

# Whitecycle

Publié le 13 juillet 2022 – Mis à jour le 23 février 2023

Date

Du 01 juillet 2022 au 30 juin 2026

Whitecycle is an Innovative European Project to process and recycle plastic textile waste. It's a partnership to reach the objectives set by the European Union in reducing CO<sub>2</sub> emissions by 2030. It's also a unique consortium rallying 16 public and private European Organizations working together for more circular economy.

## **WhiteCycle: A European consortium to recycle plastic waste**

The WhiteCycle project, coordinated by Michelin, was launched on Friday, July 1st. Its main goal is to develop a circular solution to convert complex waste containing textile made of plastic into products with high added value. Co-funded by *Horizon Europe*, the

European Union's research and innovation program, this unprecedented public/private European partnership includes 16 organizations and will run for four years. WhiteCycle envisions that by 2030 the uptake and deployment of its circular solution will lead to the annual recycling of more than 2 million tons of the third most widely used plastic in the world, PET. This project should prevent landfilling or incineration of more than 1.8 million tons of that plastic each year. Also, it should enable reduction of CO<sub>2</sub> emissions by around 2 million tons. Complex waste containing textile (PET) from end-of-life tyres, hoses and multilayer clothes are currently difficult to recycle, but could soon become recyclable thanks to the project outcomes. Raw material from PET plastic waste could go back into creation of high-performance products, through a circular and viable value chain.

16 public and private European organizations are combining their scientific and industrial expertises:

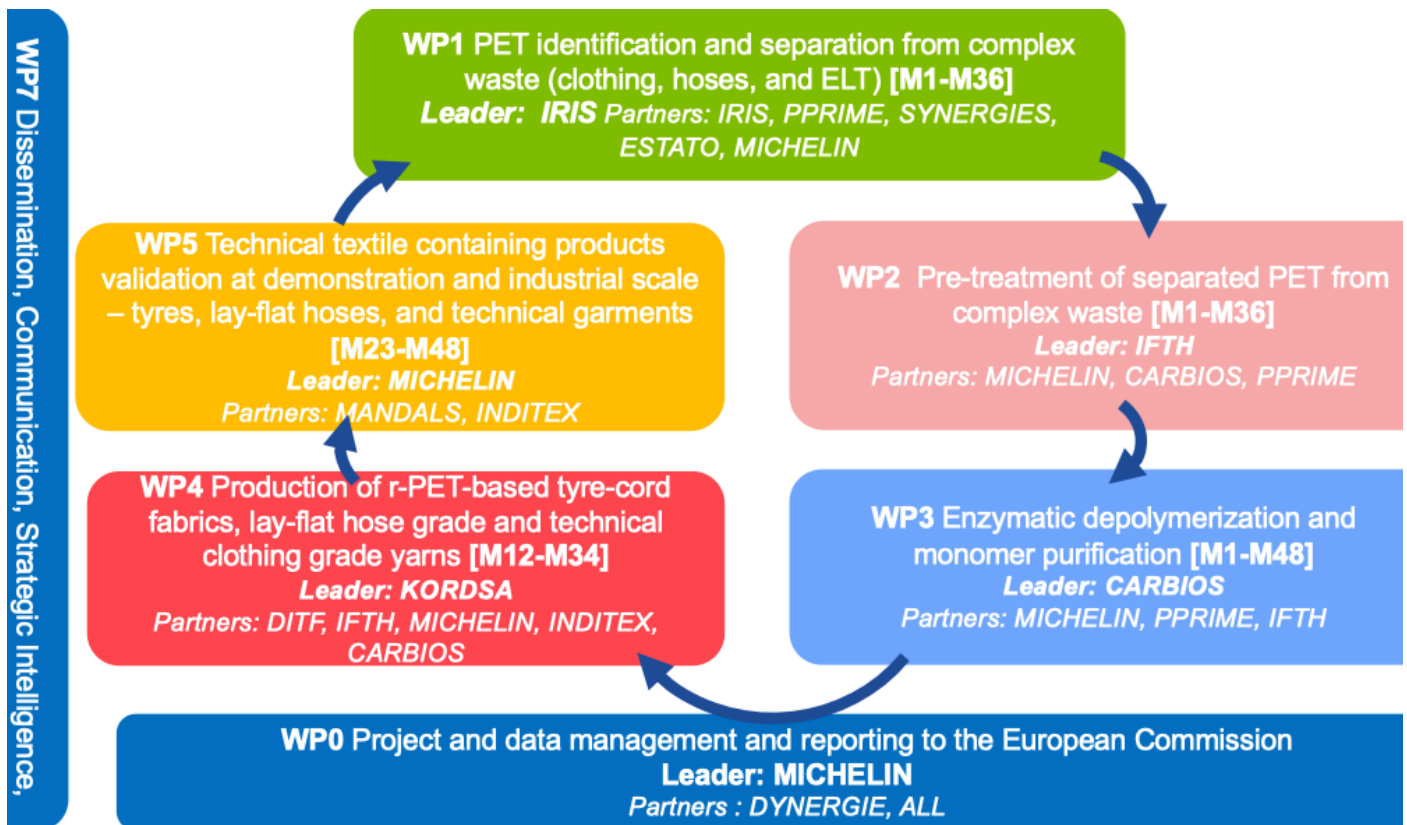
- 4 industrial partners (Michelin, Mandals, Inditex, KORDSA);
  - 2 waste management companies (Synergies TLC, ESTADO);
  - 1 intelligent monitoring systems for sorting (IRIS);
  - 1 biological recycling SME (Carbios);
  - 1 product life cycle analysis company (IPOINT);
  - 1 university, expert in FAIR data management (HVL);
  - 4 universities, research and technology organizations (PPRIME – Université de Poitiers/CNRS, DITF, IFTH, ERASME);
  - 1 industry cluster (Axelera);
- 1 project management consulting company (Dynergie).

The consortium will develop new processes required throughout the industrial value chain:

- Innovative sorting technologies, to enable significant increase of the PET plastic content of complex waste streams in order to better process them;
- A pre-treatment for recuperated PET plastic content, followed by a breakthrough recycling enzyme-based process to decompose it into pure monomers in a sustainable way;
- Repolymerization of the recycled monomers into like new plastic;
- Fabrication and quality verification of the new products made of recycled plastic materials

WhiteCycle has a global budget of nearly 9.6 million euros and receives European funding in the amount of nearly 7.1 million euros. The consortium's partners are based in five countries (France, Spain, Germany, Norway and Turkey). Coordinated by Michelin, it has an effective governance system involving a steering committee, an advisory board and a technical support committee.

Whitecycle project has been designed in different WorkPackages.



[Access to Whitecycle Plateform\(https://www.whitecycle-project.eu\)](https://www.whitecycle-project.eu)

ERASME (UCA, CERDI) and HVL are concerned by the WP 6. WP6 combines system thinking methods, sustainability evaluation, and econometrics to develop transferable circular economy tools, prototypes, and business models. The overall objective is to progress and anchor concepts for sustainable industrial transformation, which foster social inclusion and transparency along with economic sustainability, while minimizing adverse impacts on the environment and society. The result is a demonstration on how to

develop indicators for SDG reporting at corporate level. The use cases that are explored technically in WHITECYCLE (WP2-WP5), are thereby enlarged with a comprehensive sustainability assessment. Generic components of these specific investigations are identified and assessed for their blueprint potential in related industries.

*Task 6.1: Stock-taking of data to prepare the evaluation of social, economic and environment dimensions – Duration: [M1-M36] - Leader: HVL - Part.: ERASME, MICHELIN, IPOINT*

The usefulness of evaluation results rests upon data availability and data quality. This task ensures that all partners have a joint understanding about data needs, data coverage, potential data gaps, and data quality. Starting with a survey to WP6 task leaders, T6.1 identifies input requirements and user rights for the chosen methods of T6.2-6.5. Building on this information, metadata schemes are developed, linking to the project's FAIR DIP (WP0), international reporting standards, and developing a joint ontology across WP6 tasks. The final part of T6.1 is dedicated to developing standards for transparent reporting of data and results. This covers the tracking of the provenance of data and checkpoints for the transparent communication of WP results within the project and beyond (in compliance with GDPR and IPR). A first delivery will be done to WP0 by M5 for inclusion in the DMP by M6. A final version will be provided by M36 for inclusion in the final DMP.

*Task 6.2: Assessment of environmental dimension (Life-Cycle Assessment) – Duration: [M1-M48] - Leader: IPOINT - Part.: ALL*

This task performs a comprehensive environmental life cycle assessment (LCA) of the WHITECYCLE solutions and compares them with conventional alternatives, accounting for the complexity of the materials (incl. potential recyclability of end-of-life components) and criteria for technical performance (e.g., impact on the durability of materials). The LCA follows a cradle-to-gate framework and will focus on the following environmental impact categories: GHG emissions (carbon footprint, in particular biogenic carbon), primary energy demand (energy footprint), water use and consumption (water footprint), land use, as well as impacts on human health and biodiversity. Results will be used in an iterative approach along the project to i) guide the development of the investigated value chains towards more sustainable solutions, ii) quantify the potential benefits of the WHITECYCLE solution compared to alternative technologies (baseline), and iii) help future suppliers and customers make more informed decisions.

*Task 6.3: Assessment of economic dimension (Life Cycle Cost, market's structure, Circular business models) – Duration: [M1 - M48] - Leader: ERASME, IPOINT, - Part.: ALL*

This task analyzes causal relationships between cost-benefit analysis, market structures, and firm-level economic performance to support circular economy Framework oriented innovation (Blomsma & al., 2019). We start with an R-framework (4R to 10 R, Kirrchherr & al., 2017) to map the existing and proposed Circular Economy strategies and to foresee how they influence the viability of value chains for the

WHITECYCLE innovation cycle. Next, we cross the economic analysis with the analysis at three spatial scales (micro, meso and macro) to elicit generic interactions. Thirdly, we develop economic indicators (such as variables providing relevant information for decision making, company-level reporting of SDGs), differentiating between end- product production (economic efficiency), consumption, waste management and production of secondary raw materials (EC, 2015), and by adjusting them to the different properties of innovation process (Input to T.6.5). A focus on creating value for the different actors in the value chain will be designed to ensure acceptance of the circular technologies by the full value chain. Life Cycle Costing (LCC) and economic analysis of selected WHITECYCLE processes will be carried out. Overall costs of the process related to the production, use and end-of-use will be assessed.

*Task 6.4: Assessment of social dimension (Societal impacts and social acceptance) - Duration: [M13-M36]*  
*- Leader: ERASME - Part.: HVL – Part.: ALL*

This task assesses social impacts of WHITECYCLE innovations and potential issues for social acceptance. We define social aspects as all parameters, indicators or issues related to the social relations between individuals and between individuals and society (Diemer, 2019), and we apply social aspect classifications established in the Social Life Cycle Assessment (SLCA) methodology (Jorgensen & al. (2008), Dempsey & al. (2011) and Ellen McArthur Foundation (2015). WHITECYCLE use cases are investigated in the light of SLCA indicators and Sustainable Development Goals. The analysis is informed by the following empirical methods: At micro-level, we establish focus groups and communication channels within the MICHELIN, MANDALS and INDITEX companies to analyse the degree of social acceptance and diffusion of innovation. At a meso- and macro-level, we identify key stakeholders through an influence-interest matrix, eliciting stakeholder insights through semi-structured interviews and participatory scenario building exercises with the aim of creating value for citizens and consumers. As an input to T.6.5, the task contributes with suggestions for indicators of the social dimension.

*Task 6.5: Stock-taking of assessment results (Impacts Cross-Matrix of Complex System) - Duration: [M1-M48]*  
*- Leader: ERASME - HVL - Part.: HVL, IPOINT*

It integrates the results from environmental, social, and economic evaluations and maps the interactions between flows and stakeholders. Systems thinking and system dynamics modelling are used to identify systemic behaviour patterns, leverage points of intervention (Nedelciu, Diemer, 2020) and to develop company-level SDG reporting. Moreover, a systemic analysis of different circular business models (Diemer, 2020) is launched to lay open potential controversy between technological centralization of global chains and territorial de-centralization priorities.

*Task 6.6: Development of an online IS platform enabling an automatic calculation of a feedstock's environmental impact and its compatibility on CARBIOS recycling process – Duration: [M1-M48]*  
*- Leader: MICHELIN - Part.: IRIS, SYNERGIES*

Development of an IS solution able to automatically give a feedstock an environmental score based on LCA calculation made by IPOINT and the ability to be used on the CARBIOS process. The algorithm will directly use the data from the IRIS' online characterization system and will generate an environmental score according to its compatibility with CARBIOS recycling process. The IS system will be connected to the RECYCLE platform (from Refashion) which already makes the inventory of different recycled feedstock and recycling solutions available. This task is about: developing the algorithm and release a stable and user-friendly solution on RECYCLE platform. The solution will be able to environmentally evaluate a recycled PET feedstock and make the data available for the customer.

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<https://erasme.uca.fr/version-francaise/projets/whitecycle>(<https://erasme.uca.fr/version-francaise/projets/whitecycle>)