Comparative Life Cycle Impact Assessment for Autron Industry Co.

Analysis Overview

- The objective of this study is to compare the impact of Autron's sustainable fabric against comparative conventional fabrics. The findings of the study are intended to be used as a basis for communication and future process improvements. The primary audience for this study is Autron, its investors and customers.
- This cradle-to-gate comparative life cycle inventory (LCI) encompasses all upstream processes of fabric manufacture from, raw material acquisition to fibre and fabric manufacture. All the relevant life-stages of sustainable and conventional fabric are analyzed to estimate the net impact savings across three key metrics: GHG emissions, primary energy use, and blue water consumption.
- This analysis does not include impact assessment except for Global warming potential impact. It does not attempt to determine the fate of emissions, or the relative risk to humans or to the environment due to emissions from the systems.

Scope of Study

- This is a cradle-to-gate comparative life cycle inventory study
- Functional unit is 1 kg of finished apparel for each Autron and comparative conventional fabric type
- The study examines Autron manufacturing globally and compared it with conventional fabric manufacturing with global sourcing. Transportation between production processes and post manufacturing processes including consumer's transportation, use and disposal are not part of this study.

Analysis Overview (cont.)

Other data

- Transportation is included between all production stages and until warehouse storage.

Data Audit

- No internal or external audit of resource utilization data provided by Autron was performed by Green Story for this study. It is assumed that data provided by Autron and its suppliers is factual and accurate.

Critical Review

- No third-party critical review has been performed for this study.

Key Assumptions

Overall assumptions

- Autron rPET supply chains are compared to supply chains of PET produced in the same country as Autron's production.
- Impacts for CO2 emissions are given as non-biogenic carbon dioxide equivalence (CO2e) as it is assumed that all biogenic CO2e stored in the apparel will be released back to the environment at their end-of-life.
- Recycled PET granulate and PET granulate production processes are taken as Switzerland processes from Ecoinvent (2017) and adapted to Autron and comparative supplier chain through fuel, electricity grid and other raw material inputs' geographical source changes.
- The bottle collection process and sorting for recycled PET are also based on Swiss data and modified through key process and fuel source substitutions.
- The same yarn, fabric, and apparel production inputs are considered for both Autron and conventional apparel production.
- Yarn production covers the spinning of granulate material to partially-orientated yarn and the drawing and texturing for draw textured yarn. Inputs needed for these processes are taken from Van der Velden et al. (2014).
- All dyeing processes are taken from GaBi 8.7 (2018) and adapted by energy source replacement.
- Cut & Sew electricity and waste were excluded from the analysis due to lack of data on specific Autron product assembly.
- Solely weaving was considered due to Autron product types.
- The weaving process includes sizing and warping, weaving, and sanforizing with inputs requirements from Van Eynde (2015) and Cotton Inc (2012).
- Sanforizing inputs are calculated with the assumption of material weight as 170 gsm (ARKET, 2018).

Key Assumptions (cont.)

Supply chains

Material	Fiber	Yarn	Fabric	Dyeing	Cut & Sew	Warehouse
rPET	Dongguan, China	Dongguan, China	Dongguan, China	Dongguan, China	Dongguan, China	Shiling Town, China
Virgin polyester	China	China	China	China	China	Shiling Town, China

Overall waste

Waste scenario	Waste %
Yarn Production (rPET)	9%
Weaving	3%
Dyeing	3%

Key Assumptions (cont.)

Transport

- All transportation between raw material production until warehouse storage is taken into consideration for both Autron and conventional production.
- A distance of 1000 km is applied when production processes are done in the same country but cities are unknown, as indicated by Quantis (2018).
- An inner-city standard transportation distance of 30km is assumed for production processes in the same city with different facilities when exact locations are unknown.
- Conventional dyeing is assumed to be done at the same facility as fabric production, hence no transportation is included at this stage.
- All distances were calculated with SeaRates LP (2018).

Stages	rPET (km)	Virgin polyester (km)
Raw Material to Yarn (Truck)	30	1000
Yarn to Fabric (Truck)	30	1000
Fabric to Cut & Sew (Truck)	30	1000
Cut & Sew to Warehouse (Truck)	108	1000

List of sources

Secondary Sources

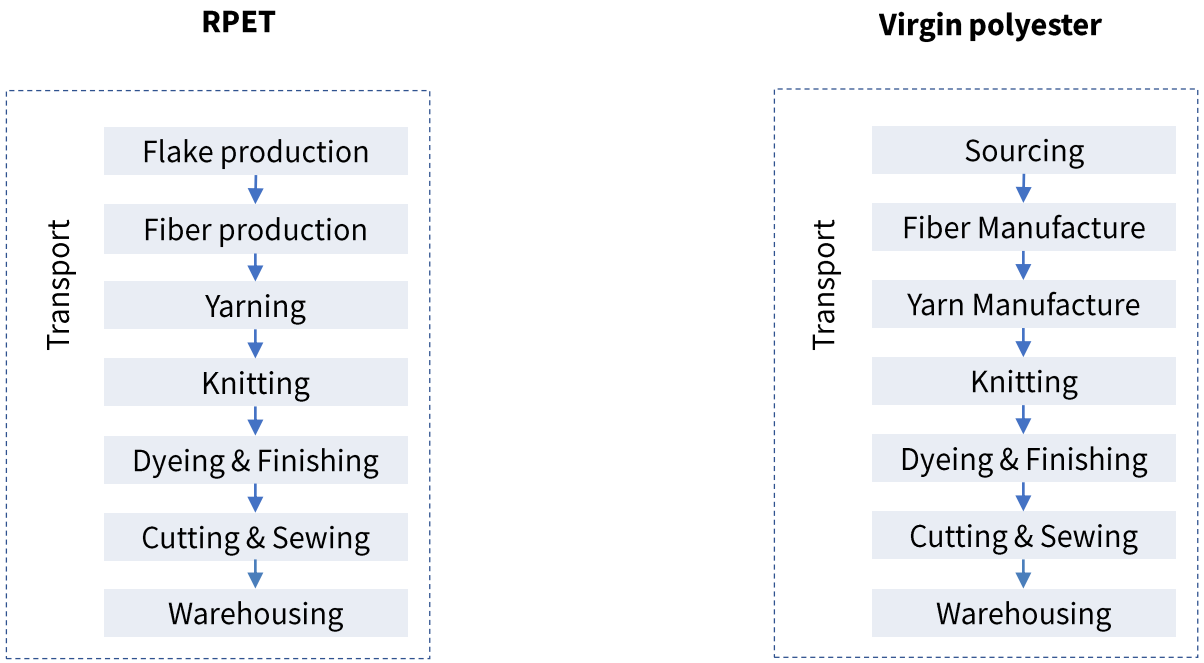
- Ecoinvent (2017) Database Ecoinvent version v3.7. The Swiss Centre for Life Cycle Inventories.
- European Commission JRC. “Environmental Improvement Potential of Textiles (IMPRO Textiles). JRC Scientific and Policy Reports. (January 2014).
- GaBi 8.7: Leinfelden-Echterdingen GaBi Software-system and Databases for Life Cycle Engineering, Thinkstep AG, 2018.
- PARCL. Approximate Weight of Goods. Education Center, Approximate Weight of Goods.
- Quantis. “Measuring Fashion. Environmental Impact of the Global Apparel and Footwear Industries Study. Full report and methodological considerations.” 2018
- Sustainable Energy Saving for the European Clothing Industry. “Benchmarking energy efficiency in apparel production”. (n.a).
- Van der Velden, Natascha M., Martin K. Patel, and Joost G. Vogtländer. "LCA benchmarking study on textiles made of cotton, polyester, nylon, acryl, or elastane." The International Journal of Life Cycle Assessment 19.2 (2014): 331-356.
- “Cotton GSM.” ARKET, 2018, www.arket.com/en_eur/c/cs-cotton-gsm.html.
- Cotton Inc, 2012. Life Cycle Assessment of Cotton Fibre and Fabric. Pre-pared for VISION 21, a project of The Cotton Foundation and managed by Cotton Incorporated, Cotton Council International and The National Cotton Council. The research was conducted by Cotton Incorporated and PE Inter-national.
- Van der Velden, Natascha M., Martin K. Patel, and Joost G. Vogtländer. "LCA benchmarking study on textiles made of cotton, polyester, nylon, acryl, or elastane." The International Journal of Life Cycle Assessment 19.2 (2014): 331-356.
- Quantis. “Measuring Fashion. Environmental Impact of the Global Apparel and Footwear Industries Study. Full report and methodological considerations.” 2018
- SeaRates LP. “Current Market Rate.” SeaRates, 2018, www.searates.com/reference/portdistance/.

Primary Sources

- Autron proprietary data

RPET vs Virgin Polyester
Comparative Impact Calculation Results

System boundary



RPET vs. virgin polyester comparative LCI (per kg of clothing)

Net impact difference

Per kg of apparel	Unit	rPET	Virgin polyester	Percentage lower
GHG emissions	kgCO2e	19.48	22.60	14%
Energy	MJ	261.50	344.10	24%
Water consumption	litres	65.28	102.10	36%

About Green Story

The Green Story team is led by Akhil Sivanandan and Navodit Babel. Both members received their sustainability reporting training from the Global Reporting Initiative.

- Navodit has 10+ years of experience in consulting and product management with global corporations. He has successfully overseen the launch of national card strategies in Canada. During his MBA at the University of Toronto, he developed a sustainability ranking algorithm for mining projects for Sustainalytics which used in the company's global operations.
- Akhil has worked on sustainability projects for companies such as Philips Lighting and given presentations and interviews on the topic for multiple publications including the New York Times. He was also intimately involved in the Ontario Cap and Trade and Offsets programs as part of the Government. Akhil received his MBA from the University of Toronto.

Green Story's mission is help companies communicate environmental and social impact to stakeholders in a clear, credible and relatable manner.

We work with a range of companies from waste management firms to one of North America's largest ecofashion manufacturers to engage stakeholders and measure and communicate impact.

Green Story is a Ministry of Environment Agent of Change, Social Capital Markets scholarship recipient, a member of the MaRS Centre for Impact Investing and of Ryerson University's Social Venture Zone.

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