RESYNTEX

La pensée du cycle de vie dans le projet Resyntex: Réaliser l'économie circulaire dans le secteur des textiles

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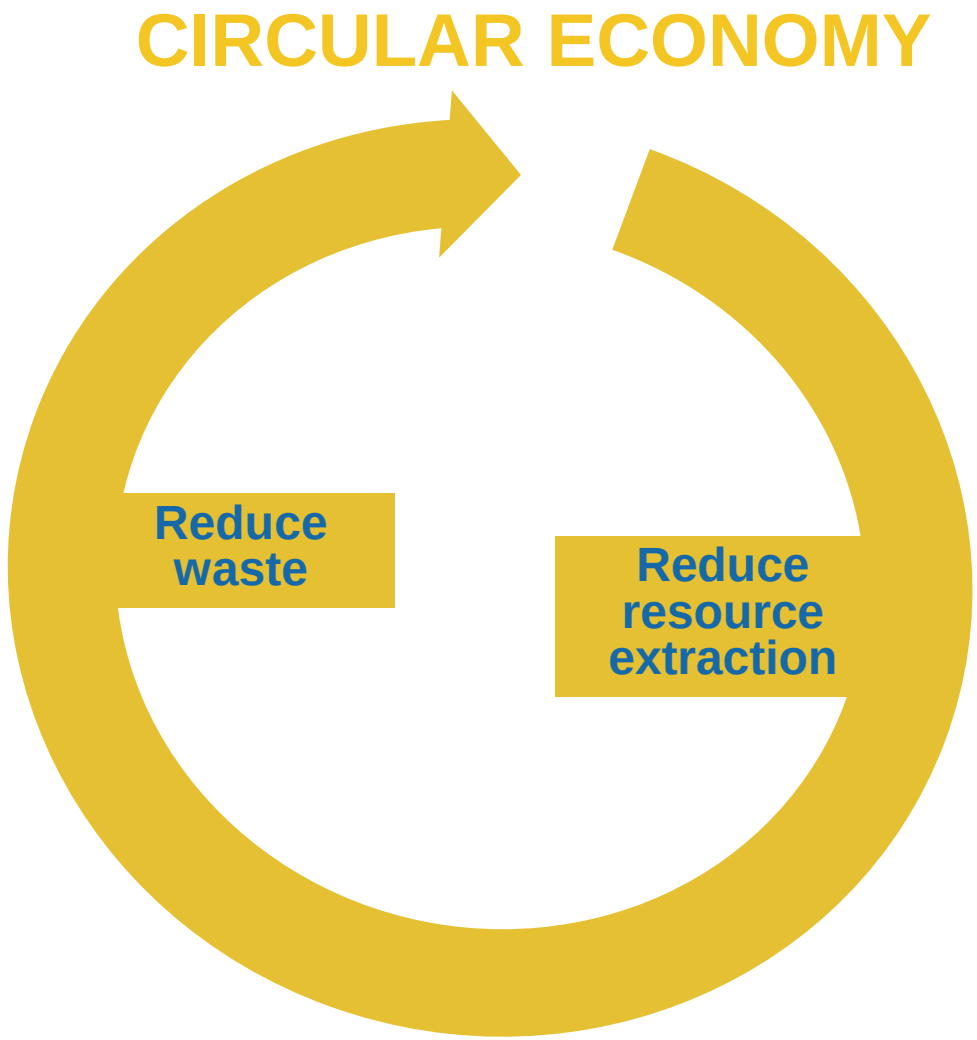
RESYNTEX

TOO MUCH TEXTILE IS WASTED
EVERY YEAR WITHOUT VALORIZATION…

… a perfect representation of **linear economy**

How can we shift this linear model towards more **circularity**?

TWO OBJECTIVES OF
THE CIRCULAR ECONOMY



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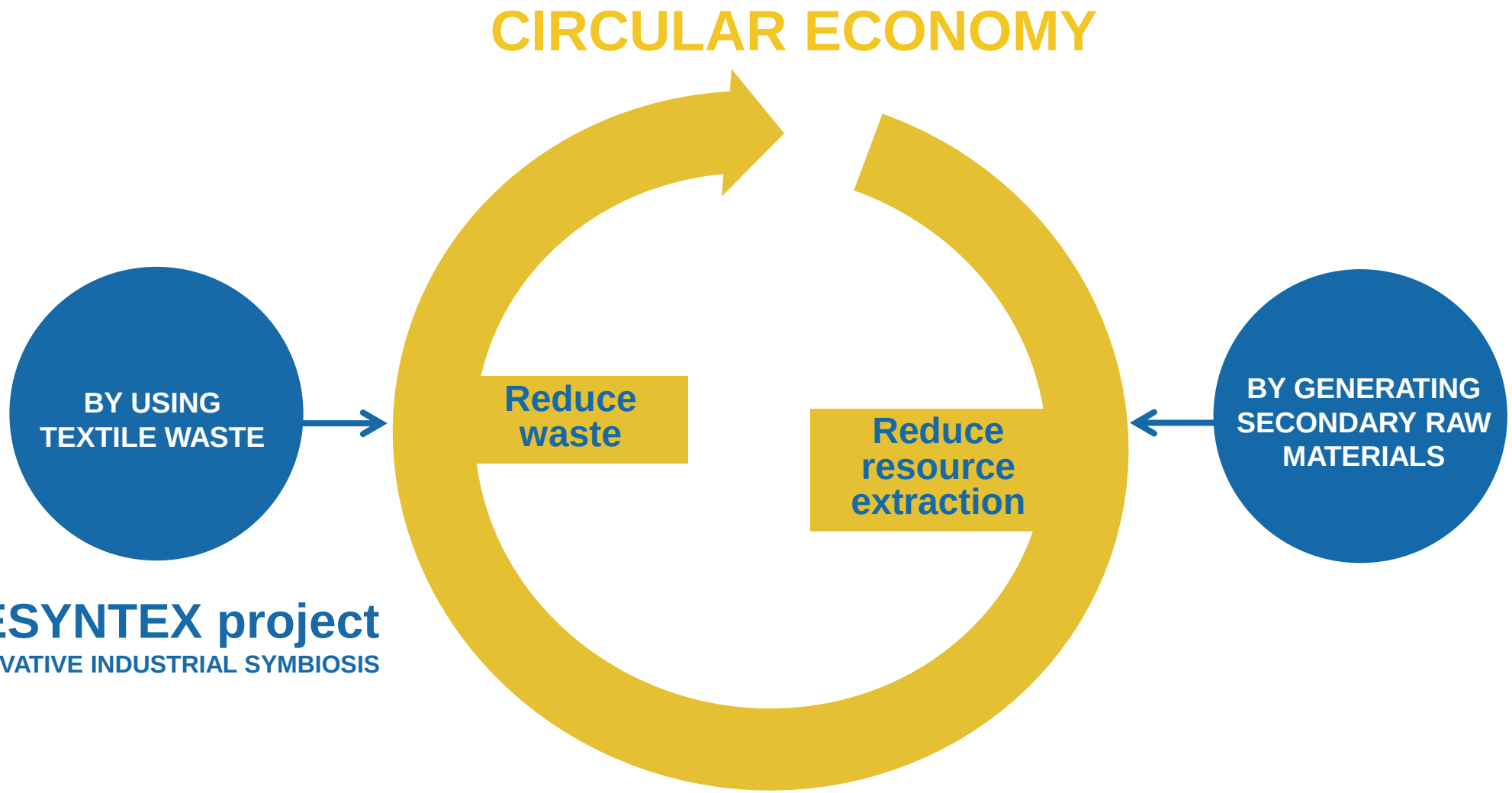

RESYNTEX project
INNOVATIVE INDUSTRIAL SYMBIOSIS

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RESYNTEX

ALL THE SUCCESS FACTORS
FOR AN AMBITIOUS PROJECT

20 partners

Multi-sectorial international **expertise**

42 months

Funding from the
EUROPEAN UNION'S HORIZON 2020 RESEARCH AND INNOVATION PROGRAMME
under grant agreement 641942

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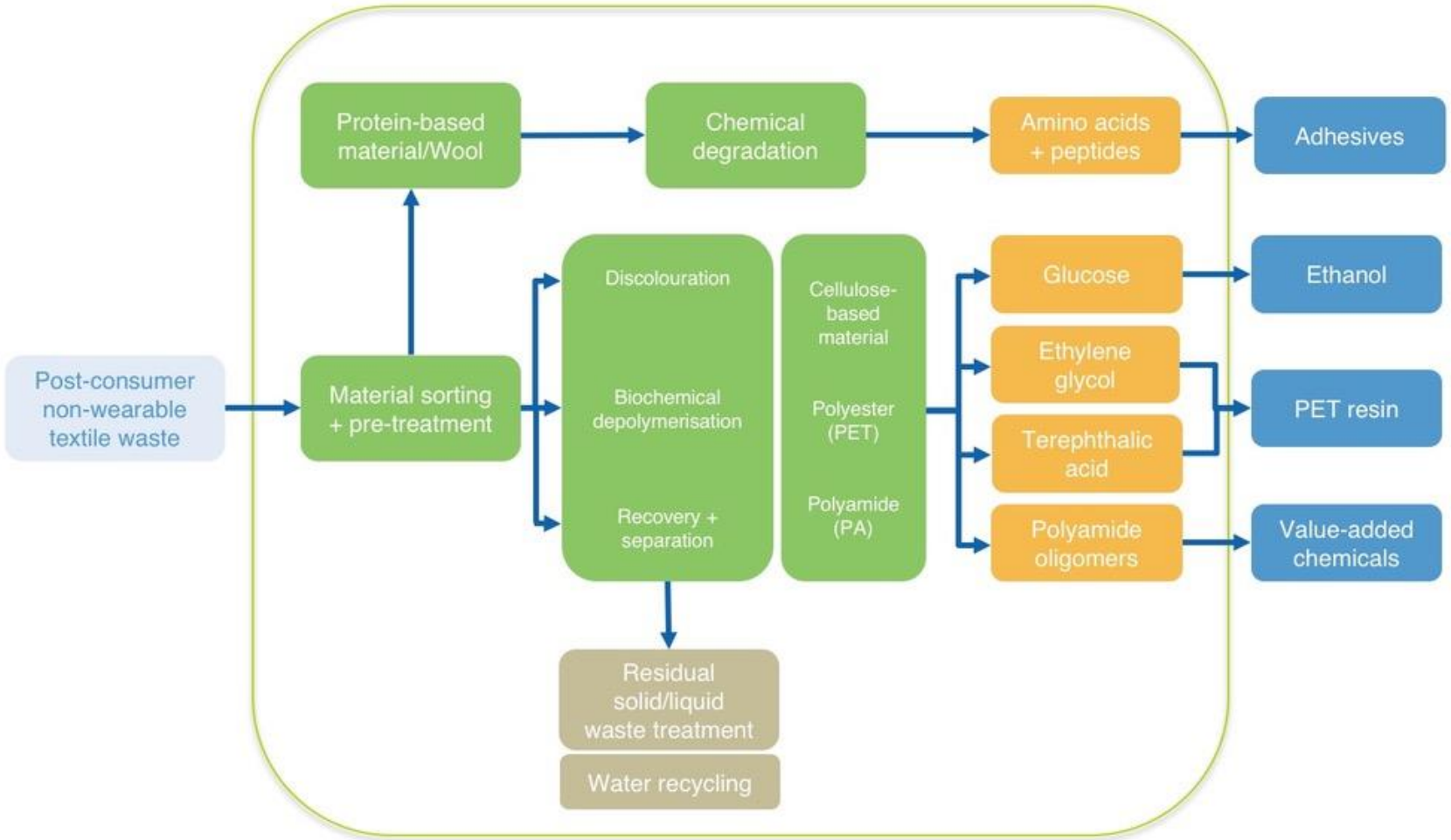
ABOUT GOODS
ARKEMA INNOVATIVE CHEMISTRY
biochemtex
BOKU
cefic
CHIMAR BINDING INNOVATION
DETTIN S.p.A.
EURATEX
imec
IOS Institute for Environmental Protection and Sensors
Manchester Metropolitan University
National Technical University of Athens
prospex institute
Quantis
SEPAREX Supercritical Fluid Technology
SOEX GROUP
SUSTAINABILITY CONSULT
tekstina 1826
University of Maribor Faculty of Mechanical Engineering
VALAGRO Carbone Renouvelable


Post-consumer non-wearable textile waste
Material sorting + pre-treatment
Protein-based material/Wool
Chemical degradation
Amino acids + peptides
Adhesives
Discolouration
Biochemical depolymerisation
Recovery + separation
Cellulose-based material
Polyester (PET)
Polyamide (PA)
Glucose
Ethylene glycol
Terephthalic acid
Polyamide oligomers
Ethanol
PET resin
Value-added chemicals
Residual solid/liquid waste treatment
Water recycling

ENGAGING WITH
consumers, collectors, and industry stakeholders along the value chain

173 young consumers (16 – 25) took part in **Citizen Labs**

in Annecy (France), Manchester (UK), Prato (Italy) and Maribor (Slovenia)

Four **regional stakeholder dialogues** to address the obstacles around collection, involving local authorities and businesses & NGOs that collect and sort textile waste

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VALUE CHAIN ENGAGEMENT

Value chain dialogue with European businesses from the textile, waste management, chemical and recycling machinery industries to:

- collaboratively assess the viability of industrial symbiosis approaches
- identify potential markets for the future recycled feedstock obtained through textile fibre reprocessing

KEY OUTCOME (stakeholder feedback):
Resyntex needs to assess a range of **end-products and markets that have not been identified by the project thus far**, for example:

Fibre-to-fibre (cellulosic fibres)

Gradual blending (polyester –packaging)

Sugar platform chemicals

Provision of certification services

TOOLS FOR MEASURING
THE RESYNTEX BENEFITS

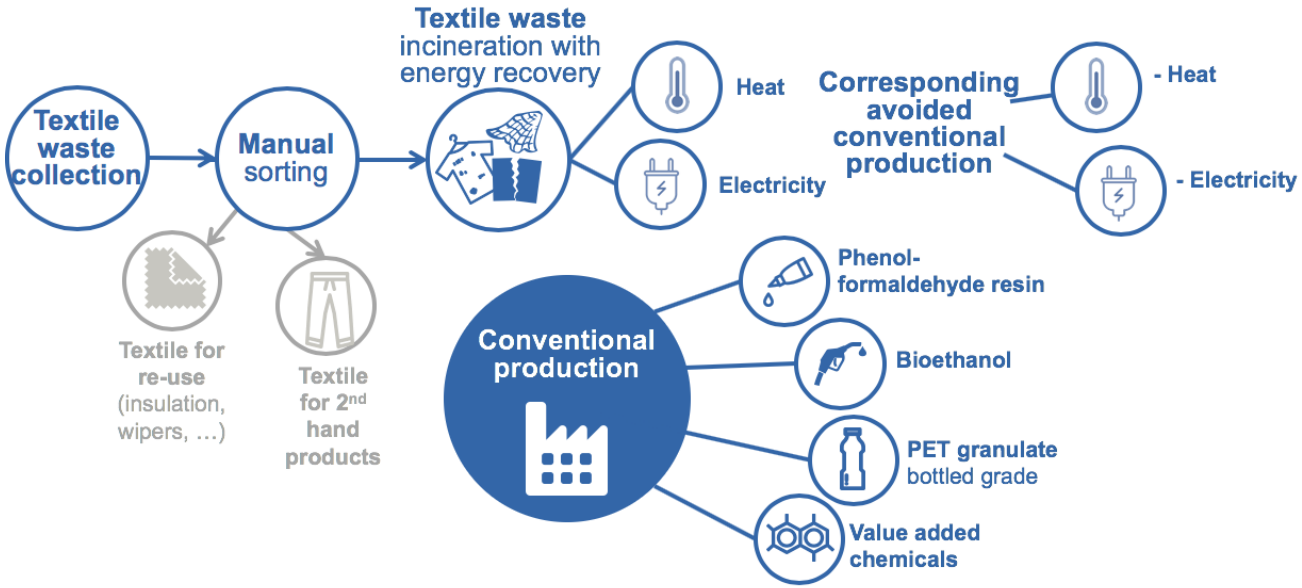
LCA
Life cycle assessment

LCC
Life cycle costing

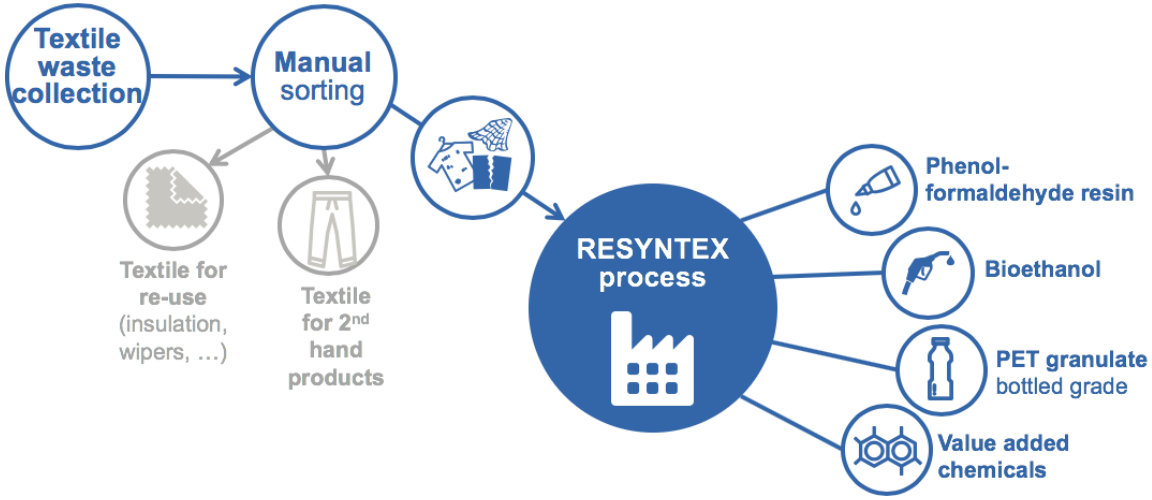
LCA and LCC
combined results

LCA AND LCC SYSTEM
FOR REFERENCE AND RESYNTEX

Reference system



Resyntex system



Resyntex plant size: 10’000 t textile waste input.
Energy, water and infrastructures partly optimized.

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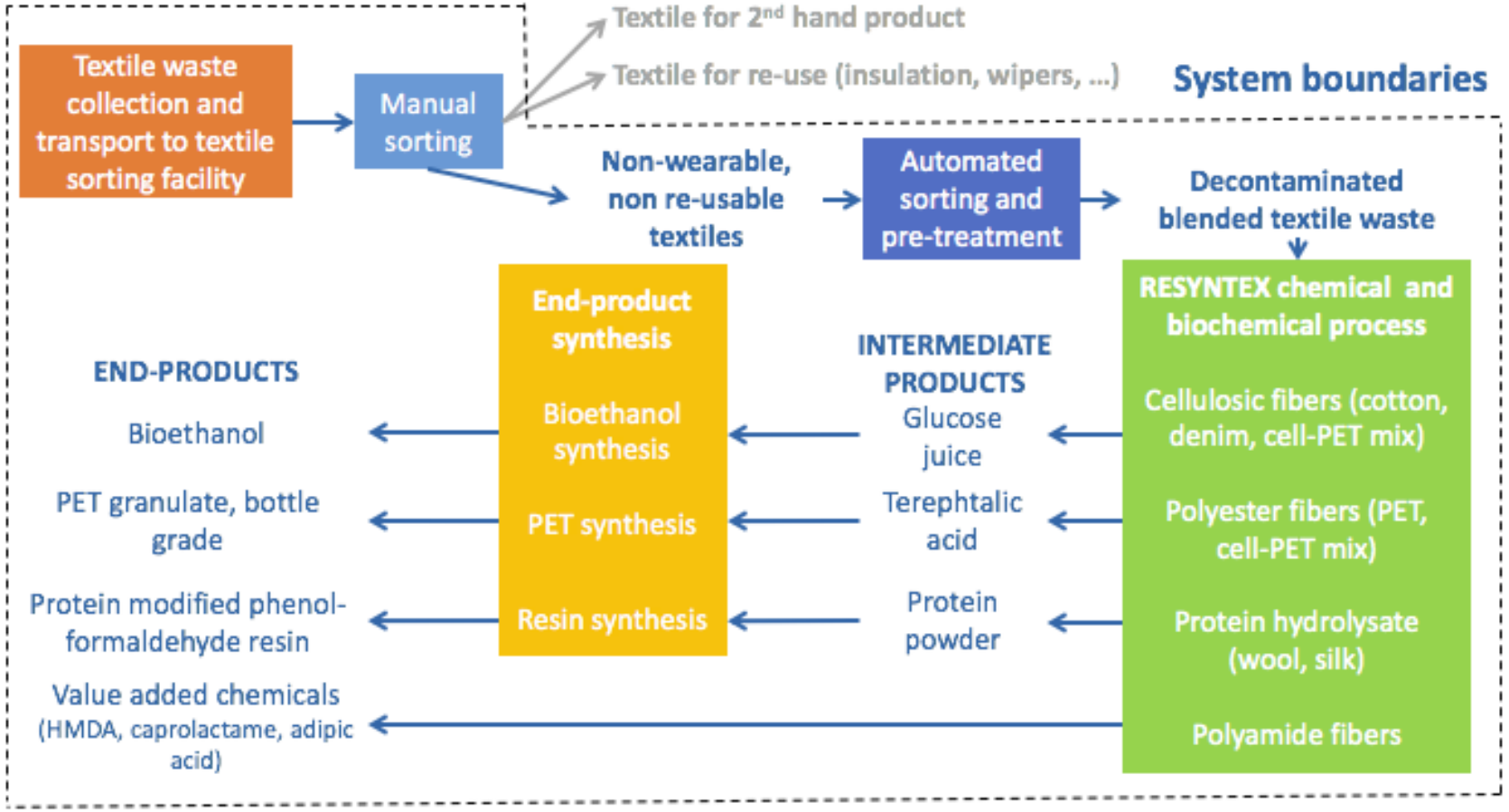
RESYNTEX SYSTEM
BOUNDARIES AND FUNCTIONAL UNIT



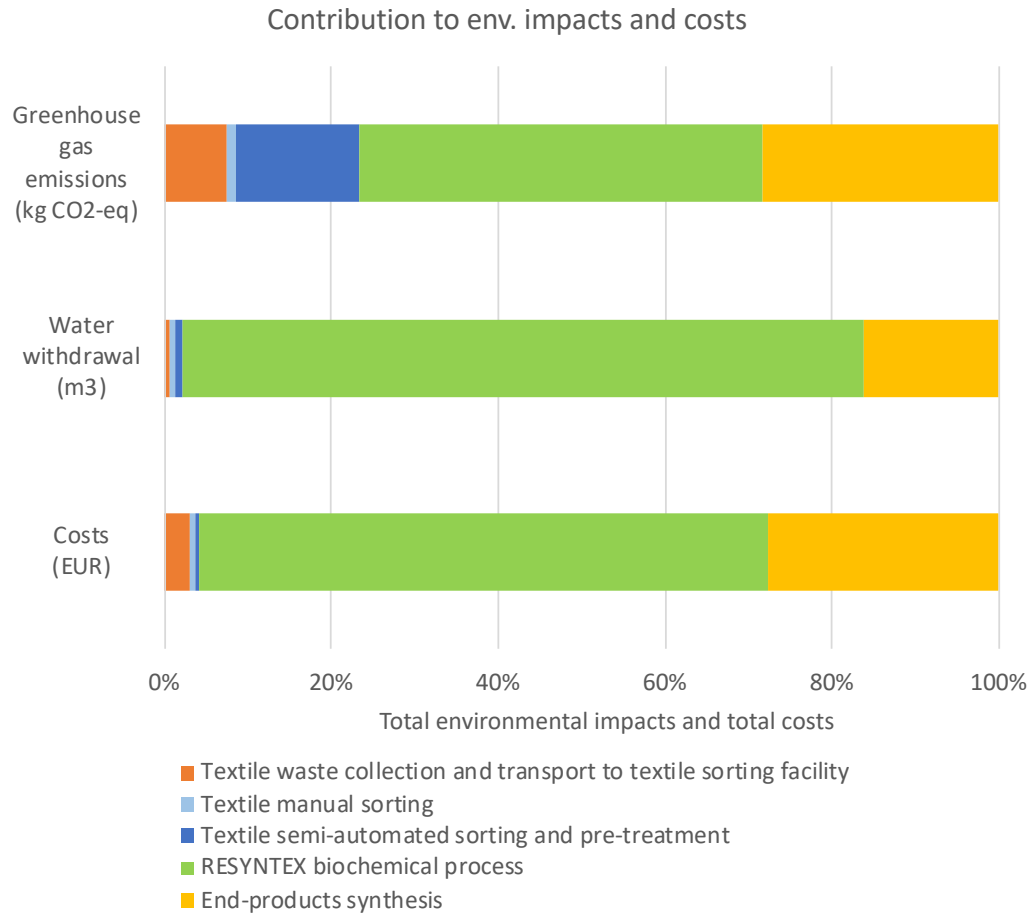
FUNCTIONAL UNIT

The **treatment** of **1 tonne of non-wearable non-reusable textile** waste and the **production of end-products**:

- phenol-formaldehyde resin for wood panel,
- bioethanol,
- value added chemicals and
- PET granulate,

in **Germany.**

RESYNTEX SYSTEM
SCORES



Main contributors

- (Bio)chemical process: steam and chemicals (e.g., NaOH, Na2S2O4)
- End-product synthesis: protein modified phenol-formadehyde resin (with partial replacement of phenol by proteins) and ethylene glycol production for PET synthesis

Key opportunities for impact reduction

- Further optimization of the energy consumption
- Yields improvement
- Type and amount of chemical used
- Additional pre-treatment enabling a yield increase or easier further processing

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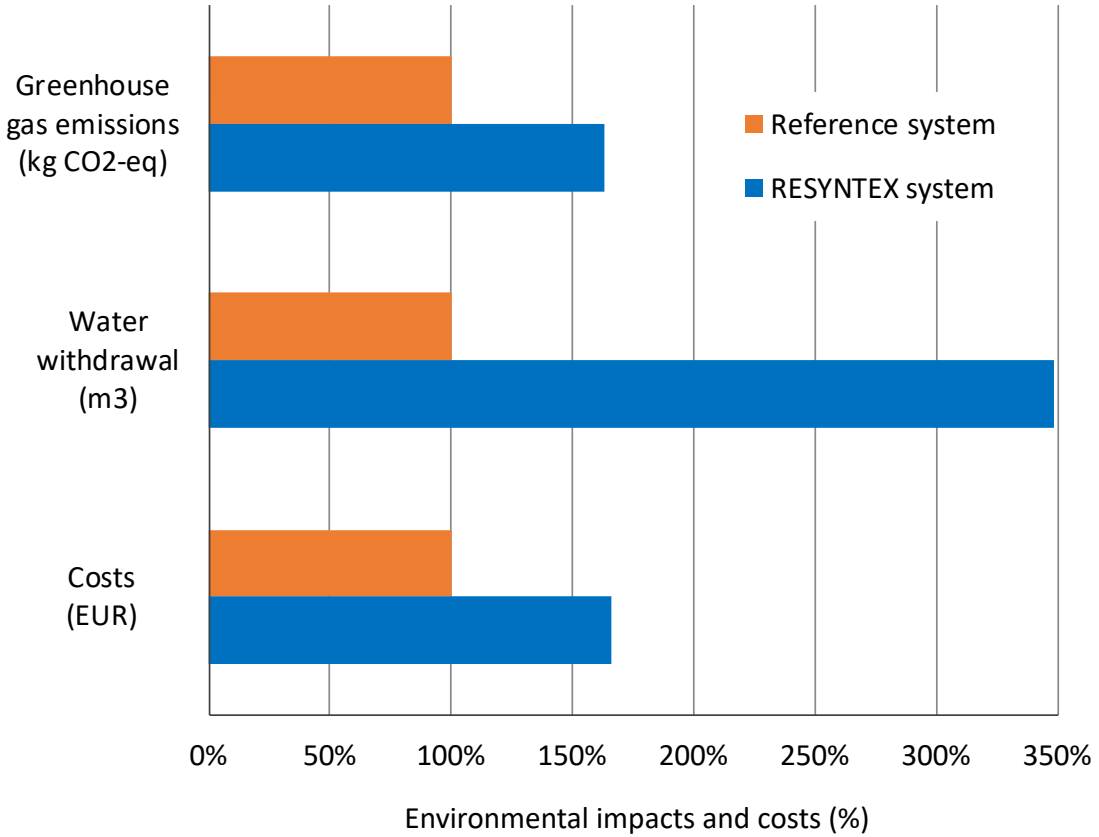
COMPARATIVE RESULTS
FOR REFERENCE AND RESYNTEX SYSTEMS



The **reference** system **has lower impacts** regarding greenhouse gas emissions, water withdrawal and has lower costs

but

it is a **mature system, fully optimized** while the **Resyntex** system is a **young technology that will evolve** and be further optimized.

The choice of other end-products could also improve the efficiency of the Resyntex system.

Some limitations

- The **reference** system **considers incineration** with energy recovery for the textile waste treatment, **landfilling** could lead to **different conclusions**
- The **end-of-life** of the products is **excluded** ("cradle-to-gate" study), its inclusion would influence the results (e.g., partly biogenic resin VS 100% fossil based)

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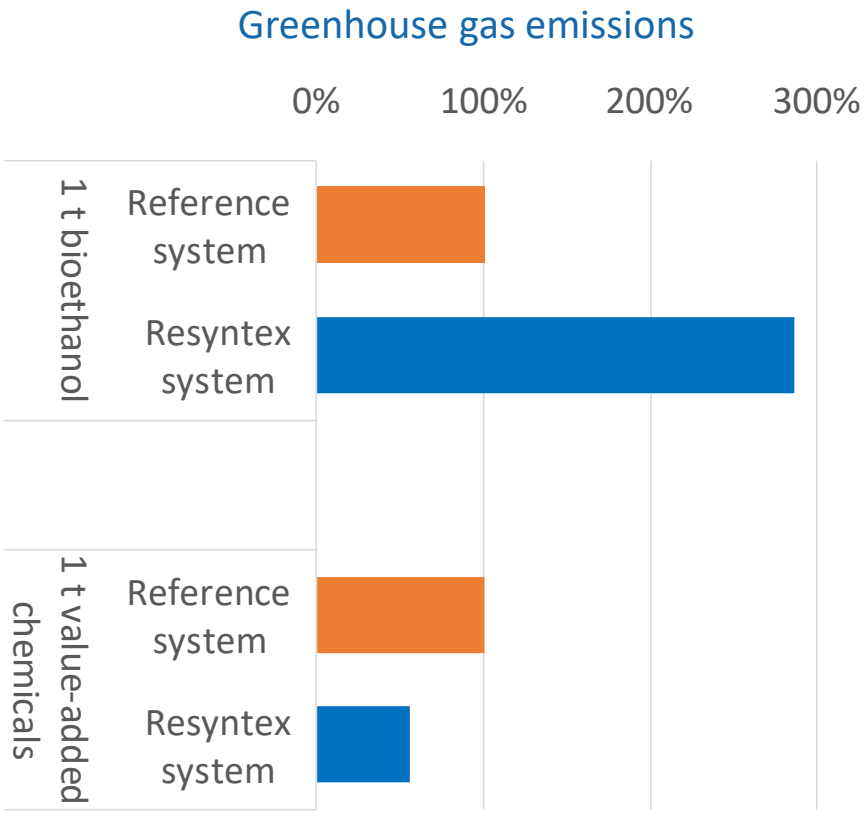
PRODUCT BASED APPROACH
RESULTS FOR TWO SELECTED END-PRODUCTS



The bioethanol from the Resyntex system emits more GHG than the reference bioethanol per t of product.

On the contrary, the Resyntex value-added chemicals emit less GHG than in the reference system.

→ **Importance of selecting the right end-products!**

Potential next-step:
Discussion with industry to understand their needs and identify the best end-products to produce from Resyntex intermediate products

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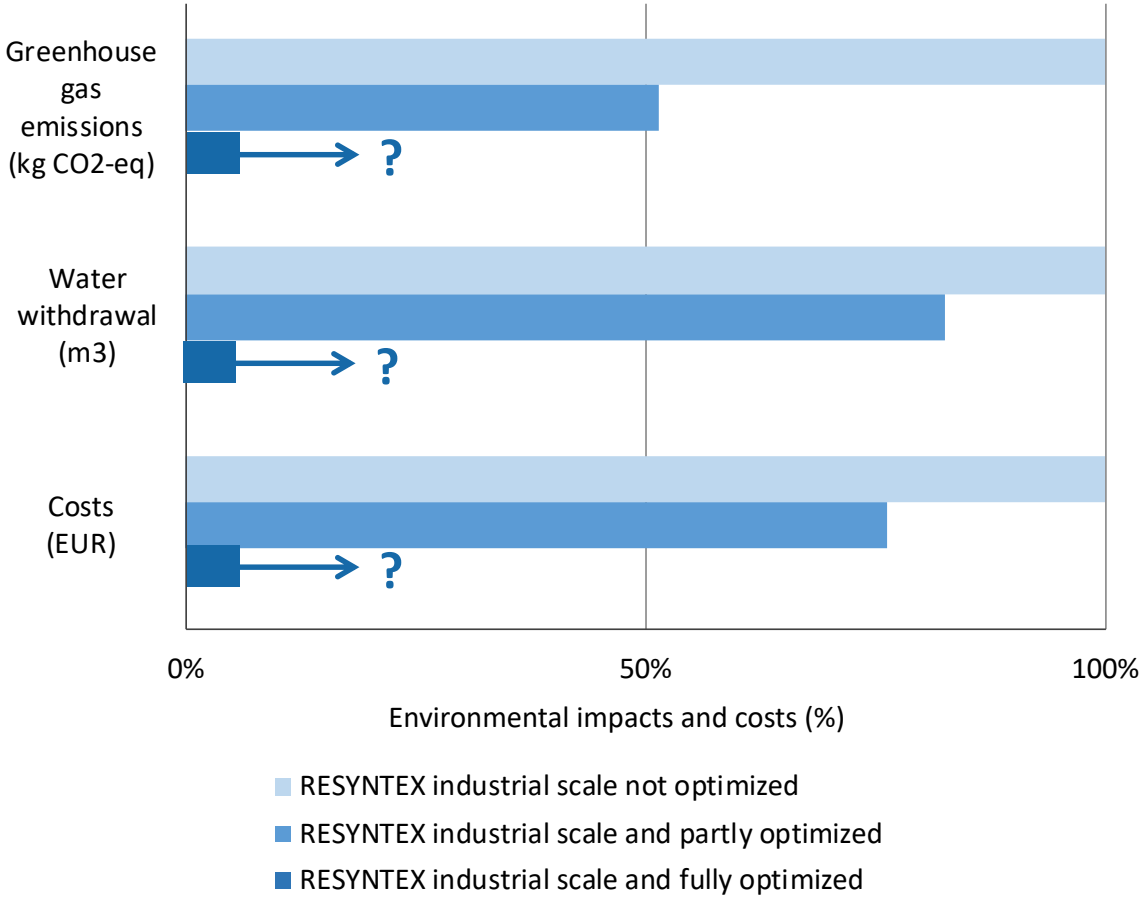
RESYNTEX SCORES EVOLUTION
FROM UNOPTIMIZED TO FULLY OPTIMIZED



The first level of optimization (partial energy, water and infrastructure optimization) leads to a good impact reduction.

Further optimization of energy and water, together with chemical optimization will lead to further reduction in the impacts.

RESYNTEX PROJECT
NEXT STEPS

- LCA-LCC: results update with data for industrial scale with further optimization
- Pilot plant building and operating

RESYNTEX

Thank you!

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or visit http://www.resyntex.eu

prospex institute

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