tecnoproteo

upcycling future

A research project
for sustainable mobility

The Tecnoproteo project is funded by the Piedmont Region
and developed by the six partners collaborating on the research.

Tecnoproteo. Upcycling Future

The Tecnoproteo project **develops an innovative process for forming thermoplastic composite sheets made with recycled materials, intended for bodywork elements of cars.**

The experimentation involves six partners including companies and research centers and holds significant importance for both the Piedmont region and Italy. The project aims to produce medium to large prototypes for the automotive industry and other sectors. It focuses on developing innovative solutions that offer environmental and economic advantages.

The experimental project studies the characteristics of the new components to evaluate their ability to replace metal ones, preserving the experience and current plants of the partners.

The implementation of the results on an industrial scale will expand the range of achievable products, making them more adaptable to different uses, including multi-sector applications.

During the research phase, the behavior and evolution of prototypes will be monitored to analyze the environmental and economic impact of the component. This analysis will also assess the sustainability of product manufacturing, maintenance, and end-of-life reuse.

Tecnoproteo exemplifies upcycling by enhancing material recovery and transformation. This creative process goes beyond simple recycling, breathing new life and purpose into materials by reinventing their function.

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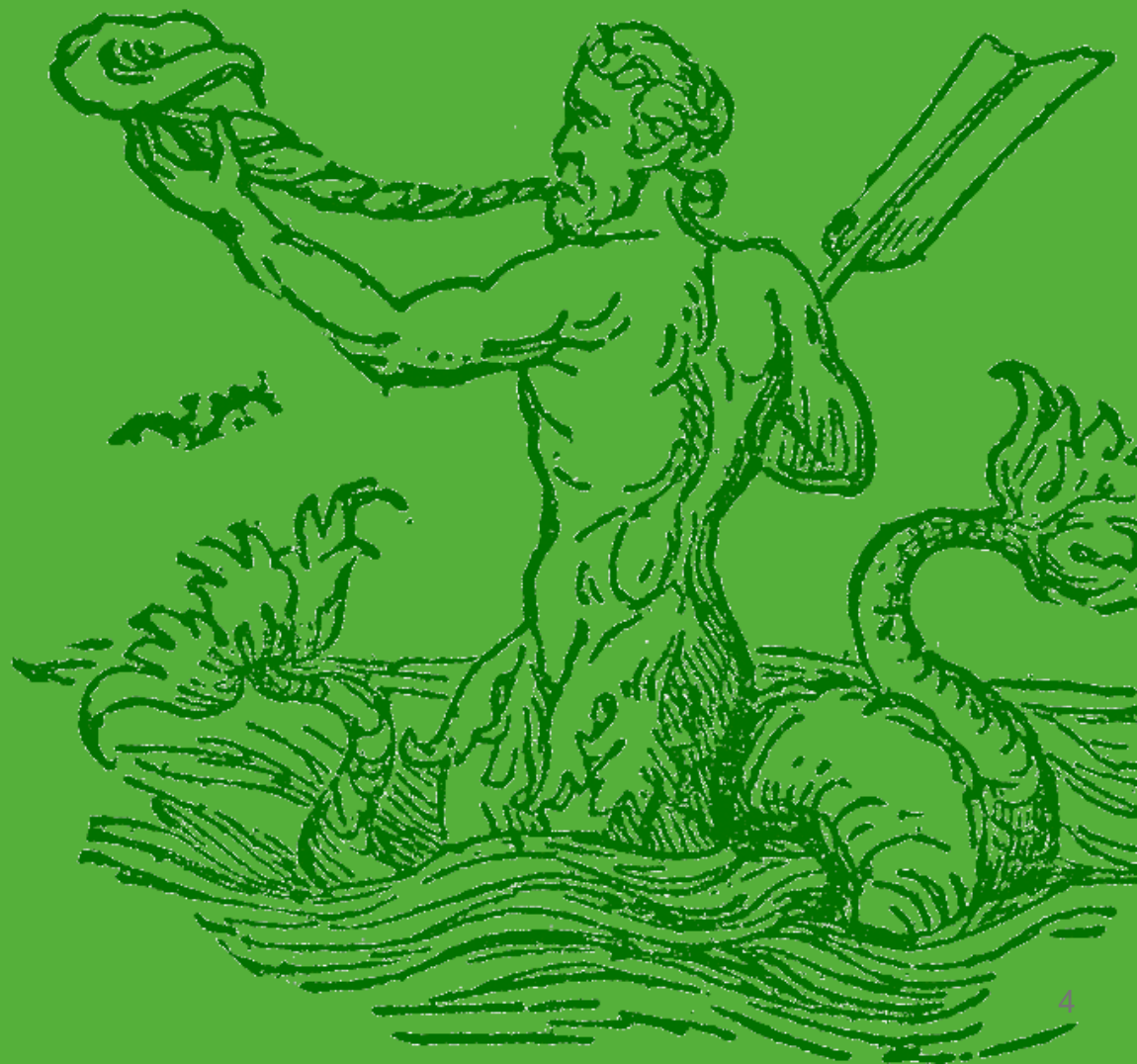
The name of the project

***T**echnological and **EC**onomic validation of process in**NO**vations aimed at the development of **PRO**totypes of Sustainable **T**h**E**rmoplastic sheets, with recycled fiber and polymer, for the realization of components for the transp**O**rt sector.*

Proteo, from the Greek *protos* (πρῶτος), means “first” and “tecno” emphasizes the avant-garde spirit that drives the project. A minor deity in the Greek and Phoenician world, Proteus was able to see the future and change shape. Both of these aspects — looking ahead and transforming — inspire the research work.

The proteus is also a small eel-shaped amphibian, with great adaptability. The pictogram of the logo stylizes its morphology and transforms it into *uroboros*, the alchemical symbol of eternal, cyclical regeneration.



Keywords

Circular economy

Total sustainability

Future

CO2 emissions reduction

Upcycling

Enhancement of the Piedmont automotive supply chain

Valorization of waste materials

Reuse

PLM

Innovation of materials

Redesign of mobility industrial processes

Ambitious goals for sustainable mobility

- Investigating innovative materials, metal alternatives, that provide comparable resistance and performance with less weight.
- Conversion of production plants
- Reorganization and requalification of human and structural resources used in the sectors of the partners
- New high-tech investment opportunities in Piedmont
- Environmental sustainability

...and for the circular economy

- Components made with recycled fibers and polymers
- Possibility of future disassembly and reuse of the component at the end of life
- Decrease in energy consumption and carbon dioxide emissions during manufacturing processes.
- Life Cycle Assessment of the component
- Reduction in vehicle fuel consumption

Technological challenge: recycled materials and lightness

The ongoing evolution in the transport sector directs production chains towards environmental sustainability criteria. Future production strategies are developed with consideration given to the subsequent disassembly and recycling of materials, the transformation of industrial facilities and systems, market dynamics, and legislative directives concerning industrial outlooks. A structured needs analysis identifies weight reduction as a key objective for minimizing consumption, particularly in the context of electric vehicles.

The new thermoplastic composites, created from materials largely from recycling, represent the synthesis between sustainability and lower weight. Furthermore, they constitute an added value to respond to European regulations, which increasingly require the use of components made of recycled materials for new productions.

Thermoplastic materials offer a virtually unlimited lifespan and complete recyclability, surpassing the durability and sustainability of conventional plastic materials, such as thermosetting resins.

The forming process of composite material sheets necessitates a reduced energy expenditure compared to metal sheets. Moreover, the prevailing production methodology for aluminum sheets permits the incorporation of only 30% recycled material, whereas Tecnoproteo strives to employ over 50% of recycled material in the fabrication of composite sheets.

Under the stated conditions, the challenge lies in manufacturing composite sheets at competitive prices while achieving substantial mechanical properties. It must be noted that the attributes of the final product are significantly determined by the integration and interplay between the polymer and the reinforcing fiber.

Industrial impact: plant reconversion and new opportunities

The project distinguishes itself through its focus on technology and environmental considerations, while maintaining due regard for its industrial implications.

A significant technological undertaking is pursued, featuring innovative elements surpassing current market offerings, achieved by adapting established production methodologies. This strategic progression facilitates enhanced efficiency and sustainability without sacrificing quality standards.

The industrial partners of the project will develop new skills and knowledge for innovation management. This know-how will be applied to adapt current production processes in the industrialization of innovation.

Eurodies will enhance its expertise in composite material forming and plant adaptation to specific requirements. In fact, sheet thermocompression will utilize existing metal molding facilities.

2Gamma will cultivate capabilities in handling and optimizing thermoplastic composite laminates for targeted applications, enabling product innovation. Laminate processing will leverage existing material lamination infrastructure.

F.T. Famat will develop competencies in laminate and thermocompression process automation, surface treatment management, and material heating. Plant automation will integrate with current operational assets.

The innovative scope: technological complexity and socio-economic benefits

Tecnoproteo requires significant technological complexity and a variety of integrated skills to create mutual benefits for all partners.

The application potential of these products and processes is poised to become a benchmark for numerous industrial sectors, while advancements in new materials will facilitate enhanced performance and considerable positive outcomes.

Innovation is realized through the development of thermoplastic composite material sheets, which feature variable structures in terms of reinforcement, utilizing fibers with diverse weaving patterns, in combination with thermoplastic polymers.
The fabrication of a prototype aerodynamic fairing, currently made of aluminum, using these tailored structure thermoplastic composite sheets, has the potential to significantly impact production chains, overcome existing technological limitations, expand product ranges, and consequently, strengthen the supply chain, thereby positively affecting employment rates.

Furthermore, Tecnoproteo contributes to the digital transformation of the Piedmontese entrepreneurial ecosystem, as project partners will analyze digital data acquired from sensor packages designed for real-time monitoring of process conditions.

The innovative and strategic approach demanded by this challenge, coupled with the composition of the partnership, establishes an optimal operational framework for achieving the stated objectives.

Role of partners: complementary skills for the success of the project

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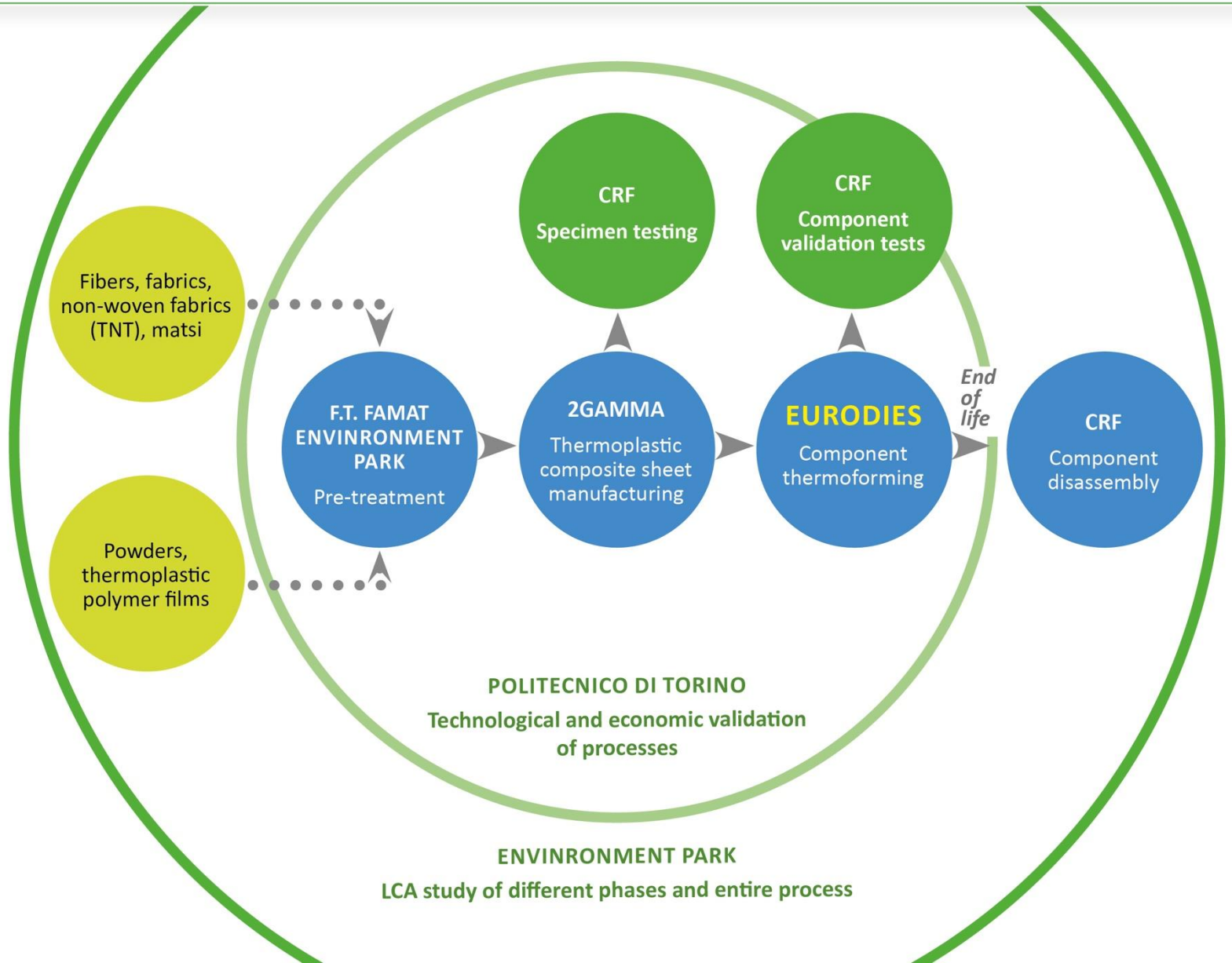
Tecnoproteo Project
Partner, roles and development phases



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The leader Eurodies has its roots **in the design of dies and related production of metal prototypes** and, for several years, has been producing complex structural parts, also characterized by significant thicknesses.

Tecnoproteo aims to apply its expertise in industrial processes for sheet metal components to produce thermoformed products suitable for the automotive industry and other sectors.

The extensive expertise in sheet metal forming is paramount to the successful execution of the project, to ascertain component manufacturability, and to ensure the viability of the industrial process, thereby optimizing all relevant facets.

Eurodies will use composite sheets to develop an aerodynamic shield. This shield will be installed on the vehicle's undercarriage, functioning as both an underbody cover and an aerodynamic component.

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2Gamma deals with the **design and production of technical thermoplastic films and composite material sheets**.

The company has significant expertise in the manufacturing of a wide range of laminate products. It is equipped with hot lamination plants with particular innovative features useful for controlling the process and capable of maintaining a high degree of flexibility depending on the raw materials to be processed.

The experience in coupling thermoplastic and thermosetting materials is the necessary requirement to arrive at the development of new materials.

2Gamma has, for some time, been looking for alternative processes to produce thermoplastic composite laminates, useful to expand its market and to reach a wider number of sectors.

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F.T. Famat, since 1988, **designs designs and creates tailor made solutions for industrial automation**, constantly investing in research and development, with a focus on new technologies.

The activity led by F.T. Famat aims to optimize the coupling of materials and to support the thermoforming process. The skills in plant engineering and ICT of the partner are fundamental to create the expected value along the supply chain of the project partners.

Thanks to its experience on industrial processes and surface treatments, F.T. Famat studies, for Tecnoproteo, the industrial process meant to make the textile fibers functional, by increasing their impregnation capacity and adhesion to the matrix, thus enabling the creation of the components.

The company will increase its skills both in the field of surface treatments, and in the development of automation and control solutions through sensors for special applications.

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In addition to its role as Stellantis' representative as the end user of innovation, the Fiat Research Center **is an applied research center of the automotive industry,** founded in 1978 as a reference for the group's innovation.

The significant experience of the CRF Materials Department will allow an evaluation of the replaceability and functionality of the new components.

Tecnoproteo aims to create a lightweight component with a low environmental impact for both internal combustion and electric vehicles. Consequently, thorough validation of its features and advantages will be crucial.

The development and construction of prototypes will facilitate a precise evaluation of the sustainability of manufacturing, maintenance, and end-of-life reuse or recycling procedures.

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ENVIRONMENT PARK

Environment Park, a Technology Park with a 25-year history of **fostering innovation for environmental sustainability in Turin**, collaborates with Tecnoproteo to expand the knowledge base in surface treatments, Life Cycle Assessment, and Ecodesign.

The partner's expertise in developing process and product innovations with minimal environmental impact is crucial.

Environment Park will conduct the Life Cycle Costing-Life Cycle Assessment study for Tecnoproteo, encompassing all project phases and the entire production chain, along with industrialization plans.

A significant portion of the work will focus on updating market analyses to identify solutions for maintaining a competitive edge, assessing the patentability of proposed technological solutions, and validating their application potential.

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Politecnico di Torino

A prestigious public institution, the Politecnico di Torino is a national and international reference for **education, research, technological transfer and services in the fields of Architecture and Engineering.**

The Departments of Management and Production Engineering (DIGEP) and Applied Science and Technology (DISAT) at Politecnico di Torino focus on the technological, economic, and organizational dimensions of goods and services production systems.

Tecnoproteo engages Politecnico di Torino, involving two of its divisions. This collaboration aligns with Polito's mission to support the growth of Piedmont's production sector.

The University offers its proficiency in industrial research and development. Specifically, DIGEP investigates molding phases and sheet behavior, while DISAT analyzes material properties before and after forming.

Technical data sheet of the project

Full Name **T**echnological and **EC**onomic validation of process in**NO**vations aimed at the development of **PRO**totypes of Sustainable **T**h**E**rmoplastic sheets, with recycled fiber and polymer, for the realization of components for the transp**O**rt sector

Duration 30 months

Scope Industrial research and experimental development with a high degree of innovation

Sectors Advanced manufacturing, technology for the sustainable factory, green chemistry

Goals Realization of thermoplastic composite sheets, with aesthetic and structural functions competitive with those of metal sheets, to be used in the automotive and other industrial sectors. Development of ecological and sustainable processes and technologies for components derived from renewable, reused, or recycled sources, minimizing environmental impact.

Opportunities Study of an innovative component and optimization of its disassembly at the end of life, facilitating material recovery for reintroduction into production processes as secondary raw materials.

Components Fibers and plastic polymers from recycling

Proponent and company
Eurodies Italia S.r.l (Medium Enterprise)

Partners 2Gamma S.r.l. (Medium Enterprise); F.T. Famat S.r.l. (Small Enterprise); Centro Ricerche Fiat S.C.p.A. (Large Enterprise); Environment Park S.p.A. (Large Enterprise); Politecnico di Torino (Research Organization)

Overall cost of the project 2.421.264,41 €

Requested contribution 1.204.887,46 €

Financing SWIch call - Support for research, development, innovation and the industrialization phases of the results to accelerate the production and/or marketing launch.

Piedmont Regional Program E.R.D.F. 2021/2027

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“The future is not what happens to us, it is something we create."

Alvin Toffler

Image concept Cinzano Dri

To be continued...

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