CIRCLE ECONOMY

CIRCLE Textiles

CLOSING THE LOOP FOR POST CONSUMER TEXTILES

ReBlend

recover

INTRODUCTION: PROJECT, CONTEXT AND KEY RESULTS

THE STORY OF REBLEND

CIRCLE ECONOMY

ReBlend is a Dutch circular fashion & textiles agency, with a mission to show the world that mixed post-consumer textiles can be recycled into new high quality products, thereby making the case for closed loop textiles.

The ReBlend concept is to work closely together with designers, makers and labels to develop new yarns, fashion and interior design that deliver high quality and comfort using only recycled materials. Using mainly, no longer wearable, post-consumer textile waste (>70%) in an ecologically friendly process (no water, no additional chemicals, no dying) to make yarn and textiles with a minimal negative ecological impact!

In 2015, ReBlend joined the Circle Economy network to take their project to the next level. They teamed up with Recover, another Circle Economy member and expert in mechanical recycling, to produce 100% recycled yarns for a new collection of beautifully knitted and woven fashion and upholstery products. Together with Circle Economy and Recover, ReBlend shows that through high value recycling, quality textile products and environmental benefits can go hand in hand.

In this project, almost 7 tonnes of post consumer garments were processed to produce 6 tonnes of new 100% recycled yarns. Four different colour yarns were made with 70% recycled post consumer garments and and 30% RPET. Circle Economy performed a Life Cycle Assessment on one of the recycled yarns (White Cream) to asses the environmental impact savings associated with producing ReBlend 100% recycled yarns. The analysis shows a decrease in energy use by 33%, a reduction in water consumption by 62%, and a decrease in greenhouse gas emissions by 18%, in comparison with virgin yarn of similar composition.

> *Recycling is focused on pure materials (100% cotton, wool or polyester). What we wear is mostly a blend of materials. It is easy to see that this creates a huge gap between theory and reality!*
> **- Anita de Wit, Reblend**

INCREASED POTENTIAL FOR HIGH VALUE RECYCLING

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High Value or textile-to textile recycling enables textile 'waste' fabrics or garments to be redirected back into the textiles loop as recycled raw materials. Currently, textile 'waste' streams throughout the supply chain remain a largely untapped resource due to the lack of established technologies, processes and business models to redirect these fibres back into the loop. However, this is quickly changing due to the growing interest of the textile industry in circular economy and the technological advancement that can enable a circular textiles industry.

- In the US and EU, approximately 85% and 75% of used textiles ends up in landfill/incineration respectively. This adds up to a post consumer textile 'waste' stream of ±14 million tonnes/yr*. If these textiles would be collected, ±55% could be reworn; ±20% could be downcycled, and ±20% would be for textile-to-textile recycling.
- In the Netherlands, 235 Kt of used textiles are discarded annually, 62 % of which end up in municipal waste bins. From the rest of the discarded textiles collected by businesses and charities 55 % is suitable for reuse and 40 %, or 36 Kt* is suitable for recycling.

Leveraging these untapped 'waste' resources to create new textiles on a large scale would enable us to drastically cut down our need for virgin textile resources, reducing significantly the impacts associated with fibre production and textile waste.

Mechanical recycling methods are already playing a crucial role in paving the road to circular, offering 'textile to textile' solutions that proximate virgin quality and that are ready for further scaling. Furthermore, game changing chemical technologies are on the horizon and are expected to provide the scale that is needed to generate a tipping point in closing the loop for textiles.

*Rough estimations based on approximate percentages known in the market and a global textile fibre production of 90 million tonnes per year.

WHAT IF...?

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It is estimated that **36 Kt** of discarded textiles collected annually in the Netherlands are suitable for fibre recycling. If all these untapped resources were to replace virgin textile materials, the environmental impact reduction would amount to approximately:

Energy:
46000
for a year

Water:
90 million
showers

CO2:
30000
international
flights per person

PROBLEM: ENVIRONMENTAL IMPACTS OF TEXTILE PRODUCTION AND WASTE

TEXTILES AS THE SECOND MOST POLLUTING INDUSTRY IN THE WORLD

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At a rapid pace, the textile industry has become one of the most polluting industries in the world. Consumption has risen through the roof and we are spending more money on clothes than ever before. To enable us in our growing consumption habits, global textile fibre production has risen to ±90 million tonnes per year (±80 billion garments per year). This level of production is economically unstable and ecologically unsustainable.

Upstream, the production of textile fibre is extremely water, land, energy and chemical intensive and reliant on finite resources. Downstream, increasing environmental impacts can be seen due to the growing volumes of post-industrial, pre-consumer and post-consumer textile waste. We are using resources and producing waste too fast for the planet to keep up. According to the report 'Sustainable Textiles for Apparel: Fact, Fiction and Future Prospects', a doubling in the number of consumers and an 84% hike in demand for textile fibres over the next 20 years will stretch resources to breaking point.

IMPACTS OF COTTON FIBRE PRODUCTION

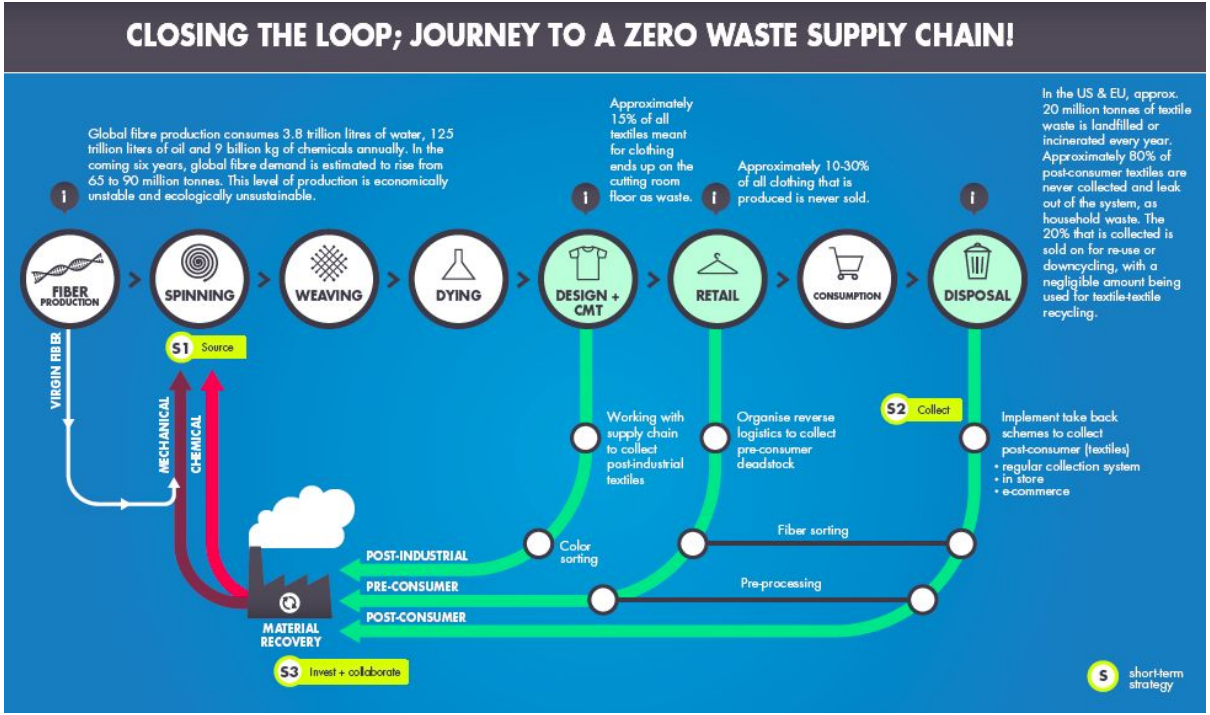
Cotton, with an annual production of about 25 million tonnes, is the second biggest textile fibre, after polyester. Current cotton production methods are widely recognized as environmentally unsustainable; cotton production consumes 10% of world's pesticides, 25% of world's insecticides, despite only taking up 2.4% of total arable land and is the 3rd biggest contributor to pesticide-illness in farmworkers. Additionally, this process is highly water intensive, with a single cotton cotton t-shirt uses up to 700 gallons of water to make.

IMPACTS OF POLYESTER PRODUCTION

With cotton production facing stagnant growth, man-made fibres are already dominating the raw material supply of the textiles industry. Made from fossil fuels, polyester is the biggest textiles fibre in production volume, estimated to account for 70 % of total fibre production by 2030, according to PCI Fibres. Polyester synthesis is an energy intensive process that that is linked to significant amounts of greenhouse gas emissions.

IMPACTS OF TEXTILE WASTE

Downstream the impact of the booming textiles industry, combined with fast fashion models of production and consumption can be seen in the growing volume of post-consumer textile waste, for which there are now limited end-of-life solutions. **In the EU and US alone, 20 million tonnes of textiles end up in landfill or incineration every year**. In addition to this post-consumer waste, **10-15% of textiles is left as cutting waste on the factory floor** (post-industrial textile waste), and it is estimated that **up to 33% of garments that are produced, are never sold and in many cases destroyed** to avoid flooding the market (pre-consumer textile waste).



A roadmap for creating a zero waste supply chain: closing the loop for post industrial, pre consumer and post consumer textiles.

RESULTS:
LIFE CYCLE ASSESSMENT

THE HIGH VALUE RECYCLING APPROACH

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In this High Value Recycling pilot, post-consumer textiles are recycled into new fibres and mixed with recycled PET from bottles by Recover to make yarns for new textile collections produced by ReBlend partners. This process can be described as follows:

1. Post-consumer garments are collected and sorted for ReBlend by Sympany, a Dutch charity. Sympany sorts collected textiles into rewearables, and recyclables. For this project, mixed, recyclable textiles are further sorted for ReBlend into 3 base colours: white, denim and multi-colour.
2. Colour-sorted textiles are transported to Recover near Alicante, Spain. There, the textiles are stripped from non-recyclable pieces such as zippers and buttons by a partner of Recover. The waste materials from this process (~17% of the total volume) are processed according to Spanish environmental regulation.
3. The cleaned textiles are then cut and pulled into fibre by Recover. These fibres are blended with recycled PET from bottles and are carded, spun and twisted into 20/2 Nm yarn for the production of new textiles (10-15 % waste in recycling and spinning process). By mixing colour-sorted post-consumer textiles according to the trade secret "ColorBlend" process, Recover avoids 80 % of the dyeing process that would be necessary otherwise with virgin raw materials.
4. Yarns are transported to the Netherlands where weavers & knitters produce different types of textile products out of them.

THE RECOVER YARNS

Recover produced 100% recycled yarn for Reblend in four different colours. The White Cream, light Bruma and Anthracite/Grey yarns are following the composition described in the figures below. The fourth colour yarn, Yellow/gold, has a different composition and consists of 40% Recycled Material 1, 30% Recycled Material 2 and 30% post-industrial cotton. Circle Economy performed a Life Cycle Assessment on the White Cream yarn.

Recycled Material 1

70 % Recycled post-consumer textiles containing 87.5 % cotton, 10.2 % PET and 2.2 % other fibres.

Recycled Material 2

30 % Recycled post-consumer PET from bottles (RPET).

Final Yarn Composition

Recycled yarn with composition: 61.25 % recycled cotton, 7.14 % recycled PET, 30 % RPET from bottles and 1.54 % other post-consumer fibres.

ENVIRONMENTAL IMPACTS of recycled vs virgin yarn

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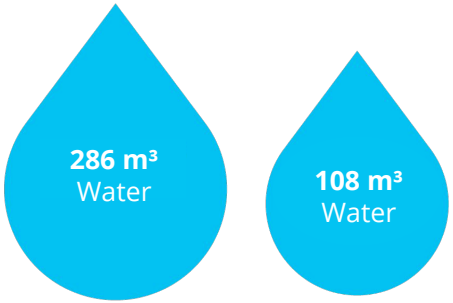
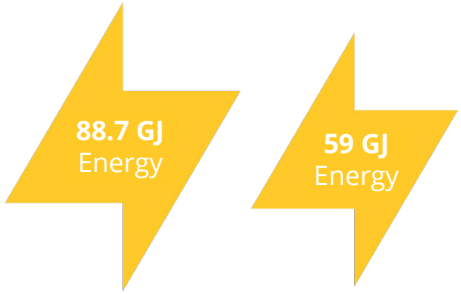
Circle Economy compared the environmental impact of producing one tonne of 20/2 Nm recycled Recover yarn (white cream) with the production of similar yarn from virgin materials. Results in water consumption, energy use and greenhouse gas emissions from the Life Cycle Assessment show that the recycled products reduce significantly the environmental impacts.



Virgin **Recycled**

Water consumption reduced by 62 %

Avoidance of virgin cotton. Recycling cotton contained in the post-consumer materials uses minimal amounts of water.
Using colour-sorted materials avoids most of dyeing, another water intensive process.



Virgin **Recycled**

Energy consumption reduced by 33 %

Avoidance of virgin PET fibre production. Recycling post-consumer materials avoids part of the energy intensive process of virgin PET production.
Avoidance of dyeing further reduces energy demand.

Virgin **Recycled**

Reduction in greenhouse gas emissions by 18 %

Recycling of cotton contained in post-consumer material avoids greenhouse gas emissions from cultivation, as well as fertiliser and pesticide production.

APPENDIX

DISCLAIMER

This case study was written by the Circle Textiles team (Helene Smits, Gwen Cunningham and Theodoros Spathas) of Circle Economy. Preliminary LCA results were used from Mr. Spathas' thesis titled "Life Cycle Assessment on Textile to Textile Recycling Technologies", supervised by prof. Greg Peters from Chalmers Technical University (Sweden) and assistant prof. Valentina Prado from Leiden University (the Netherlands). Sensitivity analysis is to be performed to check the robustness of the results. Full assessment will be released with the completion of the thesis.

Data for mechanical textile fibre recycling and yarn spinning were collected from Spanish upcycled yarn producer Recover (Hifesa Ferre).

Data for the collection and sorting of post-consumer textiles were collected from a Dutch company.

The software and main database used for the Thesis was GABI EDUCATION under free licence from ThinkStep.

Data from dyeing of woven fabric were used from the "Life Cycle Assessment of Cotton Fiber & Fabric Full Report" by Cotton Incorporated and PE International. (2012)

Recycled PET data were collected from "Final report Life Cycle Inventory of 100 % postconsumer HDPE and PET recycled resin from postconsumer containers and packaging" by Franklin Associates, a division of Ergprairie Village, Kansas (2010)