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RECYCLING OF WASTE ACRYLIC TEXTILES

D7.6: Final Policy Report

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Abstract	The Final policy report will include conclusive recommendations on research and innovation; policy for the engagement of the European industries, SMEs, Research centres and end-users; environmental legislation and policy
Keywords	Recommendations, Exploitation, Stakeholders, Project Results

Document Revision History

Version	Date	Description of change	List of contributor(s)
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Disclaimer

Project co-funded by the European Commission in the H2020 Programme		
Nature of the deliverable *:	Report	
Dissemination Level		
PU	Public, fully open, e.g. web	✓
CI	Classified, information as referred to in Commission Decision 2001/844/EC	
CO	Confidential to REACT project and Commission Services	

** REPORT: Document, report (excluding the periodic and final reports)*

DEM: Demonstrator, pilot, prototype, plan designs

DEC: Websites, patents filing, press & media actions, videos, etc.

OTHER: Software, technical diagram, etc

EXECUTIVE SUMMARY

The REACT Work Package 7, WP7, is dedicated to "Dissemination, Communication and Exploitation" and aims at defining, maintaining and coordinating the appropriate mechanisms and tools ensuring broad visibility and impact of the project's work and results. The main objective is to promote the developed project's concepts and technologies.

The shift towards a circular economy requires considerable political will.

This deliverable is addressed to policy-makers and presents the key policies and actions required to further develop, along with stakeholders, a roadmap for a successful European circular economy.

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ABBREVIATIONS

EU	European Union
PC	Project Coordinator
PCM	Plastics Circularity Multiplier Initiative
PMB	Project Management Board
SB	Scientific Board
WP	Work Package

1 INTRODUCTION

With a view to reducing the environmental impact of the textile sector, the European Union Strategy on Sustainable Textile Products (adopted on 30 March 2022) also aims to move towards a circular and climate-neutral economy by 2030. The textile products placed on the European market should be designed to be more durable, repairable, and efficient, free from hazardous substances and produced with respect for the human being and the environment.

In this context, the results of the REACT project have led to define recovery and recycling models of acrylic textile products capable of reducing the environmental impact, moving to circular business models on technical innovation and supporting policy aimed at a more conscious consumption.

To broaden the scope of REACT's efforts, the consortium is pursuing and ensuring close coordination with other ongoing Horizon 2020 projects, in particular participating to the Plastics Circularity Multiplier Iniatiative. This initiative seeks to improve collaboration in the value chain and create cross cooperation between several EU projects.

In this context, this deliverable summarizes the path followed by the partnership, which led the REACT project to set up some recommendations for policies and a roadmap to implement after the project.

During the development phases of the REACT project, the results obtained were examined and compared - at European level - with four other projects (NONTOX, Circular Flooring, CREATOR, PLAST2bCLEANED) which focused on recycling and eco-design from a Circular Economy perspective.

The five European projects (including REACT) have joined forces to increase the benefits of implementing the circularity principles through research and innovation and to start building efficient recycling models aimed at closing the loop and going to reuse raw materials.

In this context, the deliverable (Final Policy report), supported by the Horizon Results Booster, is an opportunity to show how REACT (together with the other projects) is making important contributions to the priority policies of the European Community in terms of reducing the environmental footprint of products related to plastics and other waste products, thus increasing the use of more sustainable materials.

The Policy Recommendations aim to offer the external public a concrete experience on "how to use the REACT project" and "why REACT can be valuable in evaluating the method of recycling acrylic fiber".

2 REACT SOCIAL IMPACT

2.1 REACT project's objectives

Recycle is a common word used always more and more but continues to be low for textiles in the EU, while landfill and incineration rates remain high. One of the major problems is to have secondary raw material similar to virgin one. This is because of contamination, treatments, and so on, that reduce performance of recycled materials and products.

The REACT proposal addresses the management of waste acrylic textiles coming from outdoor awnings and furnishing. A clue issue is the analysis and removal of finishing substances (fluorocarbons, melamine and acrylic resins, anti-mould agents) that affect the secondary raw material purity and their management. Removing these substances, then a mechanical recycling process could be implemented to obtain second life fibres and fabrics, which performance must be tested for best application.

A full environment friendly process to remove hazardous materials on finishing of waste acrylic textiles is investigated and developed to enhance their recycling, improve sustainability and reduce environmental and health risk. The removing of finishing products via chemical reaction involves the combination of many factors and has never been studied in this sector.

Final goal is a fully compatible recycled acrylic textile for reuse and guidelines for hazardous chemicals removing from finished textile with innovative investigation techniques.

The main objectives of this project, 40 months long, are therefore to:

- remove those substances up to 93%;
- re-use the acrylic textiles as raw material for other production cycles, also in combination with virgin fibres to reach 3,300 tons total of waste prevented from disposal;
- reduce the amount of landfill and incineration of acrylic textiles of at least 30% for the outdoor sector (awnings and furnishing).

At the end of the project, the REACT partnership aims to set recommendations on the design and manufacturing of materials for recyclability and on the recycling process for the standardization of the whole process, that would be applied on other sectors.

With the aim of ensuring the sustainability of the results once the project is over in correlation with the individual exploitation intentions of each partner, the partnership has:

- defined relevant stakeholders for participation in the project's ecosystem and the adoption of the REACT results offered for the acrylic fibres industry and manufactures;
- provided broad visibility of REACT results by disseminating and communicating them to all relevant stakeholders, including researchers, industry, European projects and policy makers;
- looked at liaisons and close coordination with related projects and initiatives both within EU and wider internationally;
- defined a sustainable framework to ensure the future evolution of the project results and, at the same time, generate business opportunities for the partners and the industry at large.

2.2 Stakeholders

Categories of identified stakeholders are:

1. European public authorities
2. National public authorities

3. Regional and Local public authorities
4. Sectoral and Environmental regional agencies
5. Infrastructure and (public) service providers (e.g. utility companies: sewage and waste collection)
6. Research and Academia and Higher education and research institutions
7. Large enterprises and SMEs (including collectors and recyclers)
8. Business support organizations (e.g. Chambers of commerce, Business associations, Clusters)
9. Certification and accreditation systems
10. Technology providers
11. Social companies (e.g. charities).

2.3 Results for stakeholders

For each result obtained within the project, each partner has identified its own interest in correlation with the interest that its reference stakeholders may have for the result in question.

For each category of stakeholder, each partner therefore defined a priority scale (3: very important, 2: important, 1: interested), thus identifying the specific interests and methods of involvement (see below Figure 1 Partners' & Stakeholders' Interest).

The objective of this process is to verify the stakeholders to whom to direct the verified recommendations with respect to the policies defined within the Plastics Circularity Multiplier Initiative in order to facilitate and encourage, at European level, the implementation of the project results.

Which Stakeholders are the recipients to involve to set up a Policy and to facilitate the results of the project?							
Results	**Deliverable**	**Available to date**	**Partner's Priority**	**Which stakeholders?**	**What is the specific interest of the stakeholder?**	**How to involve it?**	**When to involve it?**
Plan design of waste storage and classification system	D1.1, D1.2	Yes					
Acrylic textile waste characterization	D1.3	Yes					
Chemical removal	D2.2, D2.4						
Predictive model of NIR analysis	D2.6						
Industrial level chemical removal (scale-up)	D2.7						
Lab-scale wastewater treatment	D3.1						
Yarn made of recycled fibres	D4.1, D4.2	Partially					
Mechanical recycling of acrylic fibre	D4.3						
Fabrics made of recycled fibres	D5.2						
New and environmental friendly finishing	D5.1, D5.4						
Prototypes and demonstrators	D5.6						
LCA of acrylic fibres	D6.1, D6.5	Partially					
Recommendation on production chain and backlogistic	D6.2	Yes					
Recommendation for technology transfer	D6.3						
Recommendation on eco-design	D6.4						
Policy report	D7.3, D7.6	Partially					
Roadmap for exploitation after REACT	D7.5						

Table 1: Partners' & Stakeholders' Interest (template)

2.4 Results

The involvement process is over, the following tables show the final elaborations.

Which Stakeholders are the recipients to involve to set up a Policy and to facilitate the results of the project?						
Results	**Deliverable**	**Partner's Priority**	**Which stakeholders?**	**What is the specific interest of the stakeholder?**	**How to involve it?**	**When to involve it?**
Plan design of waste storage and classification system	D1.1, D1.2					
Acrylic textile waste characterization	D1.3	***	Stakeholder n.9 (Accredia)	New types of laboratory tests	with a certification method can be validated.	After an in-depth analysis on the NIR method, a certification method can be validated.
Chemical removal	D2.2, D2.4	***	Stakeholder n.9 (Accredia)	New types of laboratory tests	Studying a procedure to certify is non-destructive capable of verifying the presence or absence of chemical agents on a fabric	After an in-depth analysis on the chemical removal method, a certification method can be validated.
Predictive model of NIR analysis	D2.6	***	Stakeholder n.9 (Accredia) and Stakeholder n.6 (Bicocca)	Create databases for NIR analysis	collaborate and interact with NIR experts	Deepen the NIR method with research centers and universities. After a thorough analysis of the NIR method, it is possible to validate a certification method.
Industrial level chemical removal (scale-up)	D2.7	**	Stakeholder n.9 (Accredia) + Stakeholder n.3 (Regione Lombarida) + Stakeholder n.4 (ARPA and ISPRA)	Be sure about the possibility of recycling acrylic fabrics	Mainly, check the waste flows with the public administrations in order to verify the current legislation on how to manage and handle waste to be recycled.	Check current regulations. After a thorough analysis of an industrial chemical removal model, a certification method can be validated.
Lab-scale wastewater treatment	D3.1		?			
Yarn made of recycled fibres	D4.1, D4.2	***	Stakeholder n.9 (Accredia)	New types of laboratory tests	increase laboratory analysis experiences to distinguish recycled materials from virgin ones	After an in-depth analysis on the chemical removal method, a certification method can be validated.
Mechanical recycling of acrylic fibre	D4.3	**	Stakeholder n.7 (MC2)	Purpose to encourage companies to consider the recycling method	report the state of the art of technologies	After having certified the yarn and fabric and verified the product life cycle through LCA analysis.
Fabrics made of recycled fibres	D5.2	***	Stakeholder n.9 (Accredia)	New types of laboratory tests	increase laboratory analysis experiences to distinguish recycled materials from virgin ones	After an in-depth analysis on the chemical removal method, a certification method can be validated.
New and environmental friendly finishing	D5.1, D5.4					
Prototypes and demonstrators	D5.6					
LCA of acrylic fibres	D6.1, D6.5	***	Stakeholder n.9 (Accredia) and Stakeholder n.6 (Bicocca)	New types of laboratory tests	Create an environmental passport for products containing recycled fibers. collaborate and interact with LCA experts	After a thorough analysis of the chemical removal method and trimming methods of recycled acrylic fibers, it will be possible to validate certification method.
Recommendation on production chain and backlogistic	D6.2	**	SHs n.7	Waste traceability	Define contents to teach	
Recommendation for technology transfer	D6.3	**	SHs n.7	Training, know-how	Define contents to teach	At the end of WP5
Recommendation on eco-design	D6.4	**	SHs n.6, 7	Training, know-how	Define contents to teach	At the end of WP5
Policy report	D7.3, D7.6	***	SHs n.1-5, 8	Best practices, Innovation	Workshop and guidelines	Last project semester
Roadmap for exploitation after REACT	D7.5	***	SHs n.1-11	Best practices, Innovation	Workshop and guidelines	Last project semester

Table 2: Centrocot's & Stakeholders' Interest

Results	**Deliverable**	**Partner's Priority**	**Which stakeholders?**	**What is the specific interest of the stakeholder?**	**How to involve it?**	**When to involve it?**
Plan design of waste storage and classification system	D1.1, D1.2	***	Stakeholder n° 7 and n°5	the stakeholders concerned are all the players in the supply chain, i.e spinning mills, weaving mills, manufacturing industries and distributors	we will study a plan to create a platform for the collection of waste from the different sources identified	once we have obtained encouraging results regarding the fabric made with recycled waste
Acrylic textile waste characterization	D1.3					
Chemical removal	D2.2, D2.4					
Predictive model of NIR analysis	D2.6					
Industrial level chemical removal (scale-up)	D2.7					
Lab-scale wastewater treatment	D3.1					
Yarn made of recycled fibres	D4.1, D4.2					
Mechanical recycling of acrylic fibre	D4.3	***	Stakeholder n.7	transfer knowledge to the subjects of the PARA 'supply chain	report the state of the art of technologies	After having certified the yarn and fabric, verified the life cycle of the product through LCA analysis and carried out an economic evaluation.
Fabrics made of recycled fibres	D5.2					
New and environmental friendly finishing	D5.1, D5.4					
Prototypes and demonstrators	D5.6					
LCA of acrylic fibres	D6.1, D6.5					
Recommendation on production chain and backlogistic	D6.2					
Recommendation for technology transfer	D6.3					
Recommendation on eco-design	D6.4					
Policy report	D7.3, D7.6					
Roadmap for exploitation after REACT	D7.5					A3:H19E10A2:H19AA1:H19

Table 3: Parà's & Stakeholders' Interest

Which Stakeholders are the recipients to involve to set up a Policy and to facilitate the results of the project?						
Results	**Deliverable**	**Partner's Priority**	**Which stakeholders?**	**What is the specific interest of the stakeholder?**	**How they have been involved/will be involved**	**When they have been involved/will be involved**
Plan design of waste storage and classification system	D1.1, D1.2		SH1 European public authorities / SH2 National public authorities / SH3 Regional and Local public authorities / SH7 Large entreprises and SMEs	transfer knowledge	Presentation at regional/circular economy policy events	once we have obtained encouraging results regarding the fabric made with recycled waste
Acrylic textile waste characterization	D1.3	**	SH1 European public authorities / SH2 National public authorities / SH3 Regional and Local public authorities / SH7 Large entreprises and SMEs	transfer knowledge	Related news posted on the REACT website and channeled through social media and newsletter; communication through channels dedicated to certification bodies; presentation at scientific/industry conferences; scientific publications; presentation at REACT's 2nd webinar/final event; specialised press	once we have obtained encouraging results regarding the fabric made with recycled waste
Chemical removal	D2.2, D2.4					
Predictive model of NIR analysis	D2.6					
Industrial level chemical removal (scale-up)	D2.7					
Lab-scale wastewater treatment	D3.1					
Yarn made of recycled fibres	D4.1, D4.2	*	SH7 Large enterprises and SMEs (including collectors and recyclers)/ SH8 Business support organisations (e.g. Chambers of commerce, Business associations, Clusters)	transfer knowledge	News channeled through REACT's online outlets/specialized press; presentation at regional/circular economy policy events ; private project	once we have obtained encouraging results regarding the fabric made with recycled waste & After having certified the yarn and fabric, verified the life cycle of the product through LCA analysis and carried out an economic evaluation.
Mechanical recycling of acrylic fibre	D4.3	*	SH7 Large enterprises and SMEs (including collectors and recyclers)/ SH8 Business support organisations (e.g. Chambers of commerce, Business associations, Clusters)	transfer knowledge	News channeled through REACT's online outlets/specialized press; presentation at regional/circular economy policy events ; private project	once we have obtained encouraging results regarding the fabric made with recycled waste & After having certified the yarn and fabric, verified the life cycle of the product through LCA analysis and carried out an economic evaluation.
Fabrics made of recycled fibres	D5.2	**	SH7 Large enterprises and SMEs (including collectors and recyclers)/ SH8 Business support organisations (e.g. Chambers of commerce, Business associations, Clusters)	transfer knowledge	News channeled through REACT's online outlets/specialized press; presentation at regional/circular economy policy events ; private project	once we have obtained encouraging results regarding the fabric made with recycled waste & After having certified the yarn and fabric, verified the life cycle of the product through LCA analysis and carried out an economic evaluation.
New and environmental friendly finishing	D5.1, D5.4		SH1 European public authorities / SH2 National public authorities / SH3 Regional and Local public authorities / SH7 Large entreprises and SMEs	transfer knowledge	News channeled through REACT's online outlets/specialized press; presentation at regional/circular economy policy events	After having certified the yarn and fabric, verified the life cycle of the product through LCA analysis
Prototypes and demonstrators	D5.6					
LCA of acrylic fibres	D6.1, D6.5					
Recommendation on production chain and backlogistic	D6.2	**	SH7 Large enterprises and SMEs (including collectors and recyclers)/ SH8 Business support organisations (e.g. Chambers of commerce, Business associations, Clusters)	transfer knowledge	News channeled through REACT's online outlets/specialized press; presentation at regional/circular economy policy events ; private project	at the end of the project
Recommendation for technology transfer	D6.3					
Recommendation on eco-design	D6.4					
Policy report	D7.3, D7.6					
Roadmap for exploitation after REACT	D7.5					

Table 4: CETI's & Stakeholders' Interest

Which Stakeholders are the recipients to involve to set up a Policy and to facilitate the results of the project?						
Results	**Deliverable**	**Partner's Priority**	**Which stakeholders?**	**What is the specific interest of the stakeholder?**	**How to involve it?**	**When to involve it?**
Plan design of waste storage and classification system	D1.1, D1.2					
Acrylic textile waste characterization	D1.3					
Chemical removal	D2.2, D2.4	***	Stakeholder n.7 (Potential customers)			
Predictive model of NIR analysis	D2.6					
Industrial level chemical removal (scale-up)	D2.7	***	Stakeholder n.7 (Potential customers)			
Lab-scale wastewater treatment	D3.1					
Yarn made of recycled fibres	D4.1, D4.2					
Mechanical recycling of acrylic fibre	D4.3					
Fabrics made of recycled fibres	D5.2					
New and environmental friendly finishing	D5.1, D5.4	***	Stakeholder n.9 Certification and accreditation system			
Prototypes and demonstrators	D5.6					
LCA of acrylic fibres	D6.1, D6.5					
Recommendation on production chain and backlogistic	D6.2					
Recommendation for technology transfer	D6.3					
Recommendation on eco-design	D6.4					
Policy report	D7.3, D7.6					
Roadmap for exploitation after REACT	D7.5					

Table 5: Soft Chemicals's & Stakeholders' Interest

Which Stakeholders are the recipients to involve to set up a Policy and to facilitate the results of the project?						
Results	**Deliverable**	**Partner's Priority**	**Which stakeholders?**	**What is the specific interest of the stakeholder?**	**How to involve it?**	**When to involve it?**
Plan design of waste storage and classification system	D1.1, D1.2					
Acrylic textile waste characterization	D1.3					
Chemical removal	D2.2, D2.4					
Predictive model of NIR analysis	D2.6					
Industrial level chemical removal (scale-up)	D2.7					
Lab-scale wastewater treatment	D3.1					
Yarn made of recycled fibres	D4.1, D4.2	***	SHs n.6,7, 5 and 10	processes, industrial machinery that can produce longer acrylic fibers	-	when new technologies are mature
Mechanical recycling of acrylic fibre	D4.3					
Fabrics made of recycled fibres	D5.2					
New and environmental friendly finishing	D5.1, D5.4					
Prototypes and demonstrators	D5.6					
LCA of acrylic fibres	D6.1, D6.5					
Recommendation on production chain and backlogistic	D6.2					
Recommendation for technology transfer	D6.3					
Recommendation on eco-design	D6.4					
Policy report	D7.3, D7.6					
Roadmap for exploitation after REACT	D7.5					

Table 6: Jak Spinning's & Stakeholders' Interest

Which Stakeholders are the recipients to involve to set up a Policy and to facilitate the results of the project?						
Results	**Deliverable**	**Partner's Priority**	**Which stakeholders?**	**What is the specific interest of the stakeholder?**	**How they have been involved/will be involved**	**When they have been involved/will be involved**
Plan design of waste storage and classification system	D1.1, D1.2		Stakeholder n.1 European public authorities + Stakeholder n.2 National public authorities + Stakeholder n.3 Regional and Local public authorities	transfer knowledge	Presentation at regional/EC green/circular economy policy events	once we have obtained encouraging results regarding the fabric made with recycled waste
Acrylic textile waste characterization	D1.3		Stakeholder n.9 Certification systems for Accredited laboratory tests + Stakeholder n.6 Research and Academia and Higher education and research institutions	transfer knowledge	Related news posted on the REACT website and channeled through social media and newsletter; communication through channels dedicated to certification bodies; presentation at scientific/industry conferences; scientific publications; presentation at REACT's 2nd webinar/final event; specialised press	once we have obtained encouraging results regarding the fabric made with recycled waste
Chemical removal	D2.2, D2.4		Stakeholder n.9 Certification systems for Accredited laboratory tests	transfer knowledge	Related news posted on the REACT website and channeled through social media and newsletter; communication through channels dedicated to certification bodies; presentation at scientific/industry conferences; scientific publications; presentation at REACT's 2nd webinar/final event; specialised press	After an in-depth analysis on the chemical removal method.
Predictive model of NIR analysis	D2.6		Stakeholder n.6 Research and Academia and Higher education and research institutions	transfer knowledge	News on the REACT website and channeled through social media and newsletter; communication through channels dedicated to certification bodies; presentation at scientific conferences; scientific publications; presentation at REACT's final event	After an in-depth analysis on the chemical removal method.
Industrial level chemical removal (scale-up)	D2.7		Stakeholder n.1 European public authorities + Stakeholder n.4 Sectoral and Environmental regional agencies + Stakeholder n6 Research and Academia and Higher education and research institutions	transfer knowledge	News channeled through REACT's online outlets/specialized press; presentation at chemical industry/association events	After having certified the yarn and fabric, verified the life cycle of the product through LCA analysis and carried out an economic evaluation.
Lab-scale wastewater treatment	D3.1		Stakeholder n.1 European public authorities + Stakeholder n.4 Sectoral and Environmental regional agencies + Stakeholder n6 Research and Academia and Higher education and research institutions	transfer knowledge	News on the REACT website and channeled through social media and newsletter; communication through channels dedicated to certification bodies; presentation at scientific conferences; scientific publications; presentation at REACT's final event	After having certified the yarn and fabric, verified the life cycle of the product through LCA analysis and carried out an economic evaluation.
Yarn made of recycled fibres	D4.1, D4.2		Stakeholder n.7 Large enterprises and SMEs (including collectors and recyclers) + Stakeholder n.8 Business support organisations (e.g. Chambers of commerce, Business associations, Clusters)	transfer knowledge	News channeled through REACT's online outlets/specialized press; presentation at chemical industry/association events	once we have obtained encouraging results regarding the fabric made with recycled waste
Mechanical recycling of acrylic fibre	D4.3		Stakeholder n.7 Large enterprises and SMEs (including collectors and recyclers) + Stakeholder n.8 Business support organisations (e.g. Chambers of commerce, Business associations, Clusters)	transfer knowledge	News channeled through REACT's online outlets/specialized press; presentation at chemical industry/association events	once we have obtained encouraging results regarding the fabric made with recycled waste
Fabrics made of recycled fibres	D5.2		Stakeholder n.7 Large enterprises and SMEs (including collectors and recyclers) + Stakeholder n.8 Business support organisations (e.g. Chambers of commerce, Business associations, Clusters)	transfer knowledge	News channeled through REACT's online outlets/specialized press; presentation at chemical industry/association events	once we have obtained encouraging results regarding the fabric made with recycled waste
New and environmental friendly finishing	D5.1, D5.4		Stakeholder n.1 European public authorities + Stakeholder n.2 National public authorities + Stakeholder n.3 Regional and Local public authorities	transfer knowledge	News channeled through REACT's online outlets/specialized press; presentation at regional/EC green/circular economy policy events	After having certified the yarn and fabric, verified the life cycle of the product through LCA analysis
Prototypes and demonstrators	D5.6		Stakeholder n.1 European public authorities + Stakeholder n.2 National public authorities + Stakeholder n.3 Regional and Local public authorities	transfer knowledge	News channeled through REACT's online outlets/specialized press; presentation at regional/EC green/circular economy policy events/industry events	After having certified the yarn and fabric, verified the life cycle of the product through LCA analysis
LCA of acrylic fibres	D6.1, D6.5		Stakeholder n.1 European public authorities + Stakeholder n.2 National	transfer knowledge	Presentation at regional/EC green/circular economy policy events	After having certified the yarn and fabric, verified the life cycle of the
Recommendation on production chain and backlogistic	D6.2		Stakeholder n.7 Large enterprises and SMEs (including collectors and recyclers) + Stakeholder n.8 Business support organisations (e.g. Chambers of commerce, Business associations, Clusters)	transfer knowledge	Presentation at regional/EC green/circular economy policy events	at the end of the project
Recommendation for technology transfer	D6.3		Stakeholder n.1 European public authorities + Stakeholder n.2 National public authorities + Stakeholder n.3 Regional and Local public authorities	transfer knowledge	Presentation at regional/EC green/circular economy policy events	at the end of the project
Recommendation on eco-design	D6.4		Stakeholder n.1 European public authorities + Stakeholder n.2 National public authorities + Stakeholder n.3 Regional and Local public authorities	transfer knowledge	Presentation at regional/EC green/circular economy policy events	at the end of the project
Policy report	D7.3, D7.6		Stakeholder n.1 European public authorities + Stakeholder n.2 National public authorities + Stakeholder n.3 Regional and Local public authorities	transfer knowledge	Presentation at regional/EC green/circular economy policy events	at the end of the project
Roadmap for exploitation after REACT	D7.5		Stakeholder n.1 European public authorities + Stakeholder n.2 National public authorities + Stakeholder n.3 Regional and Local public authorities	transfer knowledge	Presentation at regional/EC green/circular economy policy events	at the end of the project

Table 7: Martel's & Stakeholders' Interest

3 METHODS OF ENGAGEMENT AND DEVELOPMENT OF RECOMMENDATIONS

3.1 Overall approach of engagement

Development of the guidelines and recommendations for policy audience use the transdisciplinary approach of the REACT project, bringing together actors from politics, industry, academic society and research.

Each partner is obviously free to contact and organize activities to involve its own stakeholders, at local, national and European level.

The main objective of the project is to address the management of waste acrylic textiles coming from outdoor awnings and furnishing, defining and sustaining an EU-wide Roadmap and a Policy recommendation at the cutting-edge for the analysis and removal of finishing substances in order to obtain second life fiber and fabrics.

The REACT project has developed new ways and technologies capable of recycling acrylic textile materials, structured methods capable of managing waste more efficiently to facilitate the transition from a linear economy to a circular economy. In this context, REACT, together with the projects included in the PMC initiative, analyzed three types of challenges to be overcome in order to demonstrate the real return on investment (in terms of public funding) on the theme of recycling and reuse and reuse of industrial textile waste.

Therefore, the challenges analyzed and which will be translated into objectives or recommendations are:

- **Scientific and technological challenges:** research and innovation must enable advances such as selection and pre-treatment techniques, demonstrations of the feasibility of integrated piloting and exploitation of by-products and the safe disposal of removed substances.
- **Challenges for society**: need for environmental sustainability, resource, and raw material efficiency.
- **Regulatory challenges:** the need to remove hazardous substances to allow plastic recycling, for example the EC directives on waste electrical and electronic equipment (WEEE); End of Life Vehicle (ELV) and Construction and Demolition Waste (C&DW), which enable plastic recyclers to comply and ensure REACH competitiveness. Other priorities must be the need to enable the creation of a cost-effective circular economy for Chloride vinyl (PVC) that is competitive with optimized PVC, as well as the reuse of acrylic fibers.

For the REACT project and for the projects involved in the PCM initiative, addressing the three challenges also meant verifying whether they are present, and it is possible to read the points of union and connection with the main European policies that address the issue of Circular Economy.

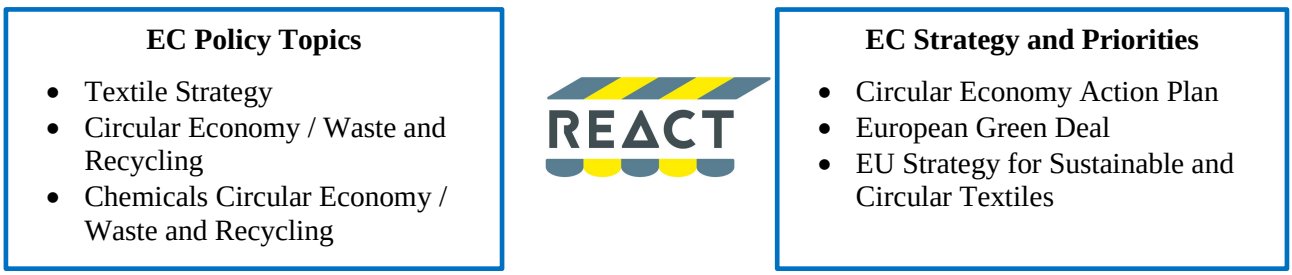


Figure 1: Framework of the regulations related to the Challenges

1. **Transition to a circular economy.** By promoting all forms of eco-innovation enabling the transition to a circular economy, EU policy measures will build on those undertaken under the

eco-innovation program and strengthen them in order to strengthen technologies, processes, services and products eco-innovations, including by exploring ways to reduce the quantities of primary raw materials in production and consumption, while reducing barriers for secondary raw materials.

2. **Lack of incentives for the collection and recycling of plastics.** From a financial point of view, recyclable materials, also known as recycled, may have a small price advantage over new materials, but they are more complex to produce, making them less attractive from an economic point of view. Furthermore, the collection systems for the different streams of plastic waste to date are difficult for recycling, as for example collection sites are scarce in many regions and the means of transport are long, thus increasing the overall costs for recycling. . Furthermore, illegal blending and exporting continues to take place. Uncertainty about the quantities of waste available on the market creates further obstacles, while stringent product requirements on the demand side prevent the extensive use of recyclates.
3. **Lack of end-of-waste criteria at EU level.** The EC Waste Framework Directive explains when waste ceases to be waste and becomes a secondary raw material and how to distinguish between waste and by-products on the basis of a five-step "waste hierarchy". Although such criteria exist in some Member States to determine when waste materials are no longer considered waste but become a secondary material, there are no end-of-qualification criteria at EU level. Therefore, a product accepted, for example, in the Netherlands cannot be transferred to another EU country, thereby hindering EU-wide trade in these materials and products.

4 INNOVATION ITEMS AND IMPLICATIONS (OBJECTIVES / RECOMMENDATIONS)

During the entire period of the project and in relation to the results achieved, and in parallel, with respect to the challenges and regulations in force regarding the circular economy, some elements emerged that REACT validated as recommendations.

The results of REACT may consist of inventions (such as "Innovative analytical methods for the identification of chemicals"), or new technological processes developed (such as "Chemicals and finish removal"), or new, more environmentally friendly approaches (such as "Investigation for new eco-friendly finishing").

These results and innovations have been generalized to generate a greater environmental, economic and social impact, addressing risks or barriers to be overcome. The last column of the table below summarizes some recommendations or objectives / needs to be met and coming from the REACT experience and lessons learned in relation to the work carried out (also within the PCMI).

<table>
<tr><th>RESULTS</th><th>INNOVATION</th><th>CHALLENGES</th><th>OBJECTIVES / RECOMMENDATIONS</th></tr>
<tr><td rowspan="2">Chemicals Removal</td><td>No solution existing (before REACT) for addressed waste</td><td rowspan="3">✓ Scientific and Technological challenges</td><td rowspan="2">Recommendation 1 - Improve the recycling of textile waste</td></tr>
<tr><td>Chemicals and finishing removal has never been studied in this sector</td></tr>
<tr><td>Predictive model of chemicals on fabrics</td><td>Innovative analytical methods for identification of chemicals</td><td rowspan="3">Recommendation 2 - Regulations and tools on recyclates</td></tr>
<tr><td rowspan="2">Environmentally friendly finishing</td><td>Green approach</td><td rowspan="2">✓ Societal challenges</td></tr>
<tr><td>Sludge evaluation treatment</td></tr>
<tr><td>Waste classification and management system</td><td rowspan="3">Treatment of industrial and post-consumer waste</td><td>✓ Scientific and Technological challenges
✓ Regulatory challenges</td><td rowspan="3">Recommendation 3 – Innovative technologies for recycling</td></tr>
<tr><td>Prototypes from recycled fibres</td><td>✓ Societal challenges</td></tr>
<tr><td>Report on mechanical recycling of acrylic fibre</td><td>✓ Scientific and Technological challenges</td></tr>
</table>

Table 8: Innovation items and implications

The following tables describe the three objectives / recommendations.

Objective / Recommendation 1 - Improve the recycling of textile waste		
Level of implementation	*Stakeholders*	*Timeline*
International	n1. European public authorities n2. National public authorities n3. Regional and Local public authorities n4. Sectoral and Environmental regional agencies n5. Infrastructure and (public) service providers (e.g. utility companies: sewage and waste collection) n10.Technology providers	Short term
Description: Material reuse is a promising circular economy alternative that could be more widely exploited for the waste materials coming from the textile sector. REACT project has developed an innovative method for recycling acrylic fabrics and demonstrated that is possible to remove chemicals from wasted textiles and obtain fibres as secondary raw materials allowing to realize products with the same performance of the virgin ones. Similar approach can be applied for other fibres and target sectors. This will increase recyclability rates of textile materials and, in turn, will create a market for recycled fibers, yarns and new products.		

Table 9: Objective / Recommendation 1

Objective / Recommendation 2 – Regulations and tools on recyclates		
Level of implementation	*Stakeholders*	*Timeline*
International	n1. European public authorities n2. National public authorities n3. Regional and Local public authorities n7. Large enterprises and SMEs (including collectors and recyclers) n8. Business support organizations (e.g. Chambers of commerce, Business associations, Clusters)	Medium term
Description: The challenge is to design targeted and well-accepted laws aiming at increasing the percentage of recycled materials used in products, thus increasing circular economy opportunities. A potential opportunity, already well investigated, is to boost the minimal environmental criteria principle in Green Public Procurement. Other opportunities could come from eco-designer directive and textile strategy. Through the results of the project, it is possible to influence companies (in primis those that use acrylic fibers) to think differently with respect to the concept of Design for Recovery.		

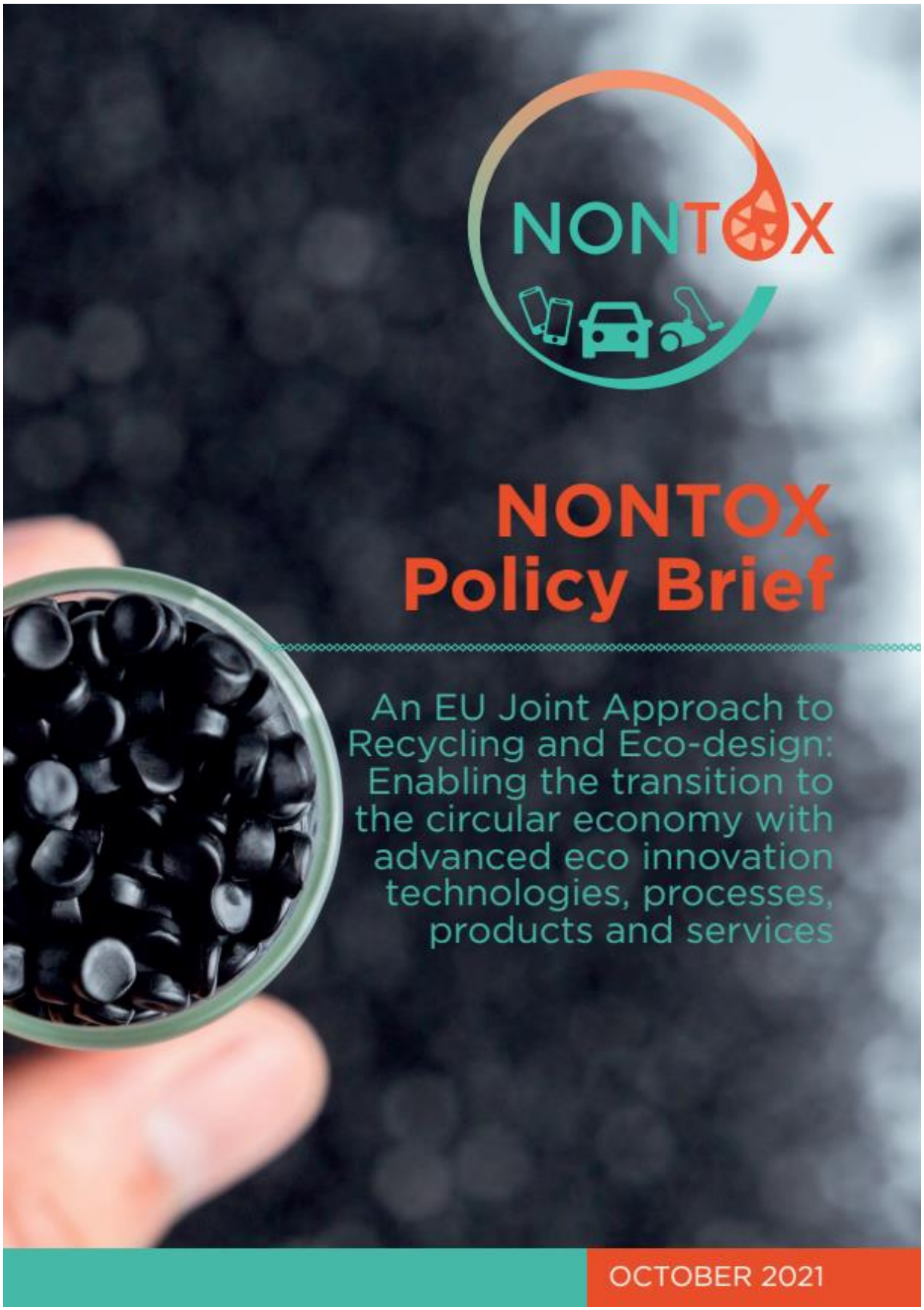
Table 10: Objective / Recommendation 2

Objective / Recommendation 3 - Innovative technologies for recycling		
Level of implementation	*Stakeholders*	*Timeline*
International	n6. Research and Academia and Higher education and research institutions	Medium term

	n7. Large enterprises and SMEs (including collectors and recyclers) n9. Certification and accreditation systems n10. Technology providers n11. Social companies (e.g. charities)	
Description: Technological innovation is therefore particularly essential when it comes to optimizing the recycling processes of textile waste, which are often very complex due to the combination of different materials and components. In this scheme, new technologies can play a key role in achieving the textile waste reduction target set by the European Union for 2025 and, in this way, also reduce the environmental impact of the textile industry.		

Table 11: Objective / Recommendation 3

5 ANNEX - HRB_NONTOX_POLICY BRIEF_OCTOBER 2021



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NONTOX

Executive Summary

As flexible, cost-effective, strong and light materials, plastics offer a unique combination of advantages. However, plastic waste can cause harm to the environment, threatening health, food safety, marine life and animals alongside adverse chemical impacts from the build-up of organic pollutants if it is not correctly handled.

Applying ambitious circularity principles for plastics in Europe will have net positive benefits in the transition towards the circular economy, unleashing opportunities to take niche ideas into the mainstream, increasing market uptake and significantly reducing damage to the environment.

With a common focus on recycling and eco-design, five projects funded by the European Commission have joined forces to increase awareness of the benefits of implementing the principles of circularity: NONTOX, Circular Flooring, CREAToR, PLAST2bCLEANED and REACT. Through their research, this project group is driving eco-innovation to enable recycling efficiency and closing the loop on the re-use of plastic materials in Europe.

Being part of the Plastics Circularity Multiplier Initiative is another strength of the project group, by contributing to improvements in value-chain collaboration and cross cooperation between European initiatives.

This Policy Brief, supported by the Horizon Results Booster, is an opportunity to show how these five projects are contributing to EC policy priorities in terms of reducing the environmental footprint of plastics and other waste products, thereby increasing the use of more sustainable materials.

Topic Overview

The vast amount of plastic waste and other materials is causing harm to the environment, from public health, food safety, adverse chemical effects to animal safety and well-being and irreparable damage to marine life.

Novel ways to recycle plastic products and deal more efficiently with waste is a vital step in the transition to the circular economy. With levers on multiple levels, from EU regulations and funding programmes to awareness-raising initiatives, Europe can now unleash opportunities to take niche ideas into the mainstream, increase market uptake and reduce the environmental footprint in the broader contexts of the European Commission's (EC) Circular Economy Action Plan[1] and related priorities under the European Green Deal[2]. Moreover, the Sustainable Product Policy[3] initiative will establish a legal framework, whereby all products produced or rolled out on the EU market are in line with technical standards for sustainability.

Topic Context

Novel ways and technologies to recycle plastic products and deal more efficiently with waste is a vital step in the transition to the circular economy. To help drive the transition to the circular economy, NONTOX, Circular Flooring, CREAToR, PLAST2bCLEANED and REACT are tackling a core set of societal, technological, regulatory and industrial challenges, showing the return on investment of funding circularity principles such as recycling and eco-design.

- **Societal challenges**: Need for environmental sustainability, resource and raw material efficiency. For example, EC policy prioritises significant reductions in e-waste as one of the fastest growing waste streams through sustainable production and consumption.
- **Scientific and technological challenges**: Research and innovation need to enable advances in sorting and pre-treatment techniques and recycling technologies; proving the feasibility of an integrated pilot plant and valorisation of by-products and safe disposal of removed substances.
- **Regulatory challenges**: Need to remove legacy substances to enable plastic recycling, e.g. the EC's directives on Waste Electrical and Electronic Equipment (WEEE)[4]; End of Life Vehicles (ELV)[5] and Construction and Demolition Waste (C&DW)[6], and on Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH) enhancing plastic recyclers' compliance and competitiveness. Other priorities include the need to enable the creation of a cost-effective circular economy for Polyvinyl Chloride (PVC) that is competitive with optimised virgin PVC, as well as reusing acrylic fibres.

To further channel the efforts towards efficient recycling technologies and deliver policy recommendations, projects of the group are members of the Plastics Circularity Multiplier Initiative[7], contributing to improvements in value-chain collaboration and cross cooperation between European initiatives.

1 https://ec.europa.eu/environment/strategy/circular-economy-action-plan_en.
2 https://ec.europa.eu/info/strategy/priorities-2019-2024/european-green-deal_en.
3 https://ec.europa.eu/growth/industry/sustainability/product-policy-and-ecodesign_en.
4 https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:02012L0019-20180704.
5 https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex%3A32000L0053.
6 https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:02008L0098-20180705.
7 https://www.plasticscircularitymultiplier.eu/.

NONTOX HRB Project Group: Connecting the Policy Dots

Policy Challenges

Materials that are recyclable, called "recyclates", may have a price advantage compared with new materials but are more complex to produce, making them less economically attractive unless there is high demand for them.

It is clear, however that challenges for market uptake are accompanied by those at policy level.

- **Transitioning to a circular economy**. Fostering all forms of eco-innovation that enable the transition to a circular economy, EU policy measures will build on and enhance those undertaken in the Eco-Innovation Programme with a view to strengthening eco-innovative technologies, processes, services and products, including exploring ways to reduce the quantities of primary raw materials in production and consumption while reducing barriers for secondary raw materials.
- **Lack of incentives for plastic collection and recycling**. From a financial viewpoint, recyclates, may have a price advantage compared with new materials but are more complex to produce, making them less economically attractive. Also, the collection schemes for different plastic waste streams to date are challenging for recycling, since for example collection sites are scarce in many regions and transportation ways long, thus increasing the overall costs for recycling. Furthermore, illegal mixing and export still takes place. Uncertainty about waste quantities available on the market creates further hurdles while stringent product requirements on the demand side prevent the extensive use of recyclates.
- **Lack of EU-wide End-of-Waste Criteria.** The EC's Waste Framework Directive explains when waste ceases to be waste and becomes a secondary raw material, and how to distinguish between waste and by-products based on a five-step "waste hierarchy"[8]. While such criteria exist in some Member States to determine when waste material is no longer considered as waste but becomes a secondary material by default, there is no EU-wide end-of-waste criteria[9]. Thus, a product that is accepted in the Netherlands for instance, may not be allowed into another EU country, thereby hampering the EU-wide trade of such materials and products. Furthermore, waste electrical and electronic equipment weighing over 25 kg cannot be sent over borders, thus hindering scale up experiments. More specifically, notification for transport crossing EU borders can take 6-18 months or even not available at all for certain WEEE plastics streams.

8 https://ec.europa.eu/environment/topics/waste-and-recycling/waste-framework-directive_en.
9 https://op.europa.eu/en/publication-detail/-/publication/be94cedf-5eea-4018-ac0c-bfca6c96c53e/language-en.

Recommendations

To overcome the challenges, the five projects in the HRB Project Group suggest the following policy recommendations.

Recommendation 1 - End of Waste Policy

End-of-waste status for recovered materials enables competition with virgin materials without the burden of still counting as waste. End-of-waste status is a quality guarantee that can be given to recovered materials only if they meet a pre-defined quality requirement that also serves as a quality certificate. Information campaigns are needed at multiple levels, including necessary awareness raising by policymakers. Different administrative requirements for shipment, transport and the issue of licenses for recyclers coupled with various categories of product-waste status is hindering a common and coherent approach in the European single market.

Recommendation 2 - Qualify Solvent-based Purification / Dissolution Recycling as "Physical Recycling" in the Taxonomy Climate Delegate Act

The EU taxonomy is a classification system for environmentally sustainable economic activities and is intended to help the EU scale up sustainable investments and achieve its Green Deal targets. The taxonomy gives companies, investors and policymakers clear definitions for economic activities considered environmentally sustainable. It is necessary to add solvent-based purification/ dissolution recycling and to classify it correctly as "physical recycling" in the Taxonomy Climate Delegated Act because it does not alter the polymeric structure. It has a higher separation selectivity than mechanical recycling and allows the reuse of polymers, thus making a significant contribution to each of the six goals.

Recommendation 3 - Information Campaign about Recyclates

It is essential to increase knowledge about the possible uses for recyclates. Increasing such knowledge is therefore a call to action for recyclers, associations and institutes within the plastics industry. Information campaigns are needed at multiple levels, including awareness-raising by policymakers.

One of the key tasks of waste management and recycling, besides safe treatment of waste, is to contribute to EU's self-sufficiency for raw materials. This means we need to better target recycling to focus on critical and valuable non-renewable materials. This will enable Europe to find more sustainable alternatives for high environmental impacts in mining and quarrying activities to generate primary raw materials.

Recommendation 4 - Material Specific Recycling Targets

So far, obligatory material specific recycling targets were only introduced for packaging. Although many waste streams have obligatory recycling targets, they are not material specific and focus mainly on the dominant materials of the waste stream. While the end of 2024 is the timeline for material-specific targets on construction and demolition waste under the water framework directive, coverage of other waste streams is still needed.

Obligatory material specific targets would facilitate targeted recycling and better utilisation of valuable and non-renewable materials while also contributing to EU's self-sufficiency for valuable raw materials as it would effectively close the loop and avoid losing valuable resources.

Recommendation 5 - Closing the Loop and avoiding losing valuable Resources through efficient Collection Systems

A significant bottleneck to recycling is inefficient collection. Still, for some waste streams such as WEEE (waste electrical and electronic equipment), most of the waste generated is not collected through official collection routes but ends up in residual waste streams or illegal - mixing and - export and does not receive proper treatment. Especially in WEEE, significant amounts are hoarded in households. These valuable materials should be contributing to the supply of raw materials, to also ensure the replacement of primary raw materials in mining and quarrying.

Recommendation 6 - Support Common Database and Larger Shipping Sample

A common database of potential substances per polymer, standardised method for screening REACH/RoHS/POP substances, standardised method to ensure representative sampling and analysis of mixed plastic wastes at European level.

Trust within the value chain in recyclates as a material must be established, for example with a guaranteed minimum quality according to standardised measurement conditions through standardisation work within relevant associations

Allow shipping of larger quantities (e.g. 1 ton) over borders to research institutes to perform scale up experiments. Currently the maximal allowed quantity is 25 kg.

Project Group

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The project group is made up of five projects - funded by H2020, the European Union's Horizon 2020 research and innovation programme - namely NONTOX, CREAToR, CIRCULAR FLOORING, PLAST2bCLEANED and REACT, aimed at supporting the transition towards a green economy with advanced recycling and eco-design.

NONTOX: Removing hazardous substances to increase recycling rates of WEEE, ELV and CD&W plastics. Grant Agreement no 820895

CIRCULAR FLOORING: New products from waste PVC flooring and safe end-of-life treatment of plasticisers. Grant Agreement no 821366

CREAToR: Collection of raw materials, Removal of flAme reTardants and Reuse of secondary raw materials. Grant Agreement no 820477

PLAST2bCLEANED: PLASTtics to be CLEANED by sorting and separation of plastics and subsequent recycling of polymers, bromine flame retardants and antimony trioxide. Grant Agreement no 821087

REACT: REcycling of waste ACrylic Textiles. Grant Agreement no 820869

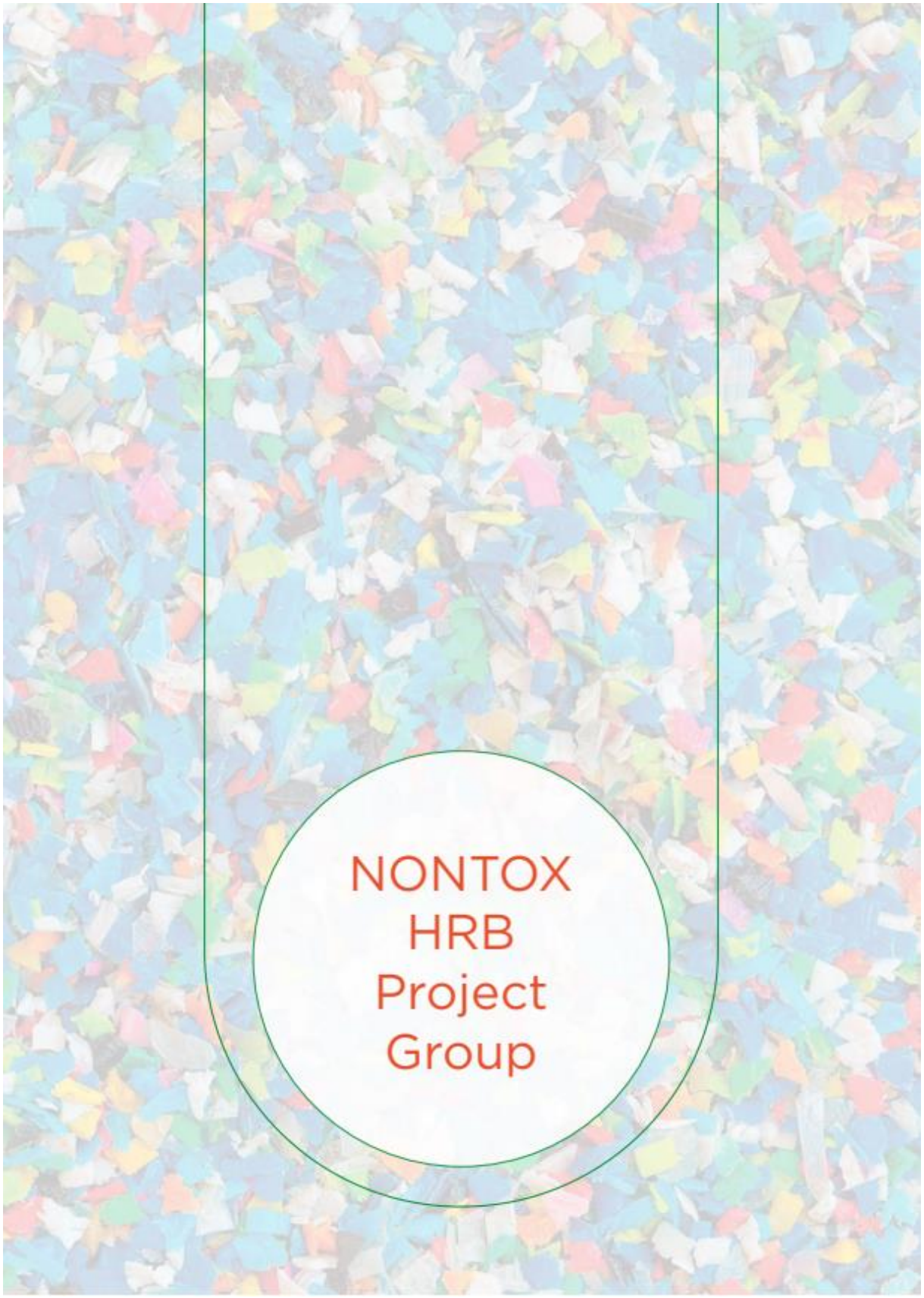
www.nontox-project.eu

www.circular-flooring.eu

www.creatorproject.eu

www.plast2bcleaned.eu

www.react-project.net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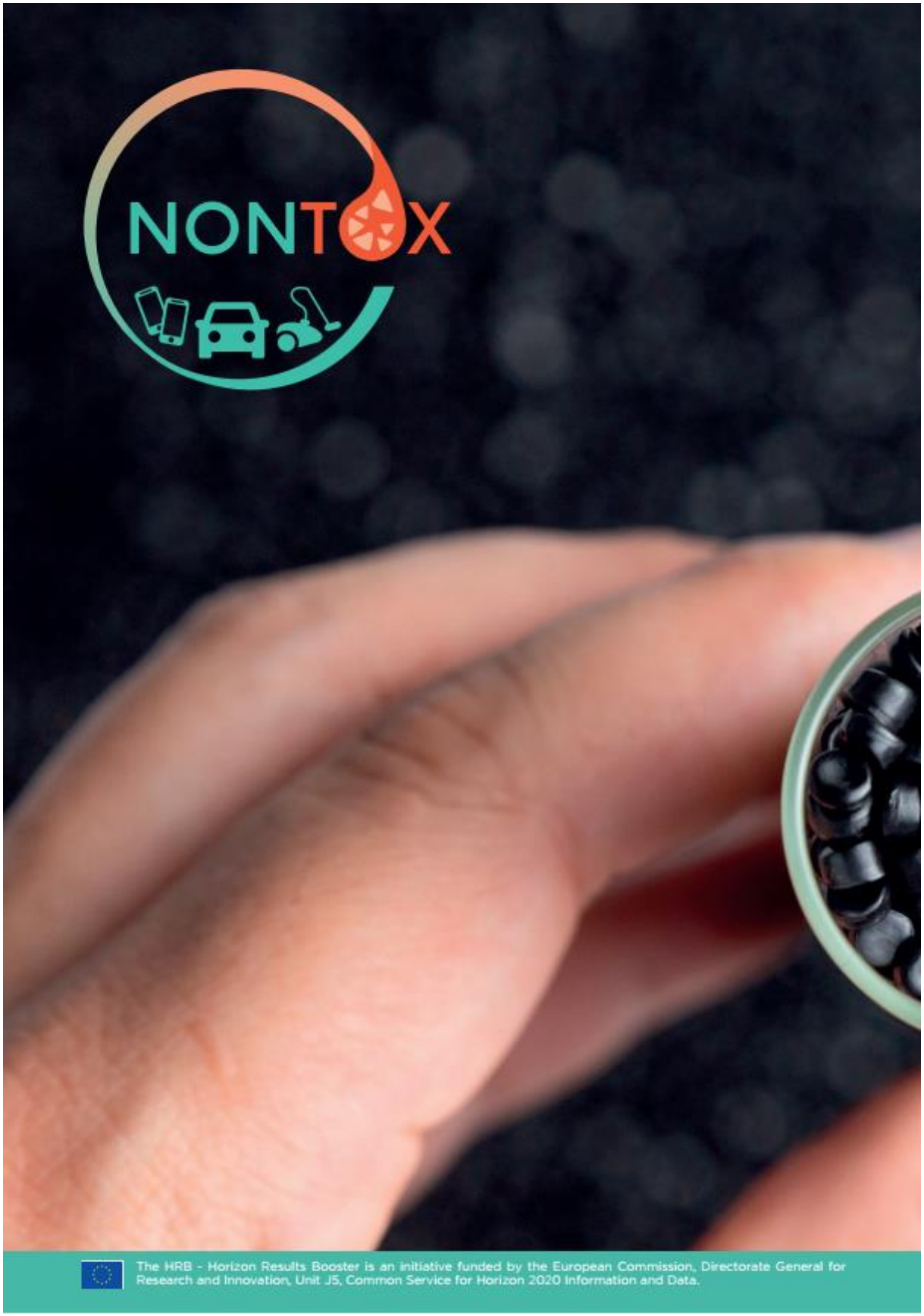
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