RESET

Interreg Europe

European Union
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Bioprocessing for Sustainable Production of Coloured Textiles: focus on water consumption and energy saving

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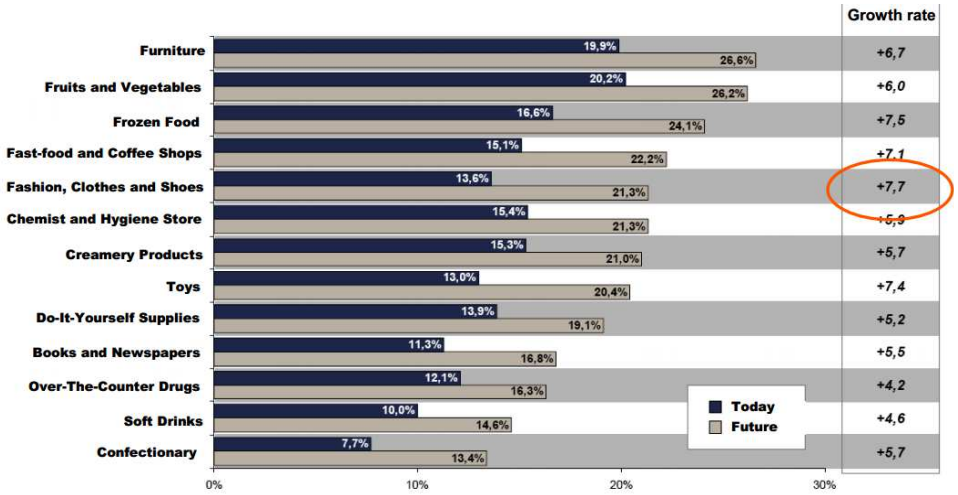
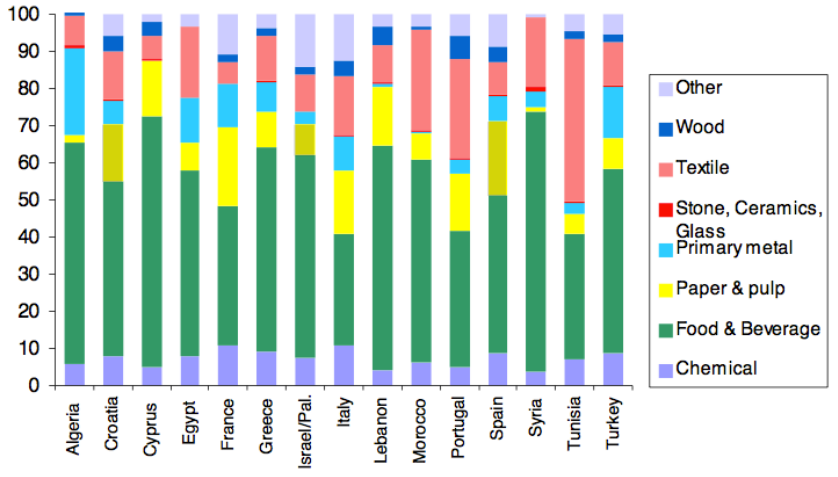
Textile Industry

The textile and clothing industry is an important part of the European economy with more than 146.000 (source Eurostat) companies and is responsible for 10% of global GHG emissions, mainly CO_2 and CH_4, owing to the use of energy in the textile processes and transportation, and the production of chemicals applied in the finishing step. Therefore, it is necessary to reduce these emissions generated.





Sustainability and textile industry

Water consuming

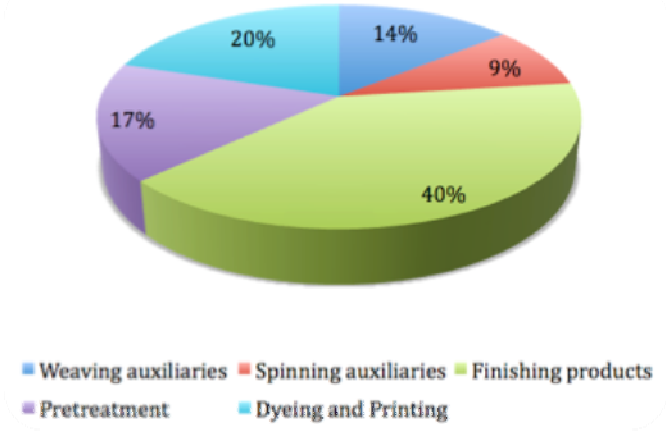
At least 40 are required to produce 1 kg of textile.

Processing subcategory	Water consumption, L/kg production
Yarn and fabric forming	0
Slashing	0.5–7.8
Preparation	
Singeing	0
Desizing	2.5–20
Scouring	19–43
Continuous bleaching	2.5–120
Mercerizing	1.0
Dyeing	
Beam	170
Beck	230
Jet	200
Jig	100
Paddle	290
Skein	250
Stock	170
Pad-batch	17
Package	180
Continuous bleaching	170
Indigo dyeing	8.3–50
Printing	25
Print afterwashing	110
Finishing	
Chemical	5.0
Mechanical	0

*Adapted from U.S. EPA (1996).

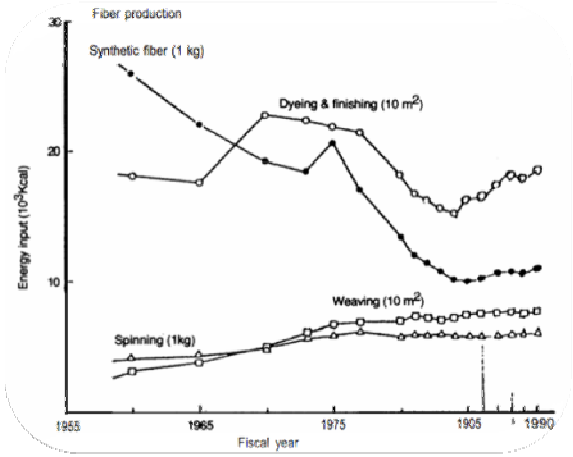
Chemical consuming

About 60 million tonnes of fibres and 6 million tonnes/year of chemical auxiliaries are consumed (source Chemical Finishing)



Energy consuming

Around 30 Tjoule per year (source UNIDO Japan)



Sustainability and textile industry: BISCOL project case

BISCOL project (CIP-EIP-Eco-Innovation-2009) will be 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.

To reach this scope different expertises optimized during other research projects by partners of consortium will be combined, in particular:

Synthesis of bio-dyes: new bio-dyes will be synthetised at industrial scale by scale-up of bioreactor containing laccase enzyme, able to bio-synthetised new coloured compounds.

Textile pre-treatments: scale-up of technologies abling to increase dyeability of selected textiles versus bio-dyes.

Synthesis of new auxiliaries: new auxiliaries at lower environmental impact, will be synthetised at industrial scale and combined with bio-dyes.

Optimisation of dyeing process: reduction of energy demand of dyeing process (e.g. lowering temperature and time of treatments) will be combined with the use of new bio-dyes and auxiliaries and treated textile in order to validate at industrial scale the proposed new dyeing process.

ECO-efficiency in textile manufacturing

Changing how ***energy*** is managed by implementing management program is one of the most successful and cost-effective ways to bring about energy-efficiency improvements, including a revision of:

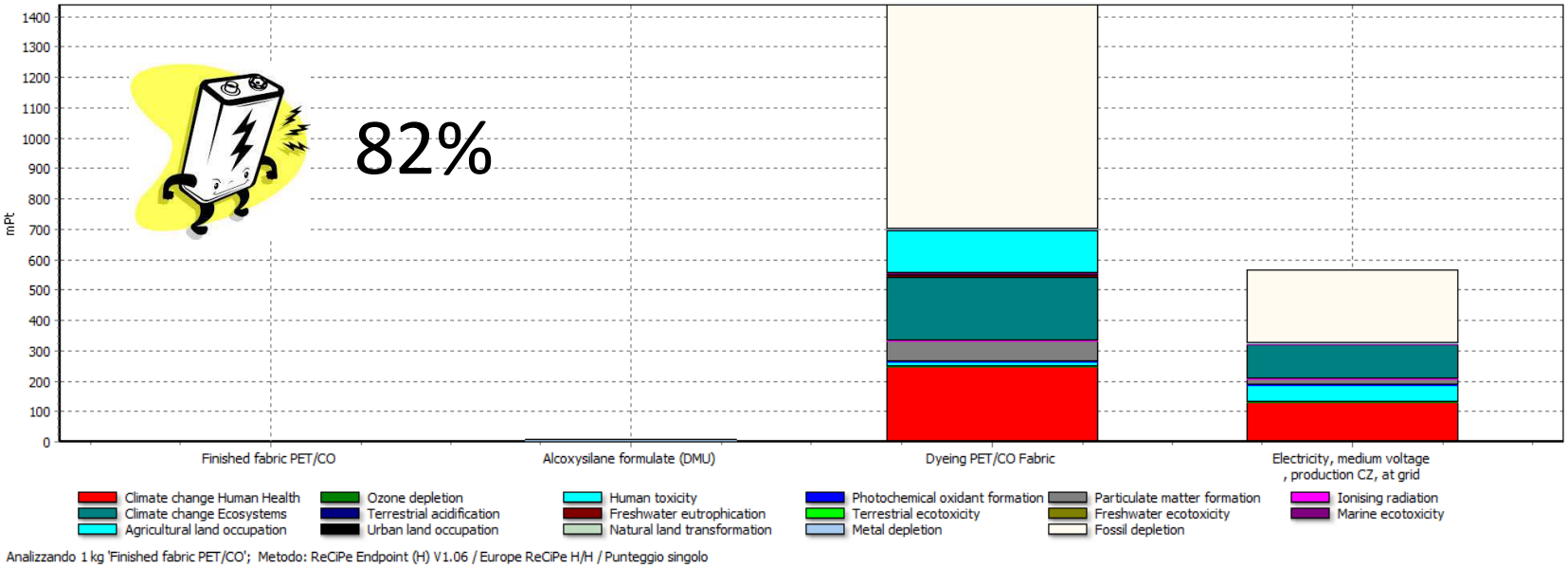
- Facilities
- Process Conditions (lower temperatures; reducing time)

Reducing non *renewable sources* consumption in the production process:

- Replacing wet processing
- Using safer chemicals
- Use of waste materials as primary resources

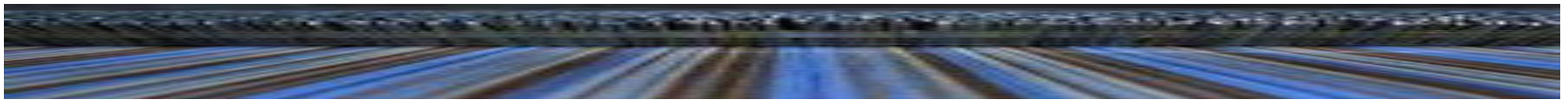
LCA and Textile Manufacturing

Production of a finished textile for sportswear



In the production of a sportwear apparel, fibres is contributing for the 53% of the overall impact (30% is due to the usage of natural fibres despite the fact it is just 20% in the total composition of the final fabric) and finishing is contributing for the remaining 46%.

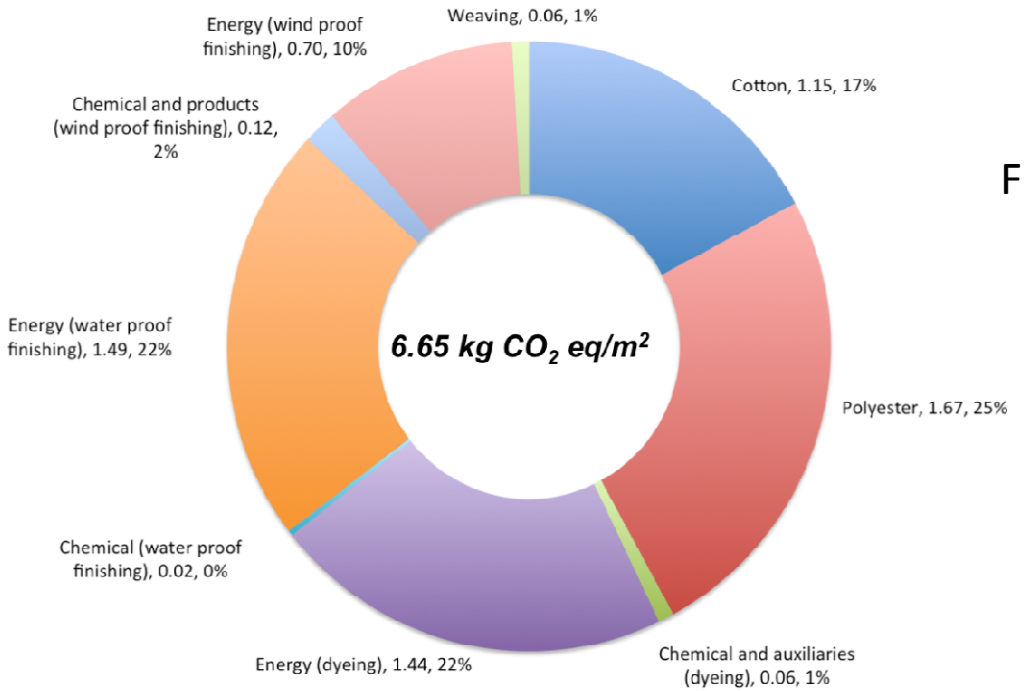
ECO-efficiency in textile manufacturing



Production of a finished textile for sportswear

82%

Finishing = 34%



Fibres = 42%

Dyeing = 23%

Ecofriendly approaches in Textile Industry

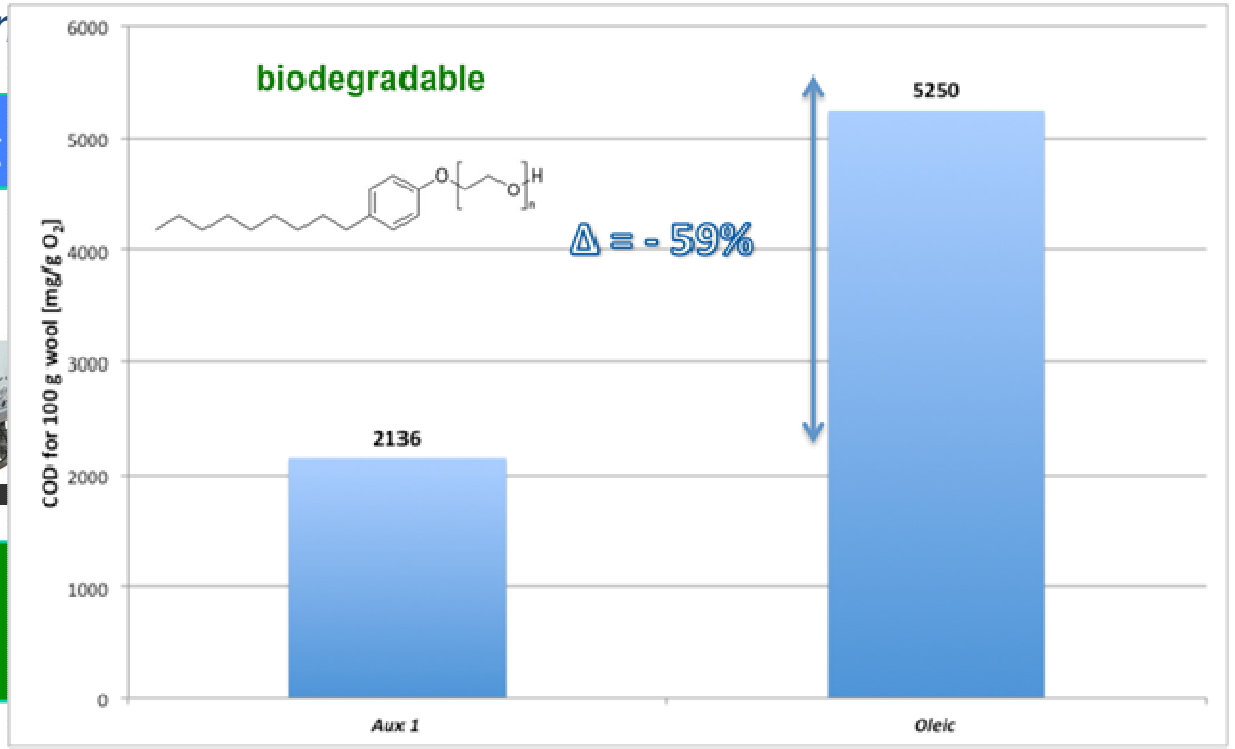
Energy Consumption Reduction

Conventior

Purge → **Antifelting**

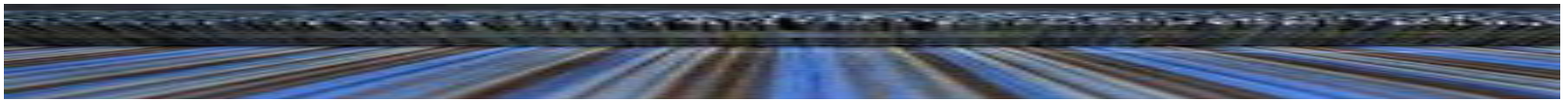
Wet process replaced with dry process

Purge → **DBD Plasma**



BISCOL Dyeing process for wollen fabrics

Ecofriendly approaches in Textile Industry



Energy Consumption Reduction

Conventional Dyeing process for wollen fabrics

Purge → **Antifelting** → **Dyeing** → **Washing** → **Drying**

20 L water
5 g surfactants
562.5 kJ energy

20 L water
200g BASOLAN
120 g acetic acid
518 kJ energy

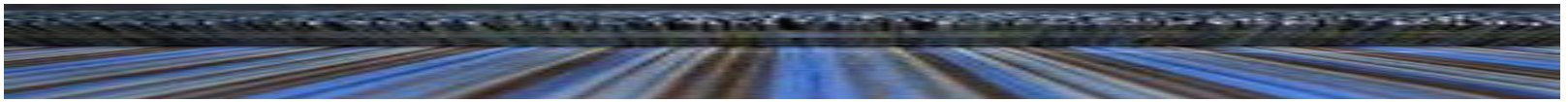
20 L water
20 ml acetic acid
10 mg dyestuff
25 g surfactant
13.65 MJ energy

20 L water
5 g surfactants
562.5 kJ energy

1.1 MJ energy

16.5 MJ

Ecofriendly approaches in Textile Industry



Energy Consumption Reduction

BISCOL Dyeing process for wollen fabrics

Purge → **DBD Plasma** → **Dyeing with new auxiliaries** → **Washing** → **Drying**

20 L water
5 g surfactants
562.5 kJ energy

89.1 L N2
82.5 L He
148.5 kJ energy

20 L water
20 ml acetic acid
10 mg biodyestuff
18 g eco surfactant
8.92 MJ energy

20 L water
5 g surfactants
562.5 kJ energy

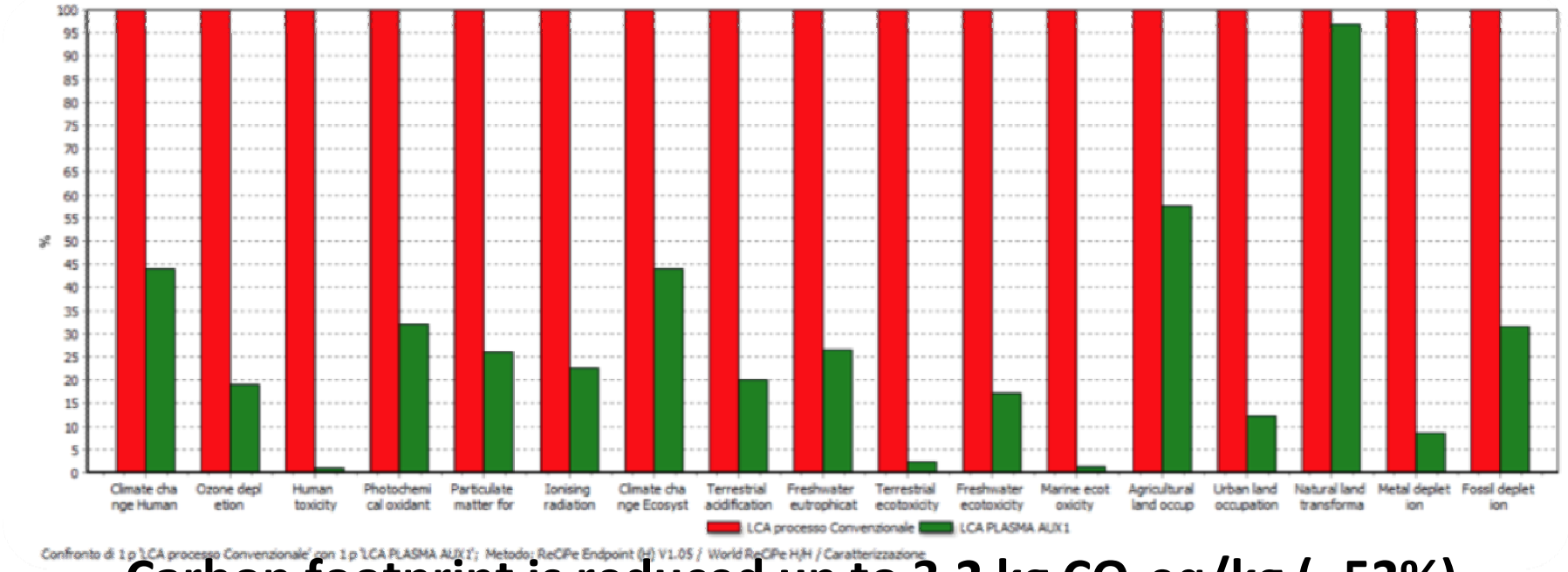
1.1 MJ energy

11.5 MJ

- 30%

Ecofriendly approaches in Textile Industry

Energy Consumption Reduction



Carbon footprint is reduced up to 3.2 kg CO_2eq/kg (- 52%)

Fossil depletion is reduced up to 0.45 Kg oil eq/kg (- 70%)

Water depletion is reduced up to 45 L/kg (-59%)

Sustainability and textile industry

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Thank you!

http://www.biscol.unisi.it/

Questions welcome

Project smedia