giving confidence in the integrity of the fibre. This is made possible through the New Zealand Merino Company's forward contract model. ZQ wool is sourced from New Zealand with additional supply also available from hand selected, ZQ accredited properties in Australia and South Africa (where required). These properties are audited to the same standards as those in New Zealand.

THE WOOL
LIFE CYCLE

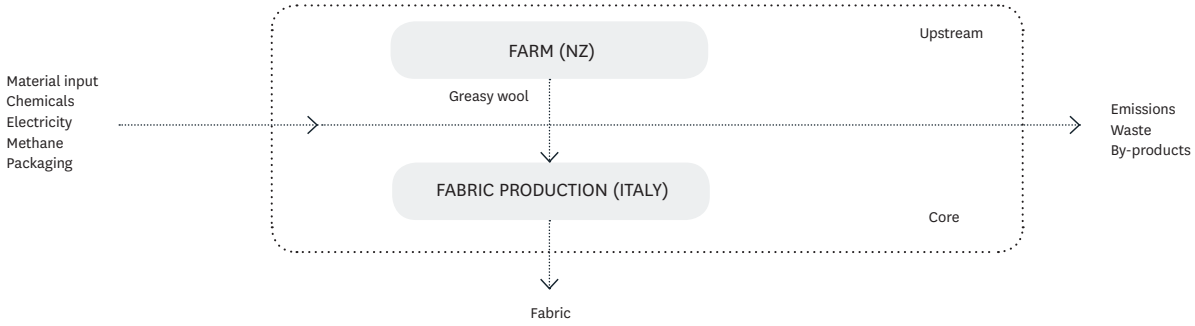
GOAL AND SCOPE
FRAMING THE EPD



WORSTED SUITING FABRIC
92% of Reda's total production by tonnes

ATHLEISURE KNIT FABRIC - FIRST LAYER
5% of Reda's total production by tonnes

SYSTEM BOUNDARIES FOR THE STUDIED SYSTEM



Summary

A Life Cycle Assessment (LCA) study was commissioned by NZM in collaboration with Reda, an Italian company that produces luxury fabric for high end clothing.

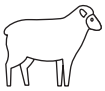
The study assessed the environmental performance of two Reda fabrics from farm to factory gate. It was completed in January 2019. This EPD summaries results for one of these fabrics: Merino wool worsted suiting fabric.

Product Category Rule

The LCA study was produced according to ISO 14040:2006 and ISO 14044:2006, the General Programme Instructions of the Australasian EPD® Programme V3.0 (AEPDP, 2018) and ISO 14025:2006, as the core (general) standard for EPDs. The background report followed rules set out in PCR: "Woven, knitted and crocheted fabrics of naturals fibres (except silk), for apparel sector"
(Version 1.01, 2018-10-06), the new PCR for natural fabrics.

Data collection

Primary data was used for all farming and manufacturing operations up to the factory gate. Farming data was from 2016/17 financial year and manufacturing data was from 2016 calendar year. Data for all energy inputs, transport processes and raw materials are from GaBi Databases 2018 (thinkstep 2018). Most secondary datasets have a reference year between 2014 and 2017 and all fall within the 10 year limit allowable for generic data under ISO 21930. New Zealand and Italian electricity grid mixes were used for upstream and core processes respectively, reference year 2014.



Farming model summary

Reda sources merino wool from Australia, South Africa and New Zealand. New Zealand wool represents 10% of supply by volume. Reda worsted suiting fabric uses wool sourced from different countries, but the wool is not mixed. Each wool batch is processed separately and the suiting fabric produced with merino wool from New Zealand is labelled as such. This EPD only covers fabric made from merino wool sourced from New Zealand.

All farms in New Zealand that provide wool to Reda are ZQ accredited. The ZQ programme, developed by NZM, ensures environmental, social and economic sustainability and safeguards animal welfare.

Three New Zealand Reda wool suppliers, which represent typical New Zealand merino farms in the ZQ programme, were chosen as case study farms. They are located in the South Island of New Zealand and supply a total of 7.3% of all greasy wool supplied directly to Reda from NZM's ZQ programme. Impacts per kg greasy wool differed based on farming practices, production and location.

2016/17 primary farming data was collected by NZM and analysed by AgResearch using the modelling tool Overseer and the NZ Greenhouse Gas Inventory.

Relevant information included:

- Farm profile; hectares, location, topography, stock units and stock reconciliation of all farmed animals.
- Material inputs; agrichemicals, irrigation, purchased feed, electricity and fuel use including internal and contracting activities.
- Production outputs; wool, meat, cropping and other co-products.

A farm data analysis tool was used to simplify the complex and variable farm systems. Farming practice, location related emissions, fertiliser run-offs and ammonia losses are included in the model.

On farm emissions such as methane (CH_4) emissions from sheep (enteric and dung) as well as nitrous oxide (N_2O) emission from excreta, nitrogen fertiliser etc, contribute to the impact category GWP. The fertiliser run-offs and volatilisations affect water quality and contribute to the eutrophication and acidification impact categories.

Methane emissions from enteric fermentation were calculated using the NZ Greenhouse Gas Inventory and nitrous oxide emissions using Overseer.

A weighted farming average was used to generate 'Upstream' LCA results. NZM analysed the 115 New Zealand merino farms that supplied wool to Reda in 2016/17 and developed a weighted average to represent typical inputs and productivity. Weightings applied: case study farm 1: 50%, case study farm 2: 15% and case study farm 3: 35%.

Further weighting was applied to irrigation water use. Although irrigation was used by the case study farms modelled, many NZ sheep farms do not have irrigation systems in place for cropping or stock finishing. Of the top 24 NZ Reda suppliers by volume, 44% irrigated and 56% did not. Further assumptions were based on NZ irrigation type averages (Dark, K.C, & Kashima, 2017) where 92.7% use a type of spray irrigation such as k-lines or pivots, as used by case study farm 1 & 2 and 7.25% use a type of flood irrigation such as border dykes, as used by case study farm 3.

Note: methane (CH_4) emissions from sheep are included in the impact indicator 'GWP biogenic'. Nitrous oxide (N_2O) emissions from excreta are included in 'GWP fossil', this is due to the following reasoning: ISO 14067:2018 does not specify whether nitrogen can be included within biogenic GHG/GWP emissions or not. However, in many places ISO 14067:2018 mentions "biogenic carbon" only. ISO 21930:2017, which includes requirements from ISO 14067:2017, defines that only CO_2, CH_4 and other carbon-based materials are included as 'biogenic'. Therefore 'non-carbon-based materials' such as N_2O (manure related emission) are not included in 'GWP biogenic'.

Allocation

For the farming phase, the method used to allocate inputs and emissions between co-products, where it was not possible to use system separation was based on the latest agreed methods outlined by FAO/LEAP, 2016.

- System separation was used on case study 3 to exclude finishing sheep brought-in and finished on a sub-block, as well as excluding the related land, inputs and outputs.
- Allocation was applied at two stages, with the first being allocation between sheep and cattle where they were being managed together (which occurred on all farms). In this case, the allocation % to sheep was calculated according to the relative feed intake (DMI) by sheep compared to that for sheep and cattle. For case study farm 1 & 3, allocation was also applied to separate Merinos from Romney sheep according to their relative DMI.
- The second stage where allocation was applied was

between the products produced by sheep, wool and live-weight sold for meat (FAO/LEAP, 2016). In this case, the 'metabolizable protein requirement' method was applied. This approach allocates the impacts based on the protein that is required for fibre (wool) growth, compared to the total protein required for fibre and meat growth. (Wiedemann S G, 2015).

For the manufacturing phase, where allocation could not be avoided, the following allocation procedures have been used to allocate the inputs and outputs to the fabric produced. The combing process at Reda produces the following co-products: clean wool and lanolin. The PCR specifies that economic allocation shall be applied to allocate between wool and lanolin. All other multi-output processes only produce wool/fibre by-products such as laps, noil, loops and single yarn. Inputs and outputs for all by-products are allocated based on mass (physical allocation) as specified in the PCR.

End-of-life allocation for Upstream and Core waste followed the requirements of ISO 14044.

Packaging

- Upstream packaging included polypropylene bales and metal clips for distribution purposes. Incoming farm packaging was also considered.
- Core packaging included plasic wrap, cardboard, metal and wood for handling and distribution purposes.

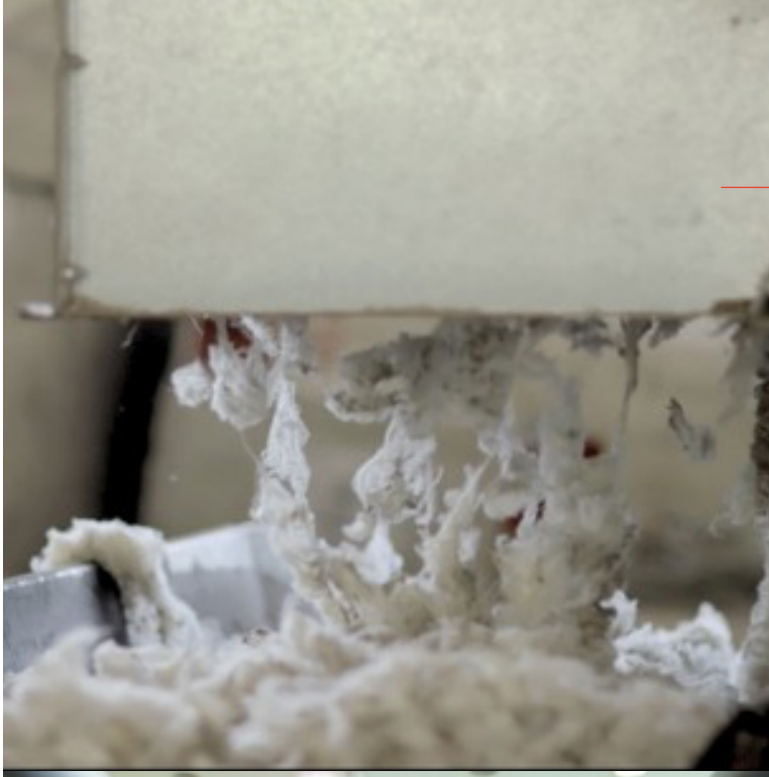
Limitations

- The transport to customer, use phase and end-of-life phase are excluded from the scope of this study.
- The farm stage is based on three case study farms in the South Island of New Zealand. All three farms supply wool to Reda. The evaluation of the three farms showed that the impacts per farm differed based on farm practices and location. The farming phase cannot be easily transferred to farms in other regions/countries.

Cut off criteria

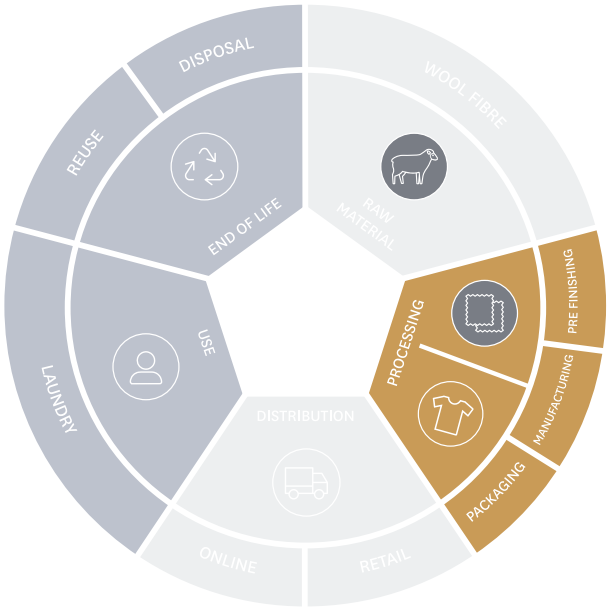
No cut-off criteria are defined for this study. The system boundary was defined based on relevance to the goal of the study. For the processes within the system boundary, all available energy and material flow data have been included in the model.

In cases where no matching life cycle inventories are available to represent a flow, proxy data have been applied based on conservative assumptions regarding environmental impacts.



LIFE CYCLE OVERVIEW

MAPPING FIBRE AND FABRIC PRODUCTION



Upstream, core and downstream processes

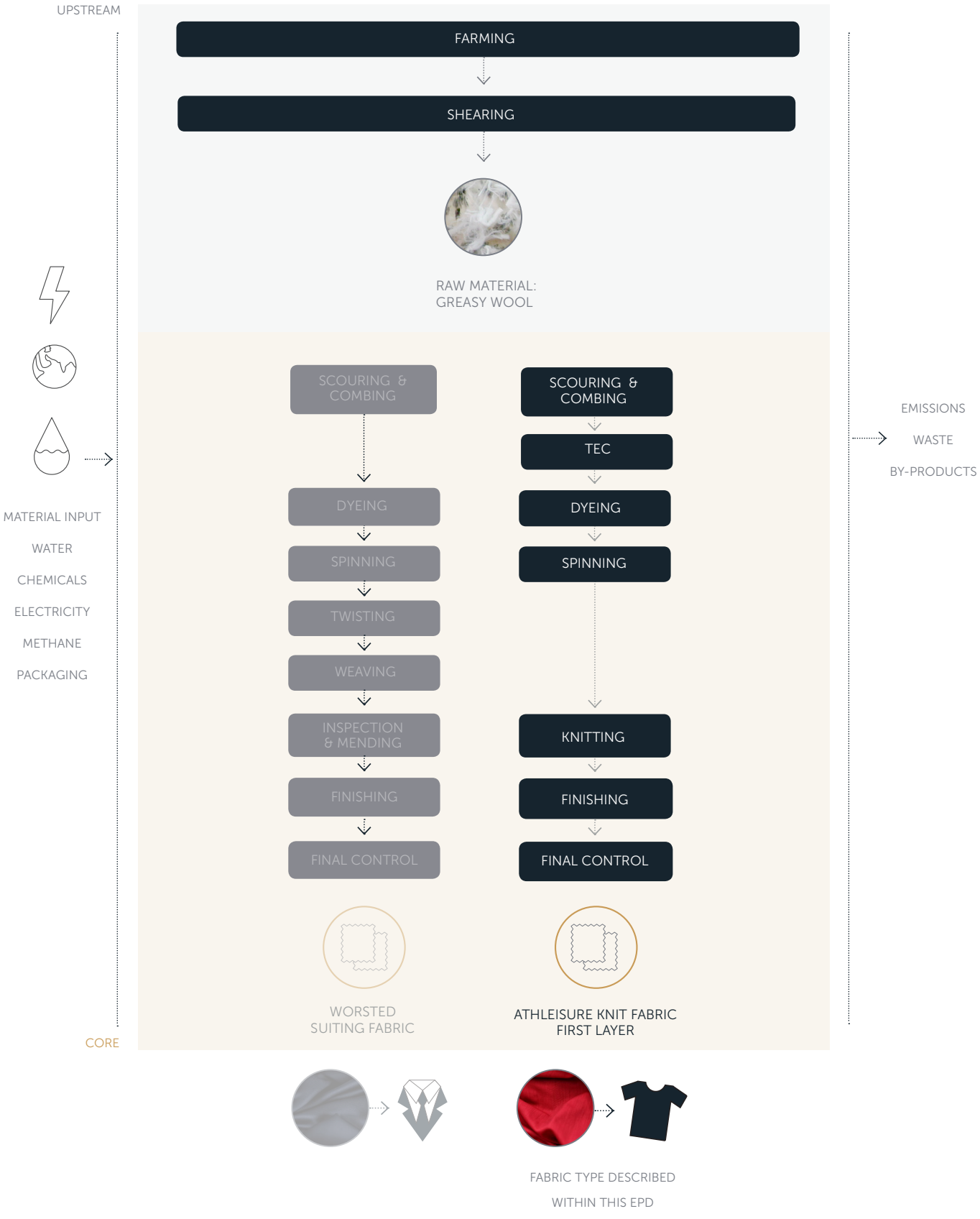
The relevant life cycle stages are described:

- Upstream processes (wool farming, storage and the production of all input materials)
- Core processes (combing, dyeing, spinning, twisting, weaving, finishing, final control, transport of input materials and internal transport);
- Downstream processes - excluded (transport to customer, use phase, end-of-life)

SYSTEM BOUNDARIES - LIFE CYCLE PHASES

Stage	Included	Excluded
Upstream - Farm (and production of other raw materials)	• Data from NZ Merino wool farms (three case studies) • Production of all input materials	
Core - Transport	• Transport from farm to ware house and port in NZ • Transport from NZ to Italy • Transport from port in Italy to Reda production site • Transport of production materials, chemicals and packaging to Reda production site • Waste transport to landfill • Waste transport to recycling facility	ø Transport past Reda's factory (exit) gate is excluded
Core - Manufacturing	• Inputs included with upstream impacts	
Core - Manufacturing waste	• Included if landfilled	ø If recycled the end of waste stage is at the (entry) gate of the recycling facility
Downstream - Transport to customer		ø Transport to customer is excluded
Downstream - Use phase		ø The use phase is excluded
Downstream - End-of-Life		ø The End-of-Life phase is excluded

PROCESS STEPS FOR EACH FABRIC TYPE PRODUCED BY REDA



IMPACT CATEGORIES

What was assessed?

Inputs and outputs across the selected life cycle phases were assessed using a range of environmental indicators, water footprint, resource use, waste and toxicity impact categories.

ENVIRONMENTAL IMPACT CATEGORY DESCRIPTION & REFERENCES

Indicator	Discription	Unit	Reference
 **Global Warming Potential** GWP – fossil GWP – biogenic GWP – land transformation **(GWP)**	A measure of greenhouse gas emissions, such as CO2, methane and nitrous oxide. These emissions are causing an increase in the absorption of radiation emitted by the earth, increasing the natural greenhouse effect. This may in turn have adverse impacts on ecosystem health, human health and material welfare. 100 year timeframe.	kg CO_2 e	(IPCC, 2013)
 **Ozone Depletion Potential** **(ODP)**	A measure of air emissions that contribute to the depletion of the stratospheric ozone layer. Depletion of the ozone leads to higher levels of UVB ultraviolet rays reaching the earth's surface with detrimental effects on humans and plants.	kg CFC-11 e	(Guinée, et al., 2002)
 **Acidification Potential** **(AP)**	A measure of emissions that cause acidifying effects to the environment. The acidification potential is a measure of a molecule's capacity to increase the hydrogen ion (H+) concentration in the presence of water, thus decreasing the pH value. Potential effects include fish mortality, forest decline and the deterioration of building materials.	kg SO_2 e	(Hausschild & Wenzel, 1998)
 **Eutrophication Potential** **(EP)**	Eutrophication covers all potential impacts of excessively high levels of macronutrients, the most important of which nitrogen (N) and phosphorus (P). Nutrient enrichment may cause an undesirable shift in species composition and elevated biomass production in both aquatic and terrestrial ecosystems. In aquatic ecosystems increased biomass production may lead to depressed oxygen levels, because of the additional consumption of oxygen in biomass decomposition.	kg PO_4^{3-} e	(Heijungs, et al., 1992)
 **Photochemical Ozone Creation Potential** **(POCP)**	A measure of emissions of precursors that contribute to ground level smog formation (mainly ozone O3), produced by the reaction of VOC and carbon monoxide in the presence of nitrogen oxides under the influence of UV light. Ground level ozone may be injurious to human health and ecosystems and may also damage crops.	NMVOC e	(van Zelm R, 2008)
 **Abiotic Resource Depletion, elements** **(ADPe)**  **Abiotic Resource Depletion, fossil** **(ADPf)**	The consumption of non-renewable resources leads to a decrease in the future availability of the functions supplied by these resources. Depletion of mineral resources and nonrenewable energy resources are reported separately. Depletion of mineral resources is assessed based on ultimate reserves.	kg Sb e MJ (net calorific value)	(van Oers, de Koning, Guinée, & Huppes, 2002)

ENVIRONMENTAL IMPACT CATEGORY DESCRIPTION & REFERENCES

Indicator	Discription	Unit	Reference
Carbon uptake (CO_2)	CO_2 stored as carbon in a product, such as wool, during the lifetime of the product.	kg CO_2 e	(IPCC, 2013)
Water scarcity potential	The water scarcity indicator quantifies the potential of water deprivation, to either humans or ecosystems, building on the assumption that the less water remaining available per area, the more likely another user will be deprived. AWARE method used. For this study the water scarcity factor for agricultural water use was assigned to water consumed in New Zealand (12.16) to reflect the water used on farms. For all other water flows, such as the water consumed during manufacturing in Italy and within background datasets the non-agricultural water scarcity factor for Italy (17.75) was applied.	m3 H_2O e	(Boulay, 2018)
Total Fresh water Use (FWU)	Consumption of surface water or groundwater.	m^3	(Hoekstra, 2017)
Ecotoxicity	Effect factors for freshwater ecosystems are based on species-specific data of concentration at which 50% of a population displays an effect, expressed as an estimate of the potentially affected fraction of species (PAF) integrated over time and volume per unit mass of a chemical emitted (PAF m3-day/ kg). The final unit is comparative toxic units (CTUe).	PAF.m^3.day (CTUe)	(Rosenbaum, et al., 2008)
Human Toxicity - cancer effects	Human effect factors relate the quantity taken in to the potential risk of cancerous and noncancerous effects expressing cases per kg of chemical emitted. The final unit is comparative toxic units (CTUh).	Cases (CTUe)	(Rosenbaum, et al., 2008)
Human Toxicity - non-cancer effects	Human effect factors relate the quantity taken in to the potential risk of cancerous and noncancerous effects expressing cases per kg of chemical emitted. The final unit is comparative toxic units (CTUh).	Cases (CTUe)	(Rosenbaum, et al., 2008)

MERINO WOOL
ATHLEISURE KNIT FABRIC - FIRST LAYER
ENVIRONMENTAL PRODUCT DECLARATION

ENVIRONMENTAL IMPACTS PER 1 M² OF ATHLEISURE KNIT FABRIC - FIRST LAYER (MANDATORY)

Indicator	Unit	Upstream	Core	Total
Global Warming Potential - total Fossil Biogenic Land transformation	kg CO_2 e	1.11E+01 3.21E+00 7.93E+00 2.18E-03	1.40E+00 1.40E+00 6.40E-03 1.79E-03	1.25E+01 4.60E+00 7.94E+00 3.97E-03
Acidification Potential	kg SO_2 e	1.00E-01	7.72E-03	1.08E-01
Eutrophication Potential	kg PO_4^{3-} e	6.16E-02	5.42E-04	6.22E-02
Formation potential of tropospheric ozone	kg NMVOC e	6.92E-03	3.60E-03	1.05E-02
Abiotic depletion potential – Elements	kg Sb e	3.53E-06	5.43E-07	4.07E-06
Abiotic depletion potential – Fossil fuels	MJ	2.47E+01	2.21E+01	4.68E+01
Water scarcity potential	m3 e	2.04E+01	8.42E-02	2.05E+01
Carbon uptake	kg CO_2-e	-2.68E-01	0.00E+00	-2.68E-01

RESOURCE USE PER 1 M² OF ATHLEISURE KNIT FABRIC - FIRST LAYER (MANDATORY)

Indicator	Unit	Upstream	Core	Total
Use of renewable primary energy resources - total Use as energy carrier Use as raw materials	MJ (ncv)	1.02E+01 7.19E+00 3.04E+00	5.87E+00 5.87E+00 0.00E+00	1.61E+01 1.31E+01 3.04E+00
Use of non-renewable primary energy resources - total (PED) Use as energy carrier Use as raw materials	MJ (ncv)	2.56E+01 2.56E+01 0.00E+00	2.31E+01 2.31E+01 0.00E+00	4.87E+01 4.87E+01 0.00E+00
Secondary material	kg	0.00E+00	0.00E+00	0.00E+00
Renewable secondary fuels	MJ (ncv)	0.00E+00	0.00E+00	0.00E+00
Non-renewable secondary fuels	MJ (ncv)	0.00E+00	0.00E+00	0.00E+00
Net use of freshwater (FWU)	m^3	1.68E+00	6.94E-03	1.69E+00

Note: The indicator 'GWP biogenic' includes methane (CH_4) emissions from sheep, but not nitrous oxide (N_2O) emission from sheep excreta. Sheep related N_2O emissions are included within 'GWP fossil', in accordance with ISO 21930:2017 and ISO 14067:2017 requirements.

WASTE PRODUCTION AND OUTPUT FLOWS PER 1 M² OF ATHLEISURE KNIT FABRIC - FIRST LAYER (MANDATORY)

Indicator	Unit	Upstream	Core	Total
Hazardous waste disposed	kg	3.92E-06	2.01E-08	3.94E-06
Non-hazardous waste disposed		5.91E-01	1.30E-02	6.04E-01
Radioactive waste disposed		3.35E-04	4.06E-04	7.41E-04
Components for reuse	kg	0.00E+00	0.00E+00	0.00E+00
Material for recycling		2.30E-02	5.86E-02	8.16E-02
Material for energy recovery		0.00E+00	5.07E-06	5.07E-06
Exported energy, electrical	MJ (ncv)	0.00E+00	0.00E+00	0.00E+00
Exported energy, thermal		0.00E+00	0.00E+00	0.00E+00

ENVIRONMENTAL INDICATORS PER 1 M² OF ATHLEISURE KNIT FABRIC - FIRST LAYER (VOLUNTARY)

Indicator	Unit	Upstream	Core	Total
Ecotoxicity	CTUe	4.99E+01	1.08E+01	6.07E+01
Human Toxicity (cancer effects)	CTUh	3.74E-08	1.21E-09	3.87E-08
Human Toxicity (non-cancer effects)	CTUh	1.40E-07	-4.51E-09	1.35E-07
Ozone Depletion Potential (ODP)	kg CFC-11 e	1.86E-12	6.52E-13	2.51E-12

SUMMARY OF RESULTS PER 1 M² OF ATHLEISURE KNIT FABRIC - FIRST LAYER FABRIC

Fabric Type per 1 m²	GWP	ODP	AP	EP	POCP	APDe	APDf	FWU	PED
	kg CO_2 e	kg CFC-11 e	kg SO_2 e	kg PO_4^{3-} e	NMVOC e	kg Sb e MJ	kg Sb e MJ	m^3	MJ
Merino wool knit fabric - first layer	1.25E+01	2.51E-12	1.08E-01	6.22E-02	1.05E-02	4.07E-06	4.68E+01	1.69E+00	4.87E+01

Biogenic carbon

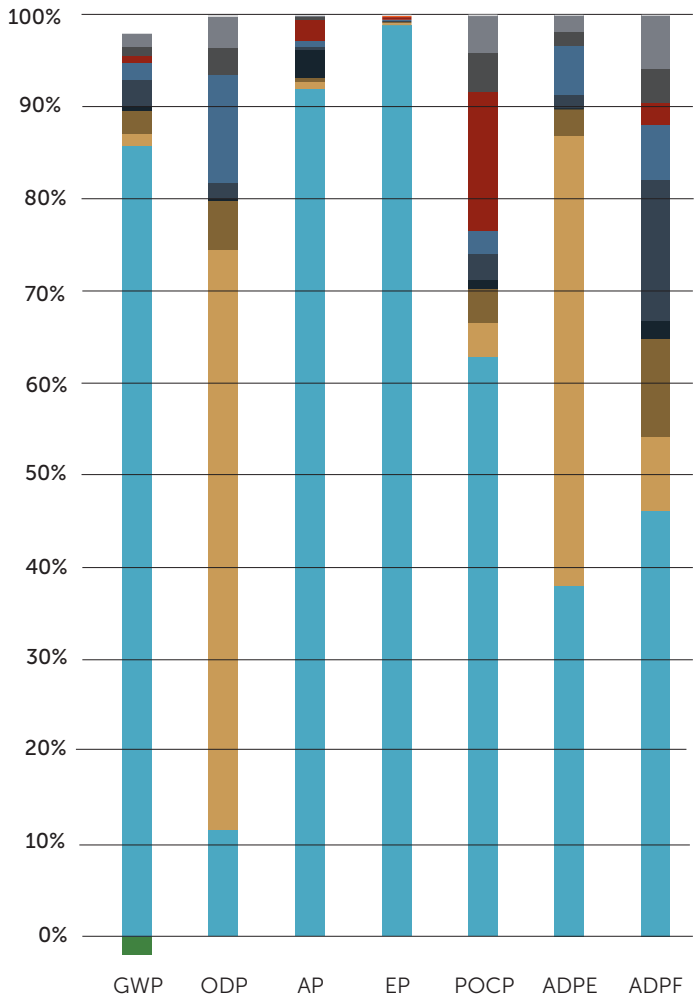
Wool is a natural, renewable and biodegradable raw material.

Throughout the sheep's annual wool growth cycle, carbon is sequestered as biomass. This natural carbon recycling process involves carbon from absorbed CO_2 being transformed into the living organism e.g. plant, animal tissue or wool. This is called biogenic carbon.

Animals and plants capture and store carbon, meaning carbon is embedded in wool fibre and resulting fabric. This carbon is eventually released into the air again at the end of life as CO_2 (biogenic carbon dioxide) or as CH_4 (biogenic methane).

0.27kgCO_2e of biogenic carbon per 1m² of merino wool athleisure knit fabric - first layer sequestered through the wool growing process was calculated as part of the EPD process.

CONTRIBUTION OF FARMING & PROCESSING STEPS - CRADLE TO FACTORY GATE (FABRIC)



ATHLEISURE KNIT FABRIC
FIRST LAYER

146 g/m² ± 5%

approx 1.3m² of fabric
required for one t-shirt

100% wool

KEY

- Carbon uptake
- Farming & Shearing
- Material input
- Combing
- Dyeing
- Spinning
- Twisting
- Weaving
- Transport
- Finishing
- Final control

REGISTRATION DETAILS
ENVIRONMENTAL PRODUCT DECLARATION

Merino wool athleisure knit fabric - first layer

EPD Australasia Limited
www.epd-australasia.com

An Environmental Product Declaration, or EPD, is a standardised and verified way of quantifying the environmental impacts of a product based on a consistent set of rules known as a PCR (Product Category Rules).

Environmental product declarations within the same product category from different programmes may not be comparable.

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

Declaration owner and EPD producer	Successori REDA S.p.A. P.Iva 01676570029 Via Robiolio, 25 13825 Valle Mosso (BI) Italy
EPD background documentation	thinkstep Ltd www.thinkstep.com anz@thinkstep.com 11 Rawhiti Road, Pukerua Bay, Wellington 5026
EPD programme operator	EPD Australasia Limited www.epd-australasia.com info@epd-australasia.com 69 Rutherford Street, Hutt Central Lower Hutt 5010, New Zealand
Product Category Rule	Woven, knitted and crocheted fabrics of naturals fibres (except silk), for apparel sector (Version 1.01, 2018-10-06)
UN CPC classification	28190 Other knitted or crocheted fabrics
ANZSIC06 classification	CC211 - Textile and Leather Manufacturing
PCR review was conducted by	The Technical Committee of the International EPD® System
Chair	Massimo Marino, contact via info@environdec.com
Independent verification of the declaration and data, according to ISO 14025	☐ EPD process certification (Internal) EPD verification (External)
Procedure for follow-up of data during EPD validity involves third party verifier	Yes ☐ No
Third party verifier	Kimberly Robertson, Catalyst Ltd www.catalystnz.co.nz kimberly.robertson@catalystnz.co.nz PO Box 37228, Christchurch 8245, New Zealand
Accredited or approved by	EPD Australasia Limited

ACRONYMS AND GLOSSARY

ADP - Abiotic Depletion Potential

AP - Acidification Potential

EoL - End-of-Life

EP - Eutrophication Potential

EPD - Environmental Product Declaration

FWU - Fresh water use / Blue water

GaBi - Ganzheitliche Bilanzierung (German for holistic balancing)

GHG - Greenhouse Gas

GWP - Global Warming Potential

ILCD - International Cycle Data System

ISO - International Organization for Standardization

LCA - Life Cycle Assessment

LCI - Life Cycle Inventory

LCIA - Life Cycle Impact Assessment

ODP - Ozone Depletion Potential

POCP - Photochemical Ozone Creation Potential

PCR - Product Category Rules

PED - Primary energy demand, non-renewable

VOC - Volatile Organic Compound

Life cycle
A view of a product system as "consecutive and interlinked stages … from raw material acquisition or generation from natural resources to final disposal" (ISO 14040:2006, section 3.1). This includes all material and energy inputs as well as emissions to air, land and water.

Life Cycle Assessment (LCA)
"Compilation and evaluation of the inputs, outputs and the potential environmental impacts of aproduct system throughout its life cycle" (ISO 14040:2006, section 3.2)

Product Category Rule (PCR)
"Defines the rules and requirements for EPDs of a certain product category."

Environmental Product Declaration (EPD)
"Independently verified and registered document that communicates transparent and comparable information about the life-cycle environmental impact of products."

Functional unit
"Quantified performance of a product system for use as a reference unit" (ISO 14040:2006, section 3.20)

Allocation
"Partitioning the input or output flows of a process or a product system between the product system under study and one or more other product systems" (ISO 14040:2006, section 3.17)

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