Recycled fibers
From virgin to eternity

This factsheet informs you about the issues around recycled fibers. It provides concrete actions to reduce the need for new, virgin raw materials.

Recycled fiber use impacts (red spheres) in the 'fiber to out-of-fashion'

The textile context
Textile recycling is the method of reusing or reprocessing used clothing, fibrous material and clothing scraps from the manufacturing process. Recycling of textiles in order to make ‘new’ high quality products from existing material, while reducing waste, is a valuable approach in making the textile production chain more sustainable. The textile’s composition and design will largely affect its durability (use-life) and re-use or recycling potential.

Textile waste has to be differentiated between pre-consumer or post-consumer waste.
Pre-consumer waste consists of:
- Fibre and yarn waste;
- Waste from trials and process tuning from the textile mills (particularly dying);
- Cutting waste from garment manufacturing; and
- Unsold stock from brands, wholesalers and retailers.

Each year many tons (differing between countries) of this waste is recycled into new raw materials for the automotive, furniture, mattress, coarse yarn, home furnishings, paper and other industries.

Post-consumer waste are the garments or textiles discarded after use because they are worn out, damaged, outgrown, or gone out of fashion. Partly they are given to charities or other commercial collectors but mostly people throw them away with their regular trash. The clothes end up in municipal landfills or incineration plants.
The environment issue ...
The environmental aspects of the waste stage of clothing depend on the method of disposal. Clothing is disposed of in two ways: with the domestic waste or through separate collection. Separate collection leads to re-use, like second-hand or recycling as cloth, yarn, or even as fibre.

In Western-Europe, clothing that has been collected along with other domestic waste is burnt. The main negative environmental impact of this is the emission of CO$_2$ (greenhouse gas). A positive effect of burning waste is the (possible) production of energy (steam, electricity, city-heating). Outside Western-Europe, clothing still partially ends up in landfills, leading to land use and potential emissions of hazardous substances to soil and ground water (depending on the way the landfill is controlled).

... Reuse
Collected garments are sorted and reused as products (about 58% in weight). About 20% in weight is processed into rags (for example for cleaning). The reuse as a product or as rags gives the textile another (limited) lifetime before it is finally thrown away. The main benefit of reuse is that virgin raw materials for those products are saved.
- Much of the still usable second hand clothing is sold in second-hand shops or shipped to developing countries and sold there on the local market. An undesirable side effect can be that the local apparel production is undermined. An environmental effect is that the clothes end up at a low standard waste dump or incineration fire.
- Sometimes new pieces of clothing are created from scraps of old clothes. By combining and making new additions, the eclectic garments are marketed as a certain style.

... Recycling
The process of recycling is as follows:
1. Incoming material is graded into type and colour.
2. The textiles are shredded and blended with other selected fibres, depending on the intended use of the recycled yarn.
3. The blended mixture is cleaned and bleached if necessary.

The application of recycled material is especially non-woven. It is used as mattress fillings, felt material for car insulation, roofing felts, loudspeaker cones, panel linings and furniture padding. Spinning of recycled fibres is much more complicated than the non-woven application.

The recycling process can be significantly different for polyester and nylon. To make new polyester fabrics, new polyester filament fibres are produced by a process of shredding, granulating and melting followed by extruding new treads.

The environmental benefit of recycling is that the fibre can principally be reused again and again. This replaces the use of new virgin fibres with each cycle. However, the textile fibre will gradually decrease in quality and ultimately end up in waste disposal or incineration (down-cycling).

Reuse and recycling both provide environmental benefits:
- It reduces the need for landfill space (also counts when incinerated).
- It reduces pressure on virgin materials and non-renewable resources (like crude oil).
- It usually results in less pollution and energy use than production from new raw materials.
**Chemical and mechanical recycling**

There are two ways of recycling: mechanical en chemical. Chemical recycling refers to the chemically dissolving of the textile waste into its basic chemical building blocks. From there as new synthetic fiber can be produces, an actual example is recycled nylon. Mechanical recycling is done by unravelling discarded textile into fibres (small, thin threads) and subsequently using that recovered fiber material (often mixes of original fibers and colors) to spin yarn. If necessary partially with virgin fibre, depending on the recovered fiber quality and yarn specifications.

**Upcycling and downcycling**

With upcycling the recycled raw materials can be used again in equal or even higher value application level (product) than its original level (e.g. recycled PET yarn form plastic PET bottles). Downcycling means that the recycled materials are used on a lower quality level (e.g. isolation felt in the automotive from roughly unravelled textile waste).

Reclaiming fibres avoids many of the polluting and energy intensive processes which are needed to make textiles from virgin materials. All recycled fibres score best of class on environmental performance (class A in the MADE-BY fibre benchmark). The Fiber Benchmark (MADE-BY) compares the environmental impact of the most commonly used fibers in the garment industry, supporting you to shift to more sustainable alternatives. Twenty-eight fibers are ranked on six parameters: greenhouse gas emissions, human toxicity and eco-toxicity (20% weight), energy, water and land use (13.33% weight). The fibers are placed in Class A to Class E, fibers in ‘Unclassified’ are not able to be ranked, yet.

**The supply chain approach**

At a certain point, clothing and other textiles need to be disposed of. In this phase of the lifecycle of fabrics, we should focus on:

**Extending the life of products (technically and emotionally):**

- Custom made clothing: this clothing extends the life and increases the emotional value of garments;
- Use (higher) quality materials that keep their shape during use;
- Increase the possibility to upgrade or repair clothing; and
- Provide information on better maintenance of clothes, so they will last longer (see Clevercare).

**Encouraging the separate collection of textile for reuse or recycling:**

- Inform consumers about why, how and where the separate collection of used textile is organized;
- Organise a separate collection of used clothing and other textile; and
- Organise a return system for used clothing.

**Use recycled or recyclable fabric/fibre:**

- To reduce the environmental impact by recycling, it requires recyclable fibres/fabrics and the input of recycled fibres in the production process;
- The focus can be on pre-consumer waste or on post-consumer waste; and
- The company can be actively involved in the recycling or it can source recycled yarn/fabric from suppliers.
What to focus on and how to improve?
There are three ways of managing and reducing the textile waste:

A. Product design and fabric selection.
B. Screening, selecting and working with suppliers.
C. Informing the consumer about ways to recycle textile.

A. Product design and fabric selection
The design of a product can either focus on the use of fabric with a recycled fibre content, or the use of recyclable fabric, which enables recycling of the product itself. Below we will give you three examples:

Recycled/recyclable polyester and nylon are available through:
Eco-fi, examples of recycled polyester fibres from PET-bottles.
Econyl, recycled nylon from fishing nets and carpets by Aquafil.
Repreve, recycled nylon and recycled polyester by Unifi.
Many Chinese suppliers - look for reliable fabric suppliers, preferably certified ones (see below).

Recycled yarn or fabric of cotton, wool, acryl or viscose is limited available for apparel manufacturing. Some mixed fabrics (blends of recycled and virgin) can be available for textile recycling. The concept of ‘Cradle to Cradle’ (C2C) focuses on products created with materials that can be circulated in closed loops. They are not designed for disposal in landfills at the end of their lifecycle. Several fabric manufacturers are developing C2C products. Well known is Victor-Innovatex with eco-intelligent polyester, but this is not (yet) available for apparel fabric (www.victor-innovatex.com).

An great initiative of Patagonia is ‘Common Threads Recycling Program’ (click here). In this program Patagonia uses a fibre-to-fiber recycling system to make new garments from old ones. Fleece (Patagonia fleece and Polartex fleece, from other manufacturers), Patagonia cotton t-shirts and Capilene base layers are recycled. The polyester is recycled and reused in new garments. On the environmental benefits Patagonia states:

“Research shows that the environmental impact of using worn-out clothing to make new polyester fiber is significantly lower than making that same fiber from virgin materials derived from petroleum. By diverting worn-out garments from landfills, we reduce solid waste. Diverting them from incinerators results in an energy savings of 76% and a CO2 emissions reduction of 71%. Garments made with recycled fibers use 50-100% less virgin polyester, which reduces our use of oil.”

Another great initiative is the one from G-Star: ‘Raw for the oceans’. G-Star states:

‘Giving materials a second life is an ultimate form of sustainable design. We have been pioneering recycled denim since 2008, resulting in new denim created from worn out G-Star items.’

But now, the Vortex Project and Bionic share G-Star’s mission to transform waste into a unique product. Together, they collaborate in an on-going creative exploration to innovate denim and make an impact against plastic pollution of the oceans. RAW for the Oceans items are made with Bionic yarn created out of plastic waste reclaimed from the sea.

Cradle to Cradle fashion design principles are also trained by www.refinity.eu.
B. Screening, selecting and working with suppliers
An important choice is to work with suppliers on making steps. There are basically three ways:
1. Choose suppliers with a credible certificate.
2. Check supplier policy and performance.
3. Work with suppliers to implement improvement measures.

B1. Choose suppliers with a credible certificate
There are labels that certify the use of recycled fibres. Below is a selection:

GRS (Control Union Global Recycle Standard)  
www.certification.controlunion.com
The GRS is intended for companies that wish to make an independently verified claim as to the amount of recycled material they use in a specific (set of) products. The GRS has strict provision for how waste is handled during the production process. The standard includes environmental processing criteria in addition to raw material specifications. The website provides a list of GRS certified products, including fabrics (e.g. wool, polyester, cotton, denim, etc.), specifying the percentage of pre-consumer and post-consumer recycled content.

REMO  
www.joinremo.com
REMO is a global movement inspiring people to discover value in their once-loved garments and embrace sustainable fashion. REMO aims to close the loop and inject new life into used fibers.
REMO’s track and trace system charts the journey of recycled fibres through the production chain. The system reveals exact information about an item’s origin and past life, a precise percentage of its recycled content, and the resulting environmental savings on energy, water and CO2. The end result is a garment tag with a measurement of recycled content as well as a call to action to dive deeper into the garment’s history.

Cradle to Cradle  
www.cradletocradle.nl
Products with a Cradle to Cradle certificate have passed the assessment on product safety to humans and the environment, as well as its design for material reutilization like recycling or composting. Cradle to Cradle certification is four-tiered, consisting of Basic, Silver, Gold and Platinum levels to reflect continuing improvement. Certification is only available through the CCPII (Cradle to Cradle products) and companies wishing to apply have to sign a confidentiality agreement.

Recycled Claim Standard  
www.textileexchange.org
The RCS is as a chain of custody standard to track recycled raw materials through the supply chain. The standard was developed through work by the Materials Traceability Working Group, part of OIA’s Sustainability Working Group. The RCS uses the chain of custody requirements of the CCS (Content Claim Standard provides companies with a tool to verify the content of specific input materials), and additional guidance for implementation of the standard may be found in the CCS Implementation Manual. The website also provides a list of suppliers.
B2. Check suppliers policy and performance

Currently, claims on recycled fibers are becoming more and more common among suppliers in the textile supply chain. But in case there is no independent certification the claims of the supplier should backed by reliable information. You can always consult a MODINT CR manager on their opinion.

But, a supplier may also be able to show its actions on the recycling of textile and use of recycled fibers through its active involvement in one or more sustainability initiatives. Examples of relevant initiatives are:

SCAP: Sustainable Clothing Action Plan
The Sustainable Clothing Action Plan was launched by the UK government at the London Fashion Week in February 2009. Over 300 organizations, from high-street retailers to designers and textile manufacturers joined the initiative. SCAP aims to raise awareness of the impacts of ‘throw-away’ fashion and strives to maximize reuse, recycling and end-of-life management of garments. Traceability along the supply chain is addresses as an important aspect.

Texperium
Texperium brings together sorters and reusers to create a refined supply chain. This makes sure the supply chain will be sustainable and offers new market chances. When participating in the projects of Texperium, participants are actively informed about new developments in the field of reusing and recycling. Texperium is an open innovation centre provided with machinery for specialized tests.

B3. Work with suppliers to implement improvement measures

Apart from a screening and selecting suppliers based on their use of recycled fibers, companies may also work with suppliers to map and increase the recycling of off-cuts and use of recycled fibers. Of course, this also goes for the company’s own operations where relevant (be a good example in recycling fabrics). Below you will find a selection of measures to manage and reduce textile waste and increase the use of recycled fibers.

Generally applicable:
- Minimise off-cuts and monitor internal reuse and (internal/external) recycling of off-cuts and factory waste; and
- This is specifically relevant for trial runs and process start-up & tuning losses, especially in respect to dyeing. These measures can be discussed and reviewed during a processing plant visit.

More advanced:
- Use (or increase the use of) recycled (post-consumer waste) polyester. Polyester is a product of crude oil, just like other plastics such as carbonated drink bottles (PET). Recycling these and/or polyester clothes can reduce oil use and energy demands;
- Use (or increase the use of) recycled (post-consumer waste) man-made fabrics like nylon, acryl and viscose. These can be completely recycled; and
- Use a sustainable approach in the design of clothing like the Cradle 2 Cradle approach.
C. Informing the consumer

The consumer is a critical player in the recycling of garments. Proper disposal of used garments in order to maximise the amount and the level of re-use should be promoted and made as easy and attractive as possible. The garment waste ranges from vintage items to greasy drapers, thus from second hand shop to dust bin. Most items will be suitable for re-use as garment via charities or be suitable for making rags or felt material. Awareness on this useful re-use and recycling is one. Second is the acceptance of reused fibres as yarn and cloth. That can be promoted as a sustainable choice.

Next to this provide good information concerning wash and care instructions, so the clothes a consumer buys will last longer. A great tool that can help the consumer to be aware of the environment when taking care of the clothes is Clevercare.

Clevercare
GINETEX, the international association for textile care labeling, created Clevercare. Clevercare are information sheets in which is explained how to reduce climate impact, effort and money caring for fashion the clever way. For the five steps in the cleaning process, namely washing, temperature, drying, ironing and dry cleaning, they produced recommendations and tips, and they explained the symbols

... GET INFORMED, AWARE, INSPIRED AND CHALLENGED!
Get inspired by:
EcoChic magazine (www.ecochiccollection.co.uk/magazine/)
Strawberry Earth Academy (www.strawberryearth.com)
If you want to work on recycling your products (and fibers), you can even participate in the ‘circular economy’ workgroup of the Dutch National Action Plan. Join now!

Designers
Provide information (awareness raising) and challenges (targets?) to address the relation between design and recycling.
Your company may decide to use recyclable fabrics or fibers to enable recycling of pre-consumer (off-cuts) or post-consumer waste, either by the company itself or by others. Consider these as alternatives.
Explore the availability and applicability of recycled fibers.

Buyers/sourcers/product managers
Be aware of the possibilities to recycle pre-consumer waste which is produced during production.
Explore the availability and purchase recycled fabric or garments and aim on certified products and suppliers.
By using the publicly available tools and measures (see websites) you may be able to further shape your recycled materials throughout the supply chain.
You can either join an initiative yourself or work with suppliers that joined one of these initiatives.

CR and supply chain managers
Check the supplier’s sustainability report and/or specifically ask for information: does the supplier have a policy on recycling textile waste or the use of recycled material, is the use of recycled material and/or recycling of textile waste monitored and reported, is the content share of recycled materials and the source made clear?
Verify the answers to these questions, preferably through a signed policy – preferably part of an environmental management system (ISO-14001), and a verified CR report including specific data on recycling and the use of recycled fibers.

Management
Develop a strategy towards increasing the use of more recycled fibers and fabrics.
Train and inform employees. MODINT can help you with training sessions, please contact a MODINT CR consultant.
Putting targets (priority) and providing means (budget).