RESET

RESearch Centers of Excellence In The Textile sector

GOOD PRACTICE HANDBOOK 1 (GP1 & GP2)

PROJECT NUMBER	RESET - PGI00016
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CONTENT

1. GENERAL INTRODUCTION

1.1 AIM OF THE RESET PROJECT

European textile and clothing sector is a most relevant economical source for the EU, accounting for 4% of the total added value of the manufacturing sector, with 173.000 companies and a turnover of 165 billion €. Its competitiveness is linked to increased investments in innovation and research both public and private which are key drivers for European companies to lead the market in the coming years. Due to its enormous environmental impact, sustainability and environment-friendly production is emerging as a new driver of textile process, product innovation and technology development. The overall objective of the project is to generate a policy change in the implementation of regional policies and programmes of the Structural Funds related to the strengthening of research, technological development and innovation to assure the sustainability of the T&C sector in the partner regions. It will be achieved through policy learning and capacity building activities on public policies supporting innovative, green and sustainable T&C production and processes. The learning potential embedded in **interregional exchange** will result in the **uptake of new Good Practices and projects by the partner regions** enabling to support excellence in R&D, to promote investments by enterprises, to develop innovative skills of T&C stakeholders, and in a deeper integration between research and innovation policies for the sector's sustainability. Sustainability driven research and innovation will concern primarily the production processes and product development and addresses **six key themes**:

// Recycling in textile and waste disposal
// Water consumption and energy saving, sustainable company organisations
// New sustainable chemistry, including reduction of chemical substances
// Smart textiles and new ways of production
// Eco-creativity, natural fibres, short value chains
// New materials and new applications

1.2 EXCHANGE OF EXPERIENCE VIA GOOD PRACTICE EXAMPLES

The policy learning process and the resulting improvement of policy capacity of partners and regions participating in the INTERREG Europe programme are based on collecting, analysing, disseminating and transferring Good Practices and policy experience economicy, technology, social and environmental sectors), in order to transfer and implement Good Practices developed by other regions in one's own area. Good Practices are initiatives (e.g. methodologies, projects, processes and techniques) undertaken in one of the programme's thematic priorities. To be considered a Good Practice, an initiative has to fulfil the following conditions:

- to be relevant to the project's objectives
- to provide added value
- to be proved successful and to have tangible and measurable results in achieving a specific objective
- to have the potential to be transferred to a different geographic region, i.e. to be transferred and implemented without any significant adaptations and changes in other regional and/or economic context

Following the above mentioned key topics, six thematic seminars were planned within the RESET project (see table below). Each partner prepares in advance of the seminar a template where the proposed thematic Good Practice is explained following a certain scheme. During the seminars this Good Practice example is presented more in detail to a broad audience from industry and policy.

No.	Title	Venue	Date
1	Recycling in textile and waste disposal	Alcoy (ES)	October 2016
2	Water consumption and energy saving, sustainable company organizations	Vila Nova de Famalicão (PT)	January 2017
3	New sustainable chemistry, including reduction of chemical substances	Bucharest (RO)	April 2017
4	Smart textiles and new ways of production	Chemnitz (DE)	June 2017
5	Eco-creativity, natural fibres, short value chain	Lodz (PL)	October 2017
6	New materials and new applications	Huddersfield (GB)	January 2018

After each seminar all Good Practice examples are assessed by the project partners together with their regional stakeholders. Hereby, the Good Practice evaluation criteria follow the RESET methodology. The most important evaluation criteria are:

Evaluation criteria	Description
Strategic relevance	long-term impact on the policy theme
Evidence of success	tangibility (concrete results/outputs measured through indicators), durability (potential to become a durable model) and visibility (communication and dissemination activities)
Added value	effectiveness (tangible achievements and results of the practice and the resulting benefits for the different stakeholders), innovativeness, efficiency, (amount of resources required for the implementation of the GP)
Transferability	the potential of the practice to be adapted to and adopted in different contexts and regions (replicability) and transregional or transnational collaboration

To simplify the assessment process, a template for an easy evaluation of the GPs was developed by the partners (see Figure 1). An assessment score from 1 (least relevant) to 5 (most relevant) was introduced and template is provided by STFI (Exchange of Experience Manager in RESET) after each Interregional Learning Event (ILE) to be completed by the partners. Each partner has to assess the GPs for each topic concerning the above mentioned criteria.

RESET Interreg Europe / European Union European Regional Development Fund	*Dear partners, please use the present questionnaire to evaluate each GP according to the RESET methodology.* *You can score the relevance of the GP for your region on a 1 - 5 scale:* *1 least relevant - 2 less relevant - 3 relevant - 4 very relevant - 5 most relevant*													
Policy Theme	**Title of Seminar**			**Name of project partner**										
	Title of the Good Practice	**Partner**	**Country**	**Municipality of Prato (IT)**	**NTT - Next Technology Tecnotessile (IT)**	**Lodzkie Region (PL)**	**CLUTEX - Cluster Technical Textiles (CZ)**	**AITEX - Textile Research Institute (ES)**	**TCoE - Textile Center of Excellence (GB)**	**STFI - Saxon Textile Research Institute (DE)**	**CITEVE - Technological Center for Textile and Clothing (PT)**	**INCDTP - National Research & Development Institute for Textiles and Leather (RO)**	**CETI - Centre of European Textile Innovation (FR)**	**Total Score for each GP (average)**
GP1														
GP2														
GP3														
GP4														
GP5														
GP6														
GP7														
GP8														
GP9														
GP10														
	Best GP examples (each partner)													

Figure 1: Good Practice evaluation template

A ranking of the scoring results has to be done and the two GP examples with the highest scoring will be presented in the **GOOD PRACTICE HANDBOOK.**

2. GOOD PRACTICE 1 “RECYCLING IN TEXTILE AND WASTE DISPOSAL”

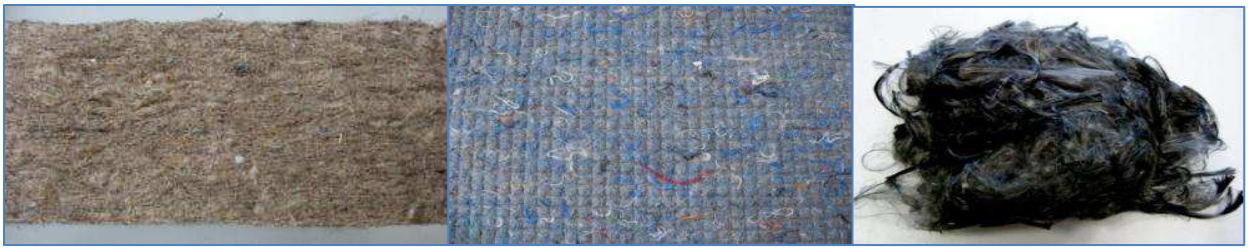
THEMATIC INTRODUCTION

The textile industry is characterized by the consumption of high levels of resources like water, energy, chemicals and natural/synthetic fibre materials. Due to the scarcity of some of them in many countries, combined with the pressure of environmental policies and the significant impact textile and clothing production has on the environment, management, recycling and waste policies of textile waste are needed to protect the environment and to enhance the sustainability of the textile value chain. In fact, since end of 20th century textile manufacturers and end-users are committed by public and private entities and initiatives to reduce textile wastes and to promote textile recycling and re-use.

Europe rejects 6 million tons of garments per year and only 25% are recycled. Recycling companies can classify rejected garments for a second use and unwearable garments are crushed, stripped and fiberized to develop new yarns or nonwovens for different uses. NGOs can also take profit from recovery of waste (mainly garments) and it could also be an interesting source of employment.
The topic of recycling is not new in the world of fashion/functional textiles, but it is taking on ever more importance now. In particular, the sports sector and also main brands/retailers aims to demonstrate that it is taking responsibility to protect the environment and natural resources very seriously. Paying attention to end-users, one of the most promising systems is to make recycling easier for them by creating an infrastructure that supports a circular economy system: Consumers may drop off any brand of clean, dry clothing or shoes in the collection boxes at local stores of a brand/retailer. Any consumer who brings an item of clothing or shoes to recycle receive a voucher for a specific % off a single, regular-priced item in-store.

At industrial level, more and more EU companies are able to collect textile wastes, not only from their own processes but also from external sources, in order to produce commodities and high-tech products. There are some successful examples in Europe that re-process textile wastes coming from industrial sources (carbon fiber, polyolefins, polyester…). Some R&D projects have been launched last years, being supported by private and public entities and national/EU bodies.

To share experience and knowledge in the management, processing, transformation and re-use of different sources of textile waste, and share (for further implementation) best practices and technologies in the field of recycling in textile and waste disposal with other European regions will be one of the foremost targets of the RESET project. In fact, some interesting initiatives have been identified, considering not only revalorization and recycling of industrial textile wastes for high-tech applications but also re-use of domestic and apparel-based textile wastes, even under a ‘re-thinking’ and alternative point of view about the expected end-uses for the textile wastes.



2.1 SHORT INTRODUCTION OF 10 REGIONAL GOOD PRACTICE EXAMPLES ON "RECYCLING IN TEXTILE AND WASTE DISPOSAL"

On 20th of October 2016, the first Thematic Seminar of the RESET project took place in Alcoi (ES) organized by RESET partner AITEX in which the project partners as well as several European experts presented a series of Good Practices and results of actions related to the management, recycling and reuse of textile waste carried out in the main textile manufacturing regions of the EU (see Figure 3).

Figure 2: Impressions of 1st Thematic Seminar in Alcoi (ES)

Policy Theme 1: Recycling in textile & waste disposal - coordination by AITEX (ES)			
	Title of the Good Practice	Partner	Short Description
GP1	**Carbon Fibre Recycling Concept – Re-use of carbon fibres in nonwovens** Bernd Gulich, Saxon Textile Research Institute (STFI/DE)	STFI (DE)	Presentation of technical method for the re-utilisation of production waste of high-performance carbon fibre material and how the recycled materials can be applied. After tearing the waste material is processed into nonwovens by a web forming technology. The web forming is possible with 100% carbon fibres or out of blends made of carbon, synthetic and/or natural fibres. The received carbon fibre nonwovens can be further processed to intermediates/semi-finished products or composites for structural components in vehicles, aeroplanes, etc.
GP2	**Recycling of ballistic polyethylene waste** Marcin Struszczyk, Institute of Security Technologies (MORATEX/PL)	Lodzkie Region (PL)	The main aim of the GP is to develop the method for the economic re-fabrication of the ballistic protections based on the UHMWPE (ultra-high molecular weight polyethylene) fibres after usability time to functional raw – sources and functional products
GP3	**REDU: Reused, upcycled and redesigned clothes and accessories** Gabriela Stoica, Mai Bine Association (RO)	INCDTP (RO)	The Good Practice REDU was initiated because of a strong need of creating an alternative to the traditional consumption and to identify an alternative for reusing the textile clothing waste. REDU is a project build by and for the community, very inclusive, that involves several types of beneficiaries.
GP4	**ACRYWAST – Active carbon particles from acrylic fibres waste** Miloš Beran, CLUTEX – Cluster Technical Textiles Textile (CZ)	CLUTEX (CZ)	Comprehensive research and development process for the preparation of activated carbon particles range in size from nanoparticles to macro particles of high specific surface from the waste material based on the PAN fibers and activating physicochemical respectively mechanical processing according to the purpose of their use.
GP5	**Waste management in Prato District** Roberto Meoni, Environment, Services, Mobility (ASM/IT)	Comune di Prato (IT)	The waste management company of Prato is looking for new technologies that offer a pathway towards the sustainable recycling of synthetic fibre residue from the local garment industry. In order to identify the best management solution different approaches are being investigated.
GP6	**Innovative apparel based on textile waste recycling** Fabio Giusti, Trafi Creatività Tessile (IT)	NTT (IT)	The project aimed to realize clothings, using processing wastes from textile industry. These pieces are recycled using the needling technique, joining different textile materials with the inter-penetration of the fibers. The idea of the project has been to transfer into textile sector with the added value to recycle waste materials.

Policy Theme 1: Recycling in textile & waste disposal - coordination by AITEX (ES)			
	Title of the Good Practice	Partner	Short Description
GP7	**Wear2' ecostitching technology** **Craig Lawrence, Textile Center of Excellence (TCoE) Huddersfield (GB)**	TCoE (GB)	Textile fabrics are produced as normal within the Manufacturing Process, Specially created yarns/threads are used in the sewing together of the various parts of the garment. These yarns replace the traditionally used cotton/polyester/nylon threads currently employed for the purpose. When subjected to Microwave Technology, the tensile strength of the yarns is greatly reduced and the garments can be separated into their various shapes. Labels, zips, buttons and other fastenings can be easily removed, the fabrics can be reassembled into new garments or easily returned back to fibrous form for remanufacturing into yarns and fabrics.
GP8	**Textile blankets made from plastic bottles wastes** Maria José Carvalho, Technological Centre for Textile and Clothing of Portugal (CITEVE/PT)	CITEVE (PT)	This idea of producing textile blankets made from plastic bottles wastes started in the Portuguese textile company Têxteis Penedo, S.A. The company developed a textile blanket using polyester recycled from plastic bottles (PET), from the urban wastes circuit (post-consumer). The main difficulty, during the project implementation, was finding the right textile process adjustments for work with the recycled polyester yarns, namely in the weaving and finishing processes.
GP9	**KOOPERA: The expertise of textile re-using** Zuriñe Fernández, Koopera Reusing Center (ES)	AITEX (ES)	Koopera demonstrates an ecoinnovative solution within the diverse stages of the chain supply concerning the reuse and recycling of textile waste. Koopera is working with innovative smart collection and logistics systems aiming to optimize the collection routes through smart sensors and development of dedicated information tools, thereby reducing the associated environmental impact. Also, Koopera uses new advanced technology aiming to increase the recovery of valuable material resources for new textile products.
GP10	**Textile Recycling Valley** Jeanne Meillier, UP-TEX & Marlene Ramos-Augereau, Centre of European Textile Innovation (CETI/FR)	CETI (FR)	On account of the urgency to structure the textiles recycling sector in the Hauts-de-France region and to develop the materials from which they will be sourced, but also to develop the collection of used textiles, the four excellence and competitive clusters: Ecological Cluster Cd2e (eco-business and eco-transition), T2M (Textile Fashion & Materials), TEAM² and UP-tex have chosen to join forces and combine their know-how and skills in a joint action plan in the Textile Recycling Valley in order to develop innovation and stimulate economic action in the field of recycled textiles.

Figure 3: Overview of GP examples on "Recycling in textile and waste disposal"

SUMMARY AND NOTES OF THE BROKERAGE EVENT

After the presentation of the regional GP examples, a Brokerage event and B2B meetings took place. GPs were discussed among the partners and participants. The main issues of this are listed below.

GP1. Carbon Fibre Recycling Concept – Re-use of carbon fibres in nonwovens

Bernd Gulich, Saxon Textile Research Institute (STFI)

This GP was contacted by contacted Leonardo Marchetti (NTT) and Fabio Giusti (Stakeholder of NTT, from Trafi Creatività Tessile); they were interested in how the GP could be transferred to Italy (Prato Region) and of further technological and technical details about machines used for the recycling process.

- Risks related to the use of Carbon Fibres both for electronic devices and for technicians involved in the process;
- Most important elements, in terms of machine, installations, facilities, that influence the price for the creation of a plant for the recycle process.
- Regarding the GP transferability, the most important issues are related to availability of relevant investments for machinery as well as of sufficient quantity of carbon fibre waste to be recycled.
- Possible follow up: organisation of a meeting with machinery producer to evaluate cost and transferability of the in Italy.

Contact also with Marcin Struszczyk (Moratex, Stakeholder of Lodzkie Region). Short introduction of STFI and Moratex, and a discussion was performed on future possibilities for collaboration mainly in the field of lightweight engineering for automotive industry and transport sector.

Other contacts: Maria Angeles Bonet & Romina del Rey Tormos (UPV – EPS Alcoi/Gandia, Stakeholder of AITEX). Discussion about the use of natural materials (like seaweed) for composite material and tea wastes for finishing processes to achieve better UV properties. Short introduction to research projects on recycling.

GP2. Recycling of the ballistic polyethylene waste

Marcin Struszczyk, Institute of Security Technologies MORATEX

This GP contacted with STFI (please go to GP1 description for more details).

This GP was also contacted by AITEX (Maria Blanes & Oscar Calvo) and description of: technical requirements, recycling efficiency and potential end-products manufactured with mixtures of virgin/recycled UHMWPE, was performed. Potential interest from industrial and government entities was also identified.

This GP also contacted with Jeanne Meillier, UP-TEX & Marlene Ramos-Augereau, Centre of European Textile Innovation (CETI). The scope of applicability of Good Practice was discussed in-depth among the participants potentially interested in the transfer of Good Practice. Moreover, other potential areas of cooperation were discussed, mainly on the design and manufacture of lightweight structural composites.

GP3. REDU: Reused, Upcycled and Redesigned Clothes and Accessories

Gabriela Stoica, Mai Bine Association

This GP contacted Marlene Ramos-Augereau (CETI). It was explained how the start-up was created (grant from Norway through the Norwegian Financial Mechanism 2009-2014, in the frame of the Green Industry Innovation Programme Romania) and further discussion about employees, number of machines and system to manage/collect textile wastes was performed. Collecting-Sorting-Cleaning-Transforming (Valorification) in new products is the value chain of the textile wastes. Orders are received from some EU countries (Sweden, Switzerland and Moldavian Republic).

This GP also contacted Romy Naumann (STFI), and main sources of textile wastes were identified: postconsumer textile waste (old clothes and accessories donated by community members) and pre-consumer textile waste (remains from the production process of local textile factories and workshops).

This GP was also contacted by Besnik Mehmeti, Municipality of Prato. Opportunities and potential collaborations/networking with initiatives TCBL or ESF-RO were identified.

Other contacts: Maria Angeles Bonet (UPV – EPS Alcoi, Stakeholder of AITEX). Opportunities to collaborate at University level were discussed.

GP6. Innovative apparel based on textile waste recycling

Fabio Giusti - Trafi Creatività Tessile

This GP contacted with STFI (please go to GP1 description for more details).

This GP also contacted with Craig Lawrence and Andrea Philipson (TCoE, UK) in relation with the TCoE's innovative technology for "debrand" and reuse garments. The most important questions were related to:

- Technical characteristics and properties of the innovative yarn (which allows to remove labels, zips, buttons and other fastenings after a microwave treatment).
- Technical features of the microwave oven.
- This innovation can simplify the work of companies involved in textile recycling processes, especially in Prato area.
- Possible follow up: organisation of a meeting with yarn producer in order to evaluate costs, and feasibility of the use of the yarn in the textile and clothing companies based in Prato area.

Please go to GP7 description for more details.

GP7. Wear2' ecostitching technology

Craig Lawrence, Textile Center of Excellence (TCoE) Huddersfield

This GP was contacted by Paulo Cadeia (CITEVE), Jeanne and Marlene (UP-TEX & CETI), Romy (STFI), Leonardo (NTT) and Oscar (AITEX), who addressed TCoE similar questions:

- Who owns the Technology? It is owned in a joint partnership 50/50 between NIRI (Leeds University) and CTech Innovations.
- What is the cost of the Technology? Several models of purchase are available: Licensing, Direct sales, Exclusivity Agreements. Further details can be obtained from the partnership companies.

- Is the Technology available now or is it a concept? The technology is available now and is in use now in the Benelux Region for Corporate Wear.
- What are the properties of the yarn, is it a metallic thread? The yarn is a synthetic polymer containing a metallic compound which reacts to the microwave energy. It is twisted with a polyester or cotton thread. It can be colour matched the garments it is being used to assemble.

Other issues:

- With UP-TEX. Discussion about projects, differing ideas, objectives and targets moving forward and shared collaboration in the use of GP's. To pass on the contact details of NIRI and CTech Innovations.
- With CITEVE. About the expansion of the technology and different process sizes (the microwave ovens can be made in various sizes and up scaled accordingly), and the technology: could be used from individual component to complete garment disassembly and create new opportunities for new entrants to the industry.
- With STFI. To pass on the contact details of NIRI and CTech Innovations.

GP8. Textile blankets made from plastic bottles wastes

Maria José Carvalho, Technological Centre for Textile and Clothing of Portugal (CITEVE)

This GP was contacted by Municipality of Prato (Paolo Guarnieri and Lorena Vidas): interested to understand how this Good Practice was adopted by the company, in what conditions, and how the plastic from bottles could be used to produce new products. Questions addressed were:

- About initial investment: Company own funding was around 40k € because they have already the technology and they only needed to make adjustments to the process.
- About the origin of the raw material: The company already buys the r-PET yarn (from an Indian company, GRS certified).
- Marketing of the product: The company works for private label so the marketing is B2B (mainly in specialized trade fairs).

GP10. Textile Recycling Valley

Jeanne Meillier, UP-TEX & Marlene Ramos-Augereau, Centre of European Textile Innovation (CETI)

Please go to GP2, GP3 and GP7 descriptions for more details.

Other contacts: Maria Angeles Bonet & Romina del Rey Tormos (UPV – EPS Alcoi/Gandia, Stakeholder of AITEX). Interest on natural dyeing and acoustics services available at UPV was identified.

2.2 ANALYSIS AND EVALUATION OF GOOD PRACTICE EXAMPLES ON "RECYCLING IN TEXTILE AND WASTE DISPOSAL"

Following the evaluation methodology, the assessment template was sent to all partners for completion. After getting back the templates, the scoring results were calculated and a scoring table created (see Figure 4).

GP	Title	Partner	Total score
10	Textile Recycling Valley	CETI/UP-TEX (F)	40
7	Wear2' eco-stitching technology	TCoE (GB)	37
8	Textile blankets made from plastic bottles waste	CITEVE (PT)	34
9	KOOPERA: The expertise of textile re-using	AITEX (ES)	31
4	ACRYWAST – Active carbon particles from acrylic fibres waste	Clutex (CZ)	29
5	Waste management in Prato District	Prato (IT)	28
1	Carbon Fibre Recycling Concept – Re-use of carbon fibres in nonwovens	STFI (DE)	26
6	Innovative apparel based on textile waste recycling	NTT (IT)	25
2	Recycling of ballistic polyethylene waste	Lodzkie Region (PL)	24
3	REDU: Reused, upcycled and redesigned clothes and accessories	INCTDP (RO)	21

Figure 4: Scoring table of GP examples on "Recycling in textile and waste disposal"

2.3 DETAILED DESCRIPTION OF THE TWO GOOD PRACTICES WITH HIGHEST SCORING

Following the scoring table (see Figure 4), the GP examples presented by project partner CETI on "Textile Recycling Valley" and TCoE on "Wear2' eco-stitching technology" were selected by the partners to be the most relevant GPs. Detailed description of both examples follow below.

1. Textile Recycling Valley (CETI/FR)

Background:

As it is the historical production and manufacturing location, the Hauts de France region has a huge deposit of textile waste.This region has a strong textiles tradition and has always been at the forefront of innovation, ahead of its time and influential on the European scene. Even after delocalization, there is a large number of major producers in the region. More particularly for the textiles sector, is CETI, the European Centre for Innovative Textiles, can also accommodate and assist in the development of collaborative R&D projects. Hauts de France region was fixed as objective to become one of the most efficient, productive and sustainable world regions. The Region leads different projects related to sustainability, circular economy and new ecological business models.On account of the urgency to structure the textiles recycling sector and to develop the materials from which they will be sourced, but also to develop the collection of used textiles, the four excellence and competitive clusters:

Ecological Cluster Cd2e (eco-business and eco-transition), T2M (Textile Fashion & Materials), TEAM² and UP-tex have chosen to join forces and combine their know-how and skills in a joint action plan in the Textile Recycling Valley in order to develop innovation and stimulate economic action in the field of recycled textiles. The initiators of the Textile Recycling Valley project will: build a common strategy and pilot it together, orient the research about regional and international current situation, finance the innovation: AAP and INTERREG projects, rise and label innovative collaborative projects support on the technological platforms, analysis and cartography of different expertise and networking the of qualified stock deposits, support the new eco-business and development of new eco-design, circular economy activities, lead the network, promote collectively the initiative
In short, Textile Recycling Valley is an agreement which aims to Develop innovation and stimulate economic action in the field of recycled textile and circular economy.

Objectives:

The main goals are

- ✓ Create profitable businesses and sustainable jobs in the textile eco-business (recycling, circular economy)
- ✓ Raise new skills to meet the sustainable sector's needs
- ✓ Create a sustainable strong chain of value
- ✓ Support, rise and label innovative eco-projects
- ✓ Create a transferable model

This agreement has the support of the French government, the Conseil Régional Hauts de France and Lille Métropole Européenne de Lille.

How does it work:

1. Watching and monitoring: potential actors, regional and national know-how, sustainable supply chain, experts and environmental institutions (ADEME, HTS DE FR)
2. Awareness: congress, symposiums, workshops (sorting, eco-design, analysis of the life cycle), colloquium and thematic days
3. Innovative Eco-projects: promote, rise, support
4. Communication: dissemination and promote, identify the modus operandi of communication and raising awareness

Project examples about Recycling/Upcycling/Waste disposal:

EKO ROOM: Development of paving stones of acoustic false ceilings in recycled textile

BETON DE CHIFFONS: Ornemental recycle Pave anti-noise

CALAFIL: This project is a new way of recovery for recycling scrap virgin production. It is an innovative industrial organization in line with the Textile Recycling Valley in Nord-Pas-de-Calais region.

Stakeholder involved:

Up-tex : a competitive Clubster in textile: Accompanies in the development of R & D projects, and labeling projects. Its mission is to federate companies and researchers around R&D projects from the idea to new products on the market. Access to technical and economic information for innovation. UP/TEX works with CLUBTEX, a network of companies specializing in technical textiles, associated with training and research centers.

ENSAIT: Is a higher education and research institute, gathering all the disciplines related to textiles. ENSAIT chairs include four departments related to education and research., offers a wide range of high level training programmes: engineering, masters, doctorates, advanced master programmes in traditional education, apprenticeship and vocational training as well as scientific, technological and managerial excellence

How does the Good Practice impact on the policy theme:

The Textile Recycling Valley agreement allows to bring together under a common entity all the value chain to reach a common goal. “Coordinate the ecological business model” creates a transferable model and shared platform.

- ✓ Embed the circular economy in the textile industry and link it with the textile recycling and end of life of textile products
- ✓ Creation of new activities, new opportunities in the textile recycling
- ✓ Reduce waste (particularly cotton / polyester)
- ✓ Eco-design development and new economic models

Remarks on the durability of the GP results and impacts:

Whats happend in the Region from 2013: as Textile Recycling Valley is an agreement, the tangibility is not always easy to prove, but the concretization of different projects in the region shows that the eco-dynamism is in operation. The agreement aims from 2013 to Develop innovation and stimulate economic action:

- ✓ Following the Calafil test prototypes, industries have planned to create new dedicated jobs for recycling and promoting eco-conception of products.
- ✓ CETI is setting-up one of the most ambitious eco projects in France about recycling / REWIND
- ✓ Several international Colloquium and congress have been carried up
- ✓ Fashion brands are interested by the dynamism created in the Region around sustainability
  - ID Group (Okaidi / Jakadi) is committed on the collection of worn fabrics and sustainable development.

- Happy Chic (Jules, Brice, Beezbee) has launched a new Made in France collection from recycled jeans recycled at 98%.
- The ecological cluster and La Redoute performs workshop with the aim of improving their sustenable strategy.

✓ The industries, competitiveness poles, fashion and sport brands and Research and Development centers work together to look for solutions addressing environmental issues.

Obstacles:

There are some major technological barriers still exist which prevent building an industrial economical model

- ✓ According to the existing economic model there are problems to access to materials for recycle: the nature of material, the process and flow, tender specifications (Sorting, dismantling)
- ✓ Unavailability of industrial tool on some products
- ✓ The need for specific machines, often expensive
- ✓ The market is still not ready: virgin material is cheaper than recycled material, mass market giving priority to the esthetics and price before environmental consciousness, the premium market is mature, but it is not big enough
- ✓ Complexity of recycling processes which are different for every material and every deposit

To go further:

- ✓ Identify new potential markets and create an efficient value chain
- ✓ Identify "secondary materials" required by the market
- ✓ Establish a transferable innovative eco-model

Good Practice vaue added at regional and transregional (EU) levels (relevance to organizations beyond RESET partnership):

- ✓ Contribute to conceive a procedure that will establish a transferable innovative eco-model
- ✓ Establish an action plan in order to develop innovation and stimulate economic in the field of recycled textile and circular economy
- ✓ Contribute to rise new skills for eco-design, recycling, upcycling, circular economy and life cycle analysis of textiles.

Contact

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2. Wear2' eco-stitching technology (TCoE/GB)

Background:

The Waste and Resources Action Program (WRAP) commissioned a report which identified (using figures from 2015) that by changing the way the UK supplies, uses and disposes of clothing could: reduce the carbon, water and waste footprints of clothing by 10-20% each and cut £3 billion per year from the cost of resources used in making and cleaning clothes. The average UK household owns approximately £4000 worth of clothes, 30% of which have not been worn in a year. Value of this unused clothing is approx. £30 billion. By extending the life of clothing by 3 months of active use would lead to a 5-10% reduction in each of the carbon, water and waste footprints. An estimated £100 million worth of clothing (350,000 tonnes) of used clothing goes into landfill in the UK every year. By reusing, de-labelling and reassembling garments, new clothing ranges could be created, charitable trusts could increase revenues for good causes, lesser reliance on valuable raw materials and environmental impact could be greatly reduced. This is greater in the use of Manufactured Fibres created from Petrochemical sources as the materials do not quickly biodegrade. By the increased application of wear2 a closed loop could be created for many manufactured garments and create affordable, environmentally friendly clothing for large populations of the world's needy populace.

How does it work:

The fabrics are produced as normal within the Textile Manufacturing Process, it is at the Garment stage where the Technology is used. Specially created yarns/threads are used in the sewing together of the various parts of the garment. These yarns replace the traditionally used cotton/polyester/nylon threads currently employed for the purpose. When subjected to Microwave Technology, the tensile strength of the yarns is greatly reduced and the garments can be separated into their various shapes. Labels, zips, buttons and other fastenings can be easily removed, the fabrics can be reassembled into new garments or easily returned back to fibrous form for remanufacturing into yarns and fabrics, or be used in nonwovens for various uses.

Financial framework:

To build up a recycling concept using wear2 will require investment and may also involve a licencing scheme. However estimated income for reusable clothing sales of £600/tonne or recycled clothes £30/tonne against costs of £75/tonne for landfill.

Stakeholder involved:

Beneficiaries of the recycling process would be recyclers, textile manufacturers, garment companies, charitable trusts, social entities, regional governance. The patent holders – Ctech Innovation Technologies and Leeds University are the Organisation behind the technology.

How does the Good Practice impact on the policy theme:

- ✓ Could be a part of the solution to improve the impact on the environment
- ✓ Creates a sustainable method of re-use of expensive raw materials
- ✓ Ensures manufacturers are more eco aware
- ✓ Contributes towards the aim of a zero waste concept
- ✓ Increases research into greater diversity of textile waste use

Tangibility, durability and visibility of the Good Practice:

GPs tangibility

Concept proven at production level, yarn dyeing trials successful. This technology could have a big impact on the future of Textile production and the impact on the environment if take up by large Manufacturers is successfully achieved.

Success factors

Trials were carried out by 2 large manufacturers and end users for the durability and wearability of clothing produced using the technology dependant yarns. Durability was demonstrated, yarn compatibility in large scale manufacturing was proven. Standard consumer testing showed that the clothing durability passed accepted standards. Disassembly of the garments trials by Oxfam proved the ability to seperate the garment components.

Difficulties encountered and lessons learnt from the practice

Technology needs to be rolled out with manufacturers encouraged to take up the use of it. Tangible benefits need to be demonstrated and incorporated into company ethos. Competition between Brands and Company end use policies may make take up difficult. It will be an ongoing process and will take time to be fully engaged.

Remarks on the durability of the GP results and impacts

Large scale trials of the GP would be required by both major suppliers and end users, and would be needed to prove technology and impacts on the viability and uptake of the process.

Possible leverage effect to trigger further improvements in policies and know-how

- ✓ Enhanced disassembly lines using larger processing equipment to make the technology more viable and cost effective.
- ✓ Greater promotion by Manufacturers to demonstrate Eco awareness
- ✓ Identify Finance opportunity for development/roll out
- ✓ Charity Organisations to create awareness and benefits long term

Good Practice vaue added at regional and transregional (EU) levels (relevance to organizations beyond RESET partnership):

- ✓ Create Industry wide standard and raise eco awareness
- ✓ EU wide definition for garment manufacture processing
- ✓ No extra cost to manufacturers of Garments
- ✓ Contributes to lower CO2 emissions in manufacturing and end of life
- ✓ Raises awareness with consumers of effects on the eco system
- ✓ Potential for new small companies to be created and greater employment opportunities
- ✓ Adds pressure to authorities to implement tighter environmental controls for textile wastes

Remarks on feasibility and transferability of the GP to other regional/local contexts:

Conditions and requirements of GPs transferability

- ✓ GP can be adopted by all member regions as part of individual Waste Management Policies

Long and short terms context impacts on GP feasibility and transferability in terms of economic, political, social and cultural environment, involvement of special competencies and skills

- ✓ Will create new opportunities for all regions in economic terms.
- ✓ Will provide new opportunities for social and cultural organisations to benefit and reduce eco footprint of environment.
- ✓ Short and long term impacts will be defined by the creative environment and uptake of new eco-friendly processes reducing the impact on landfill and Waste Disposal Authorities.

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Figure 5: Seam separation after microwave processing, demonstrating yarn breakage at multiple points

Figure 6: Seam separation after microwave processing, showing that fabric is undamaged

Figure 7: wear2 prototype microwave seam disassembly unit

3. GOOD PRACTICE 2 "WATER CONSUMPTION AND ENERGY SAVING, SUSTAINABLE COMPANY ORGANIZATIONS"

THEMATIC INTRODUCTION

Water and energy are two of the most relevant resources used in the textile sector, not only because of the quantities needed but also because of the direct and indirect environmental impacts associated to those resources.Water is essential for any forms of life (humans, animals, plants, etc.), plays a fundamental role in the climate regulation cycle, and is an indispensable resource for the economy. Protection of water resources and efficient water management are therefore keystones of environmental protection in Europe.Energy is an indispensable resource for any human activity, having a relevant role in the industrial sector, in terms of quantity, price and availability. Energy and climate changes, associated with it, are part of the EU 2020 strategy, setting three specific target that must be fulfill until 2020: reduce greenhouse gases by at least 20%, increase the share of renewable energy in the EU's energy mix to at least 20% of consumption and improve energy efficiency by at least 20%.The Portuguese textile industry recognized the relevance of those two resources, water and energy, for their textile processes and the need to implement measure to an efficient use of them. This kind of measures not only have a positive environmental impact, as also improves the competitiveness of the textile companies. Although, in general, the European textile sector has implemented measure to reduce the water and energy consumption, in some European regions exist specific water and energy public policies and specific measure, already implemented in textile companies, which should be shared and implemented in other regions. So, one of the main targets of the RESET project is to share experience and knowledge related with water and energy management, in the textile sector, and share (for further implementation) best practices and technologies in the field of water consumption and energy savings with other European regions.

3.1 SHORT INTRODUCTION OF 10 REGIONAL GOOD PRACTICE EXAMPLES ON "WATER CONSUMPTION AND ENERGY SAVING, SUSTAINABLE COMPANY ORGANIZATIONS"

On 14th of February 2017, the second Thematic Seminar of the RESET project took place in Porto (PT) organized by RESET partner CITEVE. Project partners as well as European experts presented a series of Good Practices and results of actions related to the topic water consumption and energy saving, as well as sustainable company organisation carried out in the main textile manufacturing regions of the EU (see Figure 8).

Figure 8: Impressions of 2nd Thematic Seminar in Porto (PT)

Policy Theme 2: Water consumption and energy saving, sustainable company organizations - coordination by CITEVE (PT)			
	Title of the Good Practice	Partner	Short Description
GP1	**BIOCLOC - BIOprocess ControL through Online titrimetry to reduce Carbon footprint in wastewater treatment** Ester Coppini/GIDA spa (IT)	Comune di Prato (IT)	The project demonstrates the suitability of an innovative monitoring instrument for activated sludge processes control based on the online measurement of nitrification rate. The demonstration takes place in one of the biggest European textile district (Prato/Italy). Both the instrument (the prototype) and the control strategy are new and allow to optimize the operation of the plant.
GP2	**Innovative solutions to prevent and reduce water pollution by application of ecological textile finishing technologies and wastewater treatment** Alina Popescu/INCDTP (RO)	INCDTP (RO)	The Good Practice was initiated for the framing of the textile companies located in Cross-border Romania-Bulgaria area, in the cities Giurgiu-Romania and Ruse-Bulgaria, into the conditions of a sustainable development, get them be sustainable areas, by assuring some sustainable processing and cleaning eco-technologies for wastewaters resulted from finishing textile industry, towards a clean, safe and eco-efficient production.
GP3	**100% Biodegradable water industrial filters** Marlene Ramos-Augereau/CETI (FR)	CETI (FR)	As part of a private project, a customer expects the creation of an entirely biodegradable filter, for water treatment within the Petrochemical Industry market. The aim of this project was to replace the filters usually produced from PET fibers with a new development of nonwoven carded 100% PLA fibers for the filtering market. With the intention of decreasing the environmental footprint in their process.
GP4	**AquaFit4Use** Olga Chybova/INOTEX (CZ)	CLUTEX (CZ)	The goal of AquaFit4Use was the sustainable water use in industry by a cross-sectorial, integrated approach. The overall objectives were: development and implementation of new, reliable, cost-effective technologies, tools and methods for sustainable water supply, use and discharge in the main water consuming industries in order to significantly reduce water use, mitigate environmental impact and produce and apply water qualities in accordance with industrial own specifications, contributing to a closure of the water cycle in a economical, sustainable and safe way.
GP5	**Cooperation between textile industry and universities in solving problems of water consumption and energy savings in Lodzkie Region** Zbigniew Draczynski/Technical University of Lodz (PL)	Lodzkie Region (PL)	One of the examples of Good Practice in the field of water management/consumption in Lodzkie region is a project carried out by the city of Lodz, together with scientists from the European Regional Centre for Ecohydrology and University of Lodz. The effect of the project is to develop a system of natural barriers (filters) in order to improve the status of surface waters and rivers in the region with the textile industry products implementations as a nonwoven mats.The second example of Good Practiceis project focused on the waste water purification at the Bilinski dyeing factory.

Policy Theme 2: Water consumption and energy saving, sustainable company organizations - coordination by CITEVE (PT)			
	Title of the Good Practice	Partner	Short Description
GP6	**Demonstration of natural coagulant use advantages in physical & chemical treatments in textile industry** Maria Blanes/AITEX (ES)	AITEX (ES)	The coagulation and flocculation are the most important treatments in primary and tertiary phases, big amount of chemical products are used in order to remove the suspension contamination. Later, these chemical products are separated with the primary and tertiary sludge. The primary and tertiary sludges, from urban waters, are treated and dehydrated. Two problems (metals and pH) have been reduced and quality of the trwated wastewater has been increased in the project ADNATUR (Life+ project)
GP7	**Multiplexed Laser Surface Enhancement (MLSE)** Craig Lawrence/TCoE (GB)	TCoE (GB)	MLSE (Multiplexed Laser Surface Enhancement) technology is an example of technology transfer between industries which has facilitated a leading edge development in the processing and performance of textiles. Both Plasma and UV systems are currently used for cleaning and ablation of polymeric materials. MLSE enhances these processes at a higher level.
GP8	**Bioprocessing for Sustainable production of COLoured textiles** Daniele Spinelli/NTT (IT)	NTT (IT)	BISCOL project has been focused on the dyeing industry proposing a new dyeing process as global alternative for the bioconversion of raw materials into competitive eco-viable final products: synthesis of bio-dyes, textile pre-treatments, synthesis of new auxiliaries, optimization of dyeing process. All step have been assisted by LCA to embed environmental constrains in each step of the process preventing environmental impacts linked to the whole process, and by toxicological tests.
GP9	**SGCIE - Management System of the Intensive Energy Consumption** Paulo Calau/ADENE (PT)	CITEVE (PT)	SGCIE is an instrument to improve energy efficiency which imposes targets for energy, carbon intensity and specific energy consumption through the implementation of energy rationalization measures. Thus, its implementation in companies' facilities leads to effective reductions in energy consumption and greenhouse gas emissions in those facilities', helping to achieve the national targets imposed in PNAEE.
GP10	**UV-LED curable coatings for technical textiles** Ralf Lungwitz, Saxon Textile Research Institute (STFI/DE)	STFI (DE)	The developed technology of UV-LED curing offers textile companies an energy-efficient, resource-efficient, water saving, space saving and eco-friendly method for functional coating of textile materials. The potential industrial transferability could be proved by integrating UV-LED emitters in a pilot lab plant where the developed coating formulations were successfully applied. By using special additives, additional functionalities (like improved abrasion resistance, soil repellency, hydrophobic, optical, and antimicrobial effects) could be achieved.

Figure 9: Overview of GP examples on "Water consumption & energy saving"

SUMMARY AND NOTES OF THE BROKERAGE EVENT

This summary present the key points retrieved from the brokerage event between the stakeholders and the audience of the seminar. It was compiled by CITEVE with the contributions from the stakeholders that present the GPs in water consumption and energy Saving.

GP1. BIOCLOC, BIOprocess ControL through Online titrimetry to reduce Carbon footprint in wastewater treatment (Ester Coppini, GIDA spa/IT)

a) **Spain: Maria Blanes from AITEX**

Information and clarification on BIOCLOC project has been asked by AITEX partners. The interest stems mainly from the objective of the project: the optimization of the purification process and the savings in energy consumption, pursued through the reduction of energy consumption for the oxygen transfer in biological treatment processes wastewater via the online continuous measurement of the speed of the oxidation of ammonia. Much interest has been shown for the innovative instrumentation installed at the Calice plant, including its possible use to detect the presence of possible inhibitory substances.

GP2. Innovative solutions to prevent and reduce water pollution by application of ecological textile finishing technologies and wastewater treatment (Alina Popescu, INCDTP/RO)

a) **Portugal: Paulo Cadeia and Maria Jose Carvalho from CITEVE**

Paulo and Maria inquired us to provide technical details about the ecological technology for preliminary preparation and dyeing of cellulosic textile material by combining certain stages of technological process. It was explained that the technology was developed and patented by Clariant. It is a discontinuous ecologic process for scouring and bleaching of cotton in one step, being followed by dyeing, without intermediate rinsing's and neutralization between operations. The immediate "profits" in terms of ecology are: less water (<50%), less time (<50%), less energy (<40%), shorter cycle time (< 1h), less waste water, less alkaline amount, biodegradation of residual peroxide with enzymes. It uses an auxiliary product available in commercial form, having multiple functions: oxygen-active donor, balance activation/stabilization of H_2O_2, collapsor of pH, protector against cellulose degradation, removes fatty substances, disperses oiling agents.

b) **Germany: Ralf Lungwitz and Romy Naumann from STFI**

With Ralf and Romy we discussed about suppliers of photo-initiators and UV-curing photo-polymers; Please go to GP10 description for more details.

c) **Spain: Maria Blanes from AITEX**

During the meeting with Maria Blanes from AITEX we discussed about the possibility to use the natural coagulants to the existing wastewater treatment plant in North Giurgiu Technological and Industrial Park SA from Romania.

d) **France: Marlene Augereau from CETI We discussed with**

Marlene about the PLA fibers producers. Please go to GP3 description for more details.

GP3. 100% Biodegradable water industrial filters (Marlene Augereau, CETI/FR)

a) **Romania: Alina Popescu from INCDTP**

Alina Popescu asked us about the PLA material and where to buy and to find industrialized PLA (Natureworks). We give the information in the website: http://www.fibre-maxmodel.com/fibre-pla.php and http://www.natureworksllc.com. She also asked what kind of material would be more similar to Polyester or Cellulose. CETI indicated that PLA is like polyester, but the disadvantage today is that we cannot iron it with high temperatures and it is quite expensive (around 3 Euros a kilo).

b) Germany: Romy Naumann from STFI (Saxon Textile Research Institute)

CLUTEX and STFI asked us about the end of life of biodegradable filters, in case of filter contamination. Another question was about wastewater: they asked us what happens when this filter is contaminated with metal or chemicals. Because even if the filter is biodegradable, it cannot be composted. This is an important topic which could have been addressed in the presentation to explain the process of the wastewater cycle. Wastewater processes include different levels of filtration. In order to be processed correctly, the water should be filtered several times. In this case, PLA filter is useful at the end of the wastewater cycle to allow further composting. In case a contaminated filter needs to be burnt, PLA burnt material is less contaminated that PET material.

c) United Kingdom: Craig Lawrance from TCoE (Textile Centre of Excellence)

With TCoE we talked about MLSE Synthesis Technology used to enhance hydrophilicity, hydrophobicity, fire retarding, antimicrobial without use of chemical substances or water. We were interested to know the resources required and approximative rates in order to implement these types of machines.

d) Germany: Ralf Lungwitz/Romy Naumann from STFI (Saxon Textile Research Institute)

We discussed about the Led UV Curing systems. We heard about another project which seems quite similar in France. We were interested to know more about this kind of application for coating, spaying and padding treatments to reduce required energy.

GP5. Cooperation between textile industry and universities in solving problems of water consumption and energy savings in Lodzkie Region (Zbigniew Draczynski, Technical University of Lodz/PL)

During the session of exchanging the knowledge, the participants of the delegation representing the Lodzkie Region met with the project partners in order to share insights and experiences connected with the implementation of Good Practices. The choice of partners for discussion was made on the basis of an analysis of the presentation performed during the first two conference sessions.

a) Germany: Romy Naumann and Ralf Lungwitz from STFI

The issues connected with the use of new UV light sources for fixing textile product finishes appeared very interesting. A discussion on disadvantages and advantages of the transition from the traditional UV lamp technology to the modern energy-saving sources based on LED technology. Then there were the subjects of active chemical compounds being used which are capable of crosslinking reactions under the influence of UV light. The exchange of experiences in this subject allowed us to develop the issue of a student exchange between the Lodz University of Technology and STFI within the Erasmus programme +-Internship.

b) Czech Republic: Milos Beran and Olga Chybova from CLUTEX & INOTEX

Another meeting was held with the delegation of the INOTEX from the Czech Republic. During the meeting the issues of a Good Practice presented by the delegation from the region of Łódź were discussed. The delegation of INOTEX was very interested in the use of biodegradable textile materials for the filtration systems of surface waters, which may be used as soil conditioners afterwards. Another interesting subject during the meeting was the exchange of views and experiences regarding the operation of industrial clusters of the textile industry.

c) Spain: Maria Blanes from AITEX

The last meeting, which the delegation of the region of Łódź took part in, was a meeting with the delegation of the AITEX Textile Research Institute from Spain. During the presentation of Good Practices the representative of AITEX presented interesting results of coagulation of waste water with the use of the Black Acaccia plant. During the discussion, our experiences connected with immobilisation of active substances in the polymer deposits used within the processes of waste water treatment in the textile industry were presented.

GP6: Demonstration of natural coagulant use advantages in physical & chemical treatments in textile industry (Maria Blanes, AITEX/ES)

a) Italy: Ester Coppini from GIDA SPA

She was interest in knowing if these coagulants work dewatering sludges

SERVYECO, the company which commercialize these products, have done some tests using these natural coagulants to dewatering sludges and in the majority of cases the efficiency is lower than conventional flocculants based on polyacrylamide, mainly in centrifuge processes. However, they have obtained some positive results when the sludges are dewatering with press and band filters. They have one example where have substituted ferric chloride by natural coagulant and the dosage has been decreased 80%. Another question was about what range of dosage would it be needed to clarify cleaner wastewaters? In ADANATUR project have been treated two kind more of wastewaters which were cleaner than textile ones; urban wastewater to remove nutrients and wastewaters from ceramic industry. Urban wastewaters needed 53 ppm to remove phosphorous and ceramic wastewaters needed 85 ppm to remove suspended solids. Other studies shows in tertiary treatments of urban wastewater that between 10-50 ppm is enough. Finally, the doubt about if these natural coagulants are available in the marked? These products are available in the marked but they are being produced in small scale for that reason the prize. The idea is to increase the production as sales increase. The company SERVYECO offer to contact with them in order to prove their products:

Contact: Jose F. Cabeza - R&D Manager - jfcabeza@servyeco.com - Phone: +34 964257495

b) Romania: Doina Toma from INCDTP

Question 1: Are these **natural coagulants available in the marked**?

Answer 1: The answer was in line with the previous one give to GIDA SPA.

Possible collaboration in international projects were suggested and analysed.

c) Poland: Zbigniew Draczynski from Technical University of Lodz

Asked the same question about the coagulants, if they are natural and if they are available in the market. The answer was the same as the previous. In a 2nd question, he was interested in knowing if natural coagulants could take part of the textile support as nonwoven which build filters? It was answer that it is difficult to answer without performing some trials but the natural coagulants bases their depuration in neutralization of charges and not in abortion phenomena; however, it could be interesting to prove that.

GP7: Multiplexed Laser Surface Enhancement (M.L.S.E) (Craig Lawrance, Textile Centre of Excellence (TCoE) Huddersfield/GB)

a) Portugal: Miguel Ramôa from AAF industry.

Miguel is a dyer of cotton fabrics and we discussed the availability of the MLSE Technology in treating cotton fabrics to improve the dyeing efficiency and the possibility of using the MLSE Technology to dry scour woven fabrics. We discussed the cost of the technology and how to move forward in a possible collaboration. Miguel promised to contact me at a later date, but I gave him the contact details of the MLSE manufacturer in order to make contact with regards to carrying out trials on his fabrics.

b) Portugal: Jorge Leitão from Lameirinho industry

Jorge Leitão is a finisher of cotton textiles. We discussed the possibilities of the MLSE Technology being used for the removal of size from a cotton fabric rather than a wet process. He was also interested in how the technology worked and whether the size on the cotton fibres could be used to give other functionality to the cotton garment by synthesis. I gave him the contact details of the MLSE manufacturer in order to make contact with regards to carrying out trials on his fabrics.

c) France: Marlene Augereau and Thierry Le Blan from CETI

Marlene Augereau and Thierry Le Blan (CETI) were interested in the operation of the MLSE Technology. How could the MLSE system replace current technology in use within the Dyeing & Finishing Industries. They were also interested in the possibility of the MLSE system being used on thicker substrates rather than a standard thickness fabric. I explained how the MLSE works to synthesise fibres as they pass through the system and also how the technology works in relation to plasma stability as the electrode plates move further apart, however I explained how the system could possibly be adapted for treating textile fibre instead of fabric

d) Germany: Romy Naumann and Ralf Lungwitz from STFI

Romy and Ralf (STFI) were interested in the functionalities that MLSE imparts onto a fabric and how this functionality is synthesised within the reaction chamber of the machine.

e) Italy: Daniele Spinelli from Next Technology Tecnotessile

We had a discussion with Danielle with regards to the plasma system he is using and to see if there was any possibility of integrating his plasma technology within the MLSE process as an alternative to the plasma currently used in the MLSE system.

GP9. SGCIE - Management System of the Intensive Energy Consumption (Paulo Calau, Agência para a Energia (ADENE)/PT)

a) Portugal: Octávio Pereira from Lameirinho industry

- Facility of using the platform that supports the energy audits: user friendly and with no relevant problems
- Energy efficiency fund: applications open to support industrial companies investments in implementation of energy efficiency measures

b) Portugal: Baltazar Peixoto from TMG industry

- New platform for no SME companies: not yet available (it is in development), and will have the possibility of see the company figures of previous years
- Expected news related with energy efficiency: legislation in preparation to companies that consumes less than 500 toe
- Advantage of voluntary application of SGCIE, that means, to no mandatory companies (less the 500 toe): reducing of the fuel and electricity taxes, advantageous to companies up to 400 toe

GP10. UV-LED curable coatings for technical textiles (Ralf Lungwitz, Saxon Textile Research Institute (STFI)/DE)

a) Poland: Zbigniew Draczynski and Malgorzata Koszewska from Technical University of Lodz

- Discussion on further technical details of the presented GPs, especially concerning the chemical formulations and the UV lamps used for curing
- Discussion on further cooperation (Internship for students within ERASMUS+ programme) and new project ideas (such as development of special chemical additives for UV curing)
- Discussion on the resubmission of a European project on industrial relations structures in improving competitiveness of textile and clothing industry (first submission in July 2016) together with University of Lodz

b) Italy: Enrico Venturini and Daniele Spinelli from Next Technology Tecnotessile

- NTT is interested if the presented GP has already been transferred into the practice; for the textile sector an industrial application does exist not yet, examples from wood processing and printing sectors could be given
- Discussion on how the described technology can also be used to create other functionalities, such as antimicrobial or antistatic effects
- NTT is interested in visiting STFI, date has to be defined

c) Romania: Doina Toma and Alina Popescu from National Research and Development Institute for Textiles and Leather (INCDTP)

- INCDTP was interested in details concerning used formulations, chemical substances and photo initiators as well as technical details (used UV wave lengths)

d) France: Marlene Ramos-Augerau and Thierry LeBlan from CETI

- Discussion on further technical details of the GP presented by STFI
- Discussion also about the GP presented by CETI on PLA-filters; statements on composting trials of the filters were not yet possible; discussion on prices for PLA compared to currently used materials

e) England: Craig Lawrance from Textile Center of Excellence (TCoE)

- STFI was very interested in the MLSE (Multiplexed Laser Surface Enhancement) technology presented by TCoE and the possible functionalisation of surfaces by using it; further technical details and needed investment to install the equipment were discussed.

3.2 ANALYSIS AND EVALUATION OF GOOD PRACTICE EXAMPLES ON "WATER CONSUMPTION AND ENERGY SAVING, SUSTAINABLE COMPANY ORGANIZATIONS"

Following the evaluation methodology, the assessment template was sent to all partners for completion. After getting back the templates, the scoring results were calculated and a scoring table created (see Figure 10).

GP	Title	Partner	Total score
10	UV-LED curable coatings for technical textiles	STFI (DE)	37
7	Multiplexed Laser Surface Enhancement (M.L.S.E)	TCoE (GB)	35
6	Demonstration of natural coagulant use advantages in physical & chemical treatments in textile industry	AITEX (ES)	30
4	AquaFit4Use	Clutex (CZ)	29
5	Cooperation between textile industry and universities in solving problems of water consumption and energy savings in Lodzkie Region	Lodzkie Region (PL)	28
8	Bioprocessing for Sustainable production of COLoured textiles: focus on water consumption and energy saving	NTT (IT)	27
3	100% Biodegradable water industrial filters	CETI (FR)	27
1	BIOCLOC – BIOprocess ControL through Online titrimetry to reduce Carbon footprint in wastewater treatment	Prato (IT)	26
2	Innovative solutions to prevent and reduce water pollution by application of ecological textile finishing technologies and wastewater treatment	INCTDP (RO)	24
9	SGCIE - Management System of the Intensive Energy Consumption	CITEVE (PT)	20

Figure 10: Scoring table of GP examples on "Water consumption & energy saving"

3.3 DETAILED DESCRIPTION OF THE TWO GOOD PRACTICES WITH HIGHEST SCORING

Following the scoring table (see Figure 10), the GP examples presented by project partner STFI on "UV-LED curable coatings for technical textiles" and TCoE on "Multiplexed Laser Surface Enhancement" were selected by the partners to be the most relevant GPs. Detailed description of both examples follow below.

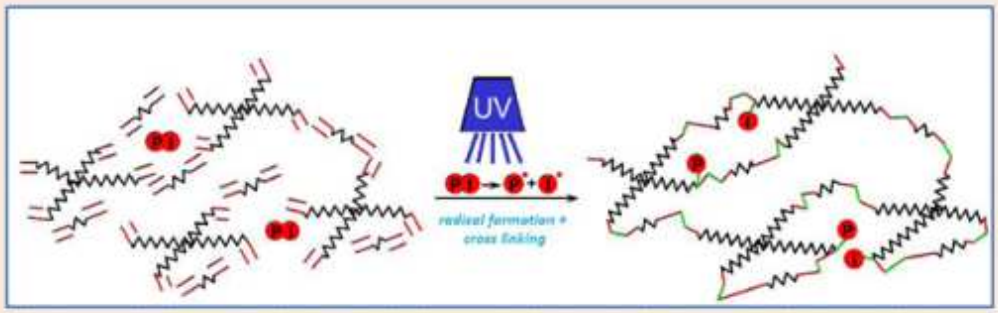
1. UV-LED curable coatings for technical textiles (STFI/DE)

Background:

Currently, the energy costs of textile finishing companies are about 25 % of their total turnover. Nowadays, coatings are mainly dried and cured thermally after application onto the textiles by means of large stenter frames. The thermal curing step represents a significant part among the energy costs. In times of continually increasing energy costs and a growing environmental awareness, the textile finishing sector needs innovative, ecological, energy and cost-efficient application and drying methods. UV curing is a well-known and established technology in many industrial sectors such as graphic industry, wood processing, electronic industry or the varnish sector. Currently, mercury medium pressure lamps (UV-Hg) are used as state-of-the-art equipment for UV curing. The disadvantages of these UV sources are the high toxicity of the mercury (problems in waste disposal and occupational safety), the short operating life, and the high amount of short wavelength UV-C radiation, which is responsible for the formation of toxic ozone. More recent developments are towards the application of UV-LED emitters. This type of UV light source is mercury-free and emits a high intensity and narrow-band light. In the sector of textile coating/finishing, the UV-LED curing technology is so far only little used, but is gaining more and more interest as an energy-efficient and eco-friendly alternative compared to thermal curing processes. For several years, STFI has been working in the field of UV-LED curing for textile applications. Aim of the research was and is the development of technological solutions for the application of UV-LED curing systems in textile coating and finishing for technical textiles (protective, outdoor, and object textiles).

How does it work:

The UV-LED curing technology is applied in coating and finishing processes of textiles. The focus of the developments is hereby on the chemistry and rheology of the coating and finishing formulations. For preparing the functionalised technical textiles and prepregs, typical textile coating and finishing technologies like bar or knife coating, padding, kiss roll or spraying are applicable. The specificity is that certain liquid applied coatings (such as PUR-acrylate systems) do not contain any solvents. Therefore, no thermal curing is possible and the curing has to be done instead via UV radiation. Specifically combined formulations form the basis for the coating process. They consist of pre-polymers, functional additives (for flame retardancy, UV protection or optical effects), coating monomers and a photo initiator. By exposure to UV light the photo initiator is activated and a chemical chain reaction is started. The coating is very fast cured (curing time ~1 s). As source of radiation, STFI uses modern UV-LED emitters.



Principle of UV-curing based on photo-initiated radical cross-linking/polymerization of acrylic groups (double bonds)

Summary:

The developed technology of UV-LED curing offers textile companies an energy-efficient, resource-efficient, water saving, space saving and eco-friendly method for functional coating of textile materials. The potential industrial transferability could be proved by integrating UV-LED emitters in a pilot lab plant where the developed coating formulations were successfully applied. By using special additives, additional functionalities (like improved abrasion resistance, soil repellency, hydrophobic, optical, and antimicrobial effects) could be achieved.

Financial framework:

To use the UV-LED curing technology it is only necessary to integrate UV emitters into the existing textile finishing line. A flexible integration is feasible due to the modular and adaptable design of the emitters. The costs for investment of an UV-LED emitter with a width of 2 m (including control and cooling system) amounts to around 120.000 €. The future trend is towards higher intensities with more effective curing (cross-linking) which allows higher processing speed. The development so far has shown that the performance values of UV emitters have been doubled annually. Following the forecast for further increasing UV-LED markets in the years to come significant lower prices for emitters can be expected.

Stakeholder involved:

The presented technology offers an environmentally friendly, space saving and energy-efficient alternative to the classically applied thermal curing of coatings mainly for small and medium-sized companies of textile coating and finishing industries. Main benefit will gain furthermore producers of technical textiles in the outdoor and object sector, but also manufacturers of industrial textiles (such as conveyor belts, tarpaulins) or leather goods (bags, backpacks) but also automotive suppliers (artificial leather). The technology of UV-LED curing can also be used cross-sectorally for rubber and plastics products (UV coatings), printing products (UV cured inks) and chemical products (photo initiators, binders, additives).

How does the Good Practice impact on the policy theme:

The Good Practice presented by STFI has impact on the policy theme "Water consumption and energy saving, sustainable company organisation" in terms of energy savings by using an innovative technology with shorter processing times as well as environmental benefits (using water and solvent free formulations for 100% systems). The use of UV-LED curing systems for the functionalisation of technical textiles is a space saving (needs about only 2% of a stenter frame), energy-efficient and eco-friendly alternative compared to classical thermal methods. Due to the high potential in saving energy (up to 75% compared to classical drying and curing) and the reputation as an ecological technology, UV applications are of great interest for the technical textiles sector. In times of increasing energy costs (from 2007 to 2013 for industrial electricity ~42 %, for heating oil ~80 % and for natural gas ~28 %[1]), the achieved energy efficiency is the main argument to apply this technology. The saved energy

costs means for SMEs and involved stakeholders to offer their products on the market at competitive prices, to save jobs and for the future to create new employment opportunities.

[1] „Preise – Daten zur Energiepreisentwicklung", Statistisches Bundesamt, Wiesbaden, 2014

Tangibility, durability and visibility of the Good Practice:

Following the above mentioned remarks, the application of energy-efficient technologies in finishing and coating will gain in the future more and more importance also under consideration of legal and political requirements for eco-friendly approaches and the saving of energy to protect the environment. National and international cooperation on industrial level including transfer of knowledge and know-how is one of STFI's main concerns. The innovative character of the developed technology could bring thus benefit to other partners or regions. From a technological point of view, the described Good Practice is transferable to other regions provided that the requested investment for machinery is available.

Success factors

- ✓ Development of innovative products (functionalisation of technical textiles for several application fields)
- ✓ Development of a process with high economic efficiency (material and energy savings)
- ✓ Saving of energy costs → use of the saved costs for new investments and further R&D activities
- ✓ Open-up new markets for functionalized technical products

Difficulties encountered and lessons learnt from the practice

Related to the technology itself, the most important problem of UV curing with UV-LED lamps is the partially incomplete surface curing. Oxygen reacts with the formed reactive species leading to an incomplete crosslinking/polymerization at the coating surface. This is reflected by a slippy or slightly tacky haptics. To overcome this problem there are different strategies with their respective advantages and disadvantages. It is possible to increase the concentration of the photo initiator, but the coatings will become yellowish and the formulation more expensive. Another possibility is to add chemical oxygen scavengers. The disadvantage is that most of these chemicals are odorous. Furthermore, higher functionalized pre-polymers/monomers can be added to the formulations, but the coatings can become hard and stiff. A common strategy from the printing industry is the UV-LED curing under an inert atmosphere (nitrogen). Therefore, an inertisation system is needed, which is combined with additional investment and higher running costs. The advantage is that the photo initiator concentration can be reduced, low odour, no colouring and a reduction of the UV dose, which is connected to energy and cost savings. The challenge is to find the right strategy or a combination of them according to the coating requirement.

More general, challenges can be seen in bringing the process and the resulting functionalized products to the market but also in getting investment costs for machinery and equipment.

Remarks on the durability of the GP results and impacts

The durability of the described technology can be seen in following aspects:

- ✓ Markets for functionalized products are expanding nowadays and in future
- ✓ Industrial sectors are strongly interested in functionalized technical products and eco-friendly technical solutions
- ✓ Ongoing research into the development of improved coating formulations and cost-efficient technologies as well as combination of 3D printing for partial functionalisation of technical textiles
- ✓ Ongoing research and development into innovative eco-friendly and energy efficient production technologies for environmental protection
- ✓ Establishment of a sustainable continuous business model

Possible leverage effect to trigger further improvements in policies and know-how

Further improvement of the know-how along with support from the policy is/are:

- ✓ Drive towards more cost-effective and eco-friendly processes and production technologies
- ✓ Protection of environment through energy savings and use of harmless materials
- ✓ Cost reduction and sustainability aspects
- ✓ Legislative requirements on integrated pollution prevention and control

Good Practice vaue added at regional and transregional (EU) levels (relevance to organizations beyond RESET partnership:

- ✓ Gaining expertise in a specialized technological field and establishing innovative technologies
- ✓ Industrial up-scaling of energy-efficient technologies
- ✓ Gaining innovative products with improved functionality
- ✓ Saving of energy and processing time → protection of the environment
- ✓ Transferability of Good Practices to other regions
- ✓ Improvement and adaption of machinery and equipment for worldwide application

Remarks on feasibility and transferability of the GP to other regional/local contexts:

Conditions and requirements of GPs transferability

- ✓ Investments for establishing machinery systems and equipment (up-scaling of already existing plants)
- ✓ Availability of needed chemical raw materials
- ✓ Existence of a market for functionalised technical products
- ✓ Acquise of customers and establishment of a customer network
- ✓ Training, education and know-how transfer by specialists and expert

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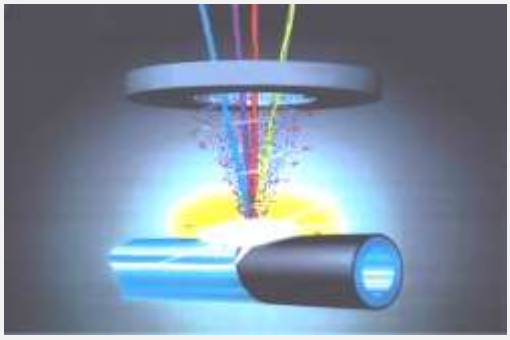
Figure 11: Lab-scale coating plant with integrated UV-LED aggregate (Photos: STFI)

2. Multiplexed Laser Surface Enhancement (TCoE/GB)

Background:



Water is used extensively throughout textile processing operations. Almost all dyes, specialty chemicals, and finishing chemicals are applied to textile substrates from water baths. In addition, most fabric preparation steps, including desizing, scouring, bleaching, and mercerizing, use aqueous systems. The amount of water used varies widely in the industry, depending on specific processes operated at the mill, equipment used, and prevailing management philosophy concerning water use. Textile operations vary greatly in water consumption. Wool and felted fabrics processes are more water intensive than other processing subcategories such as wovens, knits, stock, and carpet. Water use can vary widely between similar operations as well. For example, knitting mills average 45 litres of water per 0.5kg of production, yet water use ranges from a low of 11 litres to a high of 205 litres. The UK textile industry is currently facing significant challenges, associated mainly with environmental legislation and overseas competition. Environment-related issues of current importance include the rising costs of effluent treatment/disposal as water companies respond to EC Directives to reduce the pollution levels of sewage works outfalls, more stringent legislation relating to effluent quality, e.g. toxicity, colour (some water companies have already introduced colour charges, and this trend could increase), rising water supply costs as water companies invest in improved distribution systems to reduce leakage, new treatment plants to improve water quality and new water supplies to meet increased demand.

Historically, water supply and effluent disposal costs have been an insignificant component of total operating costs, and managers have, rightly, focused on other priorities. This situation is now changing. Water is becoming a scarce resource in relation to demand, and water supply and effluent disposal costs have risen and will continue to rise. Environmental protection is now a reality. In addition to these environmental concerns, the textile industry is having to respond to rapidly changing market requirements, as dictated by fashion, seasonality and customer expectations. TCoE commissioned the MLSE Technology to be developed for Textile Applications to reduce the consumption of water and also reduce the energy required for the preparation of the textile product for further finishing processes.

How does it work:

MLSE (Multiplexed Laser Surface Enhancement) technology is an example of technology transfer between industries which has facilitated a leading edge development in the processing and performance of Textiles. Both Plasma and UV systems are currently used for cleaning and ablation of polymeric materials. MLSE enhances these processes at a higher level. The Laser intensifies the effective power of the plasma as well as acting on the substrate in its own right. The process has demonstrated the cleaning of a woven fabric that had not been aqueous or solvent scoured. Thus at the base level, cleaning of substrates is achieved.

Increasing the treatment intensifies the ablation of the surface of the fibres, thus preparing them for secondary processing, e.g. dyeing. The controlled ablation of the surface of the fibres increases greatly the hydrophilicity of the textile substrate.

Financial framework:

The purchase of MLSE will be a considerable investment and may involve a licencing scheme. However, costs have been shown to be recouped within one year due to reduction in energy costs

and water/water treatment costs.

Stakeholder involved:

The MLSE Technology is designed to be used by any Textile Company regardless of modus operandi. The Patent Holder for the MLSE technology is MTiX.

How does the Good Practice impact on the policy theme:

The Good Practice presented by TCoE impacts on the policy theme - Water Consumption and Energy Saving – by using a technology designed to reduce the energy required to process textile fabrics as well as reduce the requirement for water to carry out future textile processes, reduces textile process times and also massively reduces the impact of the textile process on the environment. The latest incarnation of the technology processes the textile fabric at a speed of up to 60m per minute and has a much smaller footprint than a traditional aqueous scouring system. The technology requires the textile to be 100% dry therefore water savings are immediate for the cleaning cycle, and the subsequent surface enhancement of the textile substrate lends itself to reduced water and chemical dye use for the dyeing industry for example. The energy saving has been calculated at greater than 99% and subsequent effluent and water consumption at a reduction of greater than 75%, with an environmental CO2 reduction in excess of 90%.

Tangibility, durability and visibility of the Good Practice:

As the political and industrial movement is towards greater eco-friendly manufacturing and processing, legal requirements will also need to be developed to protect the eco-structure and the environment. MLSE is proven at production level and could have a big impact on the future of textile production if the take up of the system is successfully achieved by the dyeing, finishing and coatings industry.

Success factors

From a concept machine installed and developed at the TcoE, there are now 2 operational machine in use in industry in our region and lessons learned from the concept machine have been fully addressed with the 2 industrial units.

Difficulties encountered and lessons learnt from the practice

As this is new technology, the correct conditions of the plasma/laser had to be worked out, gaseous recipes had to be developed and correct modulation of the plasma reaction chamber had to be closely monitored and set. Different substrates need different levels of treatment and the user must ensure the substrate is as described as we found several instances of a substrate supposing to be cotton but was in fact polyester so control and correct identification of inward goods is crucial.

Remarks on the durability of the GP results and impacts

The durability of the GP could be analysed by the take up of the technology. There is worldwide interest in the MLSE process and many large corporate organisations are working with/wishing to engage with the technology. The MLSE technology is regarded as 'disruptive' and will change the way textile companies have always processed their fabrics.

Possible leverage effect to trigger further improvements in policies and know-how

Improvement in the understanding of the technology will guide policy makers to give greater support. The technology could be developed for even greater success in other applications with support from scientists, post graduates etc. by finance opportunities to support the technology.

Good Practice vaue added at regional and transregional (EU) levels (relevance to organizations beyond RESET partnership:

- ✓ Create Industry wide standard and raise eco awareness
- ✓ EU wide definition for standards, energy and water consumption per application
- ✓ Contributes to lower CO2 emissions into the environment
- ✓ The technology can be utilised in any region within Europe for the processing of textiles

Remarks on feasibility and transferability of the GP to other regional/local contexts:

Conditions and requirements of GPs transferability

Existing and new companies will need to invest in the new technologies. There will need to be a regular and reliable supplier of industrial gases e.g. argon, CO2, Oxygen, Nitrogen. Training will need to be provided for operation of the system

Long and short terms context impacts on GP feasibility and transferability in terms of economic, political, social and cultural environment, involvement of special competencies and skills

The economic impact will be one of investment. Political/Social/Cultural may well need some form of research network to collaborate ideas, as well as some form of support mechanism for funding initiatives for investments. Regarding skills and competencies, there will be a need for training in operating and technical training for understanding.

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Figure 12: Prototype system based at Textile Centre of Excellence (Huddersfield)

Figure 13: Production system

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