ACCELERATING® CIRCULARITY

Project Europe Update
Fall 2022

VISION

An industry in which textiles are no longer wasted.

MISSION

Accelerating Circularity is a nonprofit that creates new supply chains and business models to turn spent textiles into mainstream raw materials.

> "Circularity is a team sport."
>
> –Karla Magruder, Founder and President

amazon · European Outdoor Group · enviu · Lenzing · recover · Reverse Resources · CovationBio · INDITEX · Recyclatex Group · WWF · giz · gr3n · TEXAID · zalando · Partnership for Sustainable Textiles · TOMRA

Steering Committee Members Europe

Our Goals

SCALABILITY · **VIABILITY** · **TRANSPARENCY** · **MARKETS**

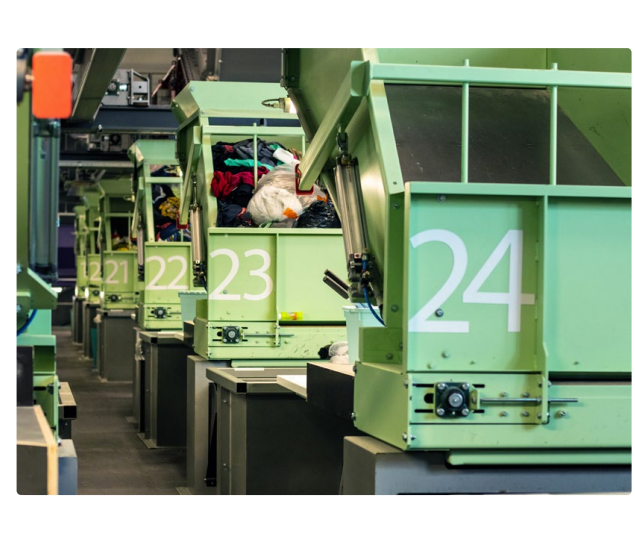
> The European Outdoor Group has been involved with a number of circularity projects in recent years on behalf of our members. The challenges associated with this issue are significant, and for success to be achieved, many parties will need to align and work together. Accelerating Circularity has brought the most impressive range of stakeholders together, and the European Outdoor Group believes this offers the best chance of progress and learnings that our members can implement.
>
> –Jane Turnbull, CSR & Sustainability Project Manager, European Outdoor Group

> To scale textile-to-textile recycling using post-consumer textile waste, we need collaboration to develop the corresponding value chains and the business case. We want to help develop these systems and enable products to be produced with raw materials coming from post-consumer textile waste.
>
> –Martin Böschen, CEO, TEXAID

> To us as a raw material producer, visibility and engagement with stakeholders are important to ensure an open and precise communication throughout the value chain.
>
> –Hao Ding, Business and Marketing Manager, Covation Biomaterials

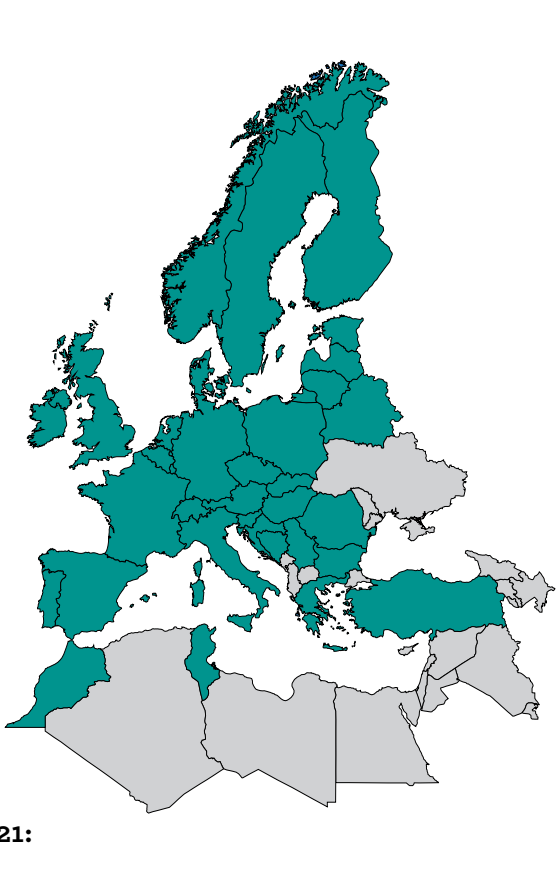
> At the Partnership for Sustainable Textiles, we believe Accelerating Circularity currently has the most promising approach to integrate the circular economy directly into existing textile supply chains. The participation in this project is a great opportunity for our members to gain valuable insight to what is possible with the state-of-the-art technologies for fiber-to-fiber recycling currently available. We are very thrilled to gain insight into the results of the trials. These will be helpful to gather data on what has and can be done at a political level to boost circular economy infrastructure and investments in it.
>
> –Creta Gambillara, Project Lead Circular Economy, Partnership for Sustainable Textiles & GIZ

What We Do



- ✓ **RESEARCH** existing systems for textile feedstock generation, collection, sorting, preprocessing, recycling, apparel & product development and brands and retailer businesses.
- ✓ **MAP** existing systems and identified gaps.
- ✓ **MODEL** new circular supply chain systems for textile-to-textile supply networks.
- ✓ **LINK** the newly identified supply chain systems.
- **PILOT** textile-to-textile supply networks.
- **REPORT** on all findings from research through piloting.

Our Scope



Our regional scope includes the EU-27, Switzerland, Norway, UK, Serbia, Morocco, Tunisia and Turkey.

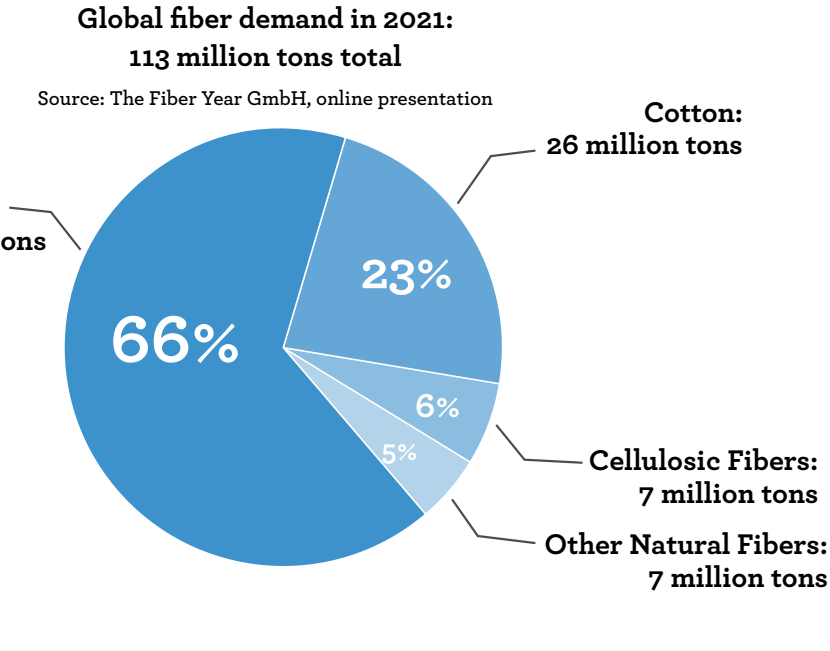
80+ circular value chain actors convened in monthly working groups.

- Collectors
- Sorters
- Preprocessors
- Recyclers
- Supply Chain Partners
- Brands and Retailers
- Partner Organizations

Recycling Technologies:

- Mechanical
  cotton and cotton/polyester
- Thermo-mechanical
  polyester
- Chemical
  cotton, polyester, and polyester blends.

Global fiber demand in 2021:
113 million tons total
Source: The Fiber Year GmbH, online presentation



Why Recycle?

POST-INDUSTRIAL
Spinning and cutting waste

PRE-CONSUMER
Non-wearable, non-marketable

POST-CONSUMER
Our focus is on post-consumer textiles. When a textile has cycled through repair, re-use, resale, and/or re-make such that it retains no readily accessible value, the material is spent. By diverting post-consumer spent textiles from downcycling, incineration and landfill, we can lower the textile industry's environmental impacts as well as reduce the use of virgin materials.

> By 2030 textile products placed on the EU market are long-lived and recyclable, to a great extent made of recycled fibres, free of hazardous substances and produced in respect of social rights and the environment.[1]
>
> –EU Strategy for Sustainable and Circular Textiles, March 2022

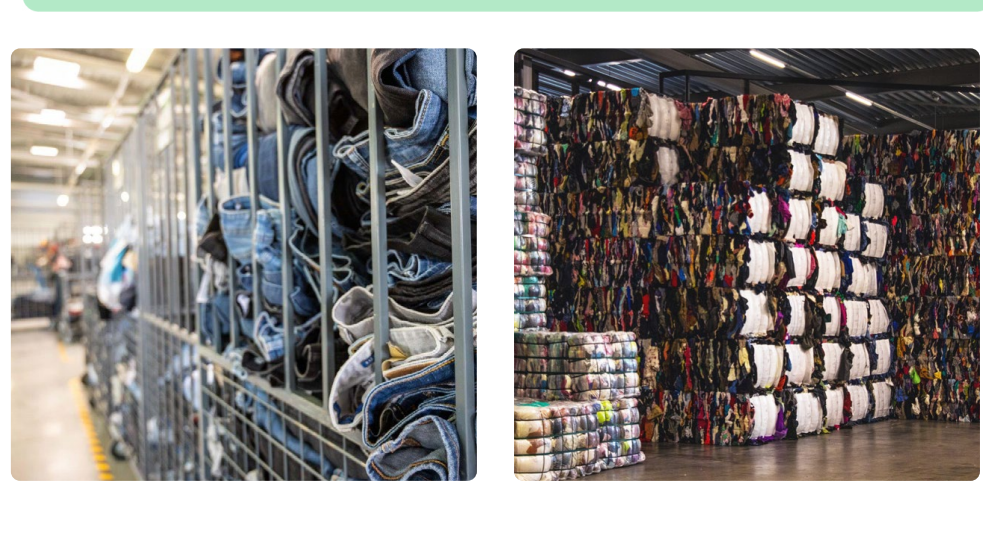
[1] Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions, EU Strategy for Sustainable and Circular Textiles, Brussels, 30.3.2022 COM(2022) 141 final

> Our vision is to be a sustainable fashion platform with a net-positive impact for people and the planet. We collaborate with our industry and organisations such as Accelerating Circularity to drive change and shape a more sustainable and circular economy. We realise that the current wasteful 'take-make-dispose' approach no longer works, and that it is to our long-term advantage to transition to a fashion system based on the principles of a circular economy. With only 1% of textiles recycled back into high-quality fabrics today, investments need to be made in new recycling technologies, and we need to find ways to collaborate across the industry to find systemic solutions to these systemic challenges.
>
> –Laura Coppen, Head of Circularity, Zalando

Textiles are too good to waste™

2025

EU Member States are required to set up systems for separate textile waste collections by 2025.

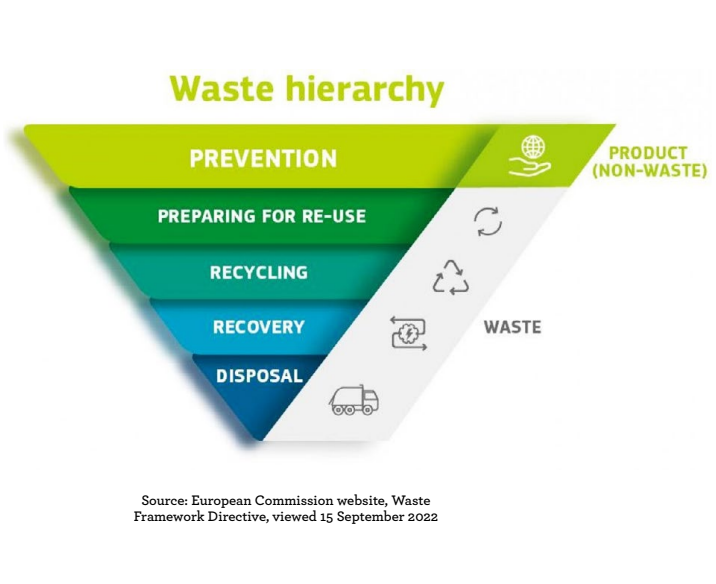


85%

of textile waste is discarded by households. Most goes into incineration or landfills. The estimated textile waste volume in the EU-27 and Switzerland is 7-7.5 million tons.

Source: McKinsey & Company, Scaling textile recycling in Europe-turning waste into value, July 2022

A Report We Recommend:
Scaling Textile Recycling in Europe–turning waste into value
McKinsey & Company, July 2022



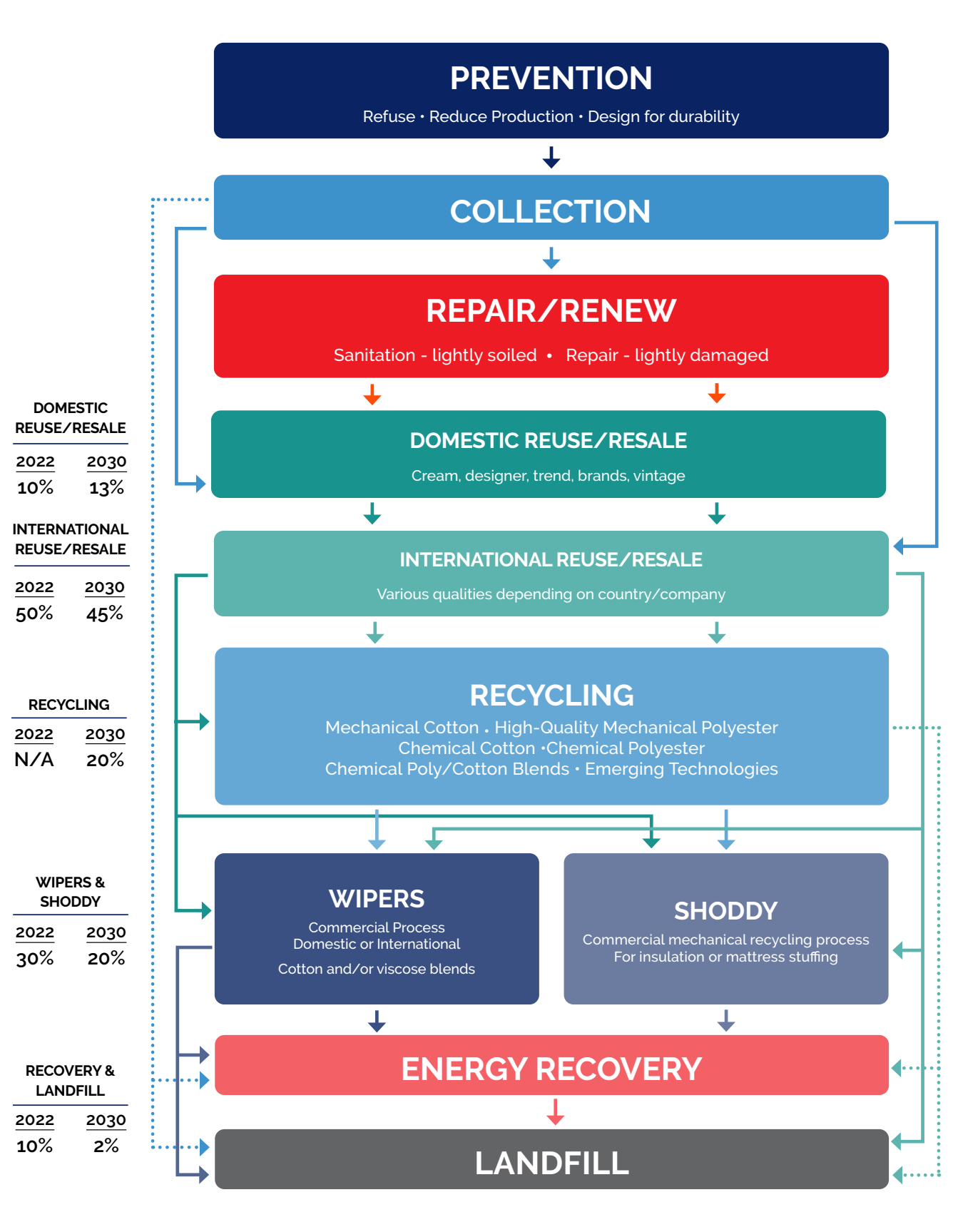
Source: European Commission website, Waste Framework Directive, viewed 15 September 2022

Together with our working group members of collectors, sorters, preprocessors and recyclers, we laid out the Spent Textiles Hierarchy for Spent Textiles based on the Waste Framework Directive.

By 2030, we want to see volumes moving from landfills to recycling.

We agree that no textiles should go to energy recovery or landfill.

Accelerating Circularity Spent Textiles Hierarchy



PREVENTION
Refuse · Reduce Production · Design for durability

COLLECTION

REPAIR/RENEW
Sanitation - lightly soiled • Repair - lightly damaged

DOMESTIC REUSE/RESALE
Cream, designer, trend, brands, vintage

INTERNATIONAL REUSE/RESALE
Various qualities depending on country/company

RECYCLING
Mechanical Cotton · High-Quality Mechanical Polyester
Chemical Cotton · Chemical Polyester
Chemical Poly/Cotton Blends · Emerging Technologies

WIPERS
Commercial Process
Domestic or International
Cotton and/or viscose blends

SHODDY
Commercial mechanical recycling process
For insulation or mattress stuffing

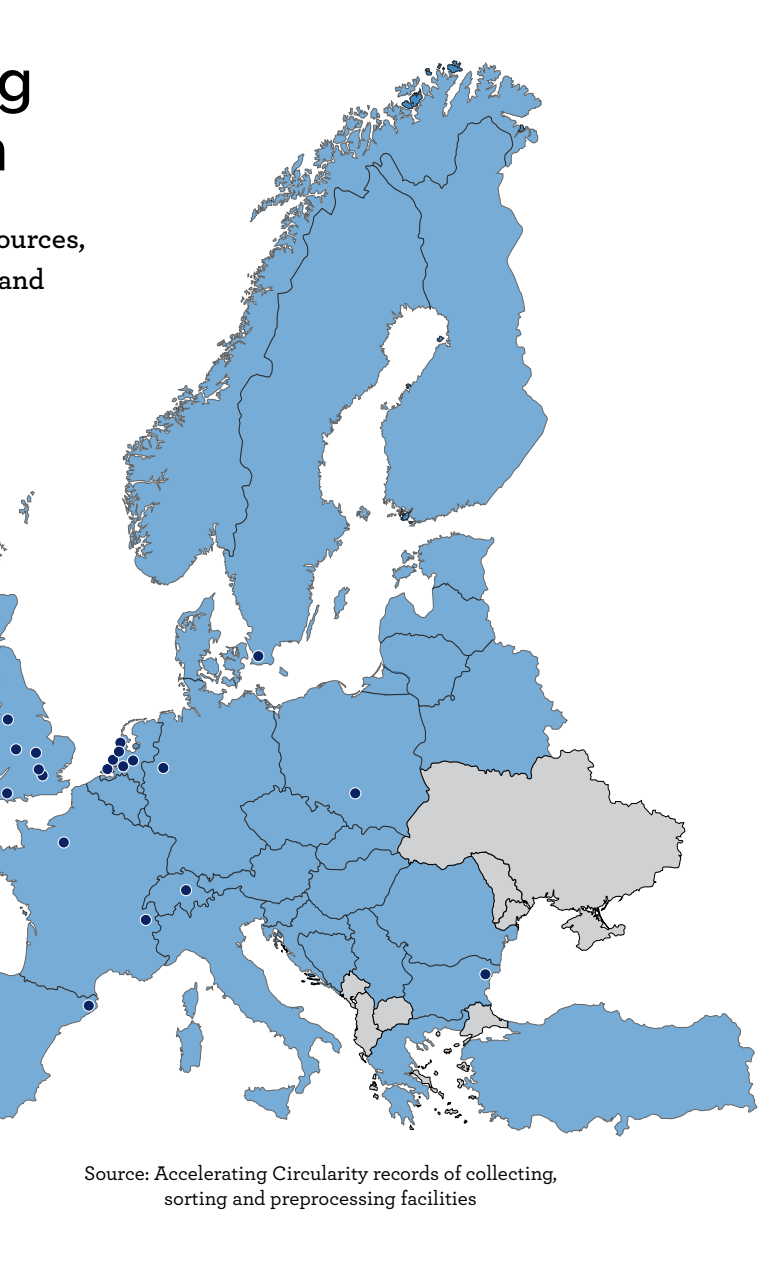
ENERGY RECOVERY

LANDFILL

	2022	2030
DOMESTIC REUSE/RESALE	10%	13%
INTERNATIONAL REUSE/RESALE	50%	45%
RECYCLING	N/A	20%
WIPERS & SHODDY	30%	20%
RECOVERY & LANDFILL	10%	2%

Requirements for Recycling Collection and Preparation

In collaboration with our strategic data partner Reverse Resources, we extended their RR platform to include collectors, sorters and preprocessors.



Source: Accelerating Circularity records of collecting, sorting and preprocessing facilities

DATA INPUT RR PLATFORM

COLLECTION
How? Where?

SORTING
By
Type?
Composition?
Construction?
Color?

PREPROCESSING
Which activities?

> To optimise the use of recycled materials and replace virgin, it is instrumental to have visibility of waste streams by compositions, colors and volumes.
>
> –Marieke Koemans-Kokkelink, Sales Director, Reverse Resources

Strategic Data Partnership
Accelerating Circularity and Reverse Resources

HOW DO WE COLLABORATE?

Together, we accelerate the collection of data to provide critical insights into textile waste material flows and trial stakeholders' ability to:

- Make strategic decisions regarding textile waste management;
- Embed traceability;
- Undertake textile-to-textile recycling;
- Channel more recycled materials into finished products.

GOALS

Industry-wide data service on post-industrial and post-consumer textile waste materials based on fiber content, fabric construction, color, format and location.

BE PART OF CIRCULARITY
info@reverseresources.net

Reverse Resources

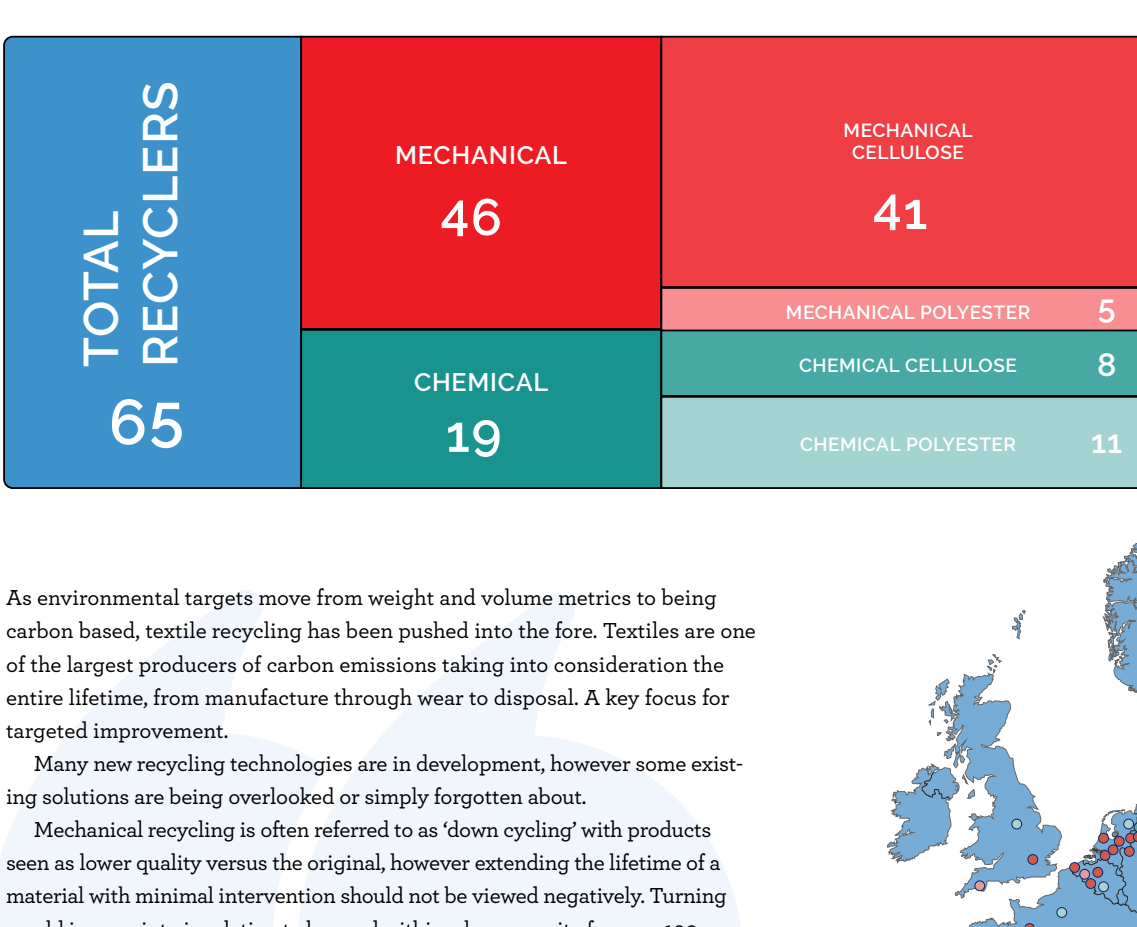
Reverse Resources (RR) is an impact-driven company on a mission to reduce the textile industry's dependence on our planet's finite natural resources.

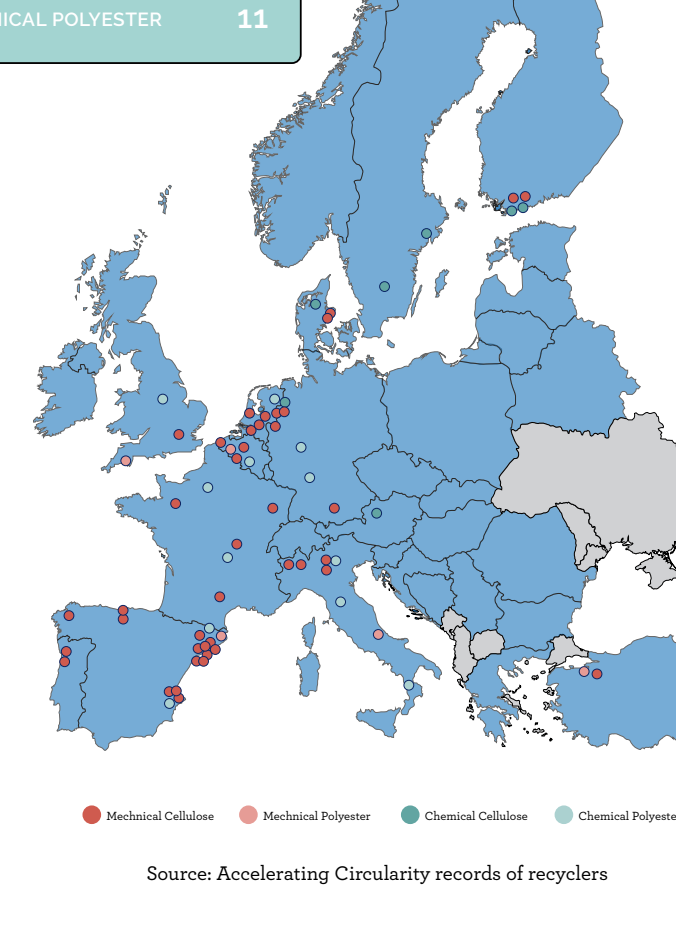
RR supports the development of a **global circular fashion industry** by:

- Identifying the **best use cases** of textile waste
- Supporting brands with insights and **real-time data** about their waste
- Allowing recyclers affordable and efficient **access** to high-quality textile materials
- Providing third-party verification
- Establishing consistent, traceable and compliant waste supply chains.

RR has developed a **digital platform** for the mapping, steering and tracing of post-industrial and post-consumer textile waste flows. Real-time data finally makes **waste streams visible**, providing fashion brands, recyclers and industry stakeholders with **accurate insights**, and embedding **digital traceability** into the circular supply chains.

Who Can Recycle It?





Source: Accelerating Circularity records of recyclers

> As environmental targets move from weight and volume metrics to being carbon based, textile recycling has been pushed into the fore. Textiles are one of the largest producers of carbon emissions taking into consideration the entire lifetime, from manufacture through wear to disposal. A key focus for targeted improvement.
>
> Many new recycling technologies are in development, however some existing solutions are being overlooked or simply forgotten about.
>
> Mechanical recycling is often referred to as 'down cycling' with products seen as lower quality versus the original, however extending the lifetime of a material with minimal intervention should not be viewed negatively. Turning an old jumper into insulation to be used within a house cavity for over 100 years can provide a higher carbon saving. It's key that existing technologies are not overlooked in preference to new technologies. It is vital to keep the intrinsic value in what we already have and that both systems coexist. Sorting needs to become more detailed. Sorting by fibre group will be necessary and will create a new value stream for sorters. As new recycling systems are developed a more holistic view of the savings and impact, both positive and negative, is required so that smart, not just marketable, choices are made.
>
> –Vanessa Wakefield, General Secretary, Recyclatex Group

Accelerating Circularity rFeedstock Matrices
General Feedstock Specifications

Matrices have been updated based on European capabilities versus the US capabilities[2]

MECHANICAL RECYCLING		CAN INCLUDE:						MUST CONSIDER:				
			Trims			Coatings/Films						
Feedstock Mechanical Recycling	Textile-to-Textile	Elastane	Plastic	Metal	Pigments/Prints	PET	Other	Chemistry/Dyes	Fabric Construction	Color	Full Garment vs. Parts	Fabric Scraps
100% Cotton	Y	N/A	N	N	Y/N	N	N	Y	Y	Y	Y	Y
98% Cotton/2% Elastane (max 5%)	Y	Y	N	N	Y/N	N	N	Y	Y	Y	Y	Y
90% Cotton/10% Other	Y*	N/A	N	N	Y/N	N	N	Y	Y	Y	Y	Y
60% Cotton/40% Polyester	Y*	N/A	N	N	Y/N	N	N	Y	Y	Y	Y	Y
60% Cotton/40% Other	Y*	N/A	N	N	Y/N	N	N	Y	Y	Y	Y	Y
Feedstock Thermo-mechanical Recycling												
100% Polyester	Y	N/A	N	N	N	Y/N	N	Y	N	N	Y	Y
98% Polyester/2% Elastane	N	–	–	–	–	–	–	–	–	–	–	–
80% Polyester/20% Other	N	–	–	–	–	–	–	–	–	–	–	–
60% Polyester/40% Cotton	N	–	–	–	–	–	–	–	–	–	–	–
60% Polyester/40% Other	N	–	–	–	–	–	–	–	–	–	–	–

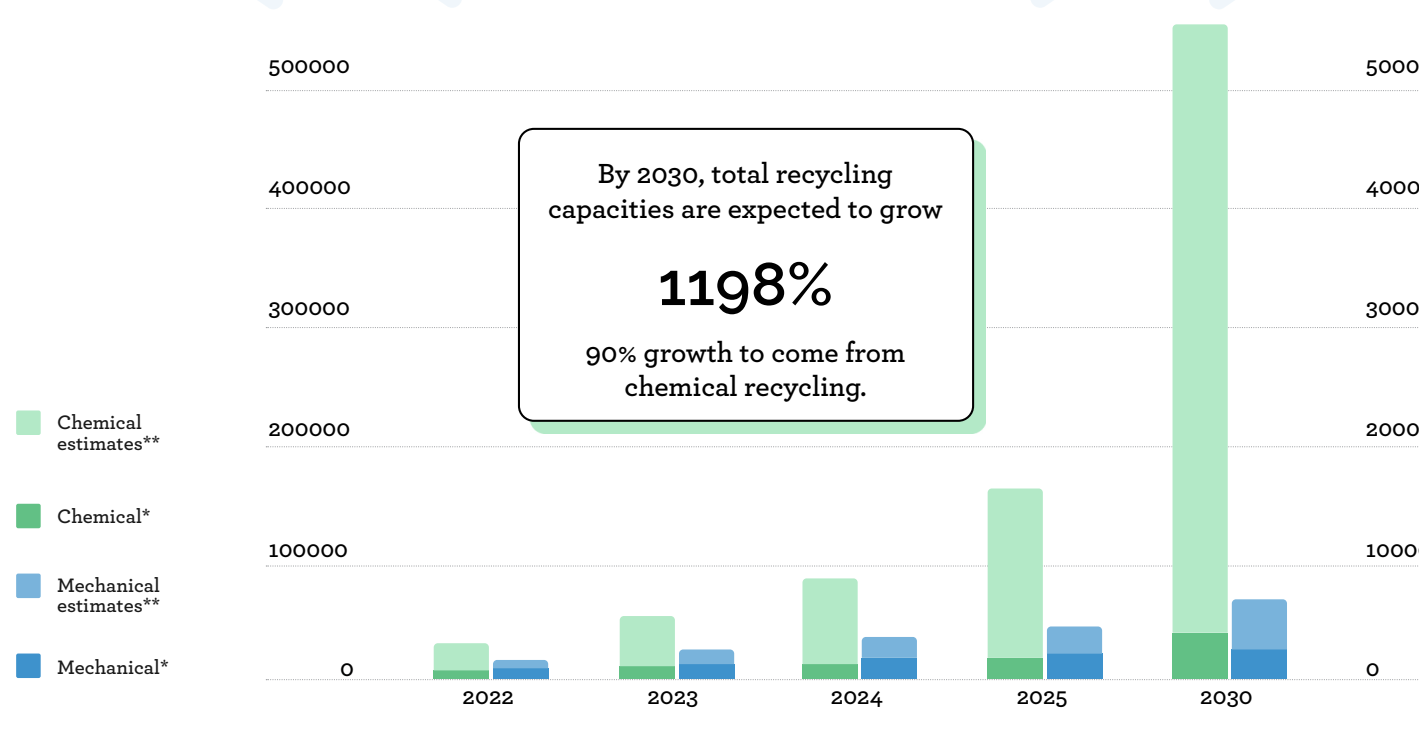
* Y if there is a confirmed buyer for the mixed fiber output.

CHEMICAL RECYCLING		CAN INCLUDE:						MUST CONSIDER:					
			Trims			Coatings/Films							
Feedstock Cellulosic Recycling	Textile-to-Textile	Elastane	Plastic	Metal	Pigments/Prints	PET	Other	Chemistry/Dyes	Fabric Construction	Color	White	Full Garments vs. Parts	Fabric Scraps
100% Cotton	Y	N/A	N	N	N	N	N	Y/N	N	Y/N	Y	Y	Y
98% Cotton/2% Elastane	N	–	–	–	–	–	–	–	–	–	–	–	–
90% Cotton/10% Other	N	–	–	–	–	–	–	–	–	–	–	–	–
60% Cotton/40% Polyester	Y	N/A	N	N	N	N	N	Y/N	N	Y/N	Y	Y	Y
60% Cotton/40% Other	N	–	–	–	–	–	–	–	–	–	–	–	–
Feedstock Polyester Recycling													
100% Polyester	Y	N/A	Y	N	N	Y/N	N	N	N	N	N	Y	Y
98% Polyester/2% Elastane	Y	Y	Y	N	N	Y/N	N	N	N	N	N	Y	Y
80% Polyester/20% Other	Y	N/A	Y	N	N	Y/N	N	N	N	N	N	Y	Y
60% Polyester/40% Cotton	N	–	–	–	–	–	–	–	–	–	–	–	–
60% Polyester/40% Other	N	–	–	–	–	–	–	–	–	–	–	–	–

[2] Modeling and Linking Report Spring 2021, Accelerating Circularity, 2021

> SCALE IS EVERYTHING.
>
> –Michael Kininmonth, Business Development & Project Manager, Lenzing

> In order for us to scale up, we need to validate the technology with all players in the value chain, and we need to map the available feedstock.
>
> –Fabio Silvestri, PhD, Head of Marketing and Business Development, Gr3n



By 2030, total recycling capacities are expected to grow

1198%

90% growth to come from chemical recycling.

Estimated Recycling Scale Up Through 2030
Global textile-to-textile recycling technologies in tons per month

Source: Reverse Resources platform profiles and estimations
* data from profiles on the RR platform
**calculated from research, interviews andcollaborations by RR with recyclers

Uncovering Challenges & Mapping a New Path

MARKET CHALLENGES

- Circular business case
- Bottleneck of preprocessing at scale and a reasonable cost
- Location of feedstocks, recyclers and product manufacturers
- Complementary systems for mechanical and chemical recycling
- Repetitions and scalability

TECHNOLOGY CHALLENGES

- Sorting by fiber composition, color, fabric construction
- Sorting for existing markets of resale and wipers versus high-quality recycling
- Digital Product Passports, transparency and traceability
- Technology for process optimization and automation

PRODUCT CHALLENGES

- Designing materials from and for circular supply chain systems
- Flexibility around quality standards and wider tolerances
- Dealing with constraints
- Complexity in replacing existing systems and internal business processes

> WWF supports the work of Accelerating Circularity because it is a collaborative project, engaging actors across the textile value-chain to address textile waste and advance textile-to-textile recycling. Especially important for WWF is to create transparency as to why significant challenges exist today, e.g. that currently material from PET bottles is required, and then to offer a way forward for transforming the industry.
>
> –Rebecca Tauer, Program Lead Circular Economy, WWF

> **Sorting for open loop versus closed loop? Competition or coexistence? Let's ask the experts:**
> At this time, it's our opinion that repurposing post-consumer waste not fit for reuse to produce wipers is ecological and sustainable. This is especially true when compared to producing single use wipers from virgin raw materials. By turning the waste into a new product, we are extending the lifespan of the materials on one hand (instead of using new) and on the other the energy used to turn the waste into wipers is less than the energy used in recycling for other purposes. Once fibre-to-fibre recycling commercializes it may become the preferred solution for textile waste after wipers.
>
> –Sirma Zheleva, Sustainability Manager, TexCycle

Conclusions

With all system actors at the table, we dove into the details, to see what works and what doesn't. Listed here are the requirements for scaling circular systems for textile-to-textile recycling:

1

The need for collectors and sorters to have and use feedstock specifications and standards by: fiber, composition, color, fabric construction and chemicals free of harmful substances is essential for textile-to-textile recyclers.

2

The need to commercialize mechanical sorting and preprocessing technologies to supplement manual sorting with the goal to increase throughput speeds. Manual sorting is a high skill type of job; it is important to retain these skills[3].

3

The capability to deliver feedstock flows that meet system processing per day/week/month of quickly growing recycling capacities and logistics favoring 40' containers.

4

The establishment of costs and/or implementation of fees for:

- Quality feedstocks
- Logistics
- Commercialization processes for new circular technologies of sorting and preprocessing.
- Extended Producer Responsibility schemes.

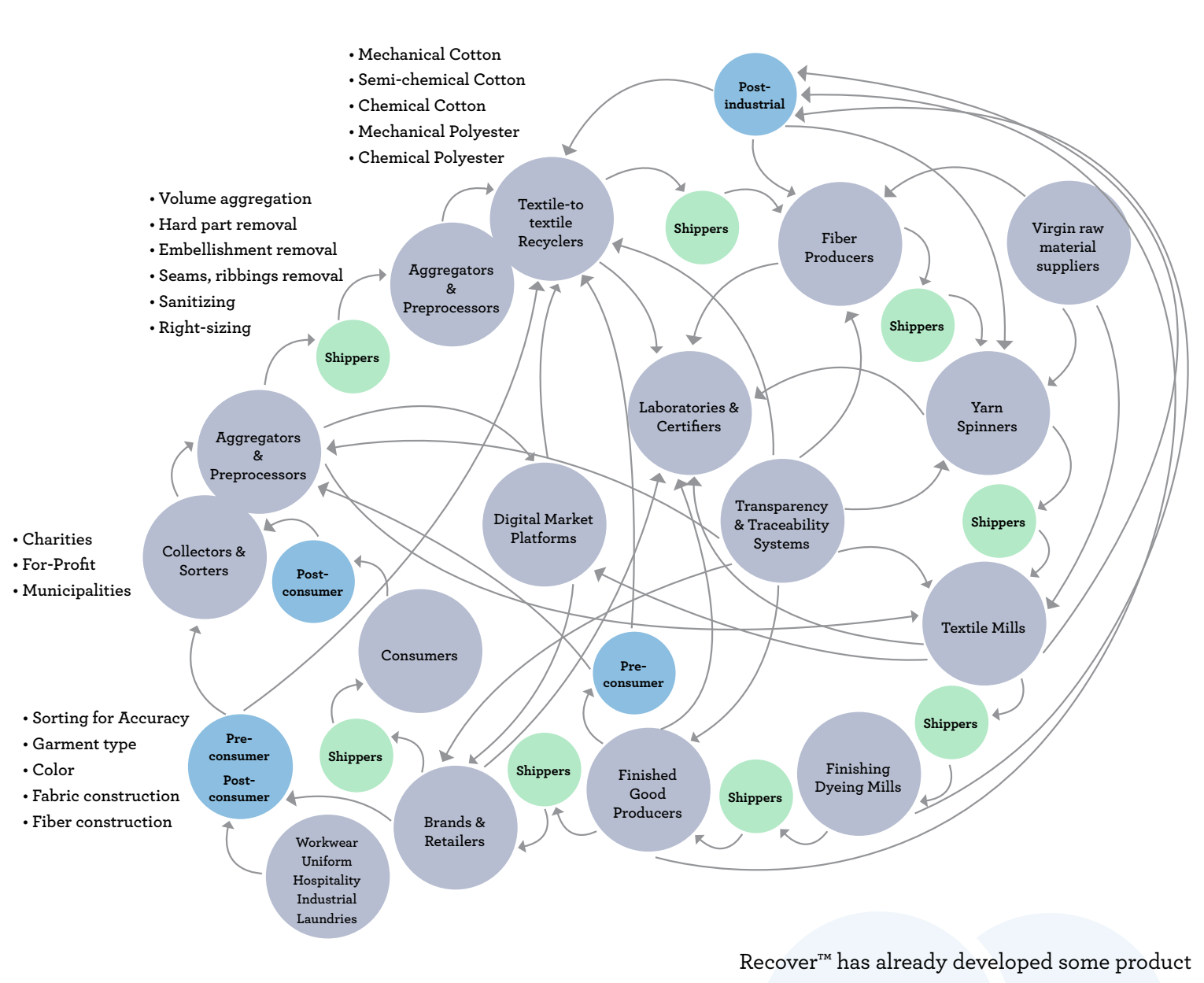
[3] Accelerating Workforce Development in the U.S. Circular Textile Economy, Treadle Tree, 2022

> At TOMRA, we develop optical sorting technology to enable scaled-up auto-sorting of textile waste. Sorting by fibre type and colour into high-purity outputs to supply fibre-to-fibre textile recyclers with material to transform back into new, recycled fibres. At a time when collaboration is key to the success of this newly forming circular economy for textiles, we are connecting the value-chain and closing the gap between collectors and manual sorters, and high-value textile recyclers.
>
> –Louisa Hoyes, Business Development Engineer, TOMRA

> At Erdotex, we recognized the need for automation to optimize our sorting process almost 5 years ago. Automating our logistical processes during sorting enabled us to create the most effective and efficient sorting facility. However, the sorting process regarding reusability must continue to be manual, due to the complexity of the variables.
>
> Automatization of the logistics of sorting is emerging as a requirement for long-term financial viability. In recent years, the quality of garments has declined, with significant negative impacts on our business case. If the reuse rate of clothing continues to drop, it may become economically unfeasible to continue collecting and sorting in Europe altogether.
>
> Textile recycling is developing and has the potential to become financially viable. Sorting facilities are creating more refined processes for sorting and preprocessing to provide feedstocks for these recycling plants. Data-integrated sorting processes are key for better accuracy of feedstocks whilst making sure notable volumes can be supplied.
>
> Here at Erdotex, we have seen the importance of data over the years. The value of these datasets is more important than ever. We believe that with image identification, artificial intelligence, data-integrated sorting systems, and political regulations the future of sorting is bright.
>
> –Ozan Ozturk, Executive team, Erdotex

A Report We Recommend:
Sorting for Circularity Europe, an evaluation and commercial assessment of textile waste across Europe
Fashion For Good and Circle Economy, September 2022

Circular Supply Chain Flow



> Recover™ has already developed some product qualities with supply chain partners that are brand accepted and approved. We now need processes to make them scalable and replicable. We need to move beyond one-offs and integrate post-consumer recycled fibers into our supply chains.
>
> –Hélène Smits, Chief Sustainability Officer, Recover™

Preview
What Can Be Made?
How Can We Use the Outputs?

DESIGN FROM RECYCLED

> Developing a product is complex. Understanding the output of a recycling process is key to keep the recycled materials in the loop. End-of-life becomes Beginning-of-life again.
>
> –Petra Schweiger, Accelerating Circularity Europe

The Accelerating Circularity Europe pilot phase kicked off in April 2022.

Check back next year for our pilot news.

Glossary

Advanced recycling: see chemical recycling

Chemical Recycling: Any process that changes a polymer's chemical structure involving some form of dissolution or chemical reaction to produce substances that can be used as raw materials to manufacture new products. Sometimes called advanced recycling.

Contaminant: A polluting or poisonous substance that makes something impure[1]. A contaminated textile is a material containing unwanted substances not deliberately added. Contamination can also mean when other waste streams are received when collecting used clothing. Contamination is sometimes referred to hardware (trims) which need to be removed for some types of recycling.

Cut-Make-Trim (CMT): A three-stage production process wherein material is cut to a pattern ("cut"), sewn together ("make"), and finished ("trim").

Deadstock: Fabric that has not been used due to quantity, quality, out-of-season or IP-relaed issues, and there is no plan for use.

Design for disassembly: A concept that prioritizes design choices that will facilitate a product's efficient disassembly at the end of its useful life so that components can be reused and/or recycled. Disassembly is defined as the process of separating a product into its different parts[2].

Design for durability: A concept that prioritizes design choices that will enhance product durability. Considerations include style, cut, fit, raw material selection, color, dye, and finish selection, and manufacturing specifications.

Design for recycling: Builds on the concept of design for disassembly to further specify the selection of materials that can be readily recycled. Strategies employed by this approach include designing single-fiber garments or selecting materials for which there are commercial recycling technologies available. Furthermore, it can be referred to designing products to aling with a specific recycling technology in mind.

Durability: The ability of a material to remain serviceable for a long time without significant deterioration in quality or value[3], the ability of a textile product to perform its function during an intended service life. Generally, it is determined by fiber type, fabric and garment construction and can be tested through, e.g. abrasion resistance, fabric pilling, fabric handle, fabric stiffness, colorfastness, dimensional stability and stretch recovery.

Downcycling: Textile recycling processes that result in a lower value or lower quality output than the originating product[4]. Also referred to as open-loop recycling where textiles are deconstructed, shredded or otherwise processed and used as inputs for the manufacture of lower value, such as insulation or fill[5].

Feedstock: A raw material supplied to a machine or processing plant[6]. A general term for raw material for a process.

Incineration: Destroys waste material through burning. When the incinerated material is used to fuel an electric generator, incineration is referred to as "energy recovery" or "resource recovery." ISO defines incineration as the controlled burning of waste products or other combustible materials in an incinerator or similar apparatus[7].

Landfill: A waste disposal site for the deposit of waste on to or into land under controlled or regulated conditions[8].

Mass balance accounting: A chain of custody approach used to document and trace the flow of materials through a complex value chain. This approach is often applied when recycled feedstock replaces an equivalent amount of virgin feedstock at the beginning of the value chain (input) to be allocated to the product (output) in such a manner that the input and output match[9].

Mechanical Recycling: Processes that use physical means such as shredding or melting to transform waste into feedstocks for new materials. For textiles, the output of mechanical recycling is a fiber or other material that can be used to make new yarn and fabric. The term can further be separated into "mechanical / fiber-to-fiber recycling" referring to shredding of natural and/or synthetic textiles into fiber for spinning and "mechanical polymer / thermal recycling" referring to melting of synthetics for extrusion.

Pre-consumer: (see post-industrial) Pre-consumer can sometimes also refer to finished garments available in supply chain that are unsellable or cannot be used due to defects.

Preprocessing: The manual or mechanical preparation of material for recycling. For textile recycling, this may include some or all of the following: aggregation, sorting, cleaning, disassembly, removal of hard parts, cutting material to size, shredding, and more.

Post-consumer: Describes material generated by households or by commercial, industrial, and institutional facilities in their role as end-users of the product that can no longer be used for its intended purpose. This includes returns of materials from the distribution chain[10].

Post-industrial: Describes material diverted from the waste stream during the manufacturing process and are leftover materials generated during manufacturing operations, e.g. spinning soft waste or clips or scraps from garment manufacturing. Excluded is the reutilization of materials such as rework, regrind or scrap generated in a process and capable of being reclaimed within the same process that generated it. Also called pre-consumer[11] as per ISO.

Reclaimed material: see recovered material

Recovered material: Material that would have otherwise been disposed of as waste or used for energy recovery, but has instead been collected and recovered as a material input, in lieu of new primary material, for a recycling or a manufacturing process. Also called reclaimed material[12].

Recyclable: A characteristic of a product, packaging, or associated component that can be diverted from the waste stream through available processes and programs and can be collected, processed during recycling and returned to use in the form of raw materials or products[13].

Recycled content: Proportion, by mass, of recycled material in goods or packaging. Only pre-consumer and post-consumer materials shall be considered as recycled content[14]. We acknowledge the comment of our member GftZ Gemeinschaft für textile Zukunft that "recycled content should (only) include post-consumer materials" underlining ACs targets of a minimum of 20% recycled post-consumer textiles and an overall minimum of 40% recycled content originating from pre-, post-consumer and post-industrial for all trials with the clear ambition for higher levels when technically feasible.

Recycled material: Material that has been reprocessed from recovered material by means of a manufacturing process and made into a final product or into a component for incorporation into goods or services[15].

Reusable: A characteristic of goods or packaging that has been conceived and designed to accomplish within its life cycle a certain number of trips, rotations or uses for the same purpose for which it was conceived[16].

Right sizing: The process of transforming spent textiles into uniform pieces to prepare the material for recycling, often by cutting or shredding.

Spent textiles: Textiles that have cycled through the value chain through use, reuse, repair, and remaking such that all readily accessible value is spent. Spent textiles are the feedstock for recycling processes that generate new material.

Takeback (program): An initiative organized by a manufacturer, brand, or retailer to collect used products, components, or materials for refurbishment, re-manufacturing, recycling, resale, or other secondary purposes. For hazardous materials or those with no recoverable value, this includes safe disposal.

Traceability: The ability to identify and trace the history, distribution, location and application of products, parts and materials, to ensure the reliability of sustainability claims, in the areas of human rights, labor (including health and safety), the environment and anti-corruption[17].

Traceability system: The system that records and follows the trail as products, parts, and materials come from suppliers and are processed and ultimately distributed as end products. Often when someone says 'traceability system' they mean an online traceability/tracking system, but this does not have to be the case. Systems used to ensure traceability vary widely and are designed to be fit for purpose (e.g. could be paper based or only go to a limited level of detail)[18].

Transparency: Open, comprehensive and understandable presentation of information relating directly to relevant information been made available to all elements of the value chain in a standardized way, which allows common understanding, accessibility, clarity and comparison[19].

Unsold Goods: Goods that have been available to sell and not sold, or merchandise with defects or quality issues.

Virgin material: Previously unused raw material such as wood, plant or animal fiber, metal ores, or petroleum. Material that has not been subjected to use or processing other than that required for its initial manufacture.

Waste: Anything for which the generator or holder has no further use and which is discarded or is released to the environment[20]. Textile waste are discarded textiles not recycled or reused.

Waste hierarchy: A conceptual framework to guide decision making in waste management prioritizing the efficient use of resources and the reduction of environmental harm.
For AC, we strictly follow the waste hierarchy as described in the European Waste Framework Directive in priority order: a) prevention, b) preparing for re-use, c) recycling, d) other recovery, e.g.energy recovery, e) disposal[21].

Waste collection: The logistical process by which solid waste materials are transferred from the point of origin or use to a point of aggregation, storage, transfer, processing, sorting, treatment, incineration, and/or disposal.

Working loss: Material remaining after textile processing that cannot be manufactured into finished goods. Also referred to as wastage.

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