
Co-funded by
the European Union

white cycle

# Circular economy of PET from Complex Wastes (Tires, Clothes, Hoses) to TRL 6-8

**Call**: HORIZON-CL6-2021-CIRCBIO-01
**Duration**: 48 months
**Estimated project cost**: 9,541,261.25€
**Requested EU contributions**: 7,080,251.50€

**Coordinator : MICHELIN** / Olivier Cardon
olivier.cardon@michelin.com

**Project website :** https://www.whitecycle-project.eu
**Project LinkedIn :** https://www.linkedin.com/company/whitecycle/

Co-funded by the European Union

# Key figures in Europe

1850 kt multilayer clothing

200 kt End of Life Tyres

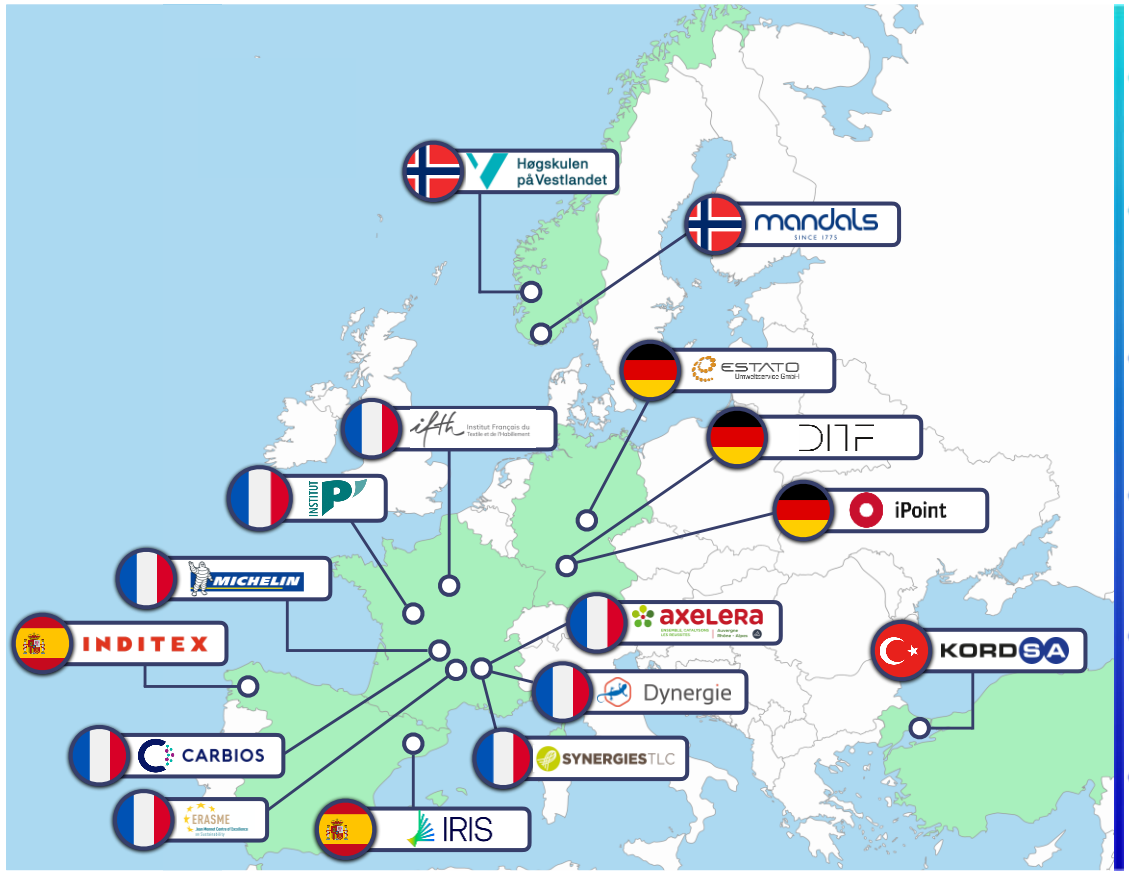
10 kt End of Life Hoses

Feedstock for 2 Mt of r-PET / year


Co-funded by the European Union

# A TEAM of Industrial Partners, Research Centers and an Innovation Cluster from 5 countries, united to develop PET recycling from complex waste

white cycle

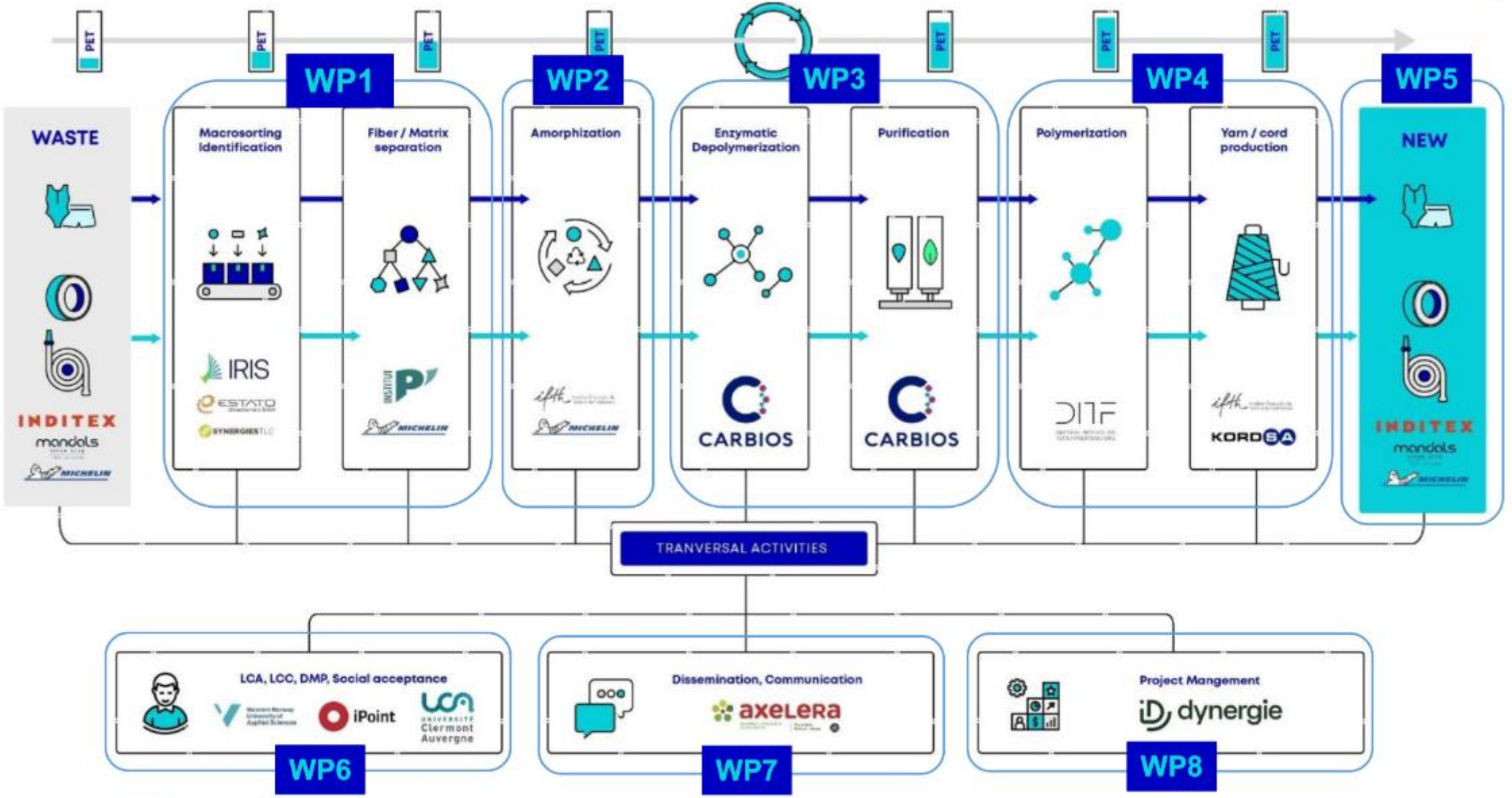




- Waste Managers
- Technology Developers and providers
- Manufacturers
- End Users and Validators
- LCC, LCA, Social and HSE Experts
- Dissemination, Communication



Funded by the European Union

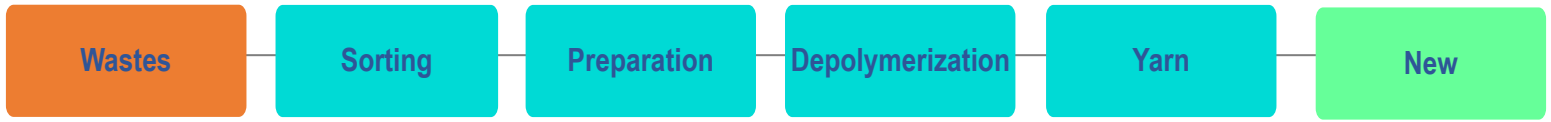
# A united multiskilled consortium to cover the overall value chain




Co-funded by the European Union

N° Grant Agreement : 101059639

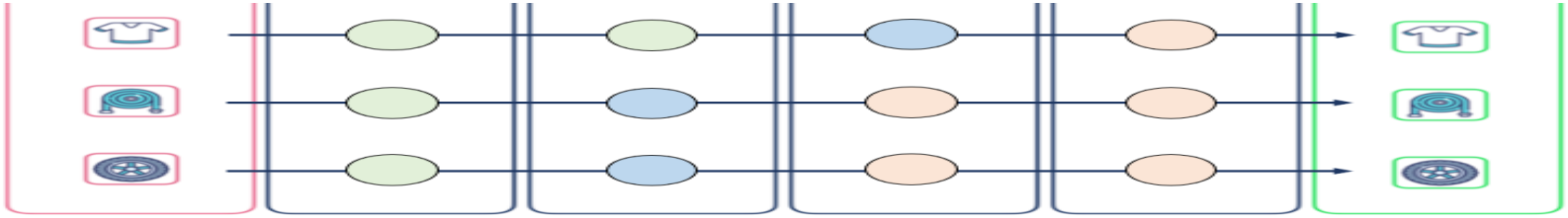
# A complete development program
## from lab scale to pre-industrial units




Volumes

*Tune preparation process at lab scale*


*Demonstrate performance at pilot scale*



*Demonstrate performance at pre-industrial scale*


*Develop pre-industrial units*

Co-funded by the European Union

N° Grant Agreement : 101059639

# Preparation of complex feedstocks : a technological challenge

***Complex feedstocks contain not only PET, but various compounds that can perturbate fabrication processes***

Technical / multilayer garments :

- Reflective tapes
- Coatings
- Puff
- Dye
- Hard points : knobs, zips
- Etc.


Technical articles (flexible hoses and tyres):

- Rubber
- Thermoplastics
- Other fibers
- Fillers
- Etc.

***Preparation steps are needed to :***

- ***Sort feedstocks with a content of 80% PET or more***
- ***Prepare the material to enable full depolymerization***

Co-funded by the European Union

N° Grant Agreement : 101059639

# Sorting of material

## *select high PET content articles in complex garment feedstocks*

*=> Upgraded optical sorting technology by* IRIS


Whitcycle developed an innovative sorting prototype (TRL5) based on IRIS identification technology

Operator gets information on all layers composition for each part of the garment (visualization at pixel size)

Operator isolates garments with 80% or more PET

Co-funded by the European Union

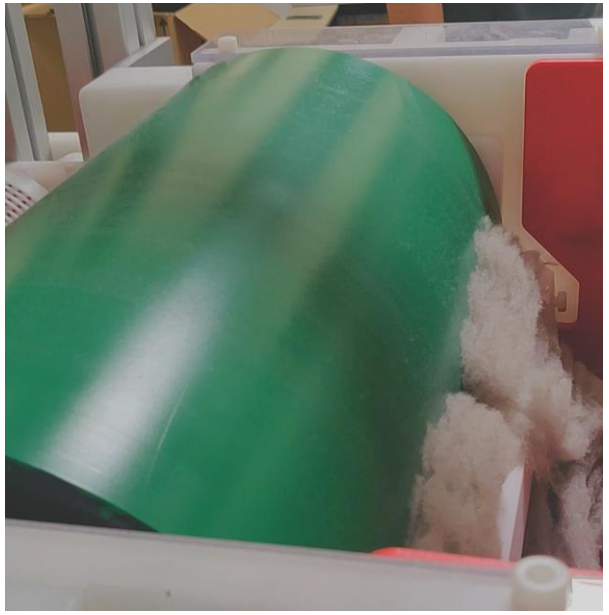
N° Grant Agreement : 101059639

# Sorting of material

## *Isolate PET fiber from milled tyres and flexible hoses*

*Innovative electrostatic sorting developed by*

Whitecycle prototype based on P' patented technology



PET fibers are collected on electrodes

Tyre material aspect before and after electrostatic sorting

Co-funded by the European Union

N° Grant Agreement : 101059639

# Sorting of material

## *highly promising technologies to isolate high PET content materials*

### Multi-layer garments

IRIS Sorting

### Tyre material

PPRIME purification

### Hoses material

PPRIME Purification

Co-funded by the European Union

N° Grant Agreement : 101059639

# Pretreatment of the material

## *1. Dismantling and milling process for complex / multi-layer garments*

Dismantling — Milling — Amorphization

**Dismantling**

SYNERGIESTLC

**Milling**

ifth Institut Français du Textile de Habillement

→ Withdrawal of
. Hard points,
. Objects in pockets
. Etc.

Co-funded by the European Union

N° Grant Agreement : 101059639

# Pretreatment of the material

## *2. Amorphization process*

Dismantling — Milling — Amorphization

**Amorphization**

*Requirements for* CARBIOS

*Low cristallinity*

*High specific surface*

ifth Institut Français du Textile et de l'Habillement

**IFTH prototype extruder enables optimization of**

→ Compaction
→ Thermal treatment
→ Material shape

Co-funded by the European Union

N° Grant Agreement : 101059639

# Material pre-treatment

## => *Amorphization technology developed for the 3 feedstocks*

| Multi-layer garments | Tyre fiber | Flexible hoses fiber |
|---|---|---|
|  |  |  |
|  |  |  |

Co-funded by the European Union

N° Grant Agreement : 101059639

# Analysis and dissemination

## Integration into the European scientific and business ecosystems

Data management

Lifecycle assessment

Lifecycle costs

Social impact

Social acceptance

Dynamic modeling


Strategic intelligence

Dissemination seminars

Discussion with early adopters

Dissemination toolkit

Training development

Co-funded by the European Union

N° Grant Agreement : 101059639

# Thanks!

## Follow #WhiteCycle