"European retailers and outdoor and sports brands are working together on Circular Challenges, aimed at reducing waste and lowering the industry's environmental footprint."

Challenge #1: Circular polyester from and in textiles

Schedule 2020-2025

1. Background

1.1 Numbers

Annually, over 4% of all petroleum and natural gas is used for producing all kinds of plastic polymer. Polyethylene terephthalate (PET), which is found in soda and water bottles and textiles, is one of those plastic polymers. In 2015, PET as a plastic polymer was number 6 in terms of volume in global plastic production. It has now risen to the number 4 spot, due to an increased demand for PET packaging materials and textiles.

Depending on the source, an average of 63% of all textile fibres produced worldwide is of petrochemical origin. Cotton comes second with 24%, and the last piece of the pie is divided between wool, viscose and a handful of other fibres.

At 80%, PET, polyester, is by far the most important petrochemical fibre.

In the Netherlands, we use more cotton (64%) than polyester (19%) in our textile products. In line with the importance of cotton for the Dutch apparel industry, attention has long been focused on recycling post-consumer textiles into high-value applications. This applies to the pilots done in ECAP in 2018-2019, for the denim deal and for the growing attention for chemically recycling cotton waste into viscose.

1.2 Plastic recycling policy

With a view to the Textiles Policy Programme, and in particular the plans for a UPV and a European Textile Pact, it makes sense to gather knowledge and experience with recycling and high-value application of polyester in textiles. In the last few years, European and national governments have been translating the need for tackling the issue of plastics into policy. By taking the lead, Europe has, for instance, made an enormous contribution to the increased demand for a particular type of plastic: recycled PET (rPET).

The European Plastics Pact is the manifesto that should provide tools for chain partners. In this pact, the main focus is on plastics for use in packaging as well as single-use plastics. This has it merits: these are main users of different types of plastics and they are creating the most waste. Deposits on PET bottles and separating plastic waste allow the consumer to substantially contribute to reducing part of the plastic waste stream in the chain. However, apart from PET (26% of volume plastics), plastics are difficult to sort and recycle, causing half of all plastic packaging to end up in incinerators.

1.3 PET in the packaging industry

The original definition of circularity speaks of a never-ending cycle of a waste product. It is, however, not easy to reuse waste from PET bottles for the production of new rPET bottles. Contaminations in this mountain of plastic waste hinder its use for food and drink packaging due to the high standards required. To start, at least 95% has to come from recycled packaging. Then it has to be washed, cleaned and sterilised. In the future, new depolymerisation technology may be the solution for part of these problems, as well as for creating clear rPET, making for a wider range of applications. Commitments from large industrial parties to young, innovative companies bring processing of large volumes closer.

1.4 PET in textiles

Eventually, two-thirds of global PET volume will be used in textiles, and one-third in packaging. In the Netherlands, for example, PET is currently found in 26% of all packaging. Data shows, that over 47% of all rPET derived from PET bottles is used for textile fibres.

The increased demand for PET in textiles is partially caused by the athleisure trend, in which casual apparel has got a more athletic-hybrid look and functionality. An ever-increasing group of consumers is looking for clothing that offers extra comfort, is breathable, offers more stretch and keeps its shape. Synthetical materials, PET above all, meet this need. Greenpeace has estimated that this trend will lead to a 200% increase in the use of polyester between 2018 and 2030.

Especially in the increase of polyester in clothing and the growing quantities of collected textiles, recycling could play a bigger role.

Where PET bottles from collected household waste are relatively easy to sort and make for homogenous waste, this cannot be said for PET in textiles. At the moment, the percentage of polyester in 'end-of-life' apparel at European sorters varies between 5% and 25%, manifesting in both mono and blends. This diversity of polyester use in clothing makes it much harder to sort, let alone recycle.

In addition to this, there is a number of other developments causing the rise in PET usage. That is why the need to create sustainable solutions is high.

1.5 Developments in PET

A number of developments has caused the price of virgin PET to drastically decline in the last few years. Such as increased production capacity, lower oil prices and shale gas extraction in the US. Since early 2020, virgin PET fibres have been cheaper than rPET fibres. Going forward, the use of virgin PET will be more attractive, partly negating good intentions to increase recycling. On the one hand, virgin PET will be cheaper, and on the other hand, the search for high-quality recycled PET without contaminants is hindered by an increase in demand. It will be down to the persistence of brands and retailers to continue to embrace rPET to meet our goals, in spite of its premium price point.

1.6 Plastic pollution

Plastic pollution in our environment is a growing problem. While plastic bottles and caps end up in our waterways, polyester clothing winds up in dumpsites in far-away lands.

Increasingly, a number of African countries have become the final destination for hard-to-sort textiles that are of such low quality, it has no remaining value. African countries such as Ghana, still a main market for second-hand clothing from Europe, are dealing with growing mountains of waste, with polyesters causing massive damage to the environment.

Closer to home, there are great concerns about microplastics. They end up in our water systems via our laundry, and pollute entire food chains when they spread through the environment. The growing demand for PET will further exacerbate this problem.

1.7 Action

In spite of these challenges, there is good news too:

During a round table discussion, organised by Textile Exchange in 2017, around 50 internationally operating clothing brands and retailers made an rPET commitment, aiming to replace 25% of PET by rPET in 2020. On average, they have managed to replace about 35% of their virgin plastics by rPET derived from plastic bottles. A number of these large corporations are IKEA, Timberland and H&M.

Recently, a number of companies have invested in chemical recycling plants to depolymerise polyester from clothing. A well-known one is Tejin from Japan, who has invested in Japanese and Chinese companies. Closer to home, a lot of effort has been put into innovations in depolymerisation, by companies such as Demeto and Ioniqa, who are trying to scale up in the next few years with assurances from governments and industrial giants such as Coca Cola.

2. Project idea

2.1 Outdoor

Following the ECAP Fiber2Fibre pilots, WORN to REBORN is a recycling project aimed at the European outdoor industry. This industry is at the forefront of using sustainable materials and is able to motivate consumers to make a conscious and sustainable choice. The outdoor consumer has an above-average connection to nature. Outdoor brands themselves tend to be forerunners when it comes to improving design and the application of new materials to reduce their ecological footprint.

Often, these new materials are based on by innovations in textiles, yarns or refinement that also enhance the functionality of the clothing. Outdoor brands and outdoor retailers are increasingly aware of the issues surrounding waste products that were previously considered end-of-life. Reuse as a possible solution for a cleaner chain is being considered by the C-suite and upper management. Completely closing the chain, in which waste is considered new raw material, requires a holistic approach of production and retail chains, and room for investment in this matter within purchasing and design departments.

Making production cycles more sustainable and environmentally-friendly is one of the policy areas of the European Green Deal. In it, the Commission states that: "The Commission will present a policy regarding sustainable products that prefers saving on and reuse of raw materials over recycling. Minimum standards will be introduced to prevent environmentally-unfriendly products from entering the EU market. Bogus environmental claims will be tackled." This way, Europe supports and encourages companies to work together on a sustainable economy as well as supporting the chance of scalable solutions for processing textile waste, among others, into new products.

Using the Green Deal's framework or roadmap, new initiatives are formed that ought to lead to further agreements, such as the European Plastics Pact and the Circular Textiles Road Map.

The European outdoor industry could use its relationship with nature to take the lead in promoting innovations aimed at reuse of materials.

2.2 Project goals and results

The WORN to REBORN project has a number of goals and results specifically focused on rPET from textile waste and polyester clothing. There is a lot of interest from outdoor retailers, brands and production partners to connect to the project. That is why it was decided at an early stage to present WORN to REBORN as a framework for several future possible research areas. Purchasers, brand owners and CSR managers have a lot of questions about other waste streams. WORN to REBORN can address these by connecting various parties in order to find answers and solutions.

The first material to take the spotlight in this project is polyester waste from textiles and clothing, presented in the format of a Circular Challenge. With an eye on multiple editions, or multiple challenges, this one was named Circular Challenge #1. In the Action Sheet 'Count Me In', retailers indicate they are also looking at wider possibilities for reuse (item 5).

Instead of tapping into the largest possible group, it was decided to find a select number of partners in a number of European countries. With a small group of like-minded parties (brands and retailers), we can come to quicker results. These are market parties that are well-represented within their country's border and whose formula is well-known to a large part of the population. Additionally, diversity in type of sales channel (online, offline, omni-channel) played a part in selection preferences.

We reason that with retailers' commitment to reserve purchasing budgets for innovations, outdoor brands have more incentive to participate. It has happened in the past that brands have launched innovations that did not end up with consumers because of barriers in purchasing.

GOAL 1:

"Commitment of at least three European retail chains to adding post-consumer recycled PET to their core assortments of clothing made from knitted or woven cloth, based on available innovations. Retailers sign a declaration of intent to guarantee this commitment."

At present, three retailers have committed to Circular Challenge #1:

- Unterwegs (Germany), with 21 physical stores and a webshop
- Bever (the Netherlands), with 40 physical stores and a webshop
- Bergfreunde (Germany), Europe's largest online outdoor store

These retailers undersign the Circular Challenge and pledge to focus their efforts in at least the following 5 areas, detailed in the Action Sheet:

1. **Supporting recycling innovations**
   Enable brands to showcase their latest recycling innovations to consumers in your retail environment. By 2025 [...]% of the floorspace is dedicated to products with recycled/regenerated content. Must be at least 5%.

2. **Increasing recovery rates from worn-out garments**
   Implement a strategy to increase recovery rates from various garment types and compositions, for instance through installing in-store donation points.

3. **Consumer engagement**
   Engage consumers in a campaign about this Circular Challenge and the WORN to REBORN project with a strong focus on education by showcasing products made from post- and pre-consumer PET from textiles and garments.

4. **Removing virgin PET from fabrics and replace with rPET**
   Introduce 100% rPET garments with a minimum amount of 25% recycled PET from post- and pre-consumer PET from textiles and garments by 2022 and actively support European upcycling initiatives for polyester garments.

5. **New business modelling**
   Pilot at least one new service with circular aim such as retail, sharing, second-hand sales, wash-and-reproof or refresh, refurbishment, repair, upgrading and spare parts service before 2025.

In the next phase, more brands will join the Challenge. So far, we have had meetings with Schöffel from Germany, Patagonia from the USA (with its European head office in the Netherlands), The North Face from USA (with its European head office in Switzerland) and Elkline from Germany.

GOAL 2:

"Via brands or private label production, the current supply has to be delivered to the consumer as soon as possible, and clear communication will be set up for this. Yarn suppliers from Southeast Asia are required to be transparent about the percentage of rPET (at least 20%) and the composition of the rPET derived from bottles and rPET from pre- and post-consumer textiles utilised, as far as can be determined at this stage."

To get results, we first need to describe the research area. Recycling polyester for reuse is primarily a mechanical process at the moment; creating fibre from textile products. This method is also used for cellulose waste and other waste types. The recycled material always has a lower quality than the source material. The outdoor industry as a whole has a reputation to uphold, by creating high-quality products that usually meet a functional need (water-proof, wind-proof, dirt-repellent, UV-repellent, breathable). Inferior fibres take away from this high standard.

Taking into account the volumes of textiles globally, the textile industry's increasing demand for polyester and the idea of circularity whereby a product is recycled into the exact same item, the focus lies heavily on chemical recycling. Depolymerising polyesters makes circularity for PET garments possible in principle. The success of this depends on many factors, something which is described in great detail in this report. As indicated before, roughly half of rPET derived from bottles goes to the textile industry. This demonstrates that the transformation from plastic bottle to polyester garments (often in combination with other fibres) is already chemically possible.

Now that research has been conducted and knowledge is more widely available, the demand for investments has increased to make chemical recycling of PET garment and textiles viable on an industrial scale. In the past ten years, the largest investments have taken place in Southeast Asia. In particular, Japanese conglomerates such as Itochu and Tejin have invested in chemical recycling companies like Jiaren and Jeplan. The latter, along with two other parties, has started the construction of a designated factory projected to be completed in 2022 (https://www.jeplan.co.jp/en/2020/09/11/8794/).

Other projects have similarly been upscaled in the last few years, each with their own methodologies for recycling various types of raw materials. Amongst these are Ioniqa (NL), Gr3n (CH), Loop industries (USA), Garbo (IT), and Sopraloop (FR).

Ioniqa is interesting in the sense that its method offers a number of possibilities to depolymerise certain types of waste from PET textiles. Volumes and correct sorting will be conclusive factors in the possible upscaling of this process. To this end, textile sorters and fiberizers will play a main role in the near future, and brands and retailers can start considering smarter products based on circular design. Producers like Ioniqa will be linked to purchasers in an early stage, allowing for a healthy dialogue and faster results. At this moment in time, Ioniqa has received the request to test the resin in a polyester yarn product from Spain, NDA.

When we look at the largest producer from rPET from textiles and garments, China's Jiaren has the greatest output. In Japan, Itochu has renamed a department into RENU Project. Its team of developers, together with Jiaren, has co-created a series of rPET yarns. By employing GRS certificates, RENU Project can 'guarantee' how much pre- en post-consumer polyester has been used in the production of these yarns. This system is not yet water tight, caused by inconsistency of the feedstock, something the RENU Project team and Itochu themselves also indicate. Considering increasing volumes and tighter European regulations on source products, this supplier's transparency on its feedstock will have to become more credible.

RENU Project's main focus is on the internal Japanese market, but it has been in talks with two European outdoor brands (under embargo). WORN to REBORN has advised them to collate all RENU yarns fabric innovations into RENU Project to ensure quality control. Experience has taught us, that agency structures cause a lot of information and knowledge to disappear. So far, RENU has sent a collection of 30 fabrics that are shared with interested parties via WORN to REBORN. Developments range from Down Proof textiles, jersey, 3-layer softshell, paddings, twill, etc.

Most brands produce their polyester outdoor apparel in SE Asia. This is definitely the case for yarns and cloth, as well as a large part of PET and rPET as raw materials: 30.8% of all PET is produced in China, 14.7% in Europe. The role of industrial waste as feedstock for chemically recycled PET is obvious.

However, we use these materials' end products in Europe. This inevitably means that its waste remains in Europe as well. This requires that, despite the possibility of transforming our textile waste into a new raw material, rPET, we have to research:

- which chains remain within Europe that are able to utilise rPET in looked-for products, and whether they can contribute to a healthy positioning within the outdoor industry, or;
- whether this new raw material can be shipped back to SE Asia for use in new yarn.

To inform retailers and brands about the possibilities, WORN to REBORN's initiator has used their own funds to have a number of items created, based on these premises:

- items are made from 100% rPET
- items contain at least 20% rPET from textile waste and discarded clothing
- items are GRS certified
- each separate component from their composition can be retraced
- items have been developed in such a way that there is no contamination from other, non-polyester materials, in other words: they have been designed for recycling/circular design
- all components such as eyelets, zips, Velcro, and stitching thread, are made from PET – or rPET where possible
- all taped seams are made from polyester rather than poly-urethane
- the production chain is completely transparent

These items were created thanks to RENU yarns made by Jiaren in China. Fabrics were produced by Sankei in Japan and Singtex in Taiwan. Production takes place at Aparso in China.

The first items have been well-received by outdoor retailers. By showing them what is possible now, their readiness to work together on possible solutions has grown.

GOAL 3:

"Creating storage facilities for one or more post-consumer PET textile waste streams from Dutch (or European) consumers, with the aim of building volume, ensuring the waste can eventually be processed in a cost-efficient manner by European recycling companies. European polyester spinning mills are approached to facilitate businesses like Ioniqa with testing capacity for the first rPET materials from its depolymerisation process, which will then be used to create garments made in Europe. Looking at the present state of affairs at Ioniqa, for example, this is unlikely to take place before Q3 2021."

Now that the first retailers have come together in the first Circular Challenge, we have to consider post-consumer waste and how these retailers can contribute to the collection of reusable waste. Based on meetings with stakeholders at Ioniqa, there are limitations, but opportunities as well. We have to look into the quantities and qualities of synthetic clothing used by outdoor consumers. The cleaner they are, the easier they are to recycle. Next, it has to become clear what is feasible and manageable for the chain. The waste stream has to be scaled up to be economically viable. As a test case, the retailers will collect a batch of textile waste from the consumer to be processed in collaboration with Ioniqa.

GOAL 4:

"To gain insight into the limitations of closing the chain in the Netherlands (and Europe), as the production of yarn and cloth mainly takes place in SE Asia right now. Ideas for upscaling results within the sector and recommendations on the measures governments can take in order to reduce these limitations."

If we succeed in executing European initiatives on an industrial scale, with a constant and reliable feedstock and the ability to create a reasonably-priced product that can compete with virgin polyester, there are production chains within Europe that are able to produce 'Made in Europe' clothing. Items that are labour-intensive to produce, are hardly made in larger volumes in Europe anymore. This is why there could be a focus on basic items such as sports tops in jersey or piqué, possibly treated to withstand odours.

Another possibility is fleece, but new knitting techniques and yarns will have to be developed to prevent microplastics from fibre shedding when clothing is worn or washed. Houdini, a Swedish brand, recently announced an innovation in collaboration with Pontetorto, an Italian knitting company. Chains are already being prepared by linking companies such as Ioniqa and Demeto with polyester yarn spinners well-informed on rPET from bottles, who in turn have a network with knitters like Pontetorto. For spinning companies, it is interesting to work together on new rPET innovations that use feedstock textiles to produce resin or pallets.

With revenues falling due to COVID-19, margins are under further pressure and the economics of an item hold great weight for retailers and brands.

Textile collectors, sorters and fiberizers operate with very narrow margins on an increasingly polluted textile waste stream. The quality is declining, the costs are rising and the market is in decline. Less pollution and better separation of the various residual materials will help the chain to remain viable. Governments can encourage consumers, retailers and brands to collect textiles separately. The revenue model for textile waste via textile containers in the street could be abolished.

In the autumn of 2020, a report was published (https://www.ellenmacarthurfoundation.org/assets/downloads/Full-report.pdf). It outlines China's vision on a sustainable textiles chain. One possibility that emerges from this report, is to approach the Dutch consulate in Shanghai to help persuade Chinese authorities to accept well-sorted European waste textiles or to be open to European-made rPET, which could be processed in China, untaxed and in competition with Chinese rPET producers. Considering China's import barriers on waste products and new Chinese legislation, this possibility may be minute: http://www.xinhuanet.com/english/2020-11/27/c_139547665.htm.

GOAL 5:

"Creating a case study with corresponding upscaling strategy in collaboration with the European Outdoor Group. This organisation is the umbrella body of the outdoor industry and works with important brands and retailers on future-proofing the industry as a whole."

In an early stage of WORN to REBORN, we contacted the European Outdoor Group (EOG). They are the association for the outdoor industry and are funded by membership fees from brands and retailers. Their main role is to bring about a sustainable change within the industry, in order to lower its members' footprints as much as possible. The EOG has embraced WORN to REBORN and wants to find an opportune time to increase its role.

Via its retail director Peter Ottervanger, EOG's entire network was made available to WORN to REBORN. WORN to REBORN and the Circular Challenges' strengths lie in the adaptability and decisiveness of their small task groups, that aim to eventually inspire others to adopt circularity. Considering the prospect of other Challenges and the diversity of areas in which circularity can play a role, it may be appropriate to incorporate WORN to REBORN into EOG. Should this happen, EOG will need to make time and resources available. For the moment, we should focus on supporting the participants in Circular Challenge #1 in achieving what they have indicated on their Action Sheet and what they want to work on.

Epilogue

WORN to REBORN has been launched and the first Circular Challenge is underway. The retailers that have committed to this project are working hard. The website www.worntoreborn.com went live on 1 January 2021, and is the platform showcasing the project's results and setbacks. The hashtag #circularchallenge is used in social media messages. There is, despite the difficulties caused by COVID-19, a great sense of urgency about lowering the industry's footprint.

The goals set in the project proposal have been met.

Despite numerous retailers' and brands' desires to be included in WORN to REBORN, we have chosen to start the dialogue with a maximum of three retailers. Gathering and keeping together retailers, and subsequently brands and producers, warrants multi-year support and guidance. A number of parties involved will continue this support after the Ministry of Infrastructure and Water Management concludes its backing. These parties will keep in touch with retailers and brands, and as such, can use this time to discuss the project's progress.

Without support, these types of projects often remain mere undersigned intentions, left to the industry, and turn out to be unsuccessful in terms of results. In time, the European Outdoor Group may take over this supportive role, and will have to make people available for that. The Group is a valued institution within the outdoor industry that regularly initiates and manages projects. They have indicated that, should WORN to REBORN have to be taken to another level, this will require governmental financial help.

In the meantime, a second project is advisable, which can seamlessly follow the first Circular Challenge. In this project, other brands and producers can join the effort, building towards a complete chain; from consumer to final products. These parties are named in this final report.

The goal of this project was to make a start with getting commitment from retailers, such as committing to innovations' purchase obligations. This has paved the way for brands to join; after all, they can rely on the fact that their efforts will pay off in the way of purchase orders. With brands on board and a concept proposal from a European chain established, the next step will be to invite producers (specifically aimed at recycling) to join the effort. Both Ioniqa and RENU are keen to get involved with WORN to REBORN.

WORN to REBORN advocates a systemic change and support for sustainable innovation from management level. A bottom-up approach will not lead to rapid change. The first Circular Challenge approach was mainly aimed at talking to CEOs, which took its time on occasion, but which has led to the commitment of three large retail parties. Eventually, such decisions penetrate deeper into organisations. In retail, this will lead to a quicker proactive attitude towards the Action Sheet: after all, it is easy to test something here. For brands, it will take longer before an innovation or idea has landed with the people that are responsible for the execution of the Action Sheet. It has consequences for planning, budget, staffing and communication between departments. With the retailers' commitment, we are actually seducing the brands: "they are participating, will you?"

A Circular Challenge is effective in a small setting in which agreements between a limited number of parties can be made, that lead to quick results. Such an accelerator maintains momentum and puts benchmarks in the near future rather than on a distant horizon. During the challenge, experiences are shared and eventually, it delivers a 'proof of concept' for the launch of one or more products; a blueprint for upscaling.

Innovations can lead to competitive benefits. European regulations about the reuse of textile waste will bring about new alliances; chain partners who make mutual agreements. For instance, RENEWCELL has found a large purchaser in H&M for its Circulose pulp, something in which H&M has heavily invested in the past few years.

"*H&M Group have worked closely alongside Renewcell since their inception in 2012, and invested in them through its investment arm CO:LAB in 2017. H&M was also the first retailer to use Circulose® when it*

debuted in its Conscious Exclusive collection in March 2020. This new agreement builds on this and marks the next stage in this collaborative journey."

If large market parities embrace innovations at an early stage, this immediately creates benefits in terms of volume and upscaling. The European Union and national governments should ensure that innovations do not remain in the hands of a small group that benefit from them, while others look on from the side lines.

As far as Circular Challenge #1, rPET, the 'proof of concept' should demonstrate whether polyester from textiles is recyclable in an economically and ecologically responsible manner.

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