EURECOMP

The Final Workshop

STAY TUNED!

20 MARCH 2026 | eurecomp.eu | PARMA, ITALY/ONLINE

EuReComp

EURECOMP Project: European recycling and circularity in large composite components

Final EuReComp Workshop

Friday, 20th March 2026, Parma, Italy

Dr. Kate Trompeta / NTUA

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EuReComp in a nutshell

DURATION
48 months

9 EU countries

COORDINATOR
Prof C. Charitidis

STARTING DATE
01/04/2022

20 partners

BUDGET
~9 M euros

PROJECT ACRONYM/TITLE
EuReComp
European recycling & circularity in large composite components

GA NUMBER
101058089
CALL: A digitized, resource-efficient and resilient industry 2021

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EuReComp Consortium

19 Industrial and **academic partners** with **complementary and multidisciplinary expertise!**

- ✓ **2 INDs**
- ✓ **10 RTOs**
- ✓ **7 SMEs**

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EuReComp Mission

The **cumulating composite wastes** are more prominent than the needed new composites. The **aircraft** and **wind energy** sectors contribute to a major share.

Across all industries about 60% of waste **fibre reinforced** composites is **landfilled**, causing severe **societal and environmental issues**.

EU's **Circular Economy plan** seeks to reduce the landfill down to 10% by increasing the rate of **recycling.**

Stakeholders seek **advanced technologies** and **end-of-life options**, which promote the **recycling** of carbon fibres.

R6 strategy

Reuse, Repair, Refurbish, Remanufacture, Repurpose and Recycling of parts from end-of-life large scale products

EuReComp project has a strong focus on **circularity**, setting out to provide **sustainable methods towards recycling and reuse of composite materials**, coming from components used in various industries, such as aeronautics and wind energy.

EuReComp pathways towards circularity:

- Repairing, repurposing and redesigning parts from end-of-life large scale products and
- Recycling and reclamation of the materials used in such parts

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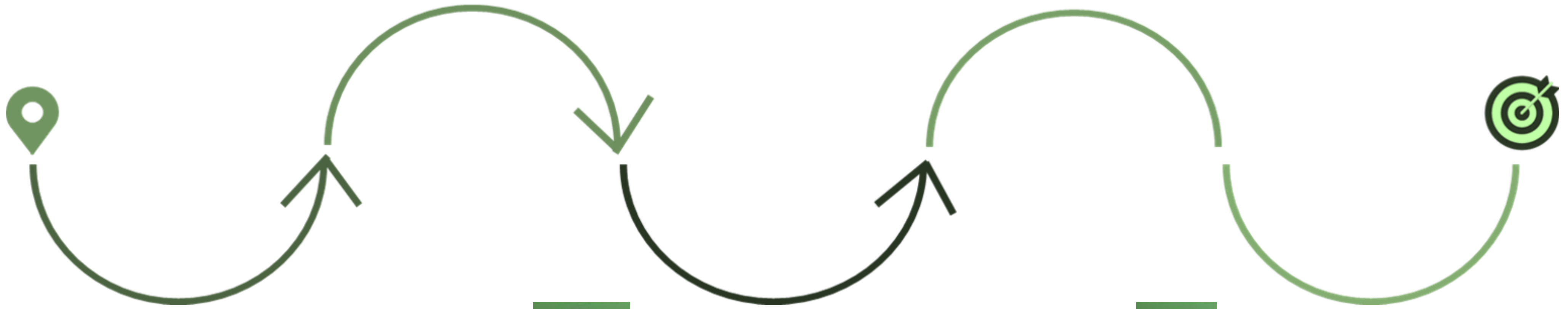
EuReComp Objectives



To propose innovative **dismantling** and **sorting** systems enabling reuse and recycling of complex composite materials

To develop and integrate novel solutions for a **higher reuse** of whole products and components

Pilot demonstration of reuse/recycling approaches of composites & secondary raw materials

To develop tools to demonstrate the **circularity** and the **environmental benefits** of the solutions tested

To consider the **co-design of learning resources** together with local and regional educational organizations for current and future generations of employees

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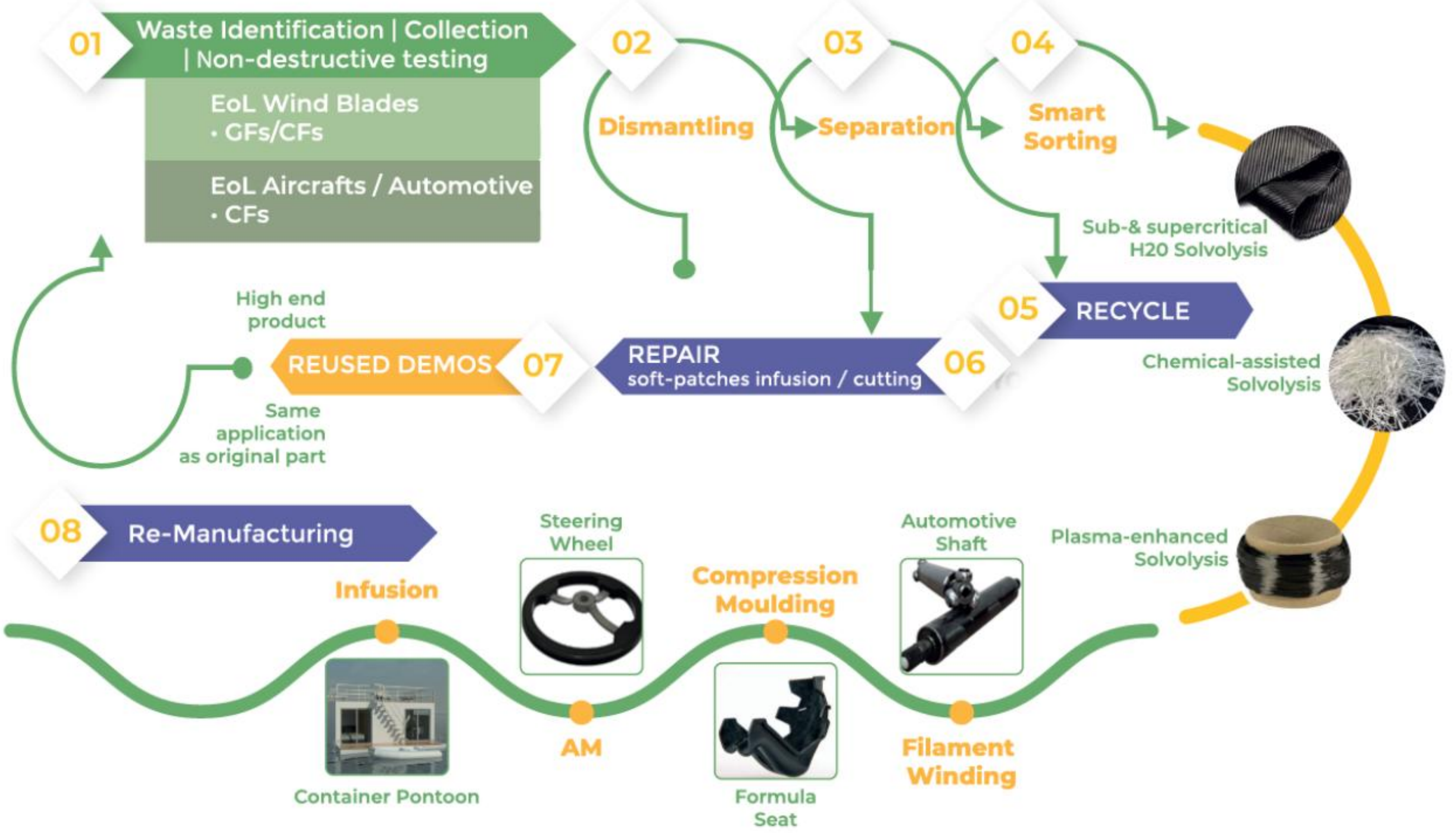
EuReComp Concept



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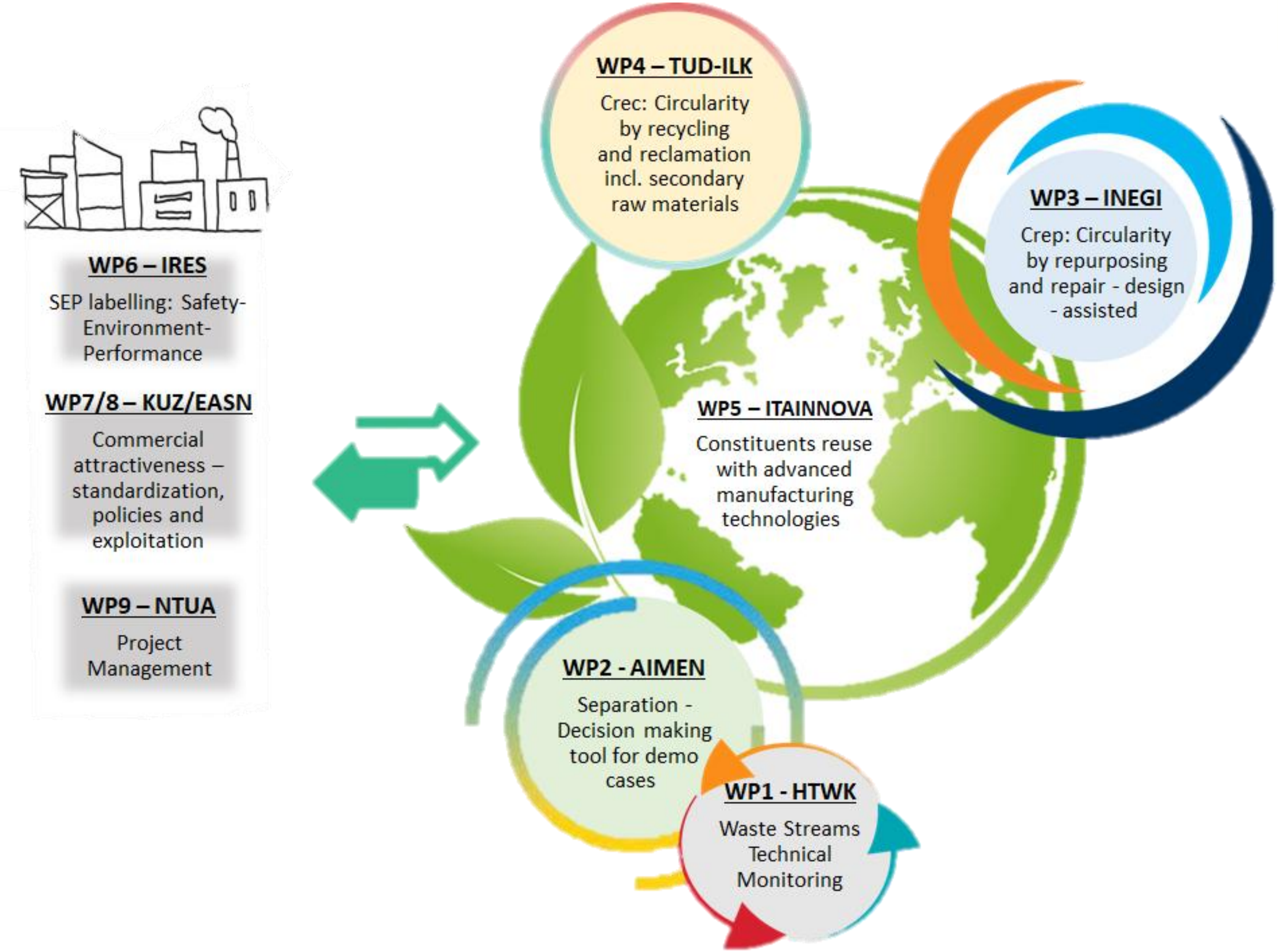
Work Plan


WP6 – IRES
SEP labelling: Safety-Environment-Performance
WP7/8 – KUZ/EASN
Commercial attractiveness – standardization, policies and exploitation
WP9 – NTUA
Project Management
WP4 – TUD-ILK
Crec: Circularity by recycling and reclamation incl. secondary raw materials
WP3 – INEGI
Crep: Circularity by repurposing and repair - design - assisted
WP5 – ITAINNOVA
Constituents reuse with advanced manufacturing technologies
WP2 - AIMEN
Separation - Decision making tool for demo cases
WP1 - HTWK
Waste Streams Technical Monitoring

Workshop’s Targets

Project results in focus

- Concise takeaways from EuReComp demonstrators.

Cross-sector application

- Automotive, aeronautics & wind turbine reuse/recycling use-cases.

Hands-on insight

- Group exercises and guided Dallara facility tour.

Networking & next steps

- Meet partners and sister projects; discuss deployment and collaboration.

Training legacy

- Overview of EuReComp training course outputs and delivery.

A Community of Enthusiasts

- Be part of a vibrant community, sharing a common passion for composites and sustainability.

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Final EuReComp Open Workshop – Meet the speakers

Lecturers within EuReComp Consortium

Dionisis Semitekolos
Project Manager

Chiara Pernechele
Material Science
Senior Engineer

Guy Simmonds
AP&M Owner

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Final EuReComp Open Workshop – Meet the speakers

External Lecturers

Gianmarco Griffini, POLIMI
RECREATE Project

Julio Cesar De Luca, IRT-JV
Suspens Project

Maria Kosarli, GCS
Blades2Build Project

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Final EuReComp Open Workshop

Contents:

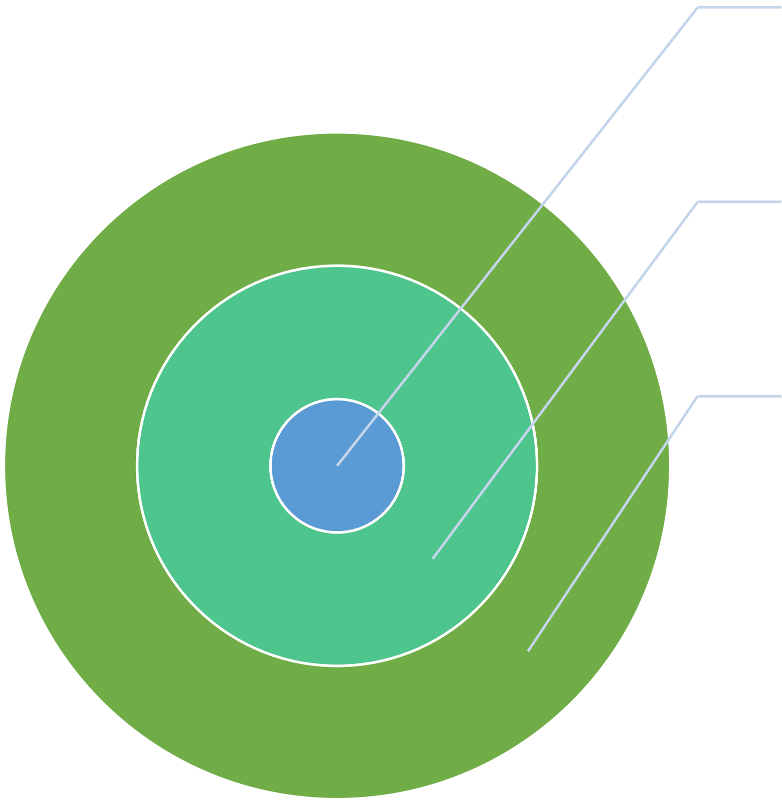
- **Lectures** from EuReComp partners on the “hottest” topics
- Presentations from **External Invited Speakers** on relevant to EuReComp Projects
- **Brainstorming Session**, including:
  - Problem solving and sharing ideas
  - Teamwork
  - Contest on the most creative idea and “souvenir gift”
- **Demonstration Session:**

40 min visit to Dallara Academy training labs, experiments related to:

  - Chassis and brakes
  - Aeroloads with a wing in a small wind tunnel
  - Experiments on materials with a testing machine and the experiment of comparison between composite and metals

40 min to Dallara Lab :

  - Fatigue analysis on components with DIC
  - Composite production
  - Ageing analysis (salt spray and temperature and humidity)
  - X ray tomography



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Acknowledgment

The research leading to these results has received funding from the European Union's Horizon Europe Research and Innovation programme under Grant Agreement No 101058089.

Thank you!

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National Technical University of Athens

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OUR VISION

We are a community that invests every day in a sustainable way for a better future and gives support, security and solidarity to its people, its families and its territory with appreciation and gratitude.

OUR MISSION

"Our aim is to Design and Produce the fastest and safest cars in the World"

Gian Paolo Dallara

DALLARA COMPANY

COMPANY OVERVIEW

EMPLOYEES

More than **900**

TURNOVER

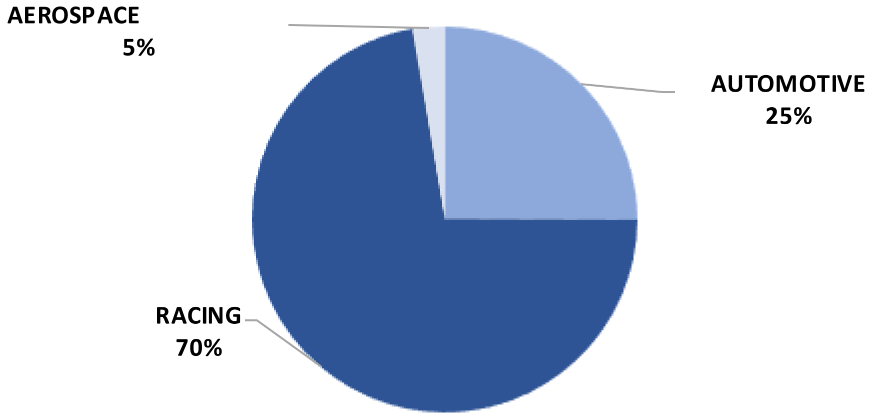
About **220** Mio

EXPORT

>80%

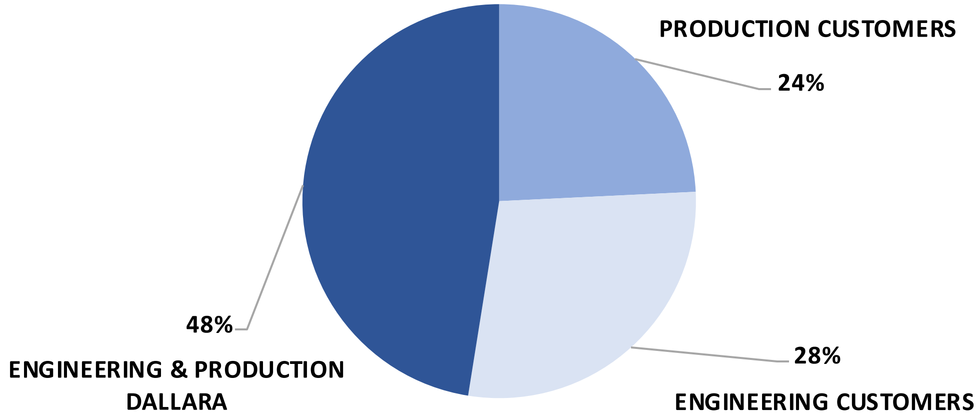
SALES BY BUSINESS UNITS (%)

(Average data of the last 3 years)



SALES BY BUSINESS MODEL (%)

(Average data of the last 3 years)



dallara

Dallara Group

dallara AUTOMOBILI

VARANO DE’ MELEGARI, PR

TOTAL AREA: 12.000 SQM

ENGINEERING & MANUFACTURING

dallara FABBRICA

VARANO DE’ MELEGARI, PR

TOTAL AREA: 2.300 SQM

MANUFACTURING

dallara ACADEMY

VARANO DE’ MELEGARI, PR

TOTAL AREA: 2.700 SQM

EDUCATION & EXHIBITION

dallara COMPOSITI

COLLECCHIO, PR

TOTAL AREA: 7.000 SQM

MANUFACTURING

dallara USA

SPEEDWAY, INDIANA

TOTAL AREA: 11.200 SQM

ENGINEERING & MANUFACTURING

Dallara Milestones

1972

Dallara Automobili

1972

Racing Business Unit

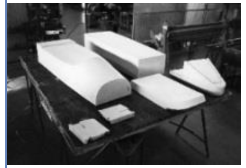
1978

1° F3 Chassis

1984

1° Wind Tunnel

1985



1° Carbon Fiber Chassis

1988

1° F1 Chassis

1998

1° Indy 500 victory

2000

1° Automotive Project Bugatti Veyron

2000

Automotive Business Unit

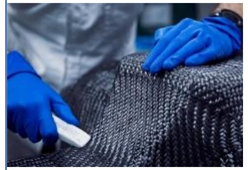
2011

1° Professional Driving Simulator

2012

Dallara USA

2015



DARC & Dallara Compositi

2017

Dallara Stradale

2018

Dallara Academy

2020

Aerospace Business Unit

2021

Dallara EXP

2024

Axiom AX-3

BUSINESS UNITS

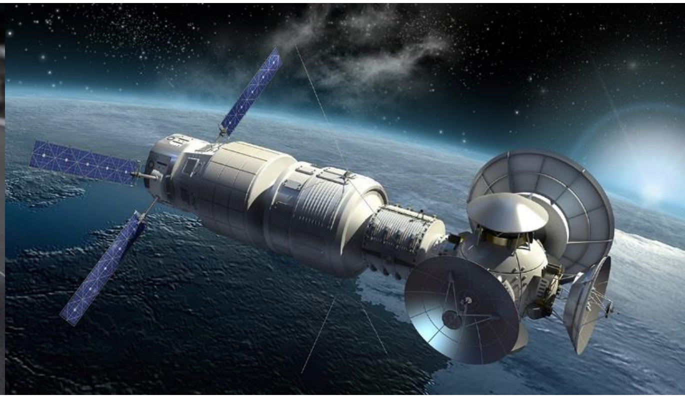
RACING

- Engineering consultancy
- Prototype & series production
- Services
- Race car & worldwide spare parts support

AUTOMOTIVE

- Engineering consultancy
- Prototype & series production
- Services
- Dallara Stradale

AEROSPACE



- Engineering consultancy
- Prototype and series production
- Services
- Engineering Delivered Solutions

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DALLARA EXPERTISE

CORE

COMPETENCIES

Full Vehicle

LIGHTWEIGHT DESIGN & STRUCTURAL OPTIMIZATION

HOLISTIC PERFORMANCE SIMULATIONS

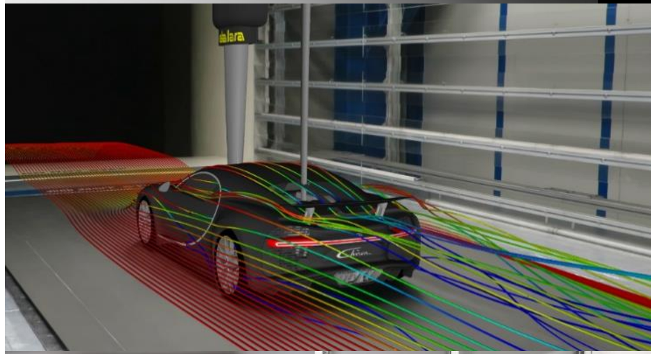
- Vehicle dynamics
- Passive and Active Cooling Systems
- ICE & Electric Power Train

AERODYNAMICS

ELECTRONIC ARCHITECTURE & DEVELOPMENT

PRODUCTION & ASSEMBLY

INDOOR & FULL VEHICLE OUTDOOR TESTING



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PROJECTS &
COLLABORATIONS

RACING


Formula 1


Formula 2


Formula 3


Formula E


Indycar


Indy NXT


Super Formula


Super Formula Lights


LMDh BMW


LMDh Cadillac


Nascar


Dallara 324


Indy Autonomous


LMH


UAE Autonomous


Moto GP

dallara

AUTOMOTIVE

Dallara Stradale

Dallara Stradale EXP

dallara

AEROSPACE

SPACEX

AXIOM SPACE

dallara

DALLARA ACADEMY

DALLARA EXPERIENCE

HUB

dallara

EDUCATION

LABORATORI DIDATTICI

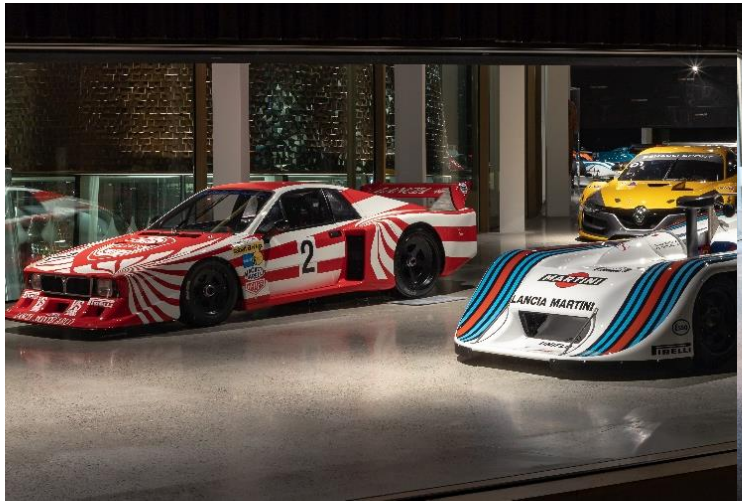
UN ER MOTOR VALLEY UNIVERSITY OF EMILIA-ROMAGNA

PURDUE UNIVERSITY

dallara

ENTERTAINMENT

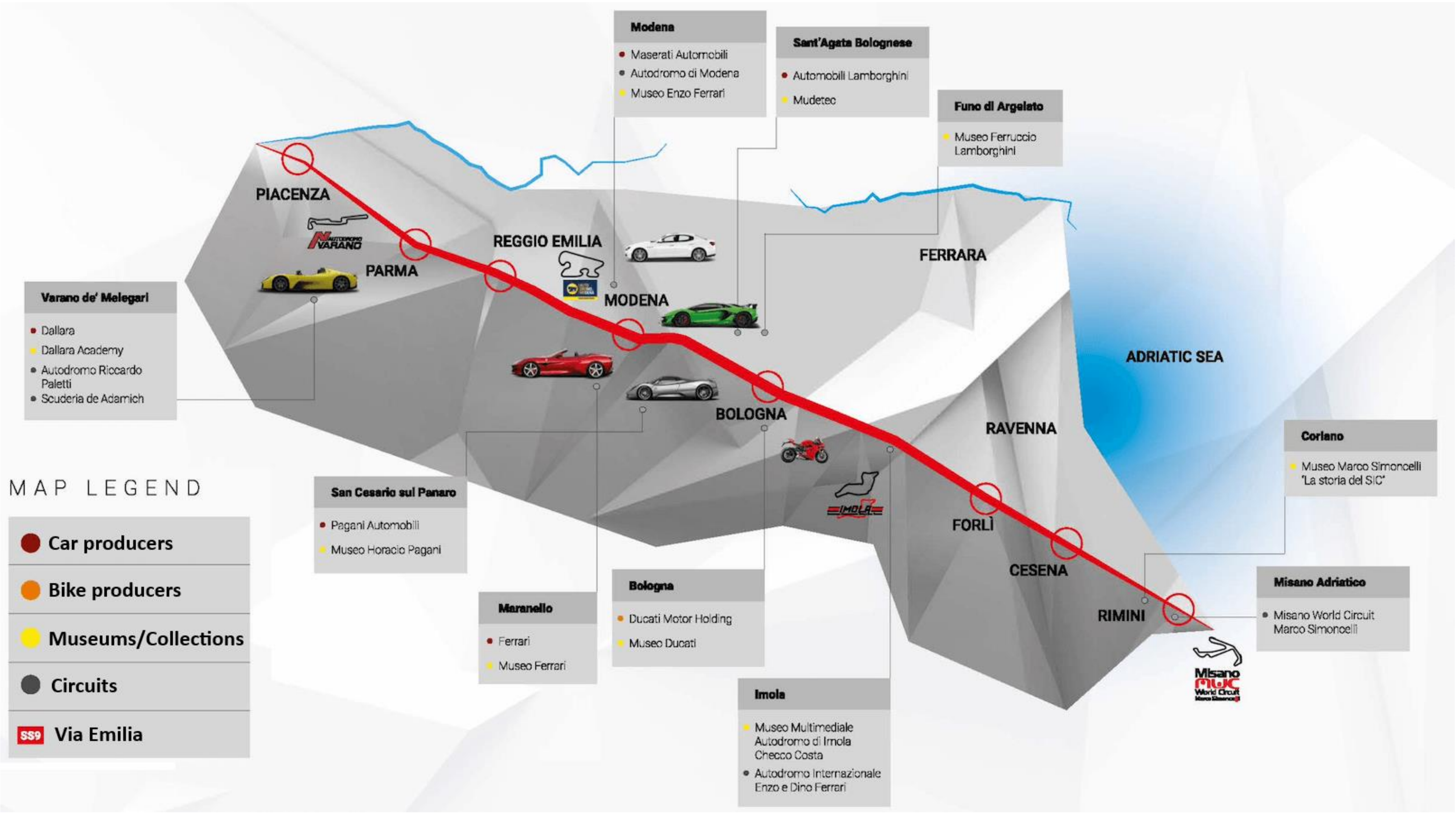
EXHIBITION AREA



EVENTS

MOTOR VALLEY

www.motorvalley.it



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Facebook.com/DallaraGroup

Instagram.com/dallaragroup

Linkedin.com/company/dallara-automobili

Youtube.com/DallaraGroup

www.dallara.it

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EURECOMP, Advancing Composite Circularity in Europe: **Learning Program**

4th EuReComp Workshop

20.03.2026, Parma, Italy

Dionisis Semitekolos, R-Nano NTUA

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R-NANO

Content Overview

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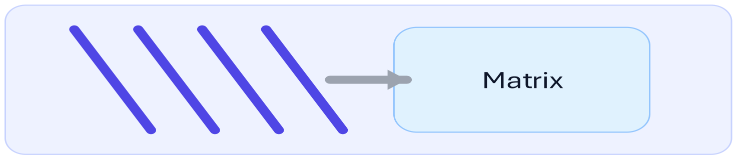
What are Fibre Reinforced Composite Materials?

A lightweight material made by combining strong fibres with a binding matrix.



Fibres carry most of the load and add stiffness/strength.
Matrix binds the fibres, transfers load, and protects them.

Main parts

Common fibres: glass, carbon, aramid.
Common matrices: epoxy, polyester, thermoplastics.

Why use them?

High strength-to-weight ratio, corrosion resistance, and the ability to tailor properties.

Typical uses

Aircraft parts, wind turbine blades, sports equipment, cars, and construction panels.

In simple terms: fibres provide strength, while the matrix holds everything together and gives the material its final shape.

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Why recycle fibre reinforced composite materials?

Recycling keeps valuable fibres in use and reduces the environmental burden of end-of-life composite waste.

Why it matters

- Keeps bulky thermoset waste out of landfill and low-value disposal.
- Recovers high-value fibres, especially carbon fibre, for second-life use.
- Lowers demand for virgin fibre in wind, aerospace, automotive and sport.

Waste FRP → Recovered fibres → Reuse

The 3 main recycling approaches

Mechanical recycling

- Cut, shred or mill scrap into flakes, powder or short fibres.
- Used mainly as filler or in lower-cost reprocessed products.
- Simple and low-cost, but fibre length and performance are reduced.

Thermal recycling (pyrolysis)

- Heat the composite with little or no oxygen to decompose the resin.
- Recovers fibres; gases, oils and char are by-products and fibres often need cleaning.
- Better fibre recovery than mechanical recycling, but heat demand is higher.

Chemical recycling (solvolysis)

- Use solvents to depolymerize or dissolve the resin matrix.
- Can recover cleaner, longer fibres and sometimes resin-derived chemicals.
- Highest-quality recovery potential, but process complexity and cost are higher.

Rule of thumb: mechanical = simplest, pyrolysis = robust fibre recovery, solvolysis = highest-quality recovery.

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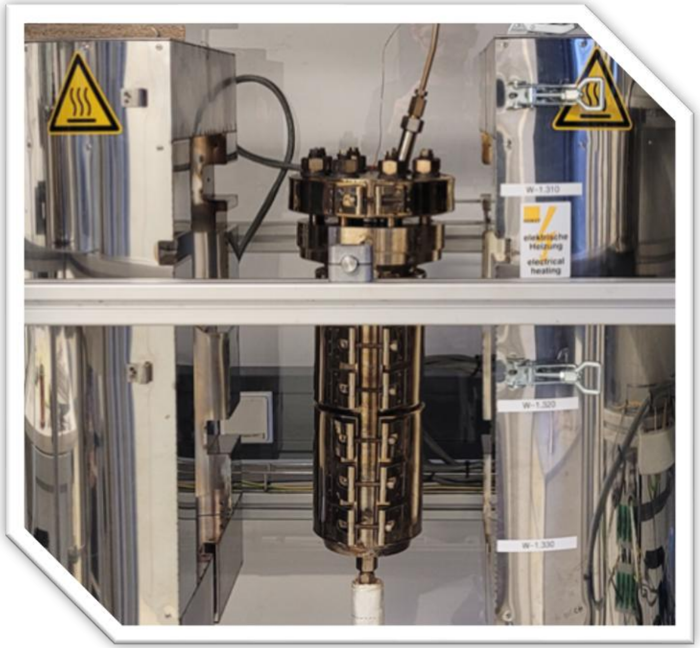
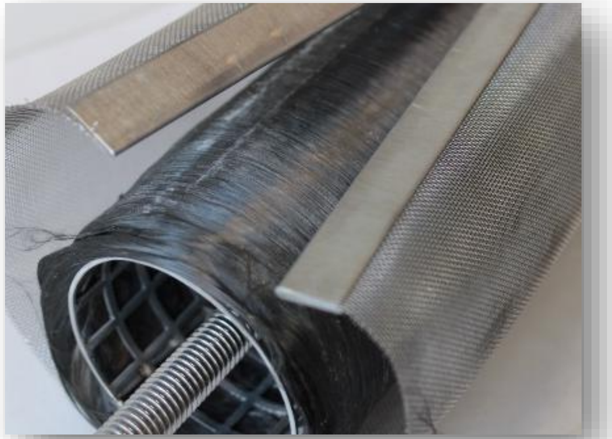
EuReComp Recycling Route

Dallara hood scrap

B&T composite tubes



Supercritical water solvolysis reactor



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Major Results

Racing Seat

Steering Wheel

Floating PV

Automotive Shaft

Rocca Cabin

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Goals

To develop and integrate novel solutions for a **higher reuse** of whole products and components

- ROCCA Demonstrator (APM)
- Floating PV Demonstrator (INEGI/HTWK)

To develop tools to demonstrate the **circularity** and the **environmental benefits** of the solutions tested

- Holistic Index Tool (UPAT)
- Traceability platform (CIRC)
- Life Cycle Assessments (IRES/SUT)

To consider the **co-design of learning resources** together with local and regional educational organizations for current and future generations of employees

- Learning Platform (NTUA)

To propose innovative **dismantling** and **sorting** systems enabling reuse and recycling of complex composite materials

- Smart Decision Tool (AIMEN)

Pilot demonstration of reuse/recycling approaches of composites & secondary raw materials

- Solvolysis processes (WP4)
- Automotive Shaft (B&T Composites)
- Steering wheel (DALLARA/BIOG3D)
- Racing seat (DALLARA/INEGI/ITA/NTUA)

To consider the **co-design of learning resources** together with local and regional educational organizations for current and future generations of employees

- Learning Platform (NTUA)

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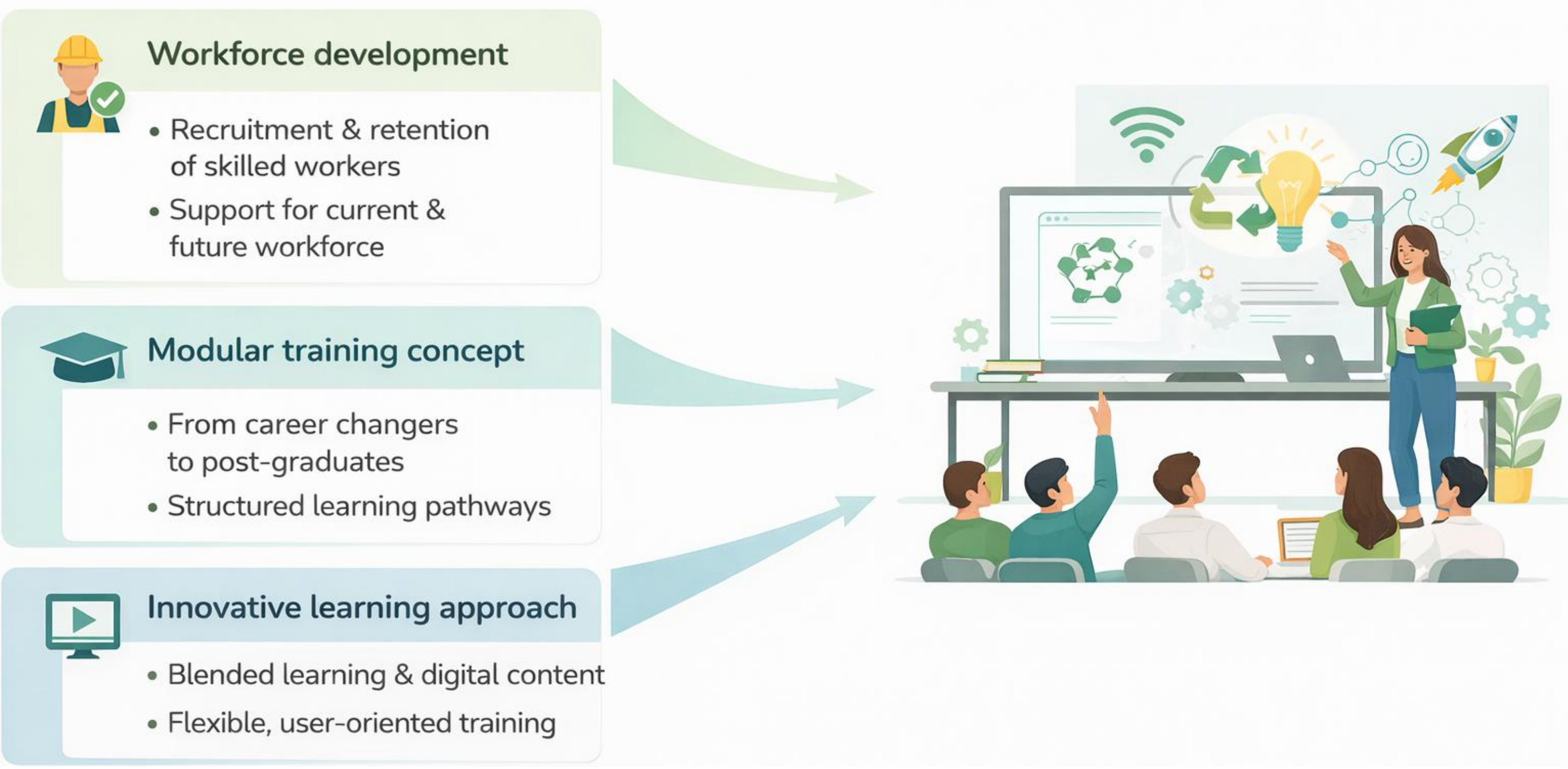
Implementation of training and life-long learning



GA Objective
Obj 1: Insurance of the **recruitment** and retention of skilled **workers** from current and future employee generations **through a comprehensive training and life-long learning** concept for the technologies developed in EuReComp.
Obj 2: **Modular training concept** depending on **technical/qualification level** – from career changers to post-graduates.
Obj 3: **Innovative learning** and teaching methods; blended learning, augmented reality, flexibly adjusted to individual focal points, **learning tempos** and regional social needs

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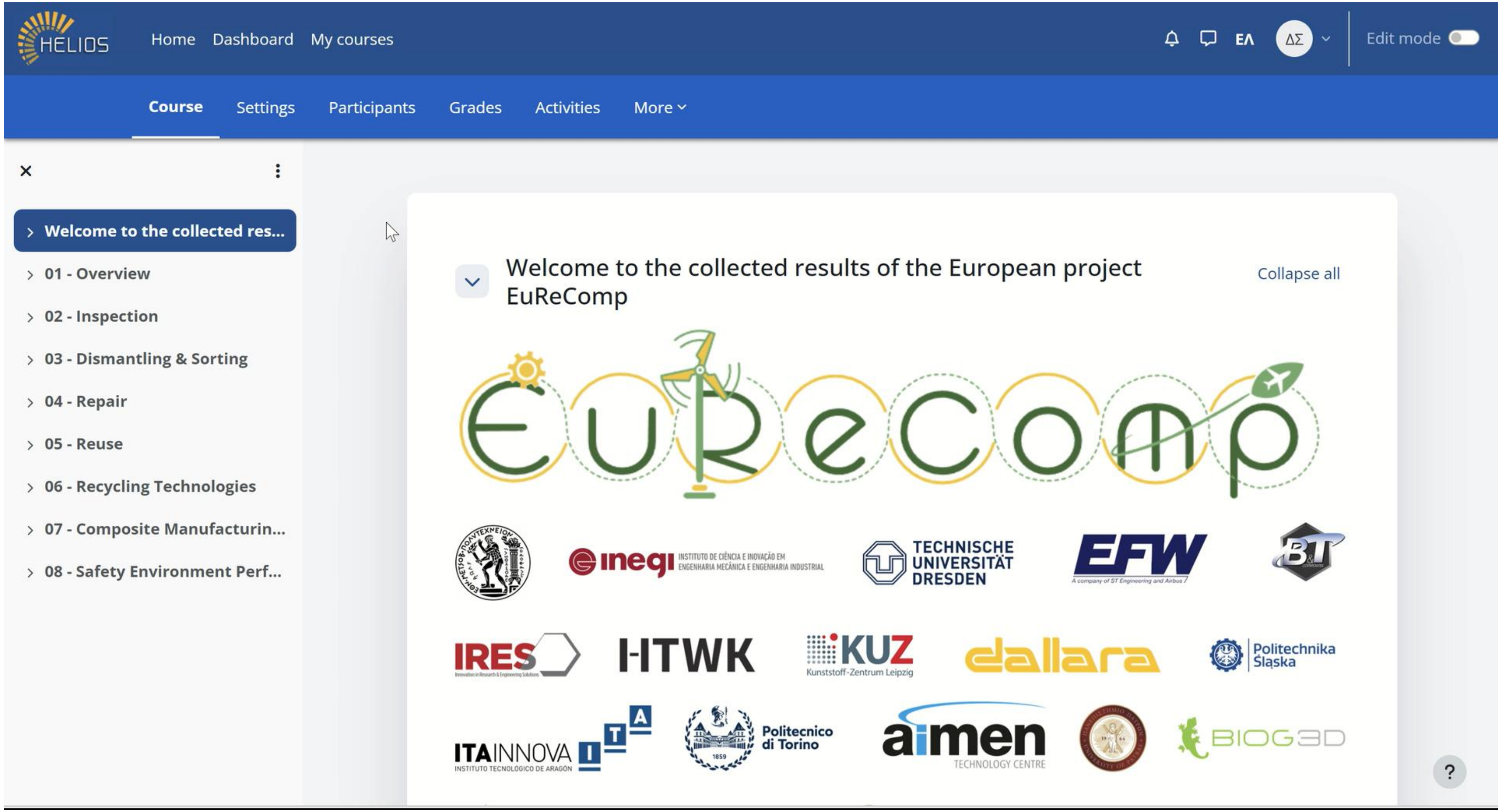
E-learning program



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WP7 –Task Updates: Open Days

Demonstration of EuReComp's Pre-preg pilot line

Extrusion line for 3D printing filament production

Demonstration of CVD reactor and CNTs growth from solvolysis wastes

Presentation of EuReComp's 2nd Gen demonstrators

Students' visits to our laboratories, introducing and **training** them to the **project's experimental processes and techniques.**

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Future Plans

1. Run a pilot demonstration of the Learning program starting late April – early May.

2. Receive feedback from colleagues who undertook the pilot.

3. Fine tune the content of the Learning program based on pilot's feedback.

4. Implement the full optimized course on the Postgraduate program of Materials Science & Technology in school of chemical engineering of NTUA on summer period 2027.

5. Run necessary procedures to establish the learning program in the e-learning platform of NTUA, while constantly upgrading the content based on recent technological trends.

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Join our Pilot

Announcement of the participants via e-mail.

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Thank you!

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R-Nano NTUA

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Consortium

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dallara

AUTOMOBILI

EuReComp

Automotive components with recycled materials

Chiara Pernechele

Material Science Lead Engineer

Dallara Automobili

Introducing Myself

Chiara Pernechele Material Science Lead Engineer

Master degree in Physics

PHd in Material Science

10 years of Academic Research

11 years of Applied Research in private Company (from 2015 in Dallara)

Field of expertise:

Properties of materials

Development of innovative materials, circularity

Thermal and thermomechanical material characterization

Support at homologative tests for racing and automotive

Adhesives and bonding processes

Recycled materials in automotive and racing components

Eurecomp Challenges

The transition toward widespread adoption of recycled composite materials is accelerating in both motorsport and mainstream automotive manufacturing. However, the pace and maturity of the solutions differ significantly between the two sectors due to very different performance and safety requirements. This is a clear trend that is pushed by decarbonization and circular economy

Some of the viable concerns are:

- Reduced Performance
- Inconsistency between different batches
- Increased costs
- Durability

AUTOMOTIVE
Interiors
Underbody panels
Noise insulation

Bio composites or biodegradable polymers

RACING

Recycled carbon fiber

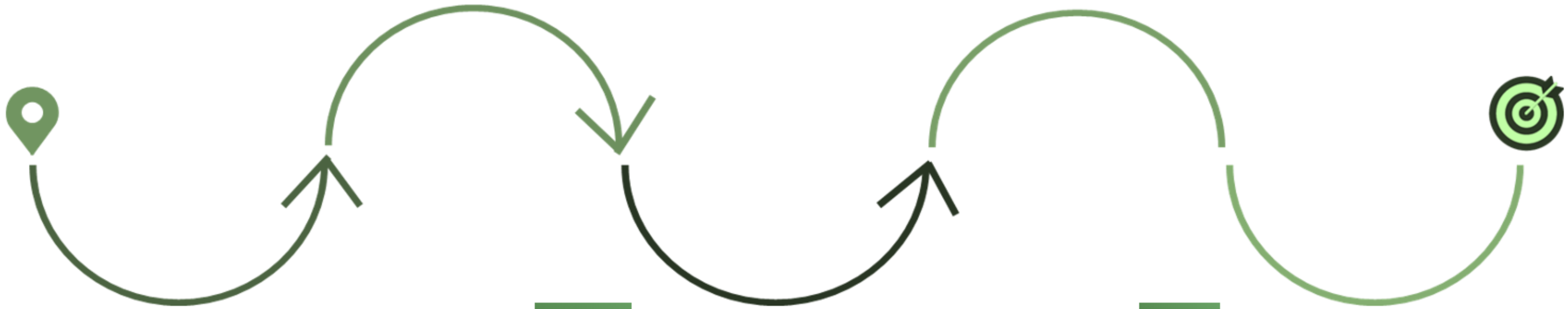
Bio based resins
…

Eurecomp Project

Overview and objectives

To propose innovative **dismantling** and **sorting** systems enabling reuse and recycling of complex composite materials

To develop and integrate novel solutions for a **higher reuse** of whole products and components



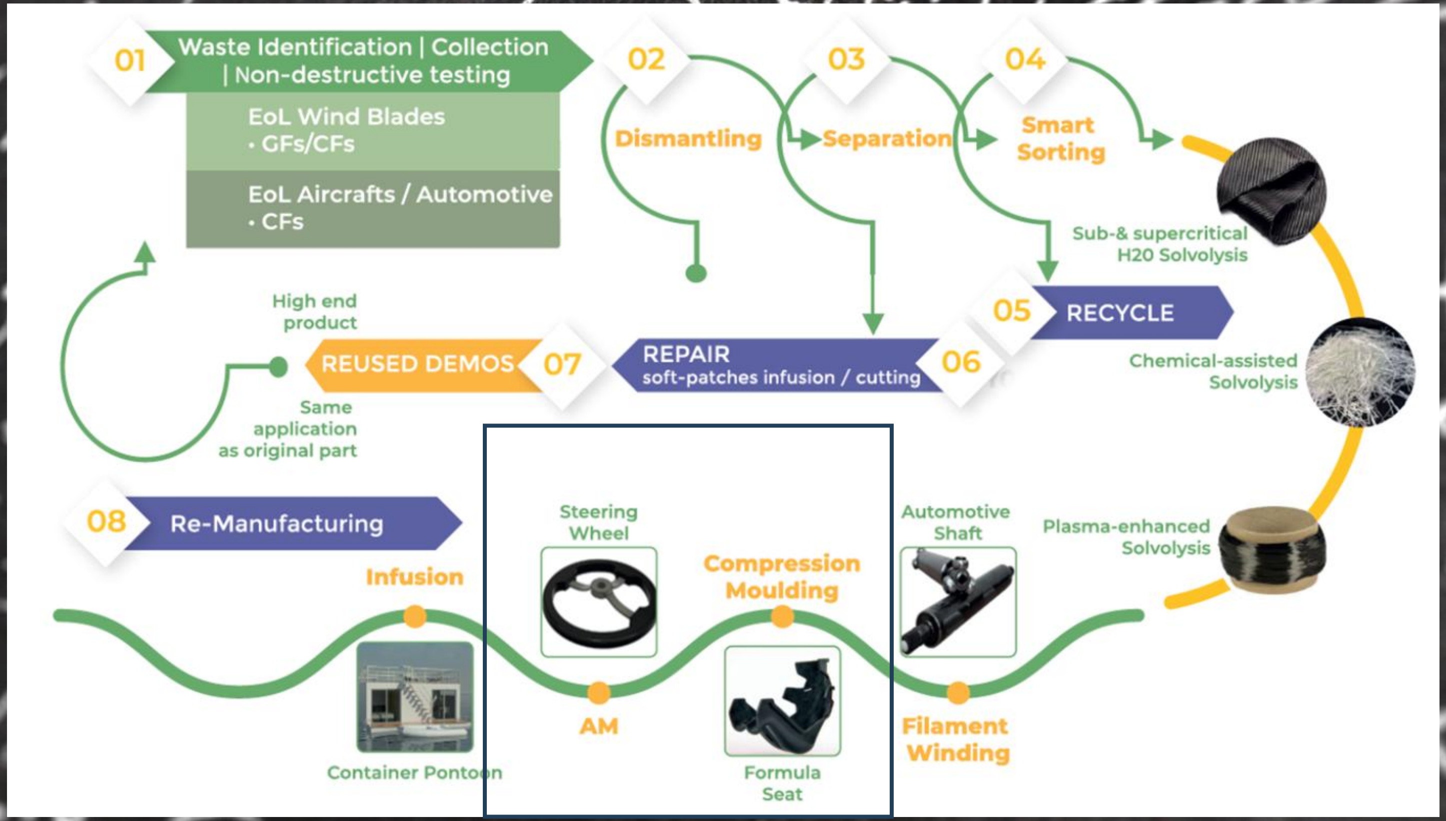
Pilot demonstration of reuse/recycling approaches of composites & secondary raw materials

To develop tools to demonstrate the **circularity** and the **environmental benefits** of the solutions tested

To consider the **co-design of learning resources** together with local and regional educational organizations for current and future generations of employees

Eurecomp Project

Overview and objectives



Recycled materials in automotive and racing components

Demonstrators

Recycled materials in automotive and racing components

Steering wheel

An automotive steering wheel is a multifunctional component that must satisfy a wide range of functional, ergonomic, regulatory, and perceived-quality requirements.

Its design combines mechanical performance, safety integration, electronic systems, and customer expectations.

In the framework of **Eurecomp** project we concentrated in the realization of a steering wheel in which

- good surface quality
- customization
- mechanical performance

By means of

- recycled carbon fiber filled materials
- and additive technology.

Several challenges were identified and tackled, starting from the filament production, the design up to the warping phenomenon.

Recycled materials in automotive and racing components

Racing seat

Challenge:

To realise a **racing seat** by **compression moulding** with **recycled carbon fiber materials**

Why Racing seat?

Racing seats made from composite materials—primarily carbon-fiber-reinforced polymers (CFRP)—play a crucial role in motorsport safety and vehicle performance. Their design must balance lightweight construction, crash energy management, stiffness, ergonomics, thermal stability, and strict FIA homologation standards.

With our demonstrator we wanted to propose a different approach in the manufacturing route together with the innovation of used recycled carbon fibers after having demonstrated their equivalency in terms of mechanical properties

Recycled materials in automotive and racing components

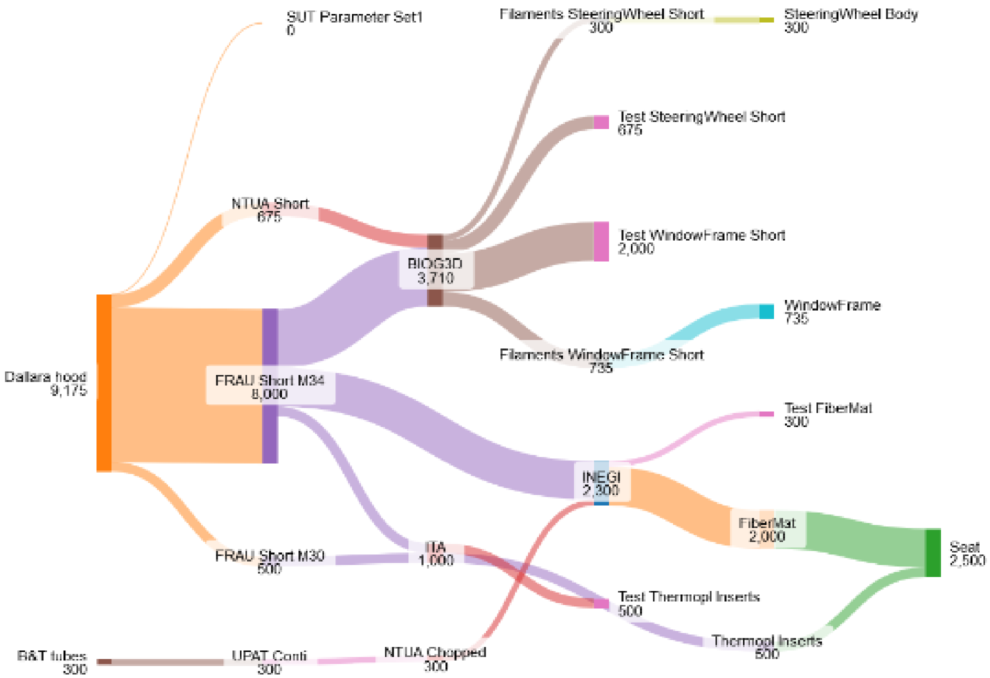
Materials

WP4 – What was achieved

General activities - short fibre material flow chart

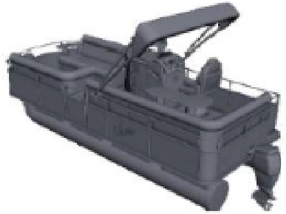
Dallara hood scrap

B&T composite tubes



3D-printed steering wheel body

3D-printed window frames



SMC fiber mats thermoplastic inserts

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National Technical University of Athens

TECHNISCHE UNIVERSITÄT DRESDEN

Politechnika Śląska

Fraunhofer

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Recycled materials in automotive and racing components

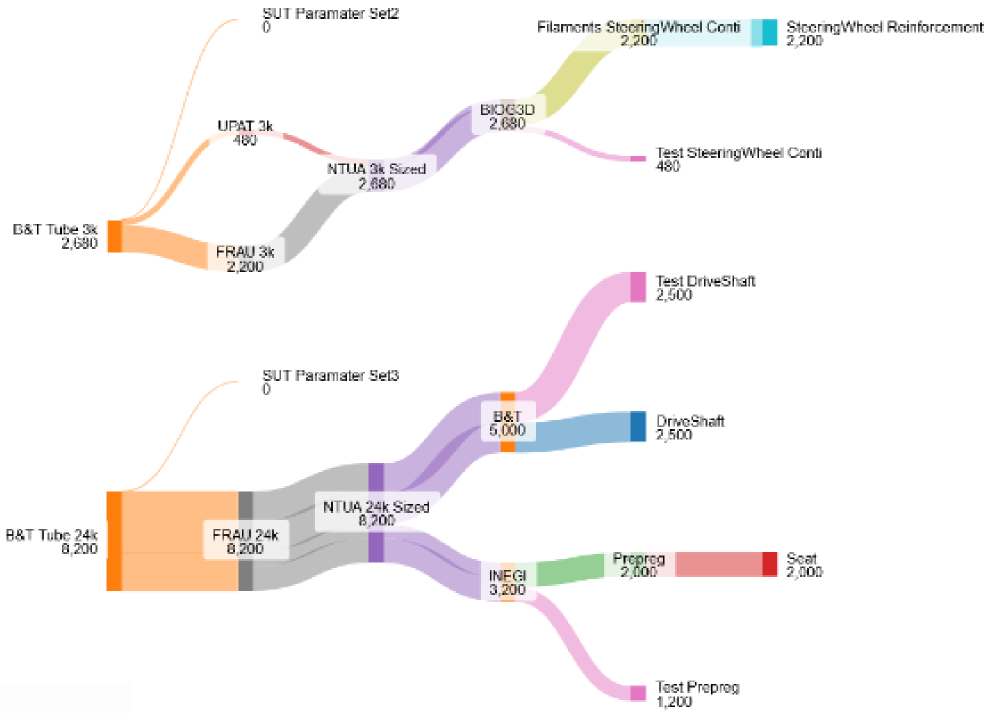
Materials

WP4 – What was achieved

General activities - continuous fibre material flow chart

B&T Composite Tubes, 3k Rovings

B&T Composite Tubes, 24k Rovings



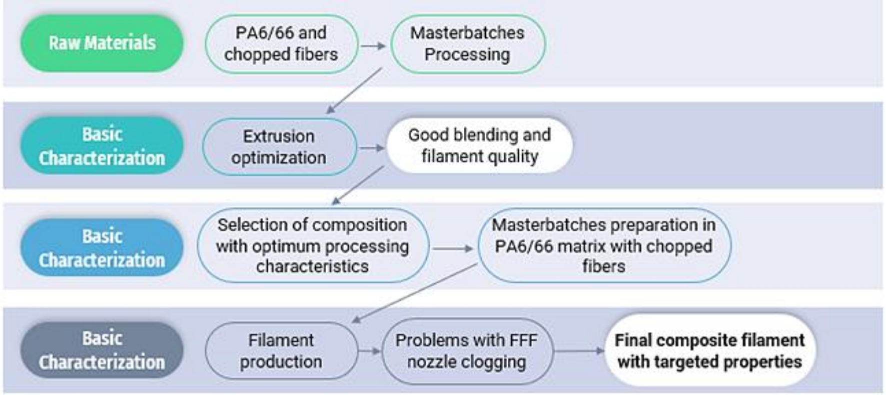
3D-printed steering wheel stiffener

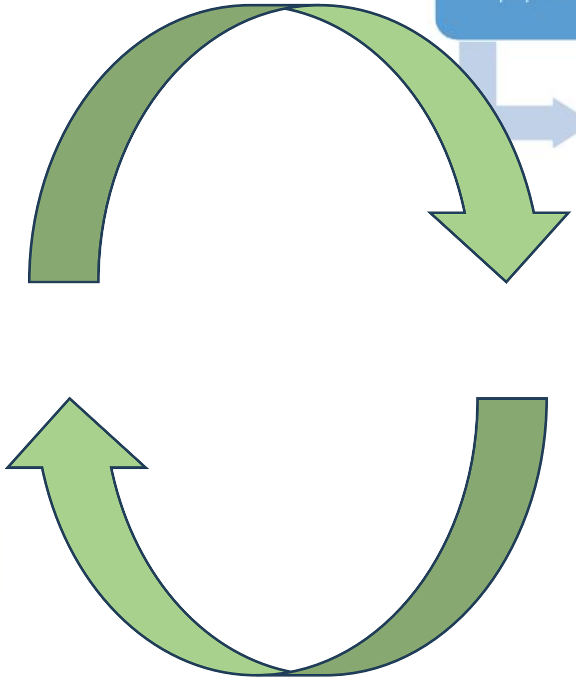
Drive shaft filament winding

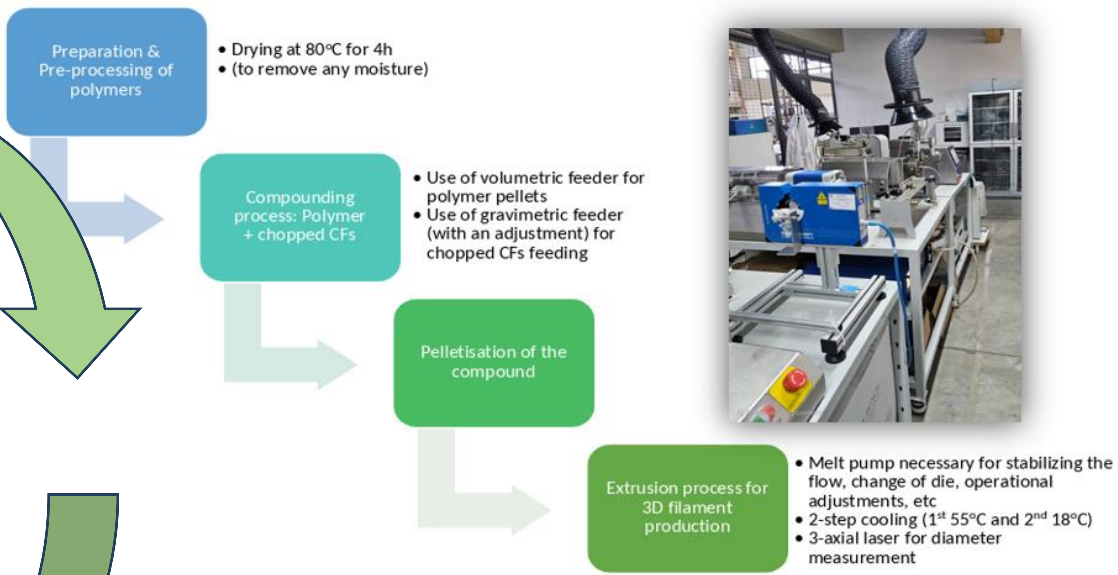
Racing seat prepreg

Recycled materials in automotive and racing components

Steering wheel



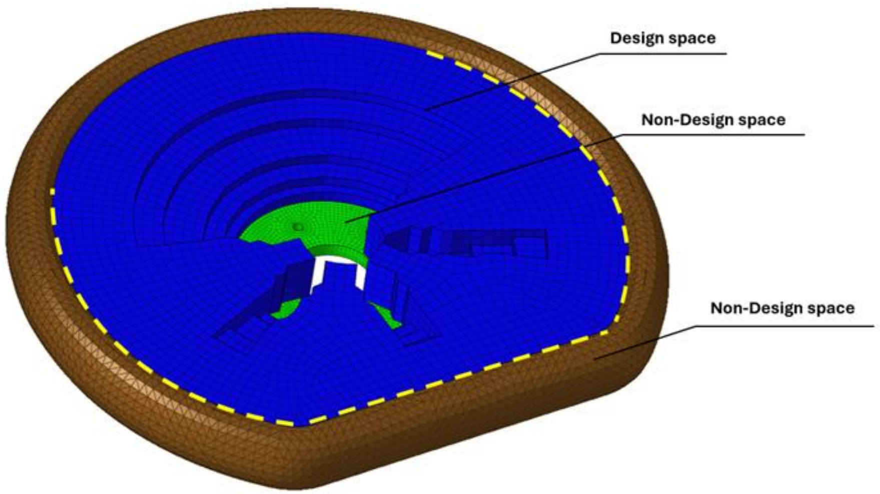




Recycled materials in automotive and racing components

Steering wheel: Design

- Virtual design approach based on topological optimisation
- Component was divided in design/non design phase:
    - Non-design space: it corresponds to the fixed features of the steering wheel, such as the external rim and the central body, which connects the component to the steering axle.
    - Design space: it is the volume in which the optimization algorithm can vary the steering wheel geometry according to the set objective and constraints.

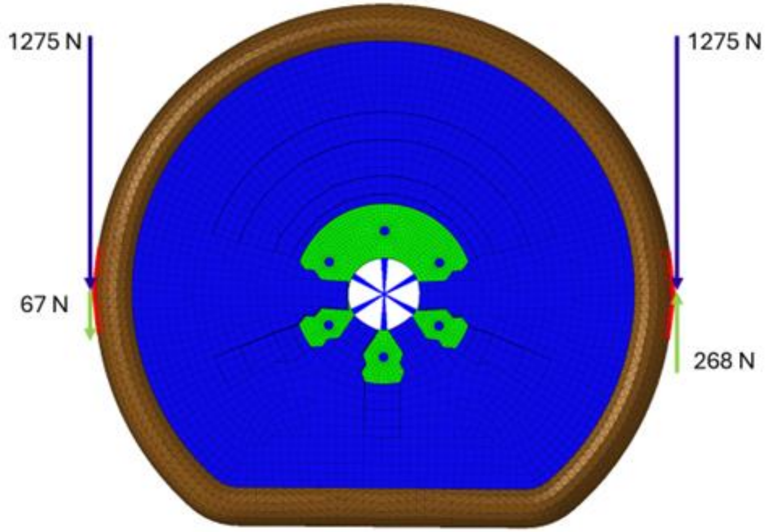


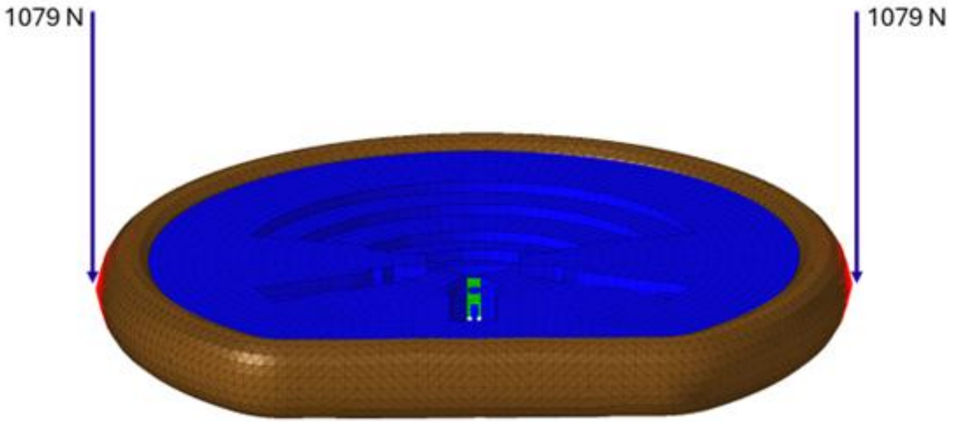
Recycled materials in automotive and racing components

Steering wheel: Design

Load cases derived from real manouver:

- Turning load case (LS1): It simulates the scenario in which the driver is taking a turn and a bump simultaneously. A 90° steering angle is assumed, while 2550 N of centrifugal force and 54 Nm of steering torque are applied in the plane perpendicular to the steering axis.
- Impact load case (LS3): 2158 N are applied downwards along the steering axis direction.

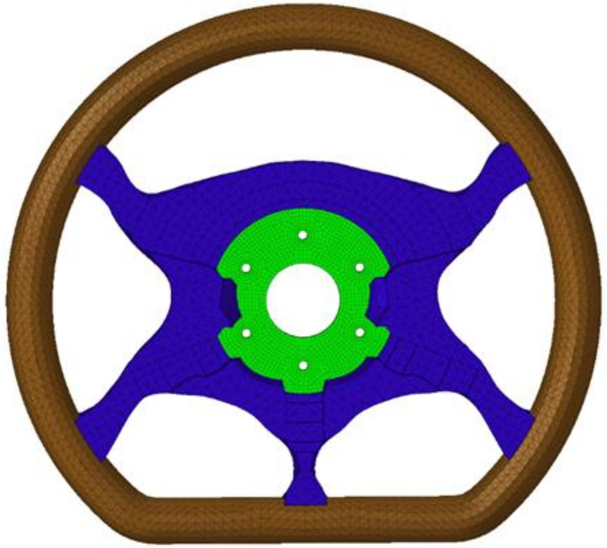




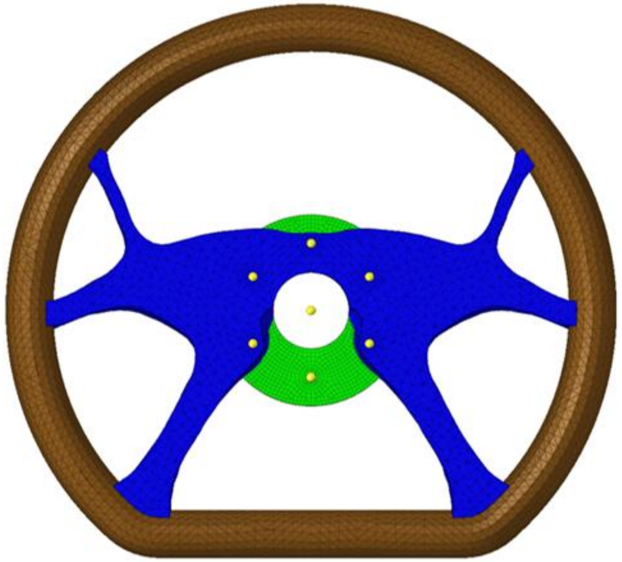
Recycled materials in automotive and racing components

Steering wheel

- Once the material was characterised, the first optimisation run with benchmark commercial material properties was changed



Benchmark material 1,350 Kg



Project material 1,450 Kg

Material	ρ [kg/dm³]	E_1 [MPa]	E_2 [MPa]	E_3 [MPa]	ν [_]	G_{12} [MPa]	G_{13} [MPa]	G_{23} [MPa]
Project material	1.25	2495	2495	1305	0.4	891	891	891

Material	UTS_1 [MPa]	UTS_2 [MPa]	UTS_3 [MPa]
Project material	34.8	34.8	16.8

Recycled materials in automotive and racing components

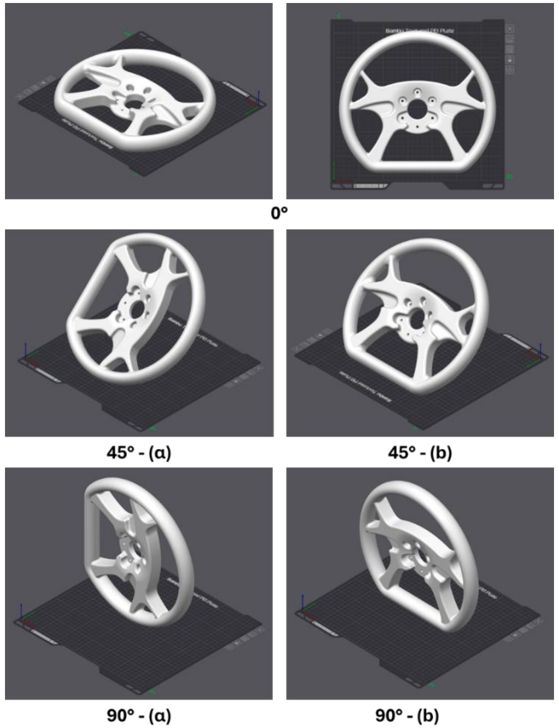
BIOG3D

Steering wheel: technological challenges

Orientation	Mechanical strength	Warping risk	Surface finish (visible faces)	Support amount	Print time
Flat (0°)	High	High	Smooth top, very low stepping; bottom = bed texture.	Low	Short–Medium
Diagonal (45°)	Moderate	Moderate	Moderate–high stepping on face; likely needs finishing.	Moderate–High	Medium–Long
Vertical (90°)	Low	Low	Clean sidewall, very low stepping	Moderate–High	Medium–Long

Despite the superior mechanical properties of the flat orientation, there are **considerations** in terms of:

- **Material**: PA-CF is warping-prone
- **Geometry**: large flat surface + requirement for 100% infill can significantly increase the **thermal stresses** during printing.
- **Equipment**: due to the material, geometry and infill combination, printability is considered challenging even with equipment featuring chamber heating



Critical factor determining **warping risk** (printability): surface/cross-sectional area per layer

Positioning the part at 45° and 90°: **surface area** is significantly reduced.

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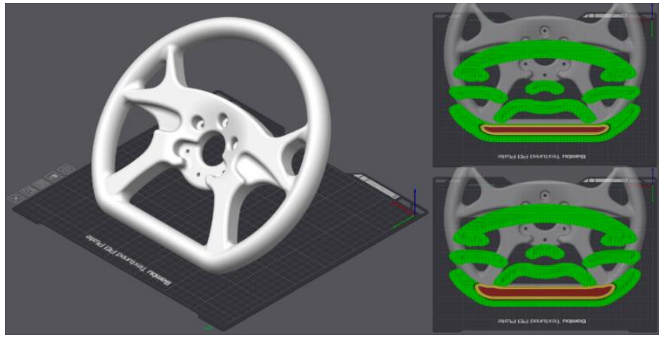
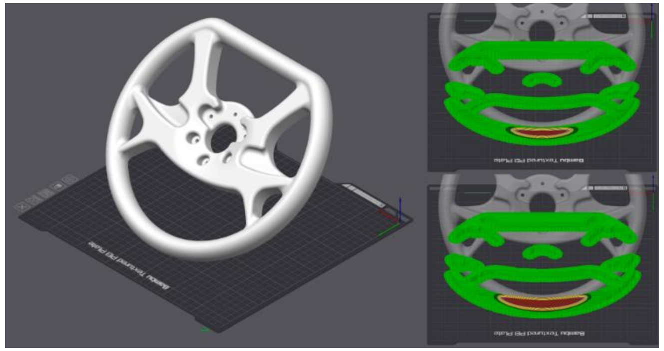
Steering wheel

- Different Printing strategy appeared to be necessary (angle, heated chamber, variable infill…)
- Warping was an important issue (it could be mitigated but it was enhanced by the rCF filament





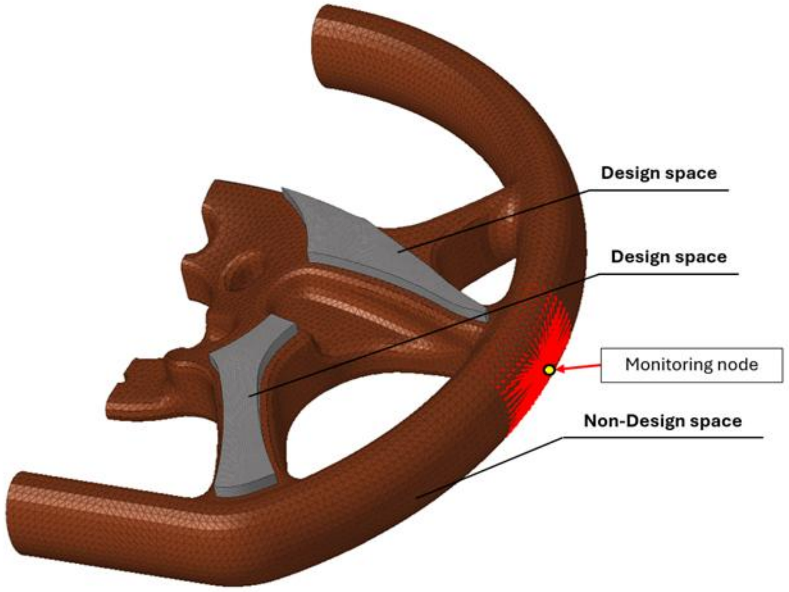
Steering wheel design with increased fillets in two alternative 45°-(b) orientations: initial (top) and reversed (bottom), 100% infill
Printing completion up to 98% due to filament issues

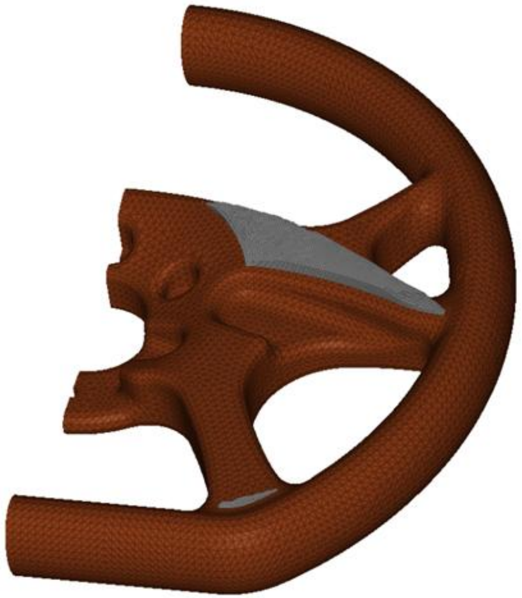
Recycled materials in automotive and racing components

Steering wheel

Last step of the steering wheel design is designing the inserts to be glued on the upper face of the steering wheel to enhance its strength and stiffness in the considered load cases. Such inserts will be printed by FDM of continuous carbon fibre.

As for the steering wheel, inserts geometry is defined by mean of a topology optimization. This time, only the impact load case (LS3) is considered, as the inserts are intended to improve the component stiffness in this specific scenario.





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Steering wheel

The two inserts were printed

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Steering wheel: conclusion

Realised rCF PA6 filament

Printing through FFD a high quality component

Validate the concept for future applications

Recycled materials in automotive and racing components

Racing seat

Use Recycled long fiber materials

With **compression moulding** technology

To realize a racing seat

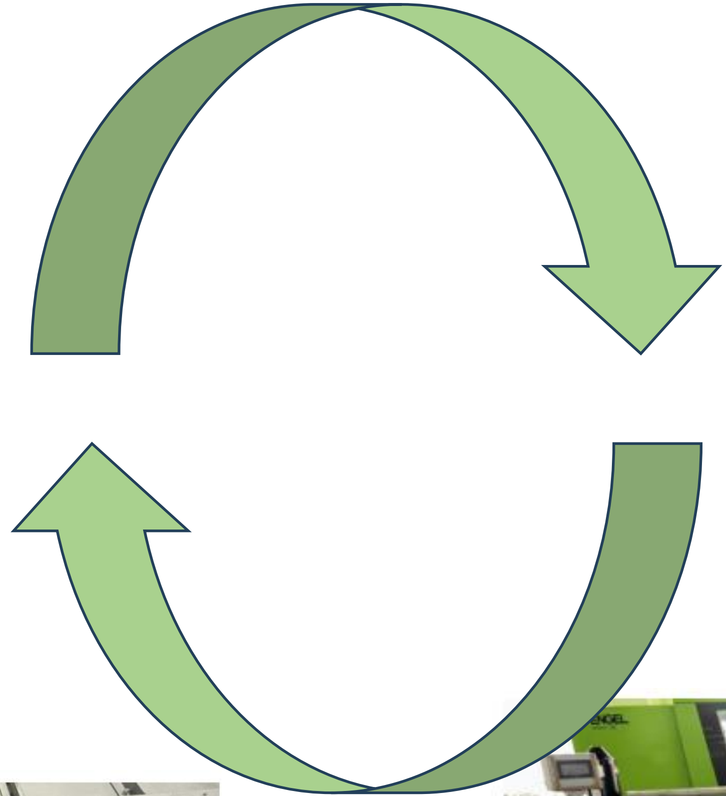
Recycled materials in automotive and racing components

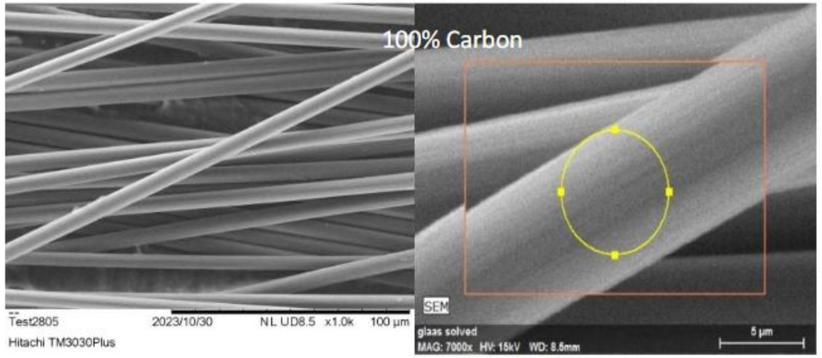
Racing seat: materials

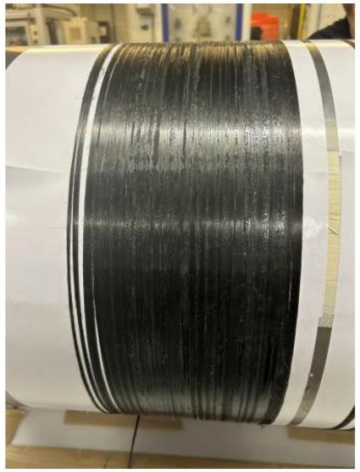

Low scale chemical assisted solvolysis

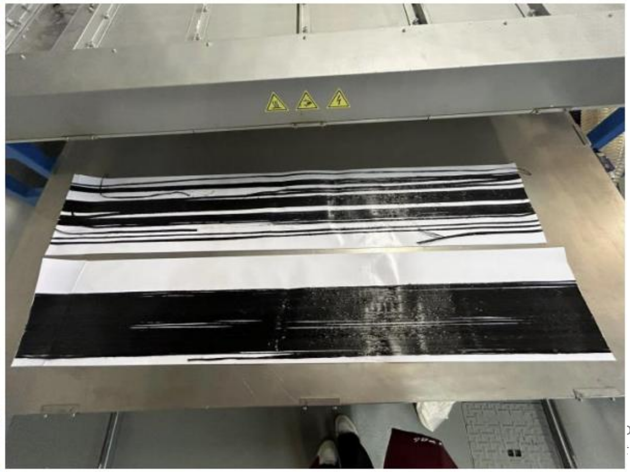

Recycled chopped carbon fibres and liquid product


B&T shaft and recovered continous 24k carbon fibre









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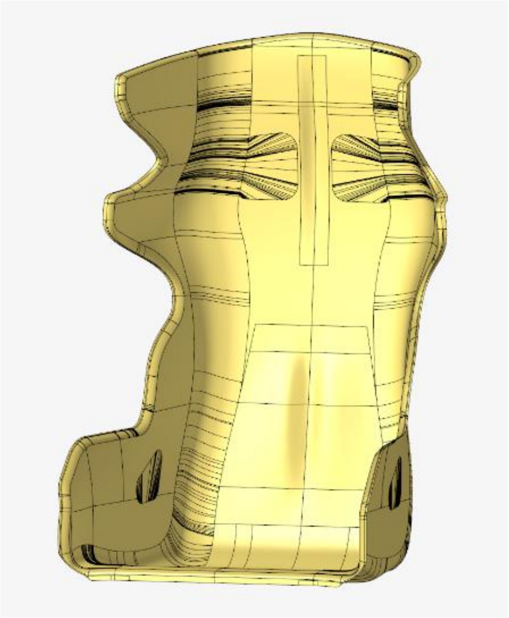
Racing seat: Design

The geometry of the seat was defined and studied in order to take into account the productive process of compression moulding. This technology requires particular attention in case of undercuts and also to insert draft angles to help the component extraction.



Challenges:
Mass production technology
Applied to
Complex geometries

recycled continuous carbon fiber material

Recycled materials in automotive and racing components

Racing seat: Structural constraints for design

Once the geometry is defined, seat sizing is performed. The aim of the sizing activity is making the component compliant with the FIA 8855-2021 standard.
This standard consists in three tests which are considered passed if the seat satisfies the requirements listed in the figure below.

This standard is an evolution with respect to 8855-1999

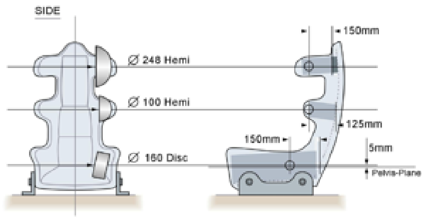
Enhanced protection for head, shoulders and pelvis

It lasts 10 years

Allowed materials CF and GF

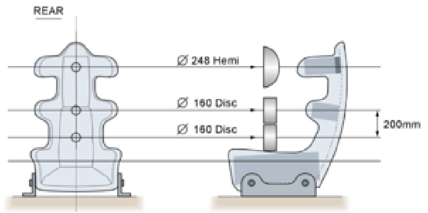
1. SIDE test: 3 pad acting simultaneously

position	*applied load [kN]*	*maximum deflection [mm]*
head	4.2	80
shoulder	6.6	60
pelvis	8.4	40



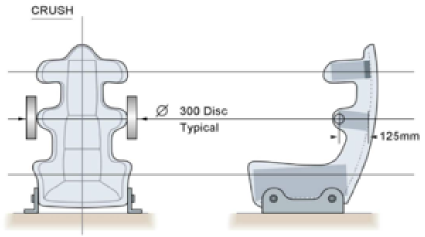
2. REAR test: 3 pad acting simultaneously

position	*applied load [kN]*	*maximum deflection [mm]*
head	4.2	120
shoulder	8.4	100
pelvis	8.4	80



3. CRUSH test: 2 pad acting simultaneously
   the seat must be capable of absorbing 600J of energy without exceeding these limits:

position	*maximum load [kN] per pad*	*maximum displacement [mm] per pad*
shoulder	30	100



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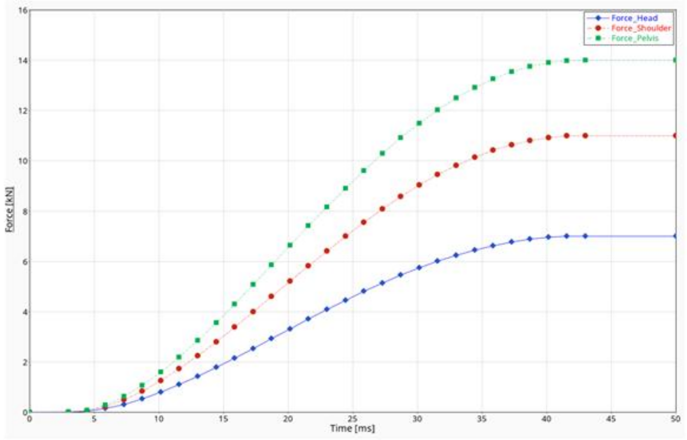
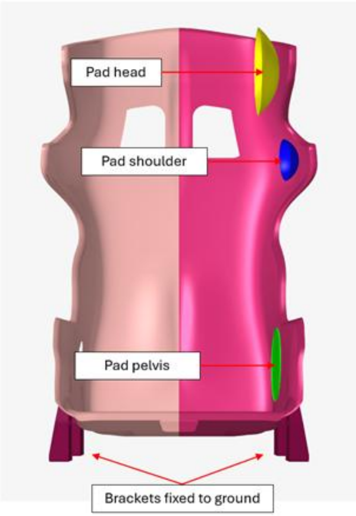
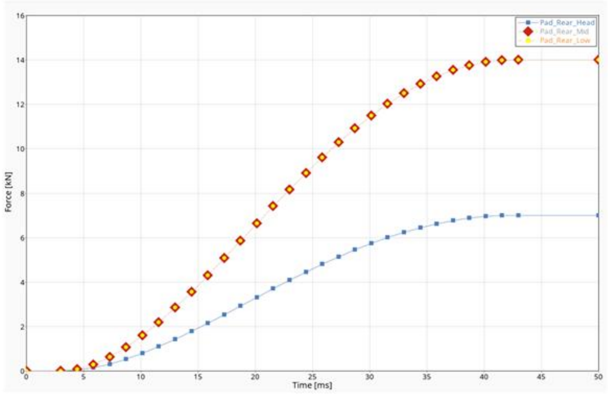
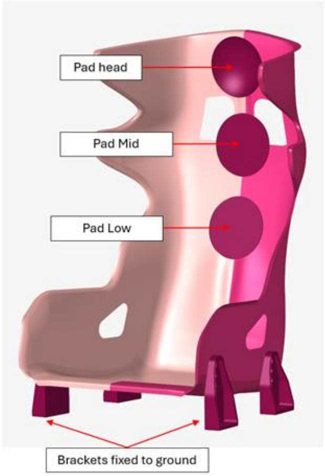
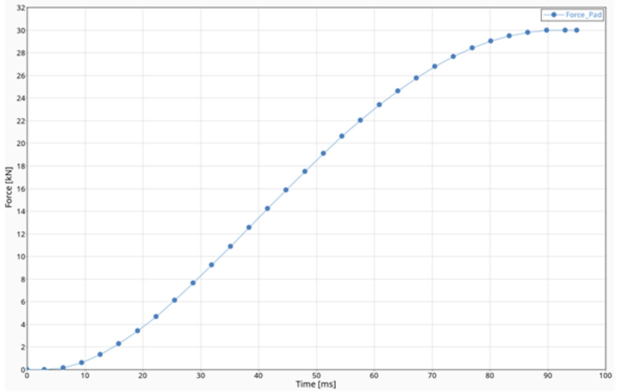
Racing seat: simulation approach











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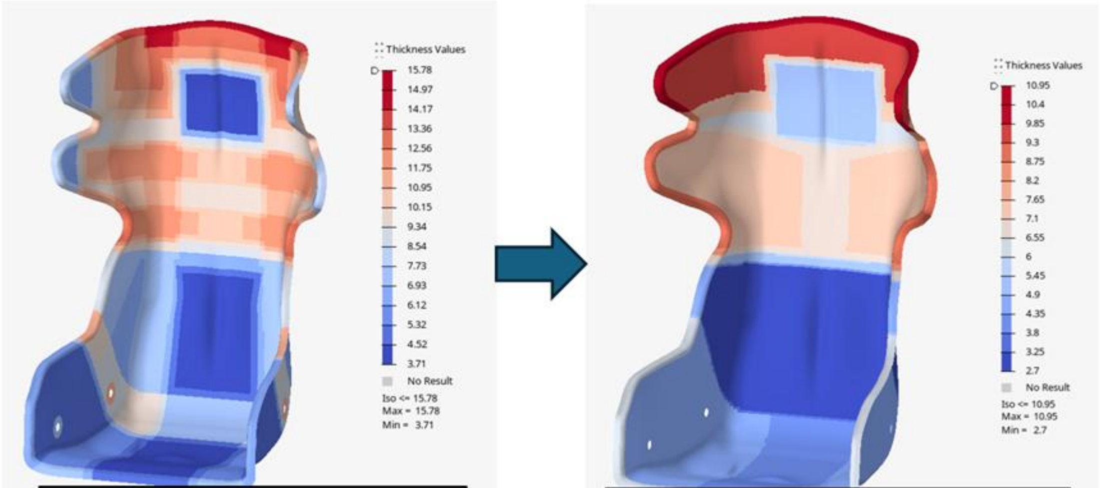
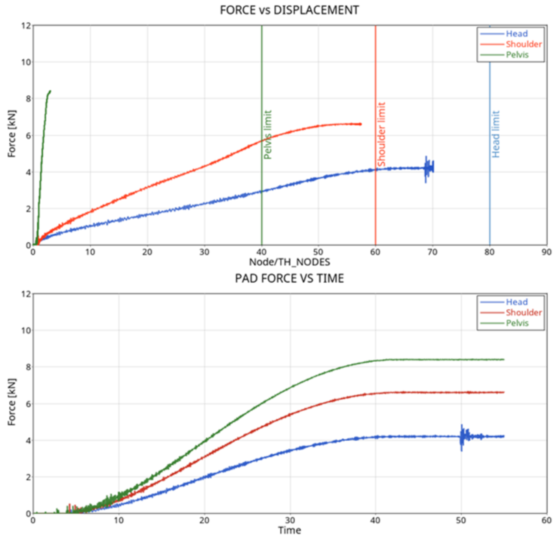
Racing seat: simulation approach



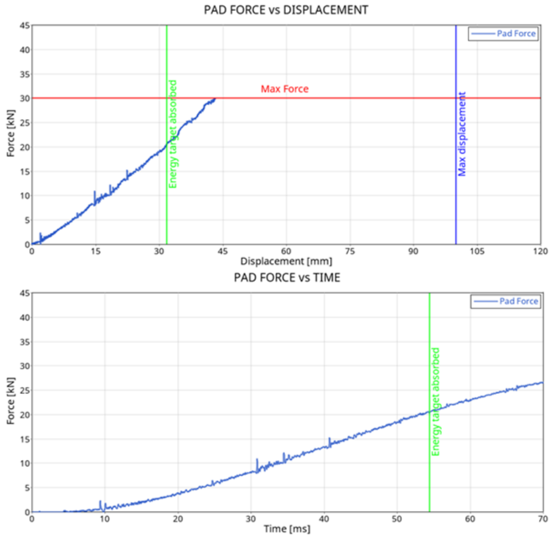
Design at end of sizing activity (Run #023)
Material quantity: 32.7 m²
Weight: 11.9 kg
Weight (w/o inserts): 11.8 kg

Final Design (Run #035)
Material quantity: 30.6 m²
Weight: 11.0 kg
Inserts are out of layup, they are glued afterwards

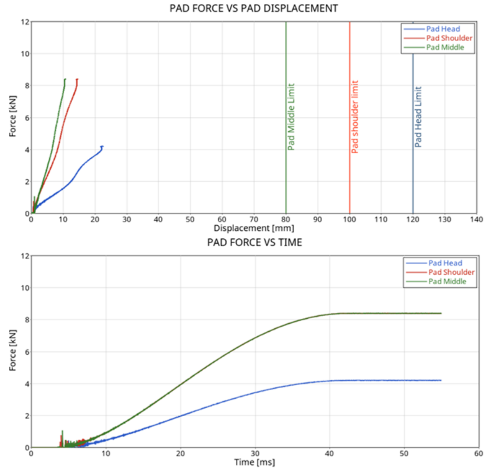
FINAL DESIGN (RUN #035) - SIDE TEST



FINAL DESIGN (RUN #035) - CRUSH TEST



FINAL DESIGN (RUN #035) - REAR TEST



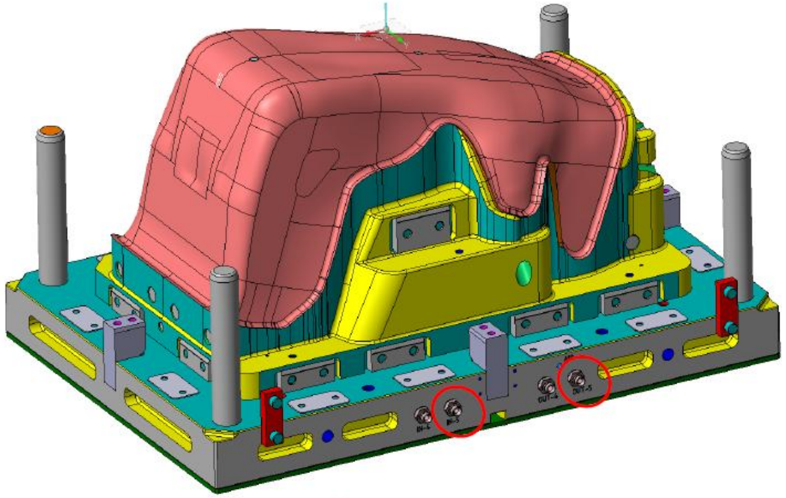
After the sizing activity, the layup has been modified due to the following reasons:

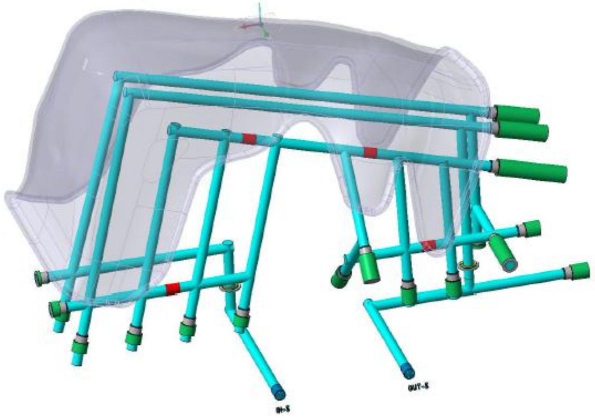
- Design for manufacturing
- Adjustments on material properties
- Adjustments on material ply thickness

Recycled materials in automotive and racing components

Production: Mould

6.2 HEAT CIRCUITS 5 lower side





In order to heat the mould we introduced steam heat technology

Aluminum moulds

5 water curcuits, 6 PT100 to monitor the temperature

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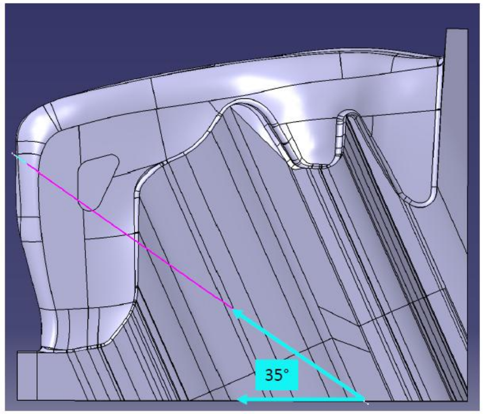
Production: Help Tool LFAM+CNC realised with PVC+CF

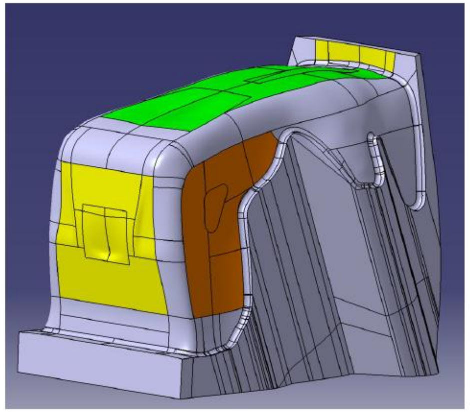
Capped surfaces

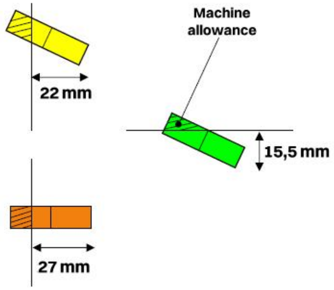
To properly print capped surfaces, a 35° printing strategy was used:



Orientation

Depending on the wall orientation relative to the deposition direction, the effective wall thickness varies across the part.





PROS	CONS
Lighter (110 Kg) Weigth reduction 30% *	Attention to the max pressure
Material saving Waste reduction 30%*	Max operation T 110°C
Lead time reduction 20% *	Max operation p 3 bar
Cost reduction 40%*	
Customization	
No assembly	
Good surface finish	

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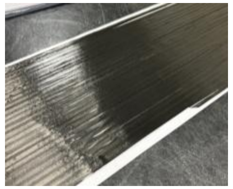
Racing seat production: Lamination of the demonstrator

- Hand lay up



rCF Prepreg

I skin

External skin

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Racing seat production: Press cure of the demonstrator

Seat extracted after the press cure cycle

Phase	Weigth (Kg)
Laminated	16,140
After cure	15,890
After trimming	15,690

Seat area	Glass transition temperature (°C)	Degree of polymerisation
Lateral right	103.22	100%
Lateral left	113.56	100%
Lower	101.69	100%
Upper	108.27	100%

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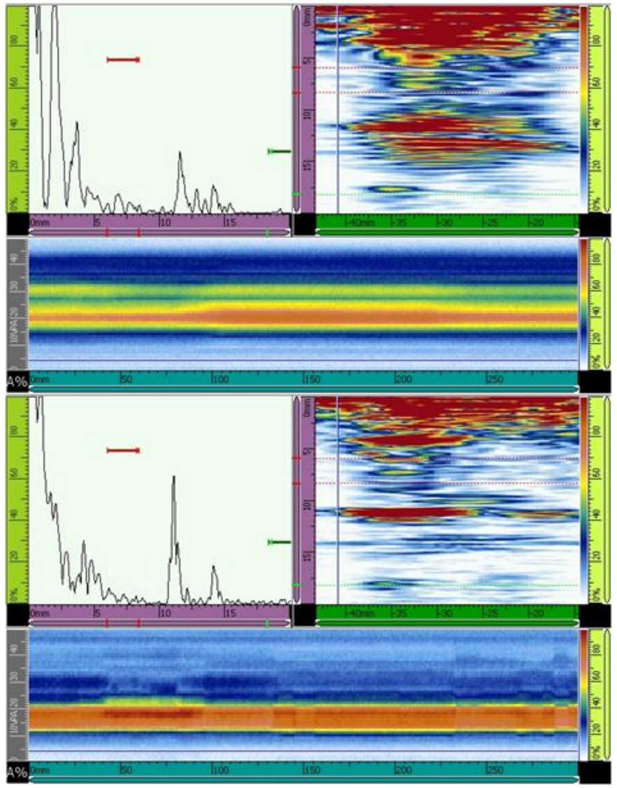
Racing seat: Final demonstrator


Phased array UT check of the final demonstrator





rCF seat upper part and bottom area images showing draping defects and some resin accumulation.

The surface quality of the component seemed to be better with respect to the first prototype, while the UT testing revealed an important presence of voids and defects:

Material compaction, difficulty in removing air trapped within the Ud layers

Recycled materials in automotive and racing components

Racing seat: Conclusions

- We demonstrated the possibility of using rCF for II generation demo production without losing mechanical properties
- We demonstrated the feasibility of using compression moulding to produce complex shapes
- We introduced a new heating technology combined with structural compression moulding

Recycled materials in automotive and racing components

Conclusions and perspectives

Recycled Carbon fibers based materials shows very promising applications, in the framework of this project they were applied to Racing and automotive products

Compression moulding and FFD are viable candidates to produce Recycled carbon fibers components

Racing seat realised by compression moulding could open the path to the mass production with this technology

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Youtube.com/DallaraGroup

www.dallara.it

Infusion-Based Hybrid Cabin Using Recycled or Reused Composites

4 th Eurecomp Workshop

March 2026 | Varano de Melegari, Italy, Dallara Automobili S.p.A

This project has received funding from the European Union's Horizon Europe research and innovation programme under grant agreement No 101058089.

Our Project

ROCCA

5 walls non-stackable mobile multi-use cabin manufactured introducing recycled composites with infusion process and reuse materials.

This project has received funding from the European Union's Horizon Europe research and innovation programme under grant agreement No 101058089.

ROCCA 5-walls cabin

How the idea was born?

Necessity of recycling EoL´s WTB composites

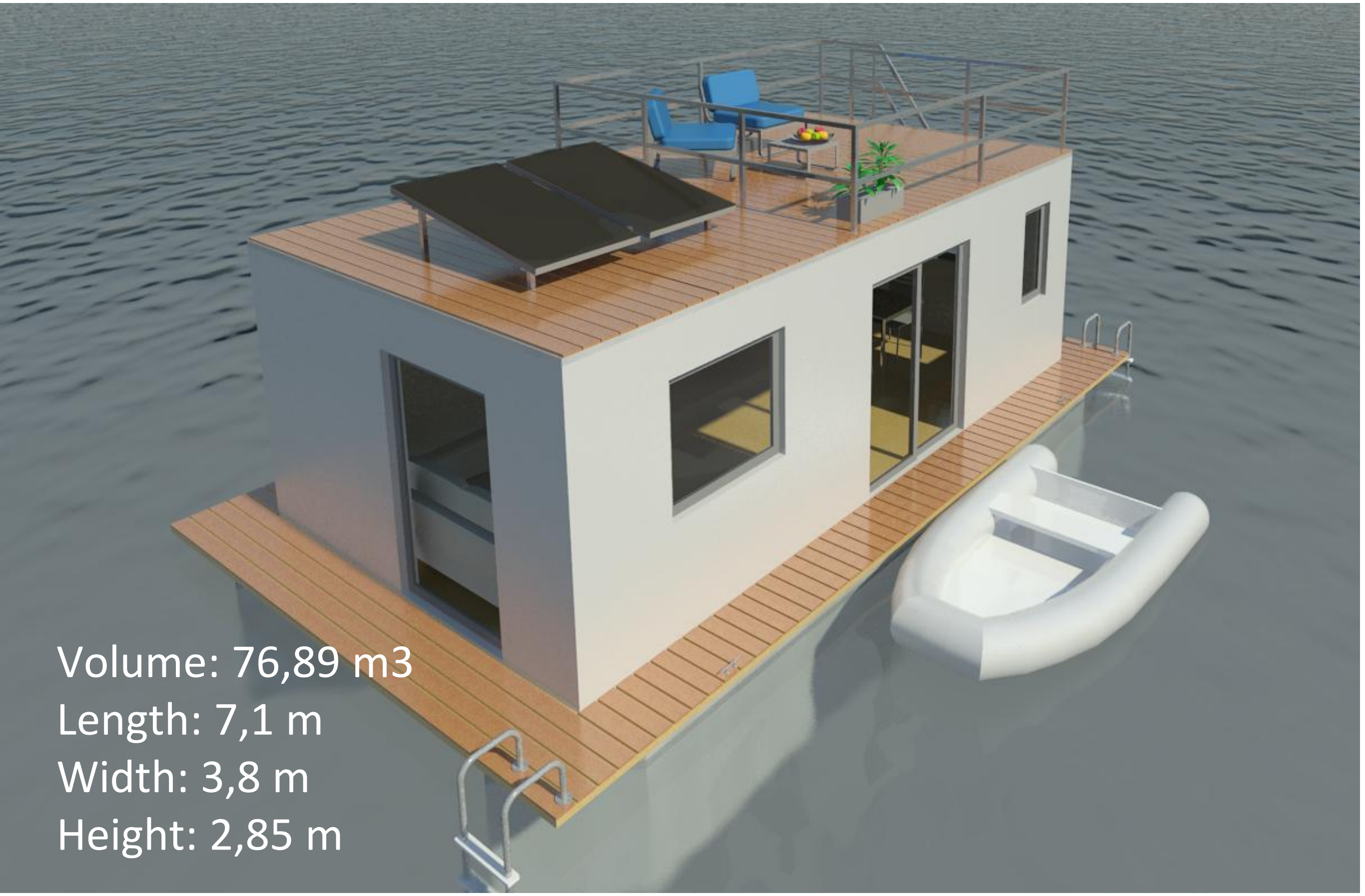
Rising housing costs and lack of available homes on the market

change in people's lifestyle - Greater mobility

ROCCA- 5 walls non-stackable Mobile multi-use cabin

This project has received funding from the European Union’s Horizon Europe research and innovation programme under grant agreement No 101058089.

ROCCA cabin



Mobile multi-use cabin

- Easy relocation
- Easy to deploy on land and water

ROCCA can be used (when the pontoon is added to the 5-walls-cabin) on water streams, lakes, rivers, or even on the sea, like a floating boat (home) unit when required; or it can be deployed on land as a house/office/retreat cabin.

The cabin were gradually built, during the project, including recycled and reused composite materials, via manufacturing processes prone to re-use and recycle composite materials.

This project has received funding from the European Union's Horizon Europe research and innovation programme under grant agreement No 101058089.

ROCCA cabin

Mobile solutions

WATER to LAND (W2L)

the cabin is removed from the pontoon and located safely on land

This project has received funding from the European Union's Horizon Europe research and innovation programme under grant agreement No 101058089.

ROCCA cabin

Mobile solutions

LAND to LAND (L2L)

the cabin can be easily and safely relocated

This project has received funding from the European Union's Horizon Europe research and innovation programme under grant agreement No 101058089.

ROCCA value proposition

Manufactured including recycled and reused composite materials

Envoirmental Friendly

Mobile

Designed and manufactured to allow lifting and relocation

A good "quality vs price" solution to the house Market

Economic

Multi Task

Boat house
Home
Storage, etc.

Designed to ease assembly operations

Easy assembly

Easy Disassembly

Designed to allow quick and safe dismantle when relocation of the whole cabin is not a viable option

Selection of interiors, equipment and finishes to enhance your living experience and reflect to your living style

Modular
Taylor Made

Durability
Longevity

Long life
Easy maintenance

This project has received funding from the European Union's Horizon Europe research and innovation programme under grant agreement No 101058089.

ROCCA manufacturing

Manufacturing of the Cabin:

- **Reuse of EOL´S Parts.**
- **Panels Manufacture :** Resin infusion - vacuum Infusion process.
- **Roof parts manufacture:** Resin infusion – vacuum Infusion process made of recovered CF patches
- **Steel structure.**
- **Assembly of Panels (**made of GF composites with embedded recycled and reused materials) **and constituents.**
- **Final assembly and amenities in the ROCCA cabin:** interior elements and utilities installation.

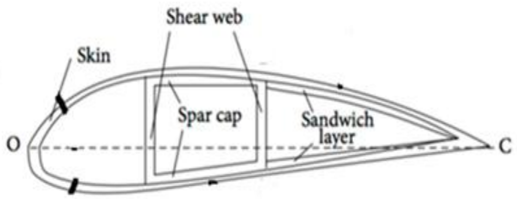
This project has received funding from the European Union's Horizon Europe research and innovation programme under grant agreement No 101058089.

ROCCA manufacturing steps

Reuse of EOL´S Parts.

Wind turbine blades : The EOL parts from wind blades. (Tips and sandwich balsa panels), are reused.

Composite sandwich balsa from WTb´s reused as Cabin walls, WC Floor, Shower base, Door threshold, kitchen sink and as reinforcements of the Demonstrator panels.



Total weight: 676 kg

WIND
BLADE TIPS

SHEAR WEB PANELS

This project has r innovation programme under grant agreement No 101058089.

ROCCA manufacturing steps

Reuse of EOL´S Parts.

Reuse of shear web panels:

- Recovery of composite sandwich balsa panels:
  - Diamond cut parts
  - Inspect and repair defects
  - Sanding
  - Final finishing, varnishing



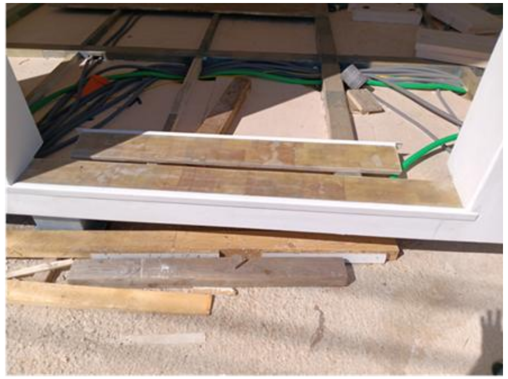

This project has received funding from the European Union's Horizon Europe research and innovation programme under grant agreement No 101058089.

ROCCA manufacturing steps

Reuse of EOL´S Parts.

Reuse of shear web panels (Balsa wood GFs panels) **as:**

- Cabin walls
- Shower base
- 2 Doors threshold
- Bathroom sink



This project has received funding from the European Union's Horizon Europe research and innovation programme under grant agreement No 101058089.

ROCCA manufacturing steps

Reuse of EOL´S Parts.

Reuse of wind blade tips:

Recovery of composite materials from wind blades tips:

- Diamond cut parts.
- Inspect and repair defects
- Polyester gelcoat application
- Final finishing





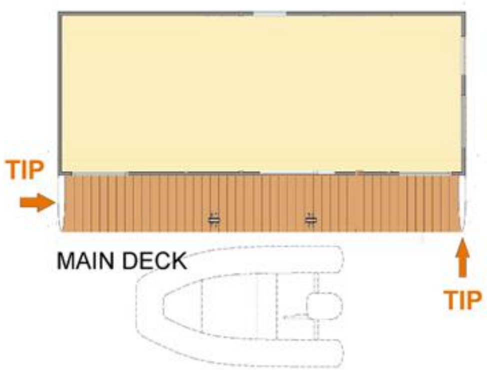
This project has received funding from the European Union's Horizon Europe research and innovation programme under grant agreement No 101058089.

ROCCA manufacturing steps

Reuse of EOL´S Parts.

Reuse of wind blade tips:

GFs composites Parts from the Wind blade tips used as architectural fixture and wind barrier in the front of the cabin.



This project has received funding from the European Union's Horizon Europe research and innovation programme under grant agreement No 101058089.

ROCCA manufacturing steps

Reuse of EOL´S Parts.

Reuse of CF pressure tank from aircraft:

Used Pressure Tank from aviation was prepared and modified to be reused in the demonstrator. The reused Water Tank was installed on the demonstrator roof terrace.

This project has received funding from the European Union's Horizon Europe research and innovation programme under grant agreement No 101058089.

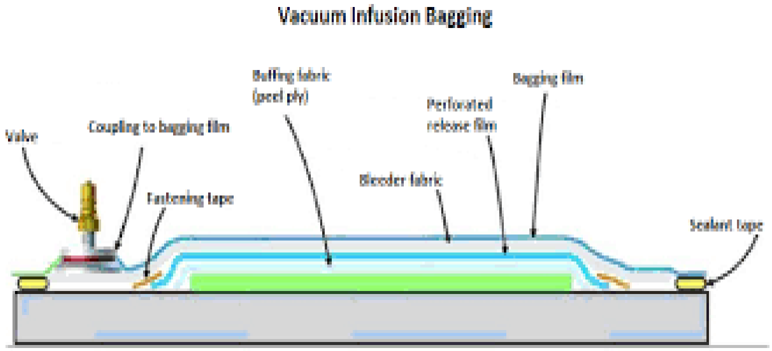
ROCCA manufacturing steps

Panels Manufacture

Resin infusion - vacuum infusion process

Production of panels with GF/PU Composites with reinforcements made from GF recycled materials via vacuum infusion, (3.1x2,85 m , 3.8x2,85 m , 4.1x2,85 m)

Operation ID	Description	Equipment
1	Mold polishing	Rotating polisher
2	Mold waxing	Rotating polisher
3	Glass fiber cutting	Stanley knife, scissors
4	Diamond cut of EoL´s component to use as reinforcement	Grinder
5	Polyester gelcoat application	Air gun
6	Location of polyurethane foam panels and of dry fiber reinforcement	Stanley knife
7	Vacuum Infusion checks	Vacuum pump, vacuum gauge
8	Resin impregnation via resin infusion	Resin impregnating the reinforcement, vacuum pump
9	Demolding	Compressed air
10	Sanding and finishing molded part	Grinder and sand-paper



This project has received funding from the European Union's Horizon Europe research and innovation programme under grant agreement No 101058089.

ROCCA manufacturing steps

Panels Manufacture

Manufacture of the mold and ROCCA panels

This project has received funding from the European Union's Horizon Europe research and innovation programme under grant agreement No 101058089.

ROCCA manufacturing steps

Vacuum-bagging, infusion process

Demolding

This project has received funding from the European Union's Horizon Europe research and innovation programme under grant agreement No 101058089.

ROCCA manufacturing steps

Panels Manufacture

Panels ready for assembly.

This project has received funding from the European Union's Horizon Europe research and innovation programme under grant agreement No 101058089.

ROCCA manufacturing steps

Panels and constituents

Reuse of wind blades parts as reinforcement inside wall panels

This project has received funding from the European Union's Horizon Europe research and innovation programme under grant agreement No 101058089.

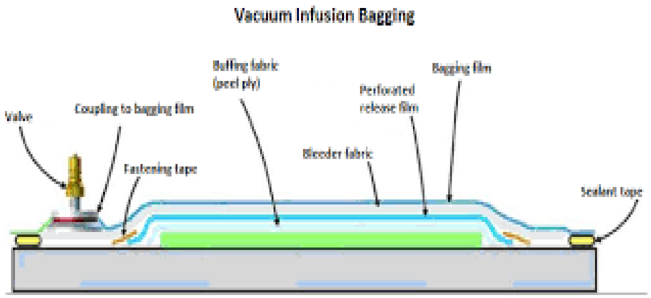
ROCCA manufacturing steps

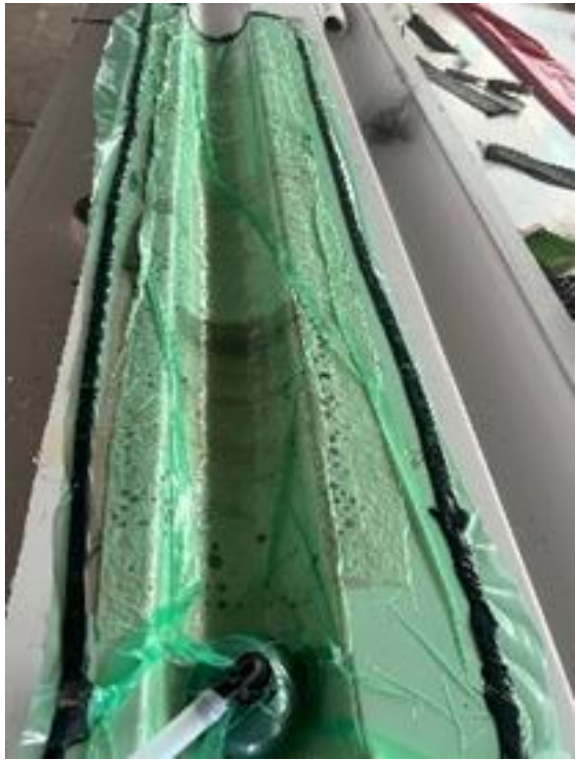
Roof reinforcement parts Manufacture

Resin infusion – Via Process vacuum Infusion, using recovered CF patches and GF CSM.

CF Patches recovered by solvolysis process supplied by **NTUA**

Resin infusion - vacuum infusion process





This project has received funding from the European Union's Horizon Europe research and innovation programme under grant agreement No 101058089.

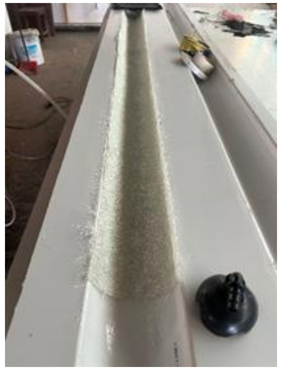
ROCCA manufacturing steps

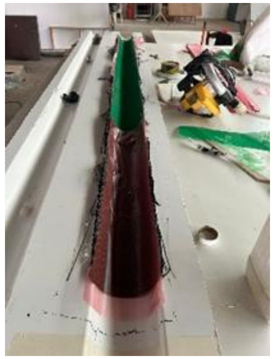
Roof reinforcement parts Manufacture

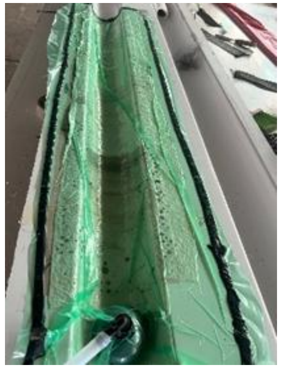
Procedure developed to manufacture the **Roof reinforcement parts**

The procedure is applicable to the production, via vacuum infusion of recovered CF patches and GF CSM.
The description of the process (procedure) is in the following table:

Operation ID	Description	Equipment
1	Mold polishing	Rotating polisher
2	Mold waxing	Rotating polisher
3	Glass fiber CSM and CF patches cutting	Stanley knife, scissors
4	Polyester gelcoat application	Air gun
5	Place GF and CF in the mold	Stanley knife
6	Vacuum Infusion checks	Vacuum pump, vacuum gauge
7	Resin impregnation via resin infusion	Resin impregnating the reinforcement, vacuum pump
9	Demolding	Compressed air
10	Sanding and finishing molded part	Grinder and sand paper
4	Topcoat application	Air gun





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ROCCA manufacturing steps

Roof reinforcement parts Manufacture

Manufacturing of the **Roof reinforcement parts :**

Infused components manufactured using recycled carbon fibre reinforcement

Manufactured components added to the demonstrator

This project has received funding from the European Union’s Horizon Europe research and innovation programme under grant agreement No 101058089.

ROCCA manufacturing steps

Steel structure

Manufacture - Steel structure

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ROCCA manufacturing steps

Assembly of panels and constituents

Assembly of manufactured composite panels to the welded structure

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ROCCA manufacturing steps

Interior Cabin

Interior finishing

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ROCCA manufacturing steps

Assembly of 3d printed naval window

Ø 360 naval window separated in 4 subcomponents

Ø 560 naval window separated in 8 subcomponents

Demonstrator side showing the 3d printed naval window

This project has received funding from the European Union's Horizon Europe research and innovation programme under grant agreement No 101058089.

ROCCA cabin at a glance

This project has received funding from the European Union's Horizon Europe research and innovation programme under grant agreement No 101058089.

ROCCA cabin at a glance

Interior and furniture demonstrator built using reclaimed composite panels from wind turbine

This project has received funding from the European Union's Horizon Europe research and innovation programme under grant agreement No 101058089.

ROCCA cabin at a glance

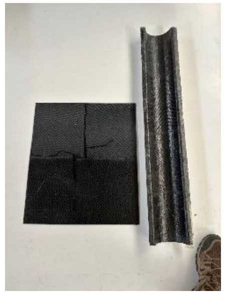
Outdoor kitchen using reclaimed composite panels from wind turbine

This project has received funding from the European Union's Horizon Europe research and innovation programme under grant agreement No 101058089.

ROCCA cabin at a glance



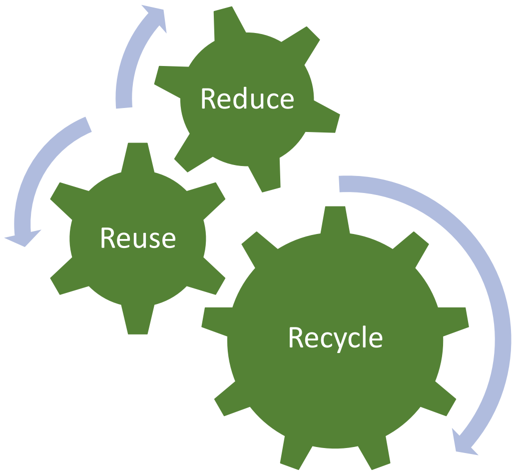

Eco-Friendly!




Low cost House

Multi Task

Durability & Longevity



This project has received funding from the European Union's Horizon Europe research and innovation programme under grant agreement No 101058089.

ROCCA cabin

Thank you to all the consortium team for their support and help!

The consortium team gathering outside ROCCA demonstrator

Guy Simmonds

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+351 919 849 952

This project has received funding from the European Union's Horizon Europe research and innovation programme under grant agreement No 101058089.

The RECREATE project: fiber-reinforced composites going circular

Ambition. Methodology. Results.

Prof. Gianmarco Griffini

Department of Chemistry, Materials and Chemical Engineering "Giulio Natta"
Politecnico di Milano - Italy

EURECOMP – The Final Workshop

20.03.2026, Varano de' Melegari (Italy)

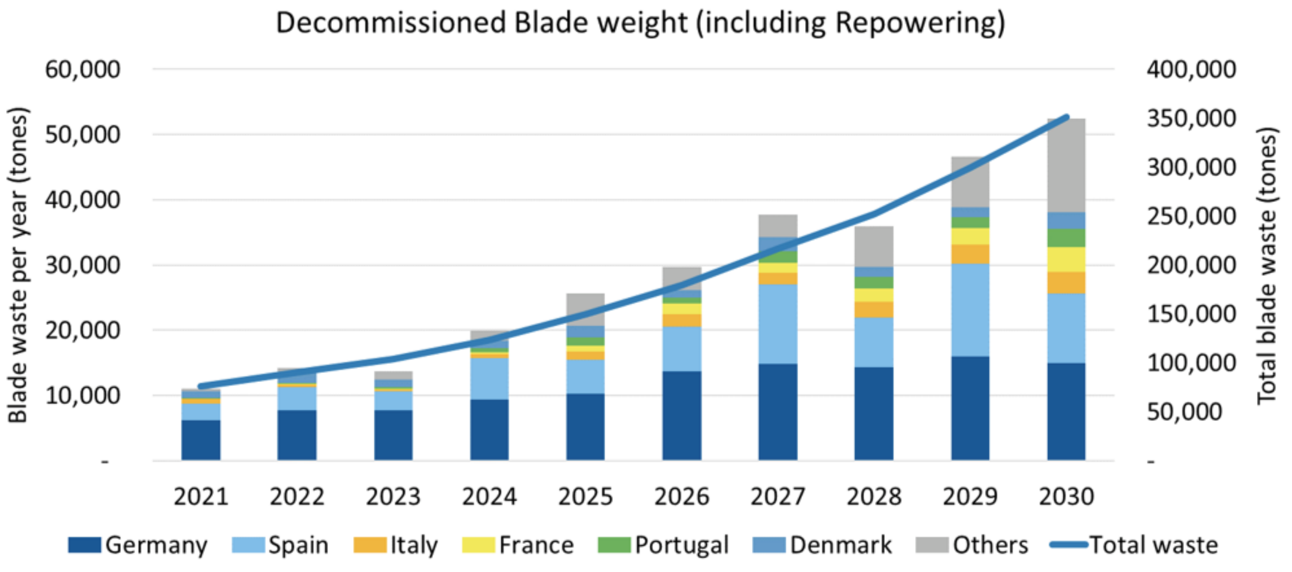
This project has received funding from the European Union's Horizon Europe research and innovation programme under Grant Agreement No. 101058756

Funded by the European Union

Composite waste generation

Increasing volumes of **fiber-reinforced composite waste** generated annually:

- wind
- aerospace
- automotive



Source: WindEurope

The Economist

Benjamin Rasmussen/Getty Images

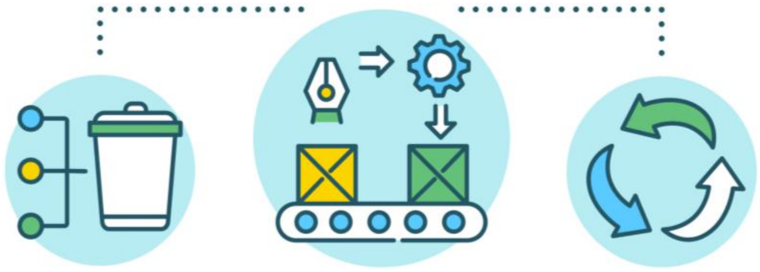
RECREATE

REcycling technologies for **C**ircular **RE**use and remanufacturing of fiber-reinforced composite m**ATE**rials

The aim and the ambition

Provide a competitive advantage to the European manufacturing industry by developing **innovative technologies** that will enable the **circularity** **of fiber-reinforced composite materials**.

These technologies will **turn** **end-of-life** **composite waste into** **feedstock** for profitable reuse and remanufacturing of parts and materials in the high-performance, lightweight-design manufacturing industry.



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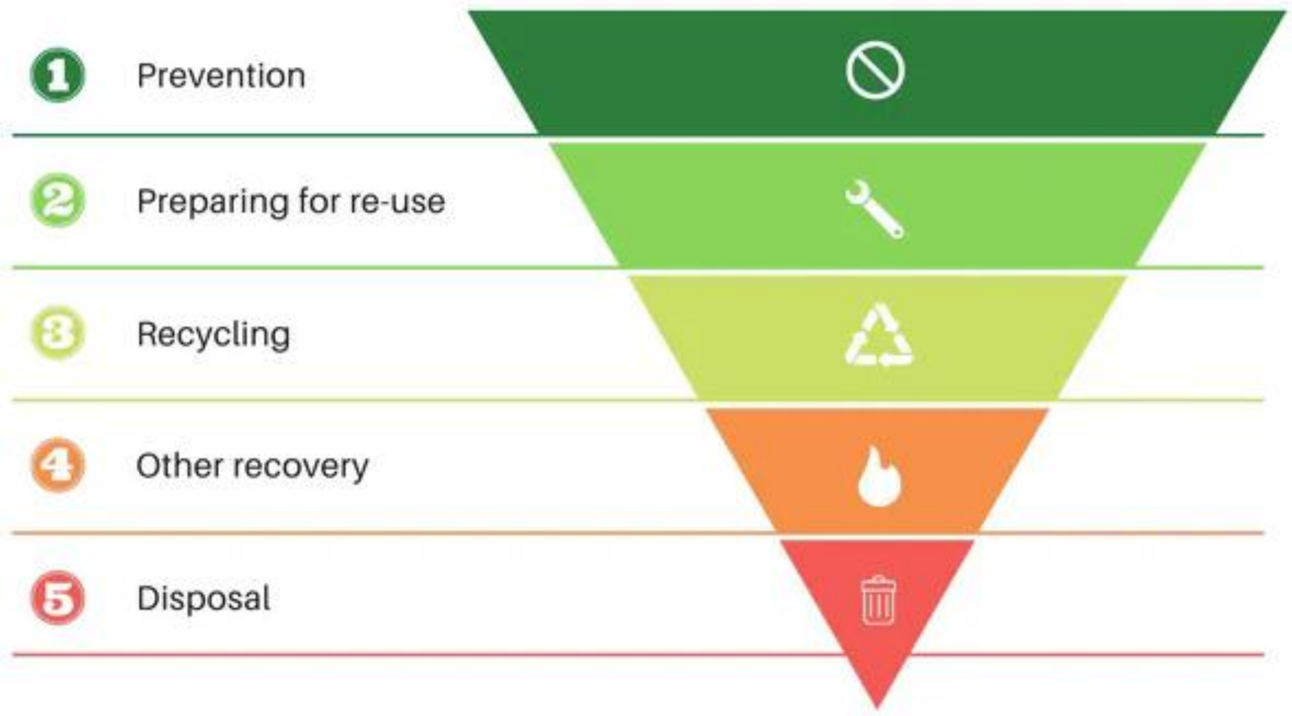
End-of-life management: it's all about hierarchy!

Avoid waste

Manage waste



Funded by the European Union

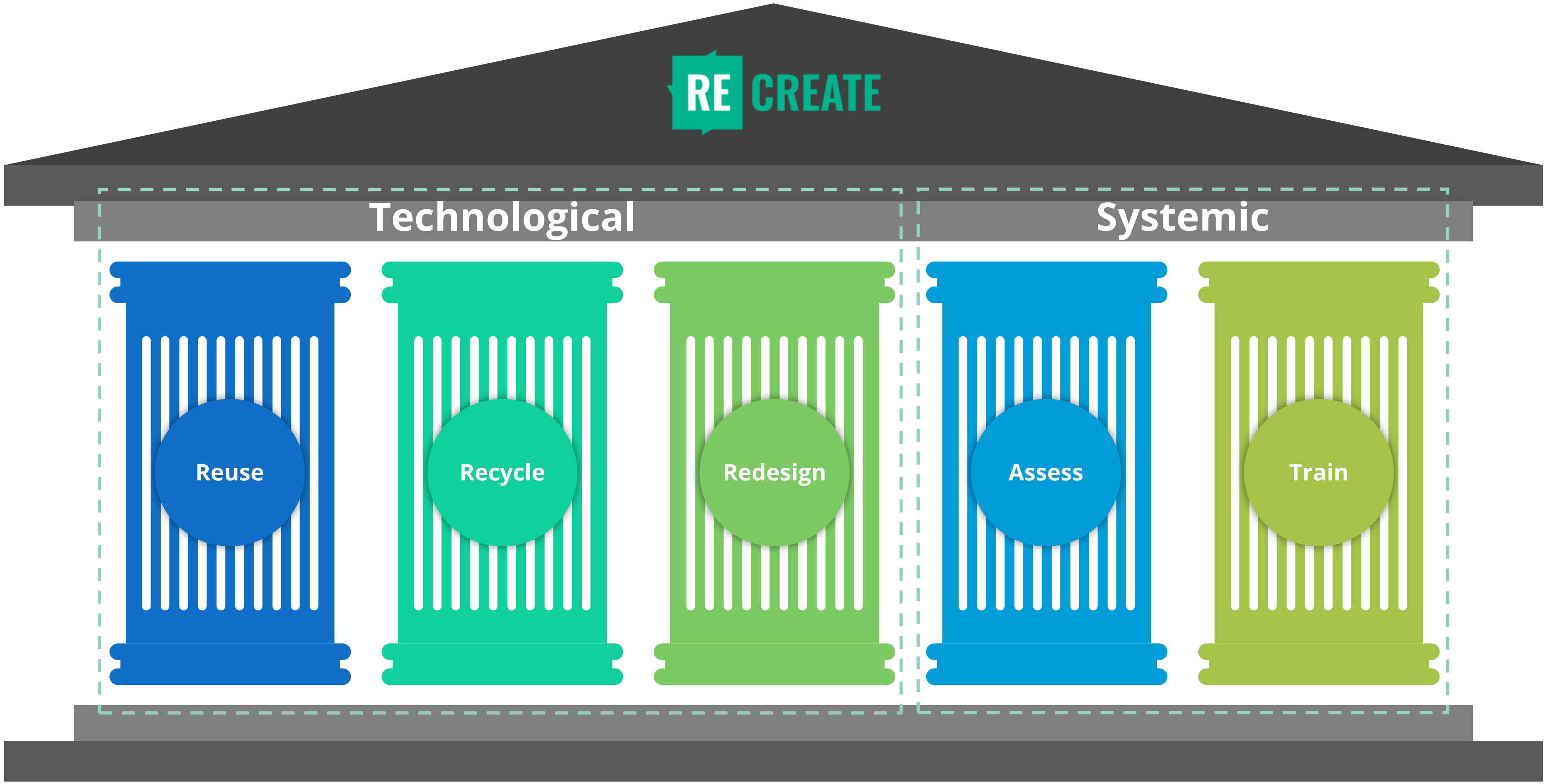
End-of-life management: it's all about hierarchy!

Funded by the European Union

End-of-life management: it’s all about hierarchy!

Funded by the European Union

RECREATE – A multidisciplinary approach



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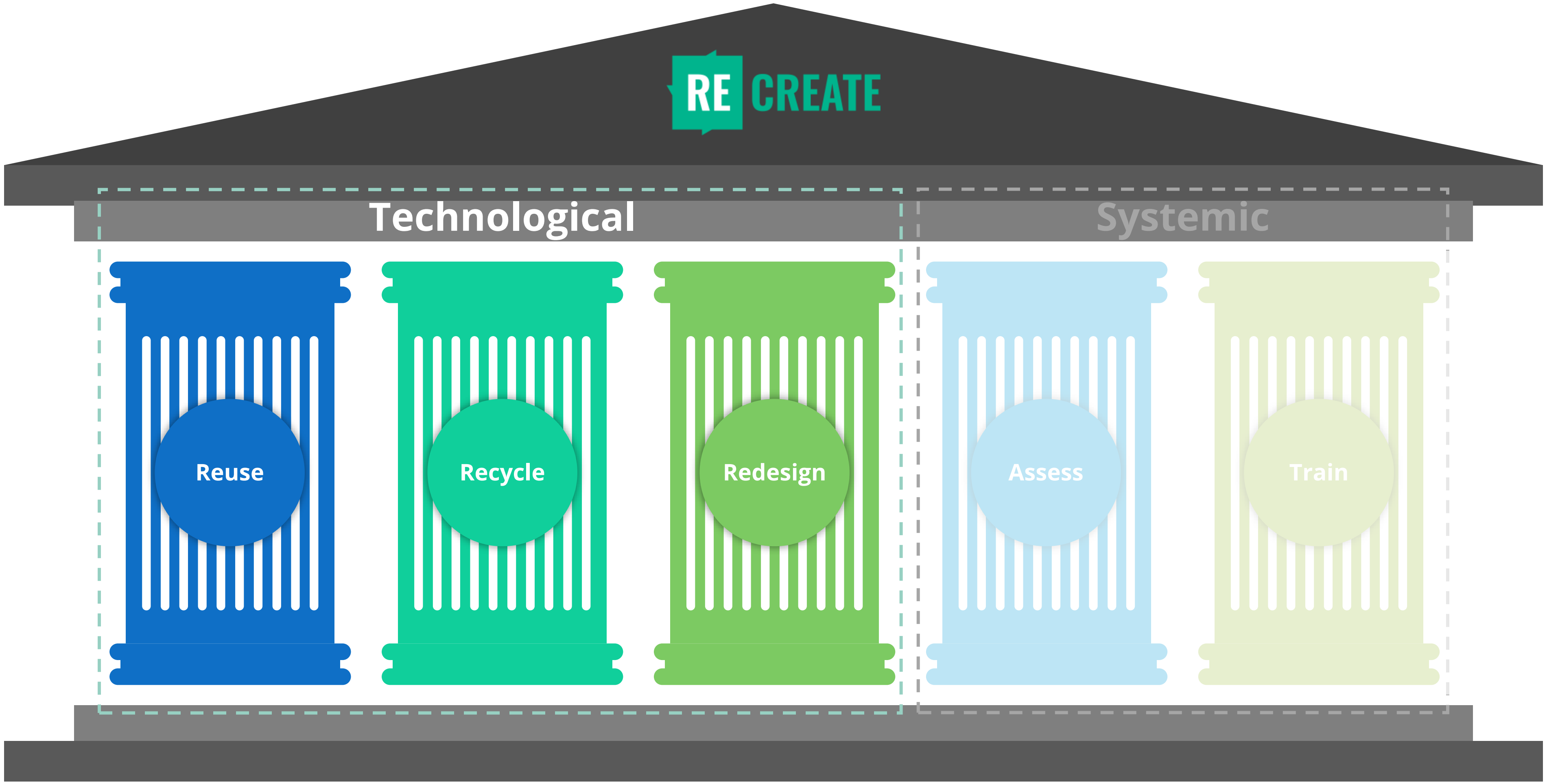
RECREATE – A multidisciplinary approach



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the European Union

RECREATE – A multidisciplinary approach

Technological pillars:

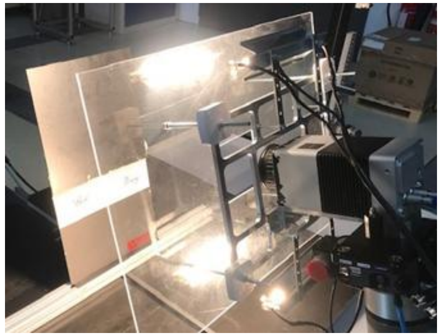
1) **Reuse** of current generation EoL GFRC and CFRC parts.

2) **Recycle** materials for clean-fiber liberation and recovery of a reusable organic fraction.

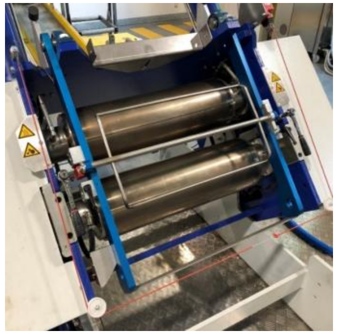
3) **Redesign** of reversible materials for next-gen circular-by-design FRCs.

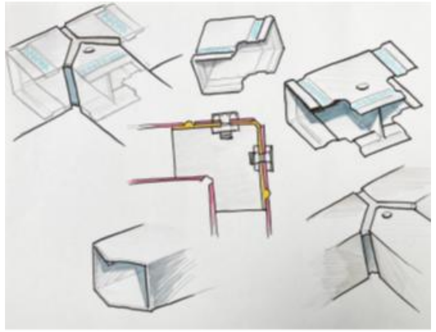
TRL6

NDT and disassembly

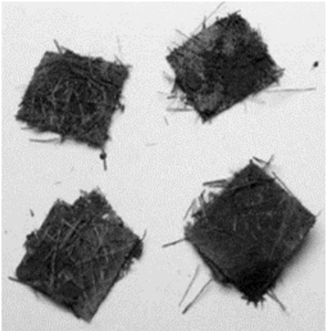


EoL part reuse and remanufacturing

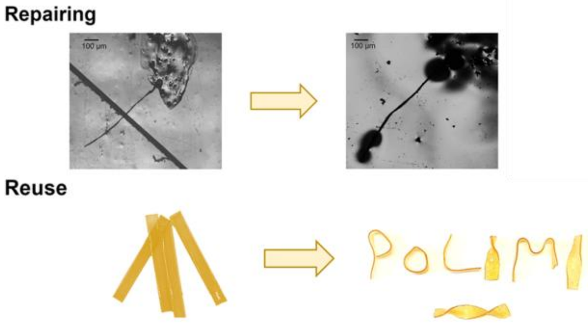




Undamaged fiber liberation



Design-for-circularity



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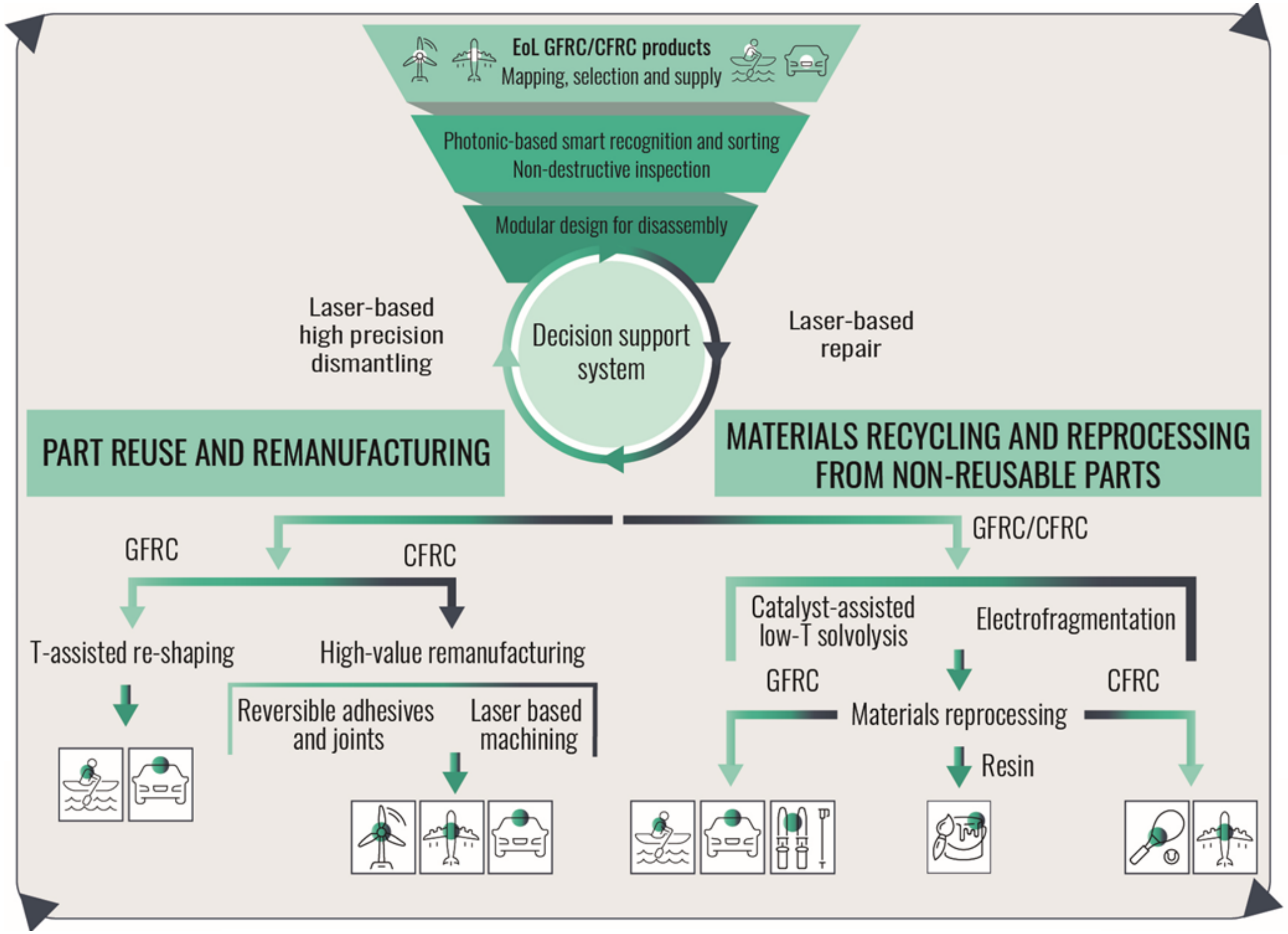
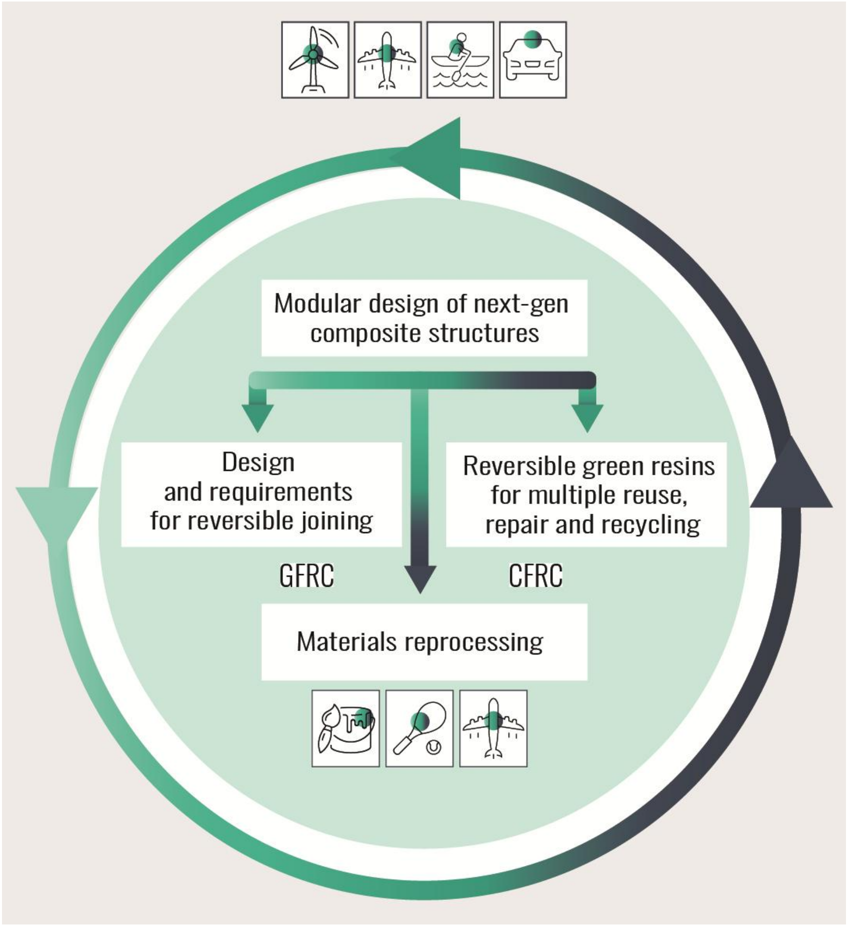
RECREATE – Technological pillars

Current generation



Next generation



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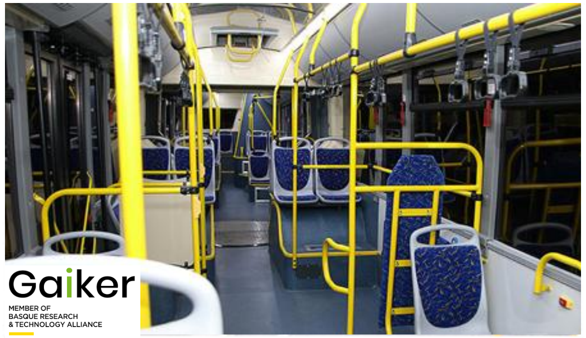
RECREATE – Technological pillars

Repair, reuse, remanufacturing and recycling technologies validated *via* **physical demonstrators**, with **exploitation potential** in a variety of composite **lightweight design markets**:



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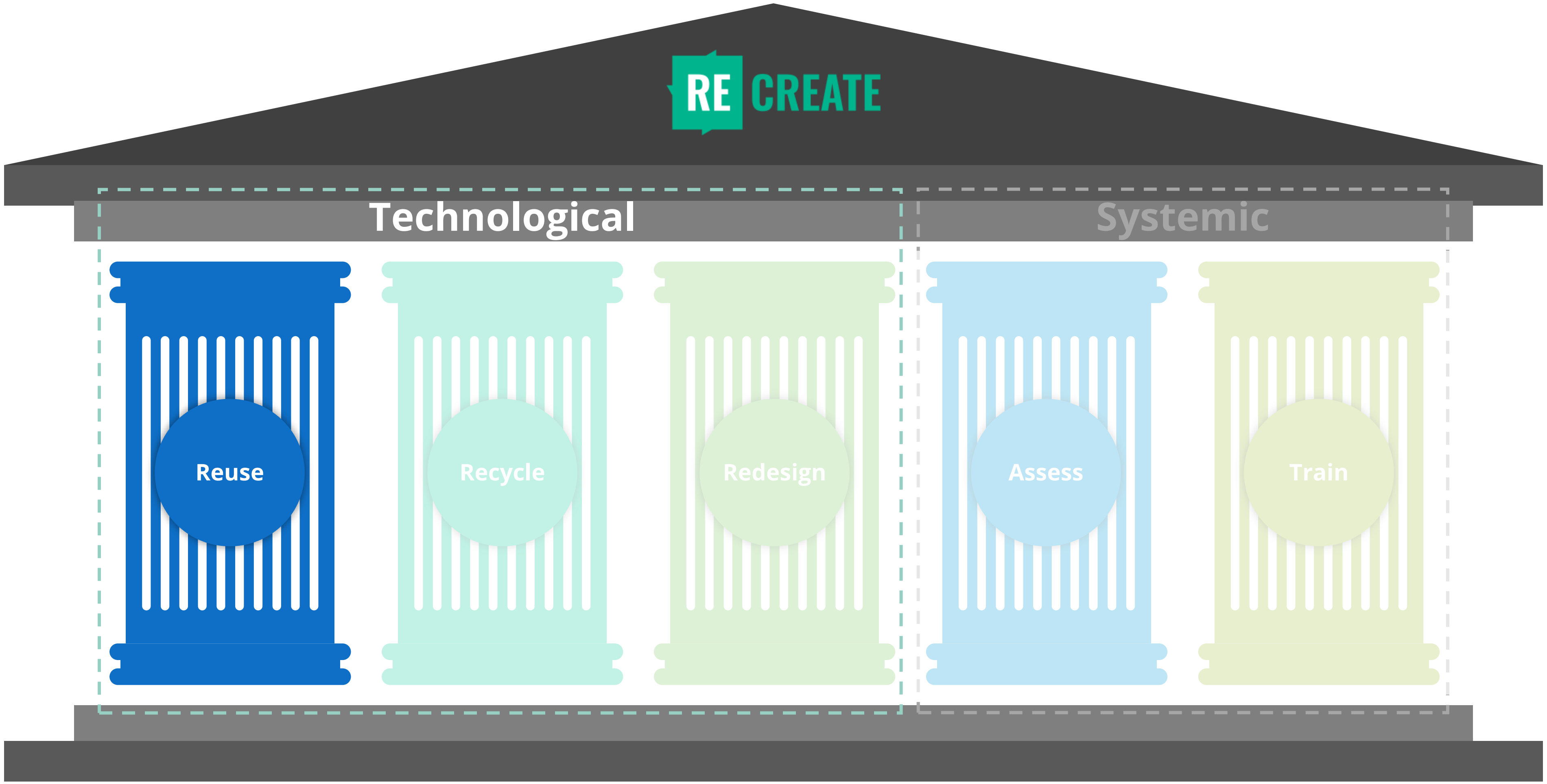
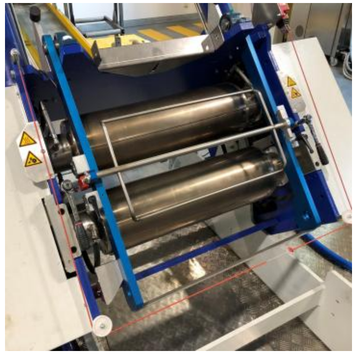
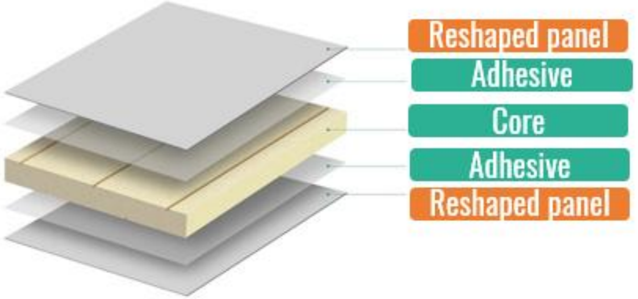
RECREATE – Technological pillars



Funded by the European Union

Reuse of EoL GFRC parts in technical boards for transportation





Key performance indicators:

- Weight, dimensions
- Bending strength, modulus
- Thermal conductivity, stability
- Acoustic isolation
- Water absorption
- Fire resistance

From curved EoL marine GFRCs to reshaped GFRC panels for transportation

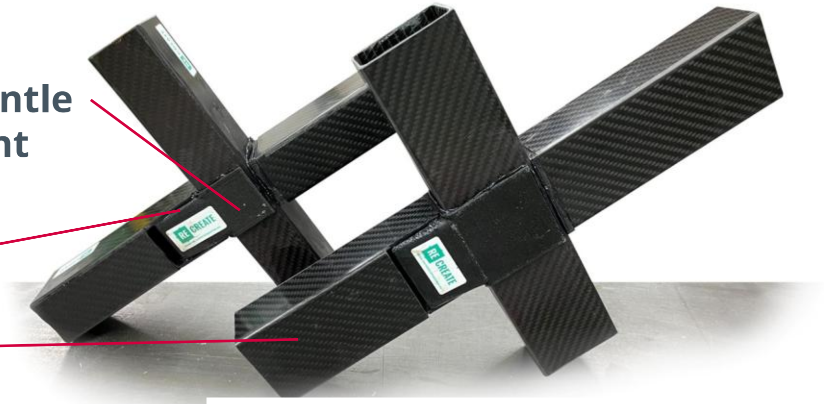
Funded by the European Union

Reuse of EoL CFRC parts in modular structures for mobility

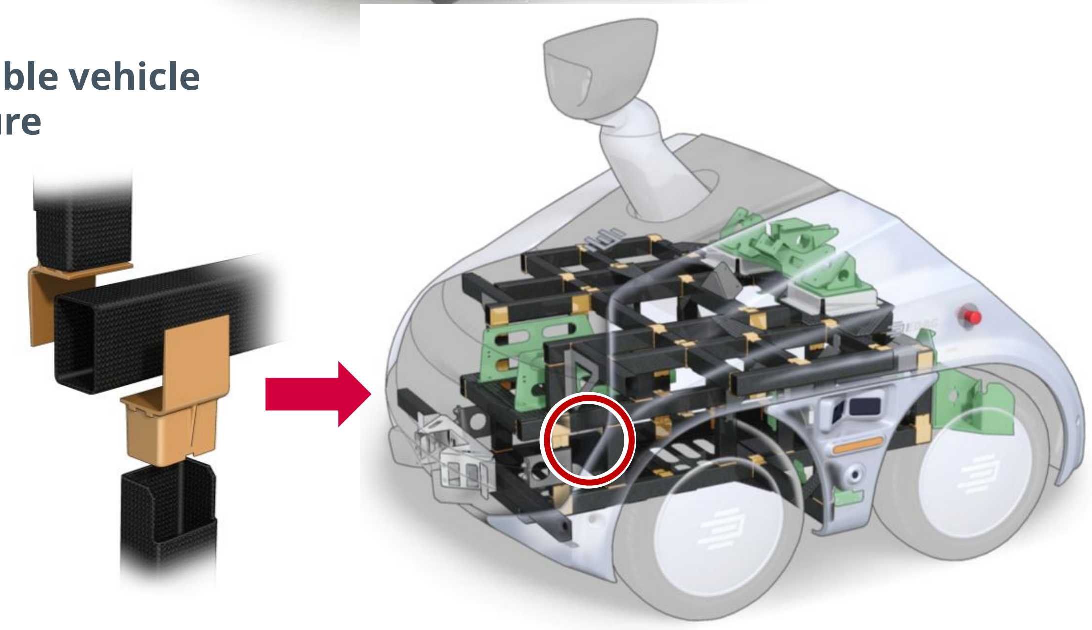
Reusable and easy-to-dismantle joining element

Detachable adhesive

CFRC profile



Reuseable vehicle structure



Circular Reuse and Remanufacturing of fiber-reinforced Composite Materials

Characteristics of innovation:

- Novel design methods for durable, dismantlable and reusable lightweight composite structures
- **Detachable adhesive** principles utilizing heat trigger to separate components
- Set of methods, materials and **joining methods** to achieve design for circularity
- Undiscovered technologies for circular composite use, e.g. **reshaping**, **laser-shock dismantling** or **high voltage fragmentation**
- Establishing a service for **circular design** of products independent from their material composition or purpose

Customer benefit:

Challenges

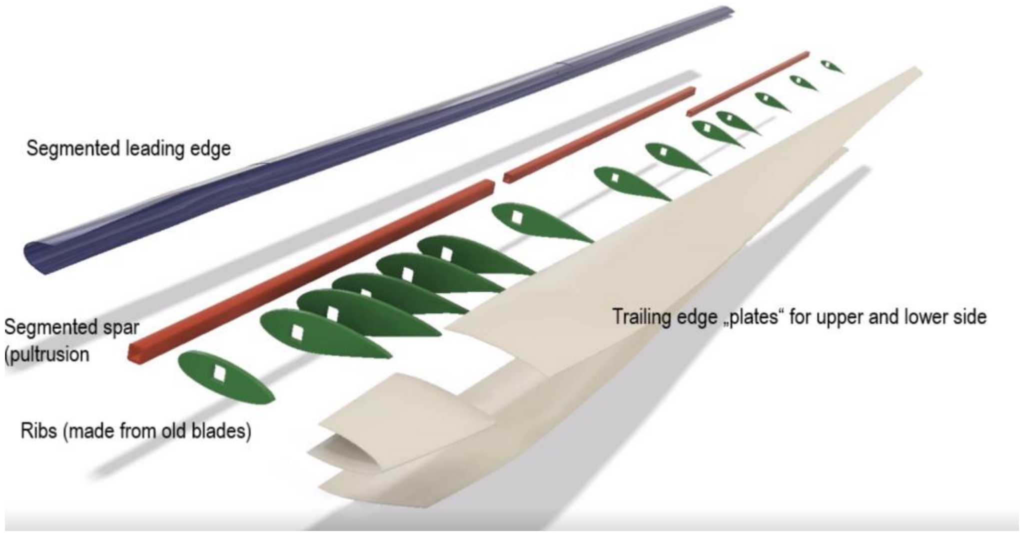
- Reuse and remanufacturing are not possible for current vehicle designs
- Dismantling and recycling are hampered by adhesives

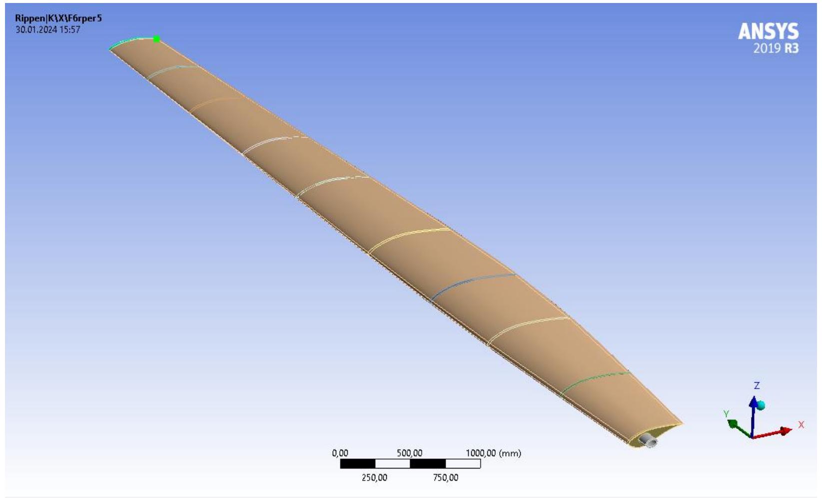
Solution

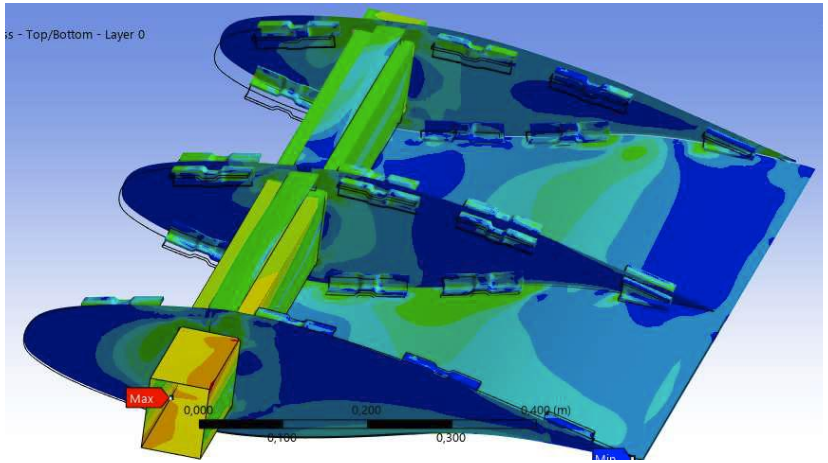
- Durable lightweight design for high-utilized vehicles
- Concept of remanufacturing utilizing detachable adhesives

Funded by the European Union

Reuse of EoL parts in segmentable rotor blades for wind energy







Strategy:

- **Modular** design
- **Detachable connections** for assembly and disassembly of the segments through DoD technologies
- Use of **EoL materials** (GFRC, CFRC)
- Finite Element Analysis

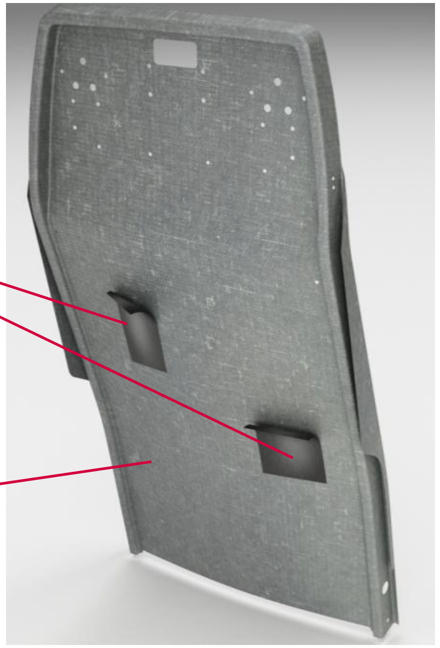
Funded by the European Union

Reuse of EoL CFRC parts for aircraft cabin interiors

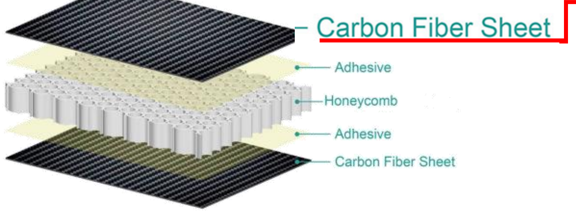
Reusable and easy-to-detach reinforcing patch

Reversible adhesive

CFRC seat backrest



Composite EoL flat panel



Reusing for

Circular reuse of fiber-reinforced composite materials

Characteristics of innovation:

- Novel design methods by implementing **reusable reinforcement** patches for lightweight composite backrest in aircraft seating
- **Reversible adhesive** principles utilizing heat trigger to separate components
- Set of methods to **reuse CF layers** from EoL composite interiors panels to achieve design for circularity
- **Laser-shock dismantling** technique for composite layers separation and sorting for circular use
- Establishing **in-service repairing** of damaged aircraft seating for airlines during air travels

Customer benefit:

Challenges

- Reuse and remanufacturing are not possible for current seat backrest design
- Due to thermosetting resins the dismantling and recycling is not possible without compromising the mechanical behavior

Solution

- Lightweight reinforcement patch from reused composite waste
- Concept of remanufacturing utilizing detachable adhesives

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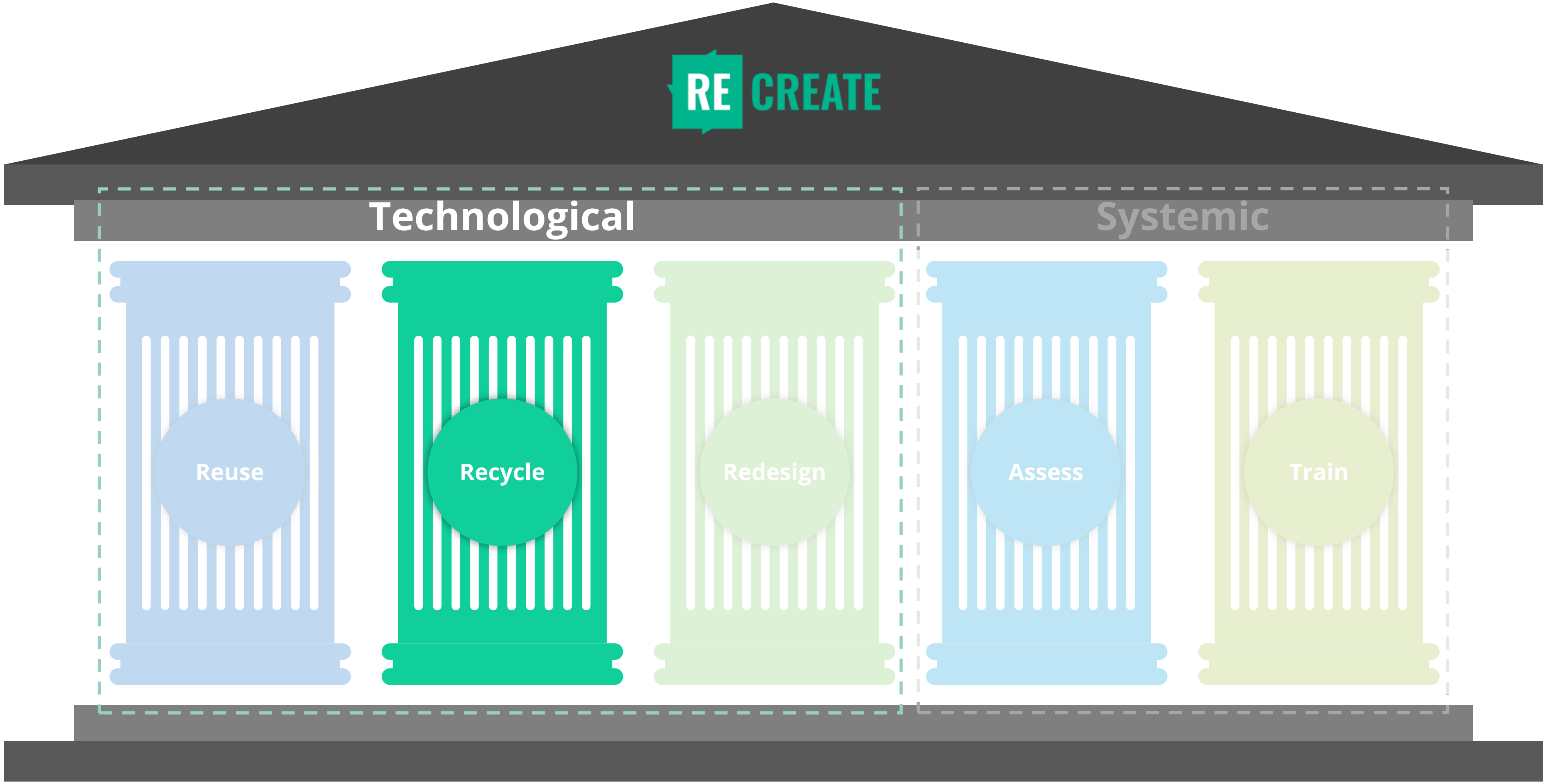
RECREATE – Technological pillars



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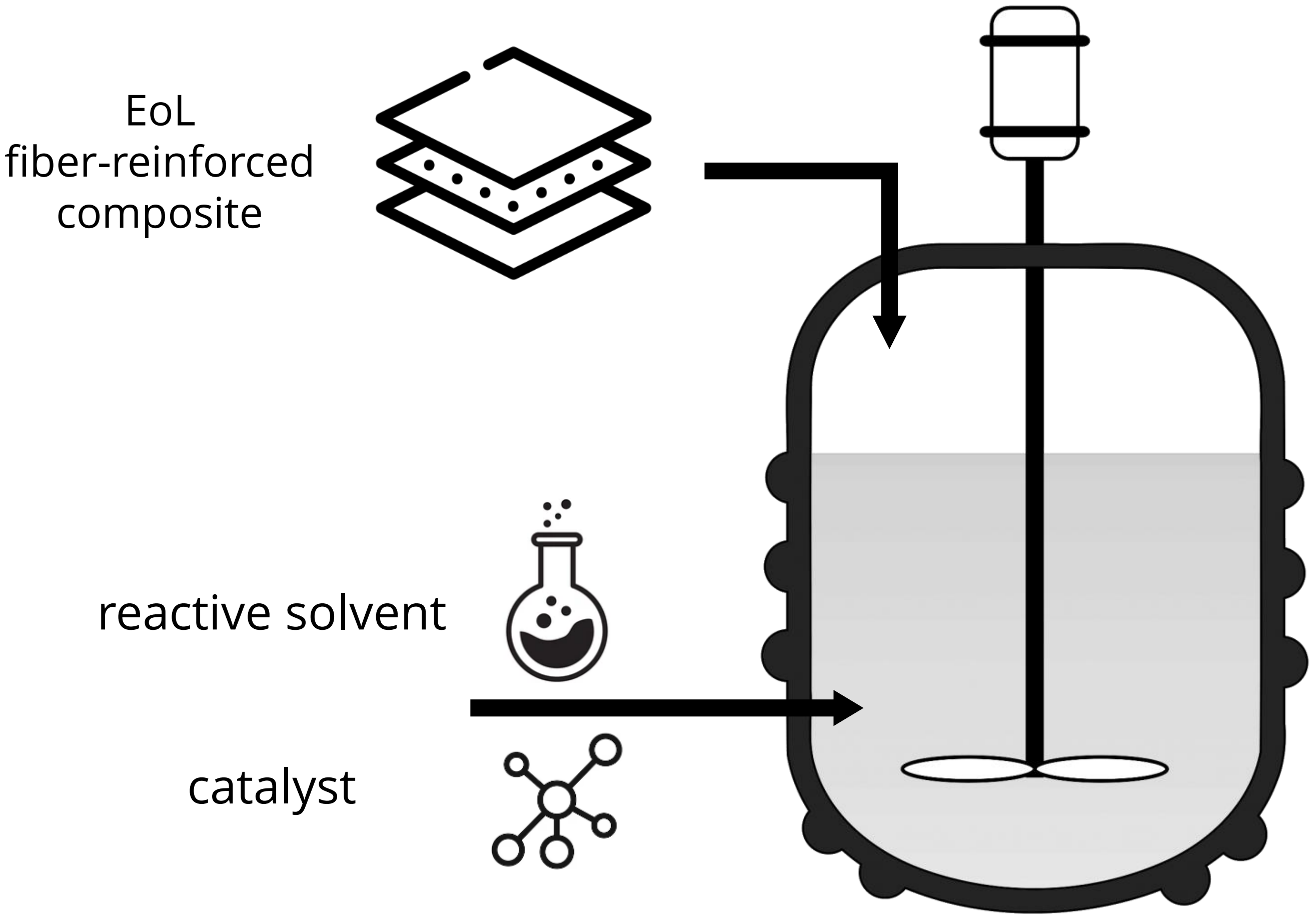
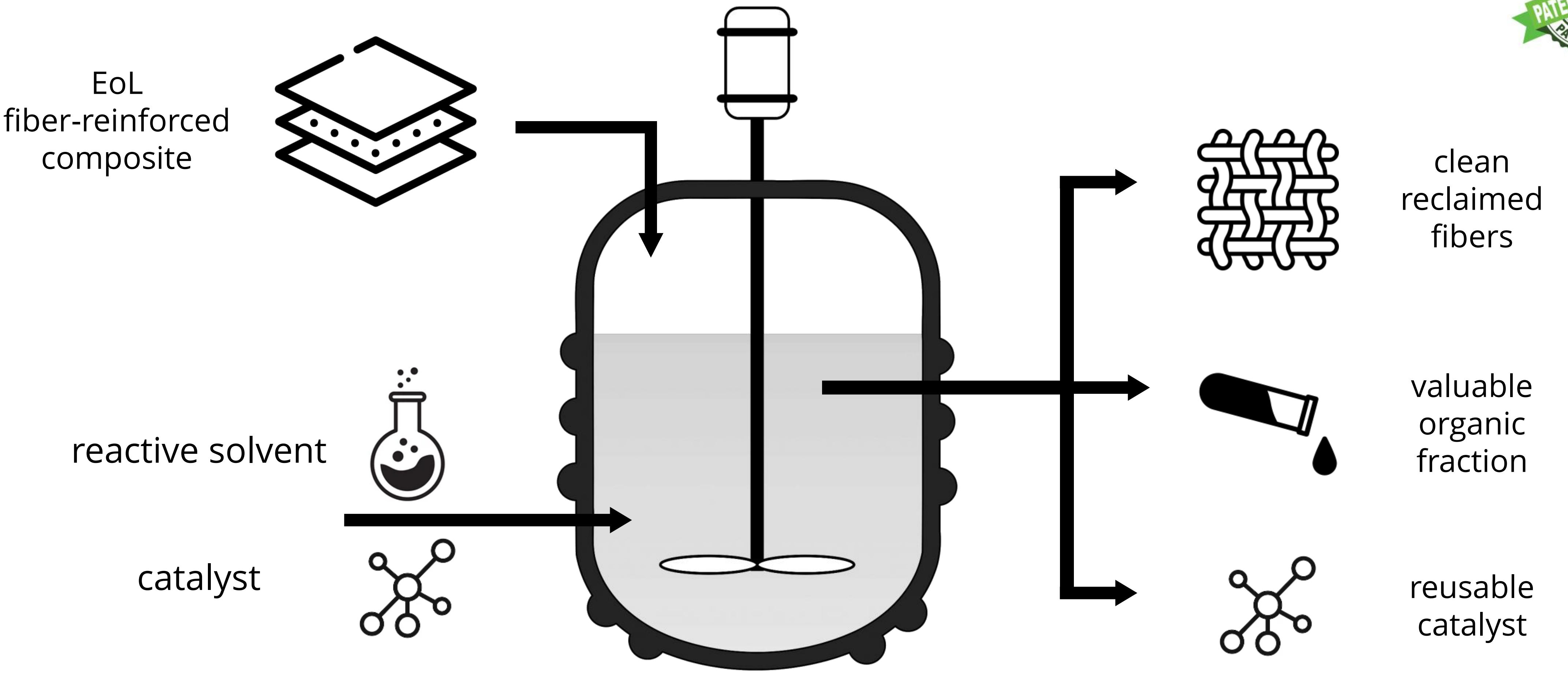
Catalyst-assisted green solvolysis



P_{amb}, T < 250 °C, t

Funded by the European Union

Catalyst-assisted green solvolysis



P_{amb}, T < 250 °C, t

Funded by
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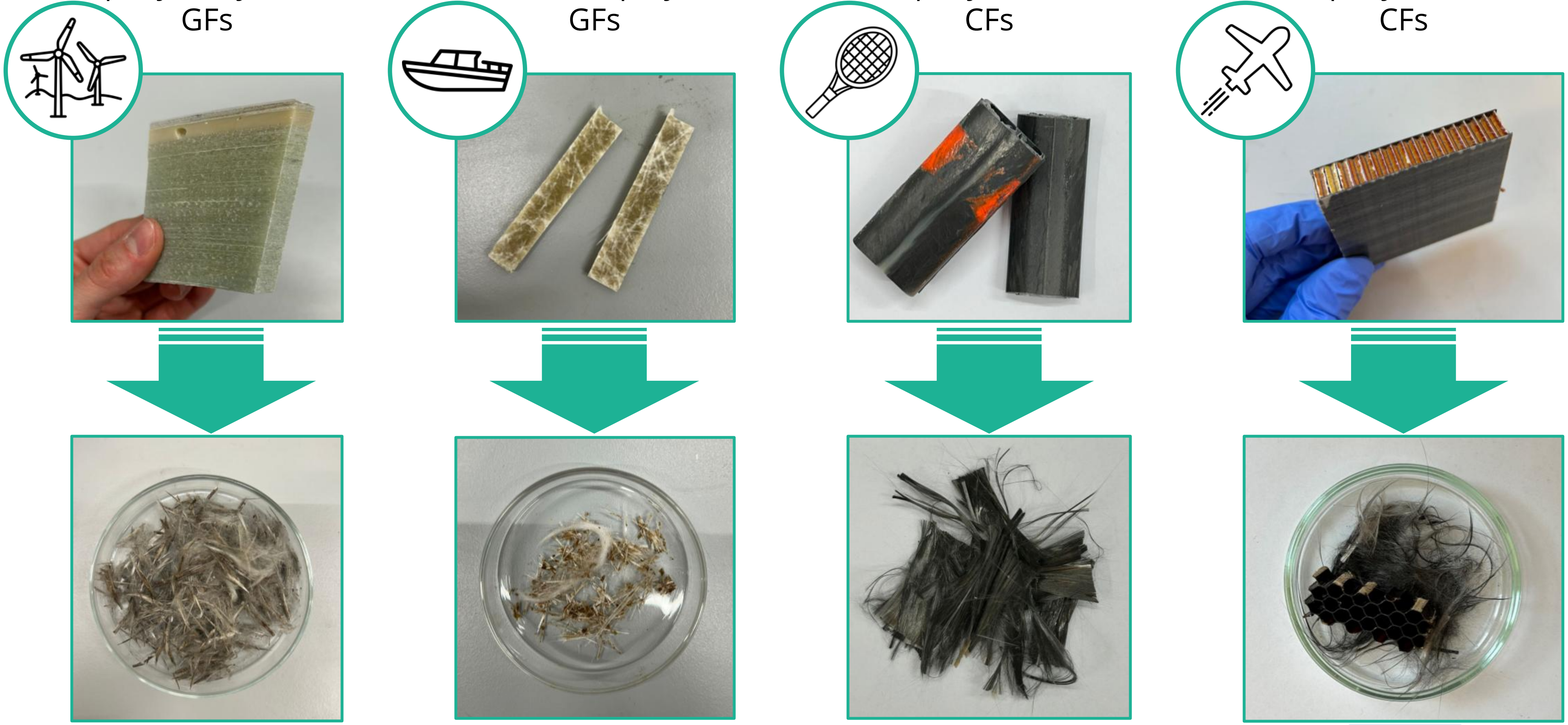
Our process: catalyst-assisted green solvolysis

epoxy-anhydride GFs | unsaturated polyester GFs | epoxy-amine CFs | epoxy-amine CFs



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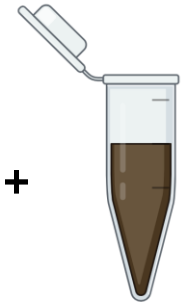


organic fraction

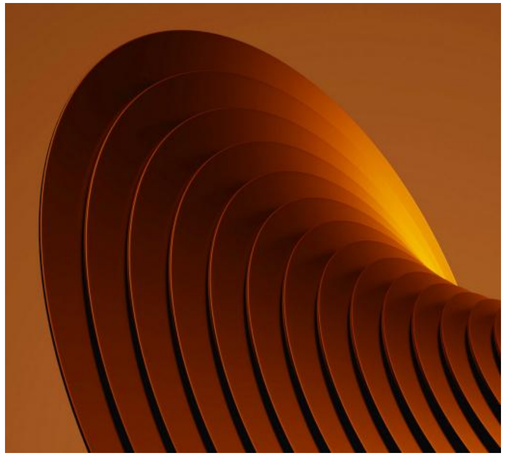
Funded by the European Union

Recycled organic fraction for industrial coatings

BENASEDO
Resins for coatings since 1959

Is there anything else in addition to fibers?



Characteristics of innovation:

- Different fields of application require specific characteristics
- Current formulations incorporate critical elements (toxic, oil-based)
- **Reusing** the recovered **organic fraction** coming from the chemical recycling of fiber-reinforced composites, leveraging the mild to moderate process conditions aimed at retaining the polymeric nature of the impregnating matrix
- **Formulation design** for enhanced performance and sustainability

Customer benefit:

Challenges

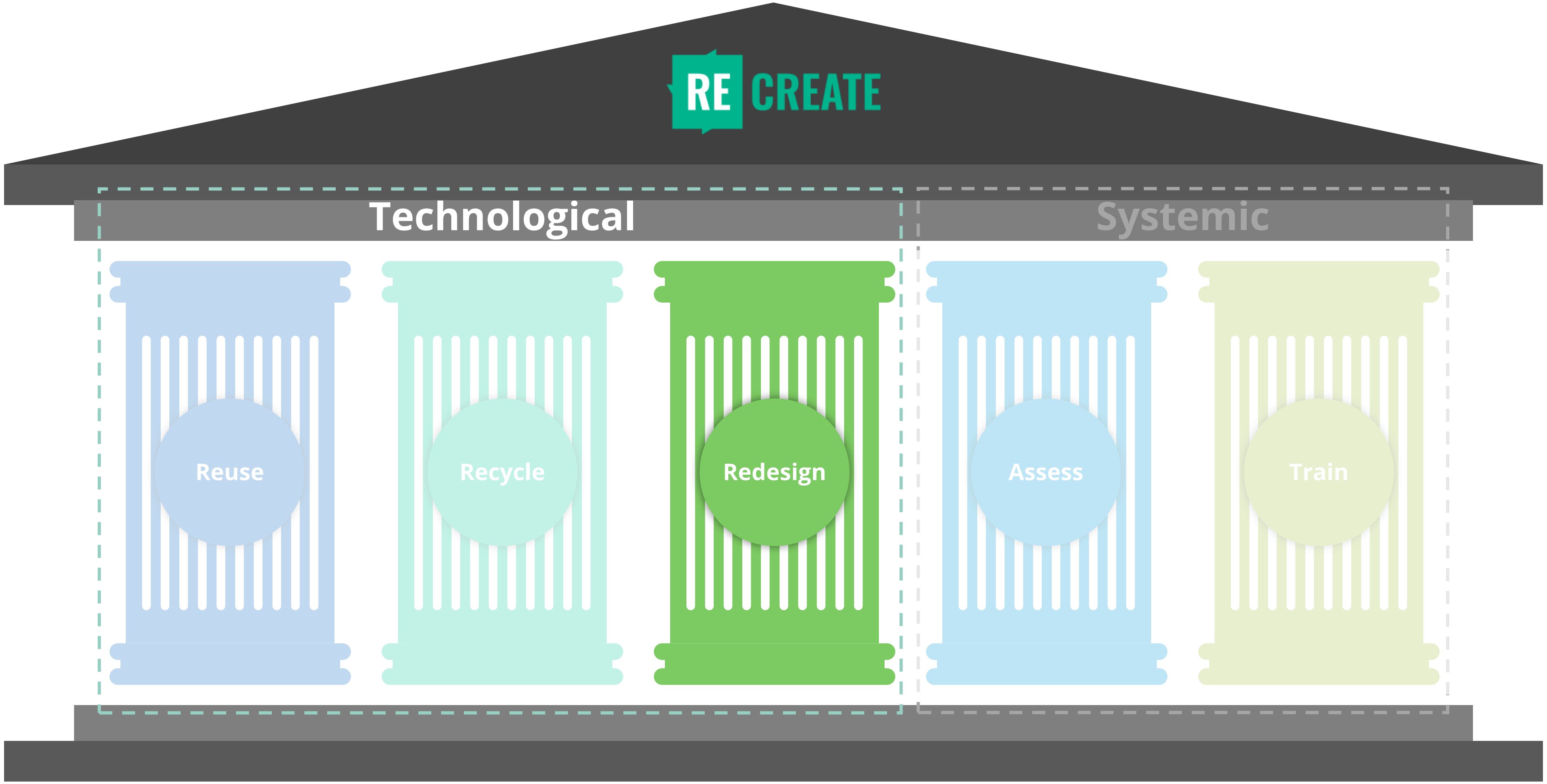
- Toxicity of some base resin components
- Moderate to low sustainability

Solution

- Incorporation of recovered organic fraction (up to 20 wt%) into target formulations for can coating, coil coating and industrial coatings.

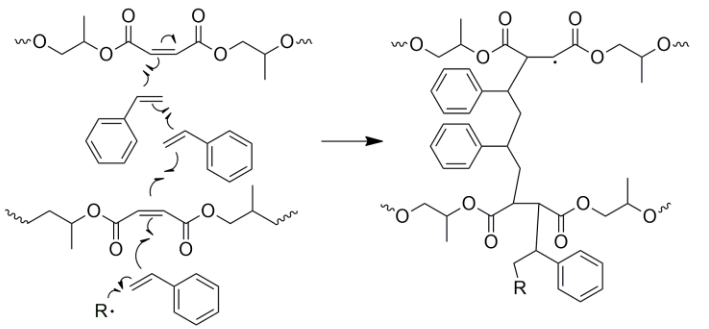
Funded by the European Union

RECREATE – Technological pillars

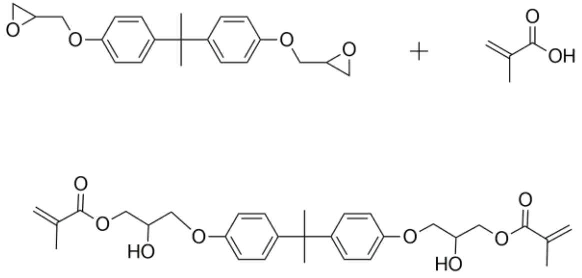


Polymer thermosets for composites – what's the deal?

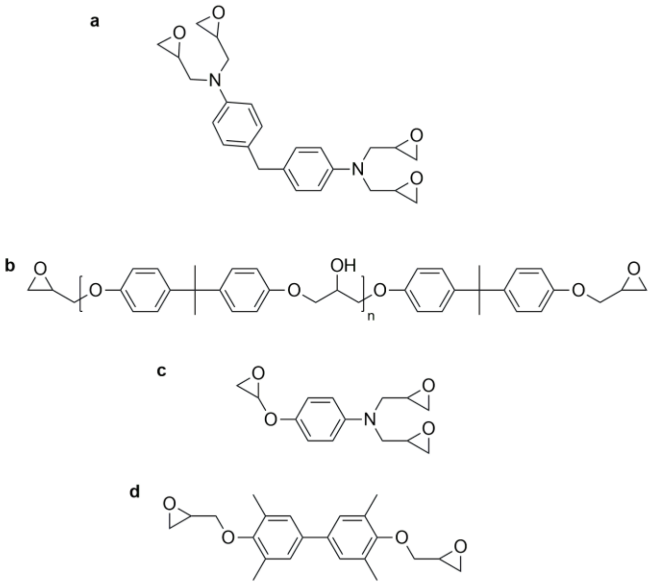
Unsaturated polyesters



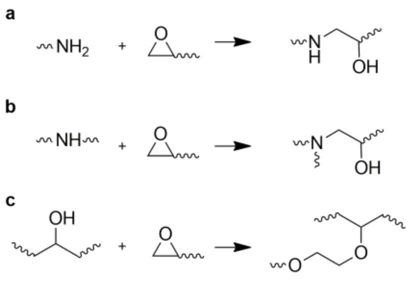
Vinylester resins



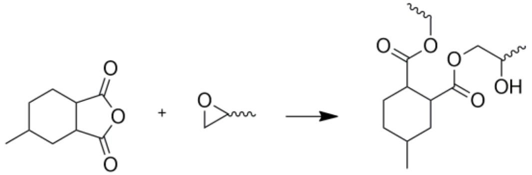
Epoxy resins

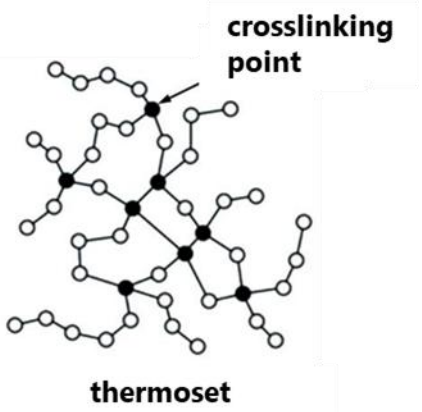


amine-cured



anhydride-cured





- Covalently **crosslinked**
- Insoluble/**chemical resistant**
- Reduced **creep**
- Remains **hard** when heated

- Non-reprocessable
- Non-recyclable
- Non-repairable

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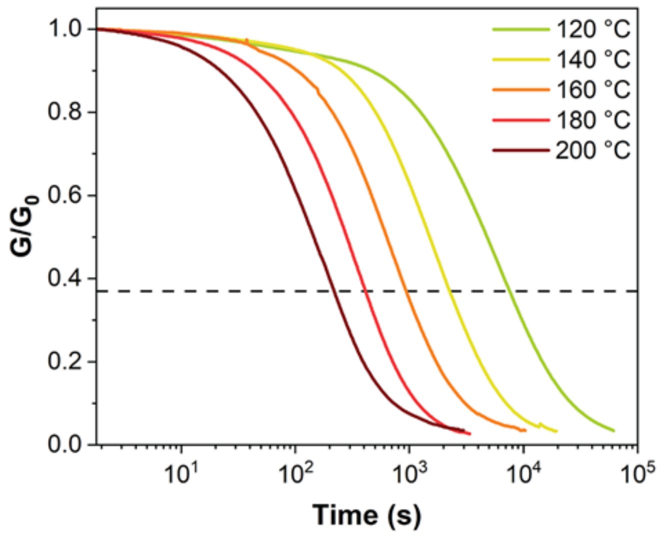
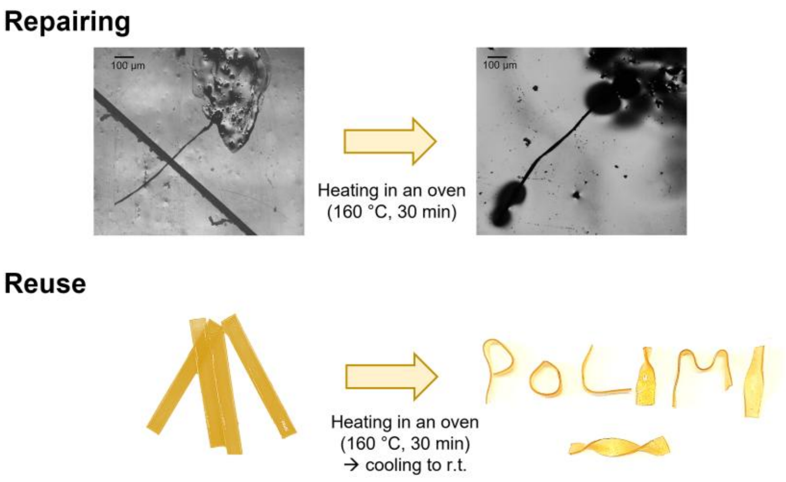
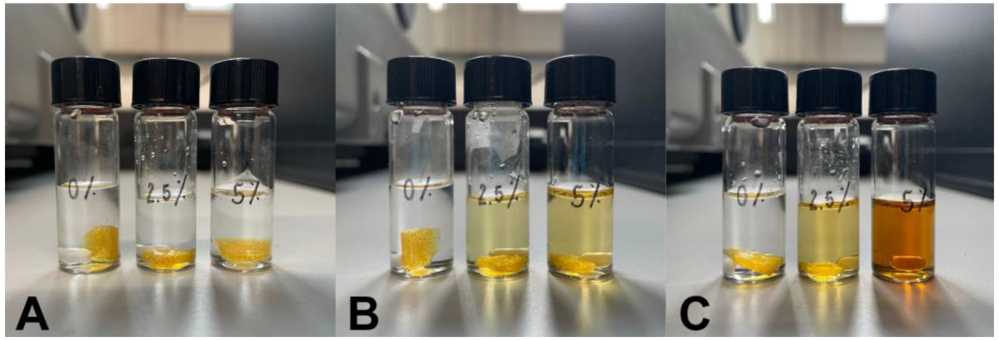
Next-generation epoxies

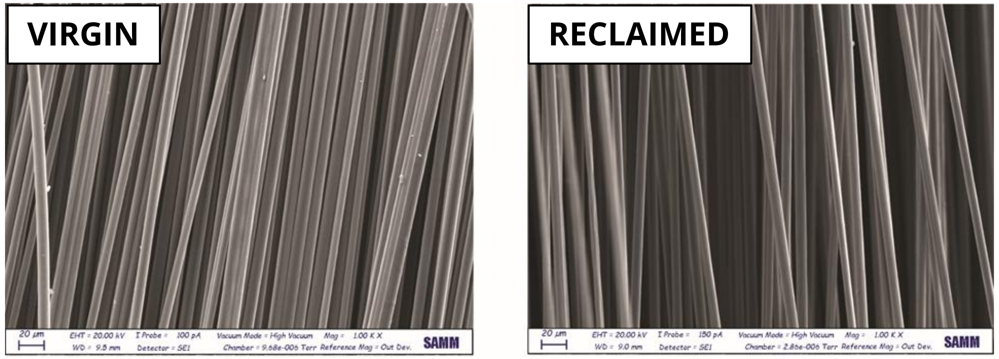
Biobased vitrimers for GFRCs and CFRCs

Thermally-triggered catalyst-assisted transesterification (TE) exchange reactions









- **Tunable** Tg (90-150 °C) and mechanical properties via formulation engineering
- Increasing **biobased** content (40-100%)
- **3R** → Reusable, repairable, recyclable

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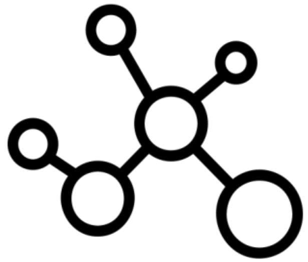
Next-generation crosslinked polyesters (revisited)

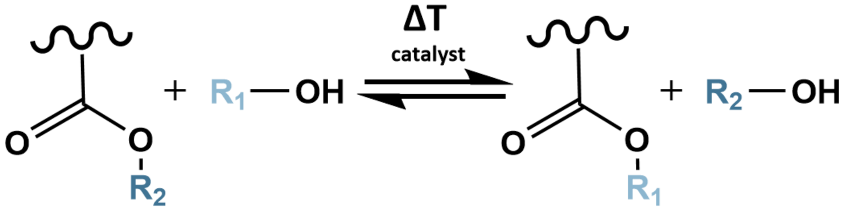
Reversible vinyl-ester resins for GFRCs

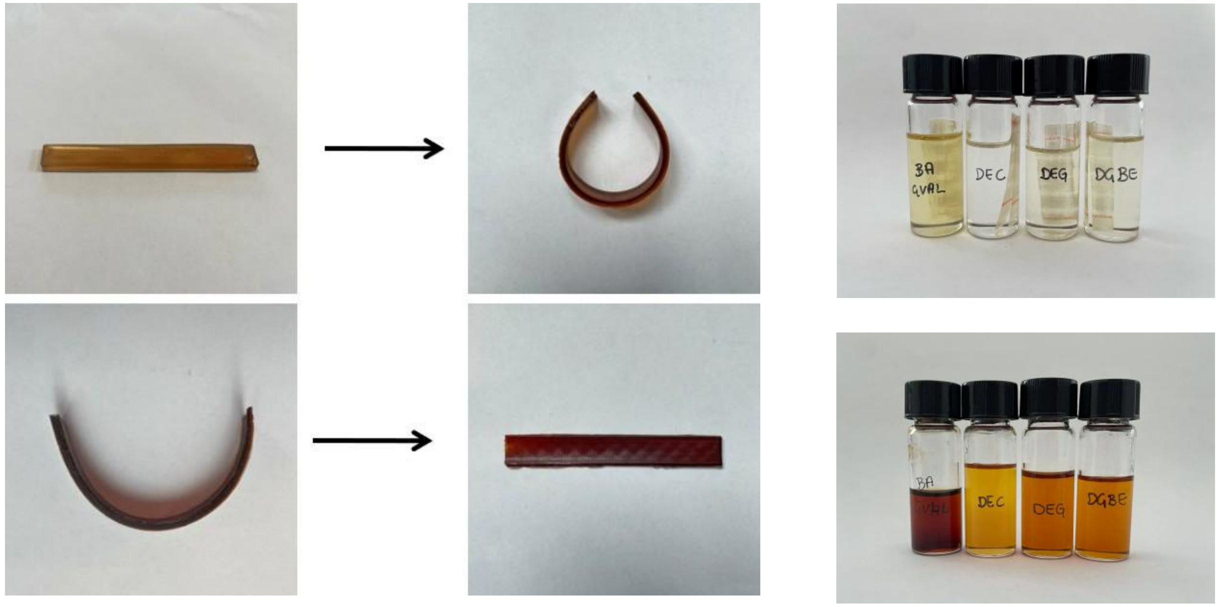
Thermally-triggered catalyst-assisted transesterification (TE) exchange reactions

Going vitrimeric



- TE catalyst incorporated in the resin formulation
- Intrinsic vitrimeric behavior





- Suitable **Tg** (~70 °C)
- Tunable **viscosity** and **mechanical** properties
- **3R** → Reusable, repairable, recyclable

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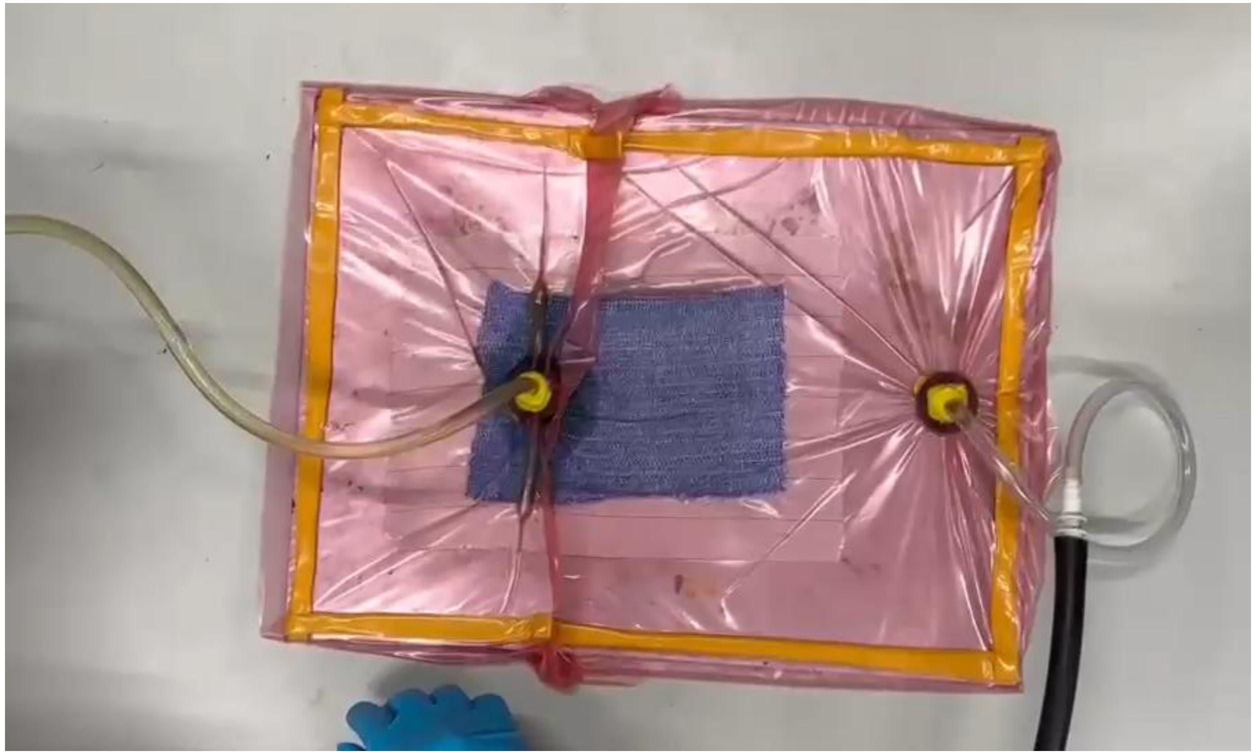
Resin processability

Viscosity tunability

→ **scalable** composite production technologies



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Reprocessing of recycled CFs with reversible resins for sport equipment

From racket to racket

Characteristics of innovation:

- Tennis rackets, due to their requirements and shape are built from ~100% UD carbon fiber prepregs
- Due to a flat hitting surface, Padel and Pickleball are produced with a different technology and have different mechanical specifications
- **Recycled fibers**, from Tennis rackets or other sources can be processed in a kind of SMC/BMC process and can fulfill the KPI
- **Reversible resins** can be used to increase product circularity

Customer benefit:

Challenges	Solution
• Quality of recycling fibers for new process • Isotropic properties especially at thin layers • Repairability/recyclability	• SMC/BMC Process adaption

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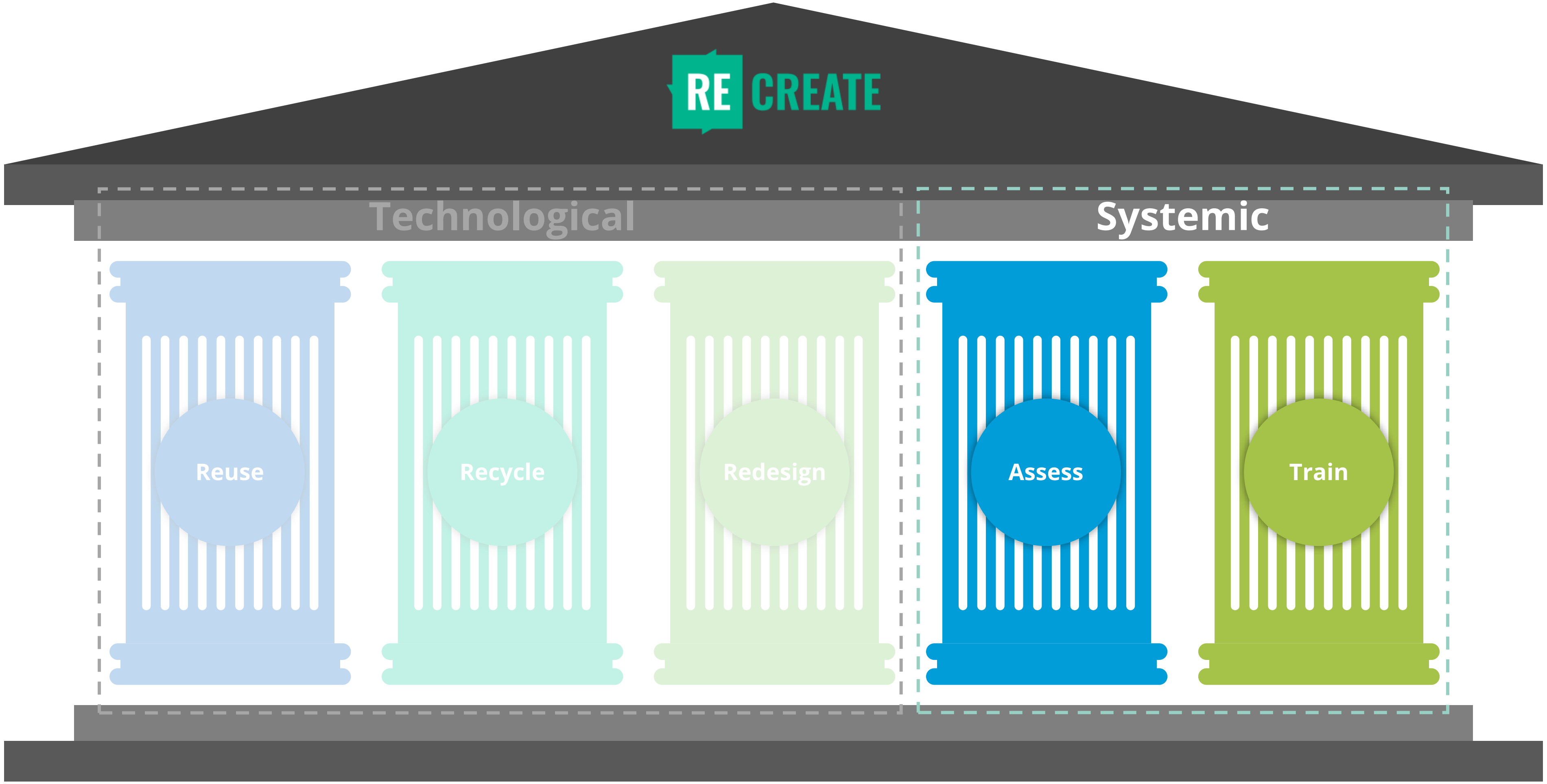
RECREATE – Systemic pillars



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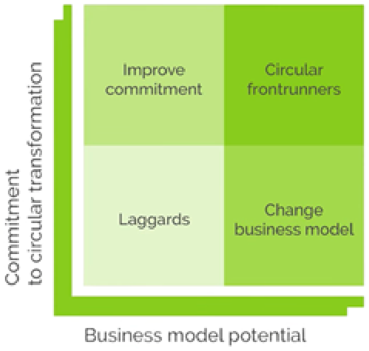
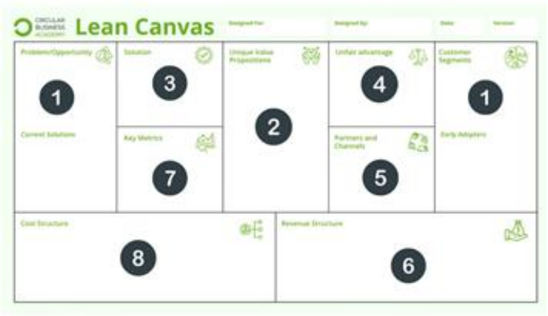
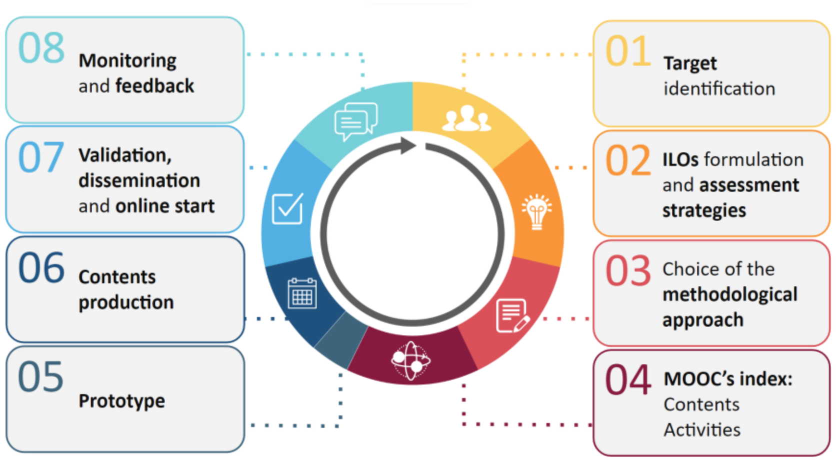
RECREATE – Systemic pillars

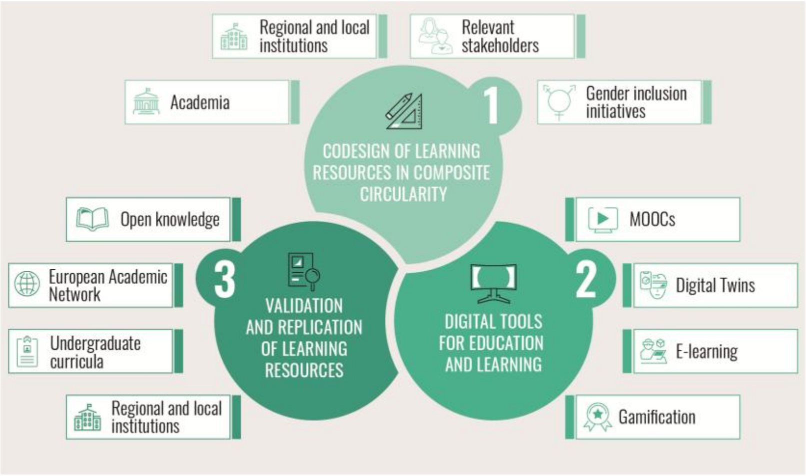
Systemic pillars:

1) **Assessment** and acceleration for circular economy and sustainability *via* quantitative digital tools.
2) **Educational** and learning instruments through digital technologies.









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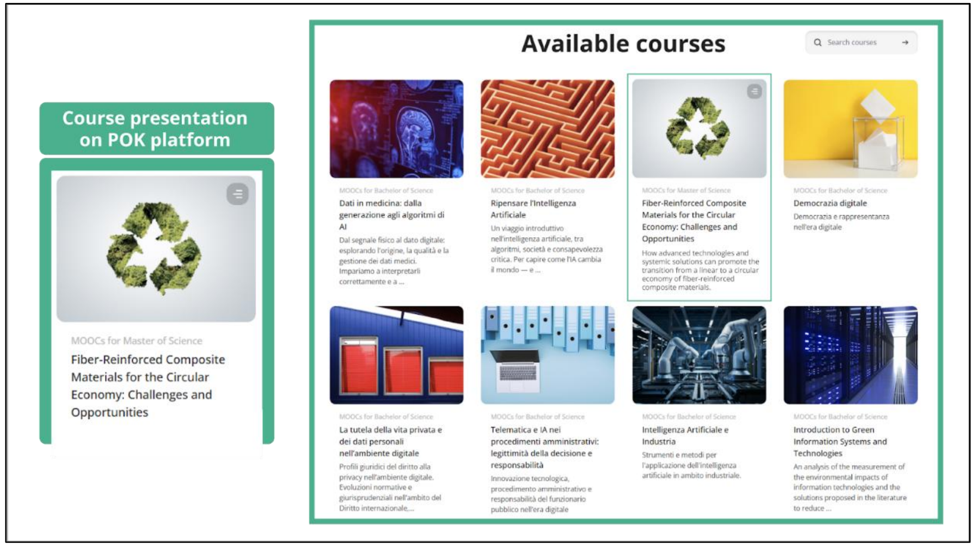
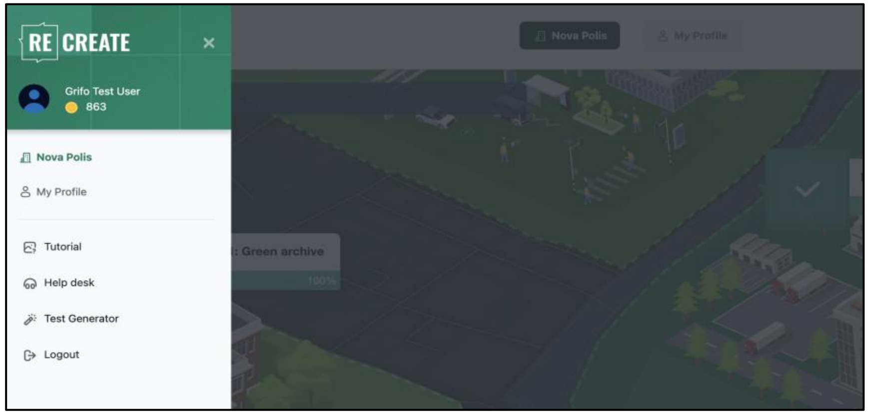
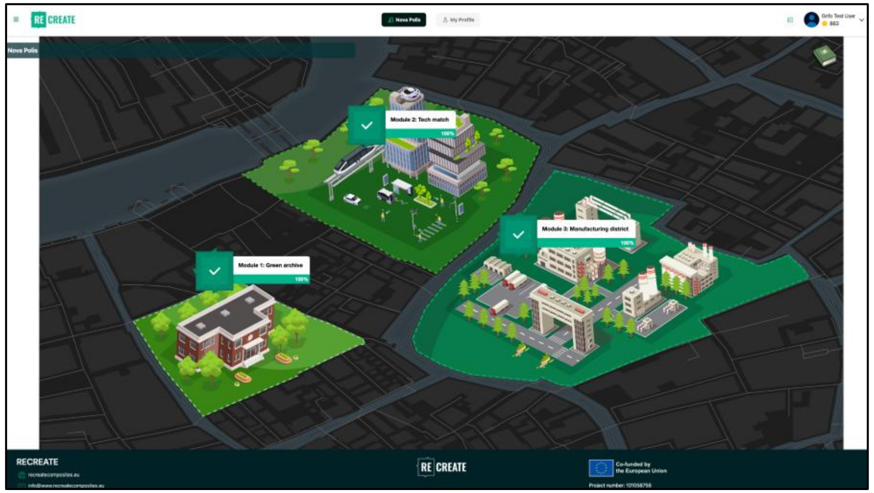
RECREATE – Advanced learning resources

Massive open online course (MOOC)

Fiber-reinforced composite materials for the circular economy: challenges and opportunities







- Multidisciplinary approach and content
- Serious gaming and digital twins

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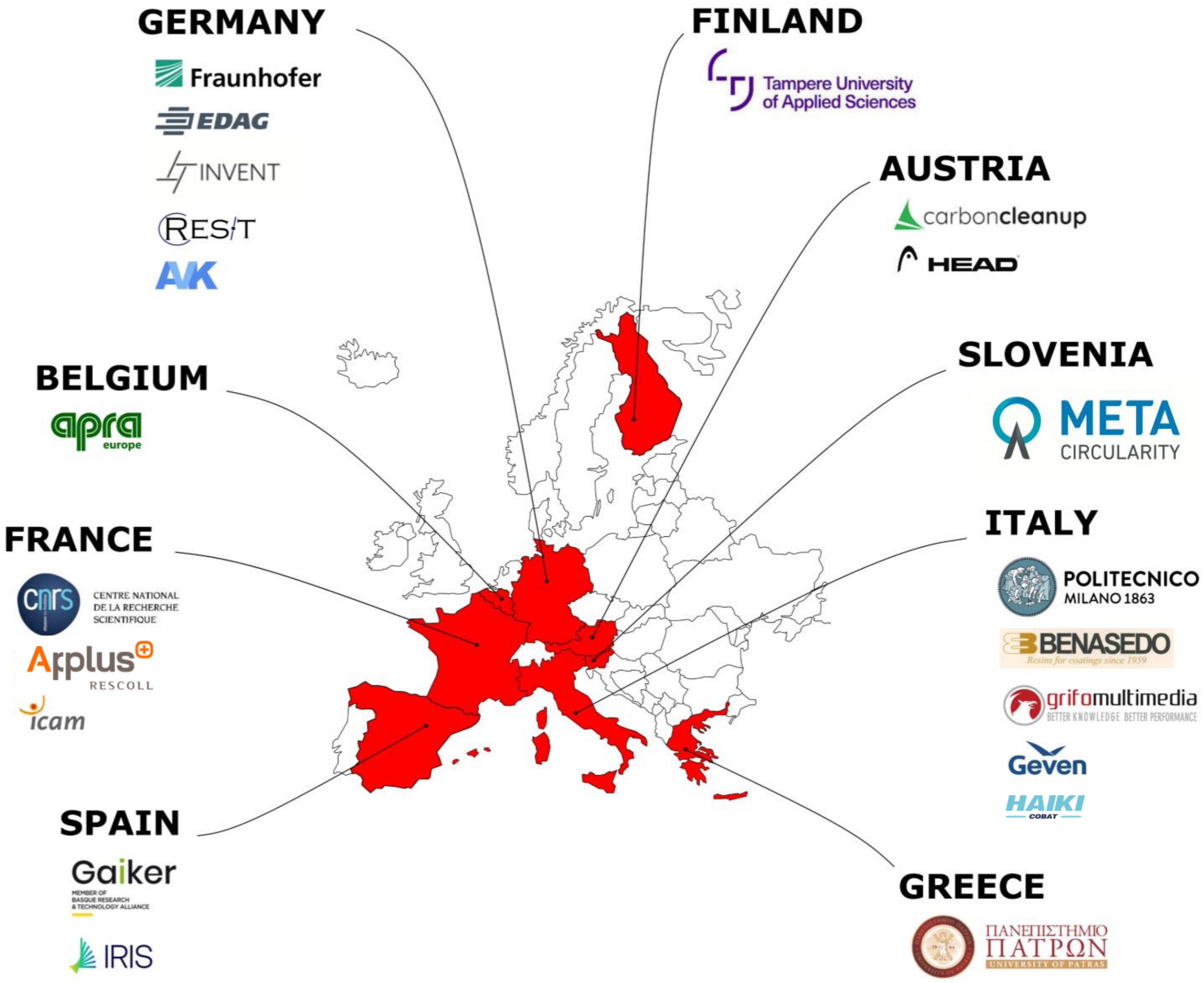
RECREATE – The Consortium



- 7 HEIs / RTOs
- 8 SMEs
- 4 LEs
- 2 Associations

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Join us in Brussels for our final RECREATE Workshop!

www.recreatecomposites.eu

Funded by the European Union

Thank you
for your kind attention

Contacts:

Prof. Gianmarco Griffini

Department of Chemistry, Materials and Chemical Engineering "Giulio Natta"

Politecnico di Milano - Italy

gianmarco.griffini@polimi.it

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the European Union

Sustainable structural sandwiches and hollow composite parts for automotive, boat and aerospace markets

IRT JULES VERNE

SUSPENS

Design sustainable composites

START
01.01.2023

END
30.06.2026

TOTAL BUDGET
€4 900 000

NUMBER OF PARTNERS
12

EureComp Workshop 2026

DALLARA-IT, March 20th, 2026

EuReComp

Funded by the European Union

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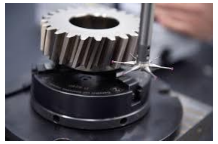
Julio Cesar DE LUCA, PhD - Career journey in a nutshell



Metrology & Automation

1987-1999

Automotive & F1 motorsport

2000

2014

Adv. Manufacturing & EU R&D

2014 - ....

R&D Team Leader in Metrology at CERTI (Brasil)

NVH Development Engineer at EATON (Brasil)

Automotive NVH Team Leader at Renault-Nissan (France)

F1 R&D Engineer at Renault F1 Team (UK)

R&D Team Manager & EU R&D Technical Program Officer at IRT Jules Verne

Education:

- PhD in Automotive NVH, ISVR-UK, 1998
- Business Marketing at Audencia-FR, Sept25
- MSc in Metrology & automation, UFSC-BR, 1990
- BSc Mechanical Engineering, UFSC-BR, 1986
- Course in Metrology & Standards, Japan, 1989

Awards, Patents & Publications:

- 5 Innovation Awards (2x 2025, 2022, 1998, 1990)
- 5 Crowdsourcing Prize
- 4 Innovation Patents (1 Global Implementation by Renault-Daimler)
- 20+ Publications (*orcid.org/0000-0002-2621-9911*)

Mob. +33 640100669 *https://www.linkedin.com/in/juliodeluca/*

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MANUFACTURING THE FUTURE

French non-profit R&D Institut in Manufacturing & Robotics

7000m² Building with > 4000m² in Workshops

100+ Industrial members & stakeholders

€25M Turnover in 2024

150+ Collaborators

80+ Patents

100+ FR / 25 EU R&DI projects

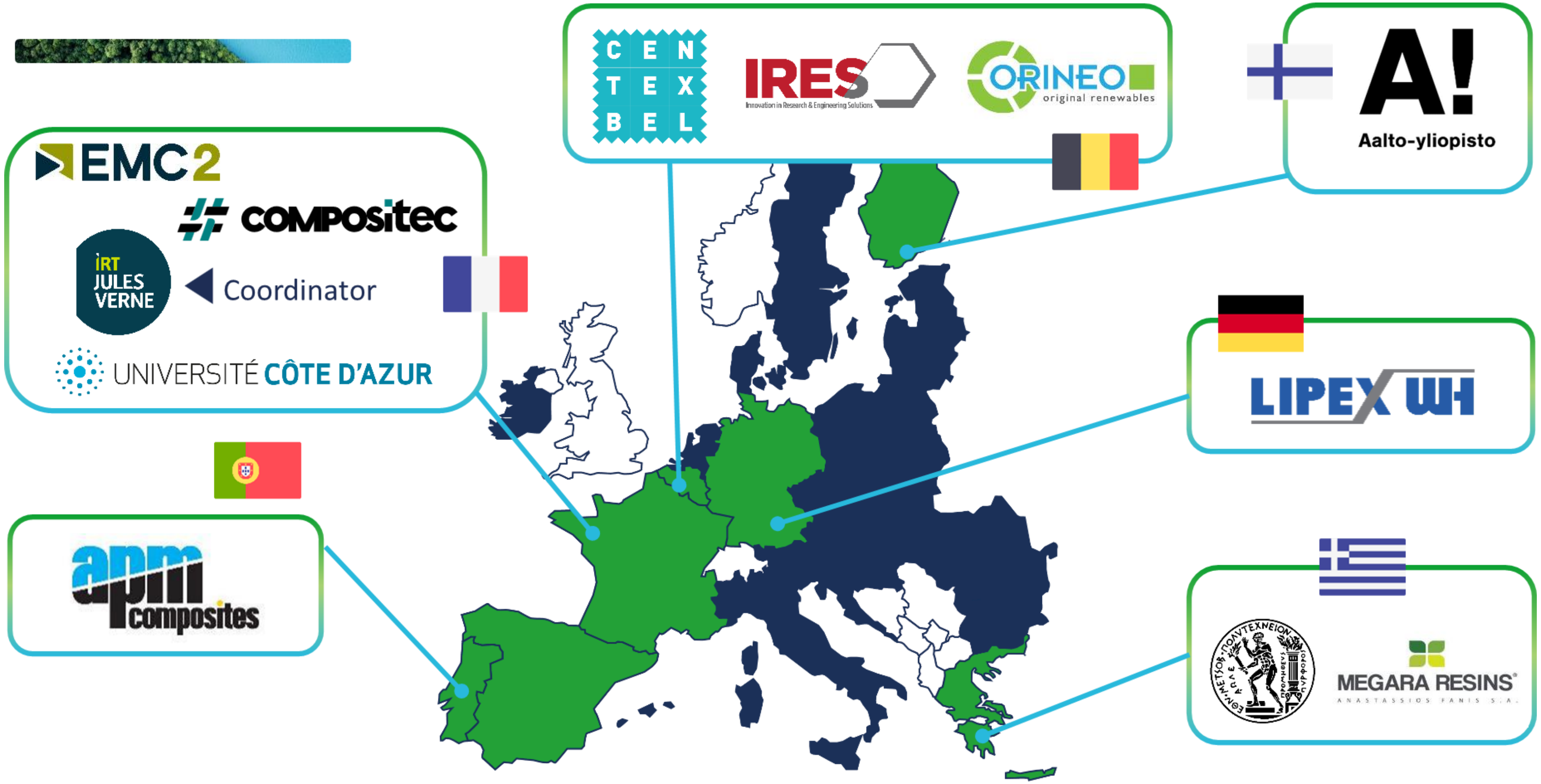
16 FR Academics & R&D centers

€20M+ Equipment Assets

EuReComp

SUSPENS - 12 Partners from 6 countries

***HORIZON-CL4-2022-RESILIENCE-01-11 (RIA)** - Advanced lightweight materials for energy efficient structures*



"Manufacturing and recycling inefficiencies diminish the lifecycle benefits of lightweight composites"

Environmental challenges for composites

1 MADE FROM FOSSIL RESOURCES

2 High Energy Consumption

3

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SUSPENS Approach

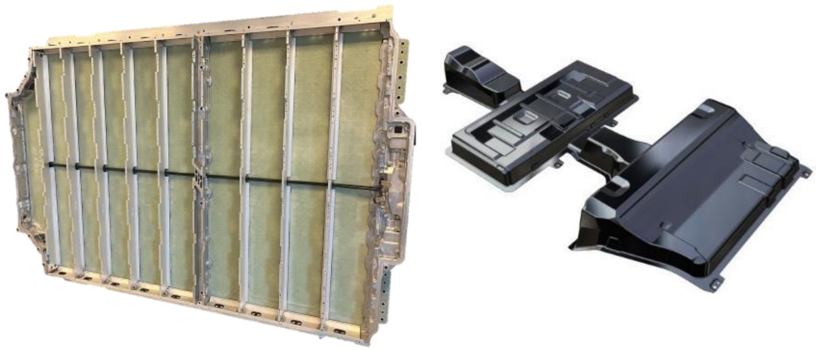
Environmental impact reduction & sustainability

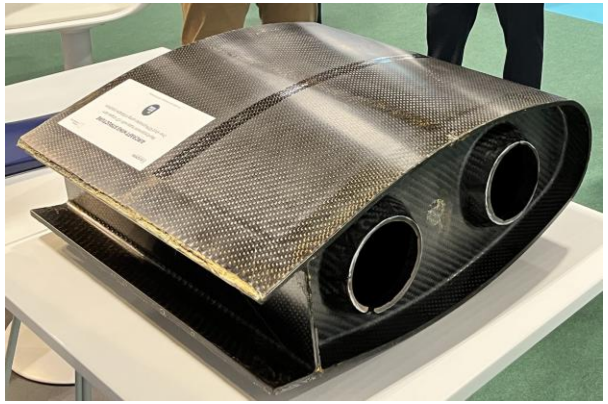
- **Ingredients**
- **Manufacturing process**
- **End-of-Life**

Materials / Process / EoL

- Ingredients → Bio-based, Recycled, Fast-cure
- Manufacturing process → Energy-efficient, Multi-functionnal
- End-of-Life → Separable, Reprocessable

Target applications – use cases (demos)





Car battery-pack

compositec

Sailing boat hull & deck

ANTHONY PATRICK
& MURTA LDA

Aircraft wing structure

IRT JULES VERNE

Materials – Bio-sourced resins

Epoxy with >95% bio content

Bio-based Unsaturated Polyester resin (50% BB) + Substitute Styrene by bio-diluent

UNIVERSITÉ CÔTE D'AZUR

ORINEO original renewables

MEGARA RESINS

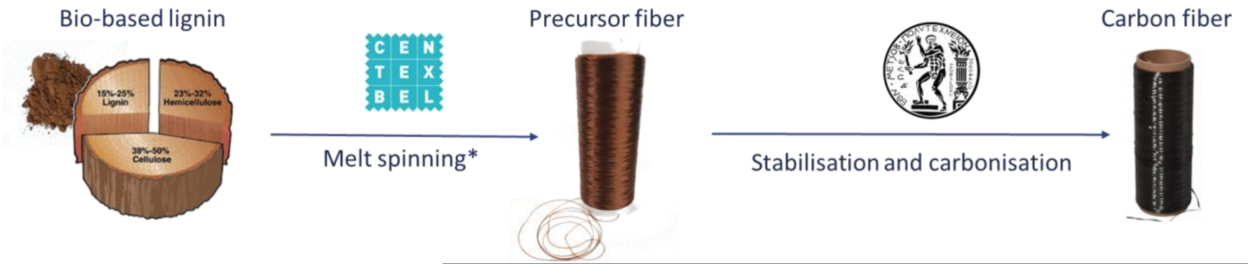
CENTEXBEL

SUSPENS

IRT JULES VERNE

Materials - Bio-sourced & Recycled fibres

Carbon Fibre produced from bio-precursor (Lignin/BioPA)



CF continuous staple yarn from prod. waste

TECHNISCHE UNIVERSITÄT DRESDEN

IRT JULES VERNE

Glass fibre produced from EoL wind turbines

presolisis

LIPEX WH
GLASS AND BASALT FIBRE TECHNOLOGY

High performance cellulose fibre

Towels hotel => viscose fibres

Aalto University

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Manufacturing & Recycling Processes

Low-energy manufacturing process

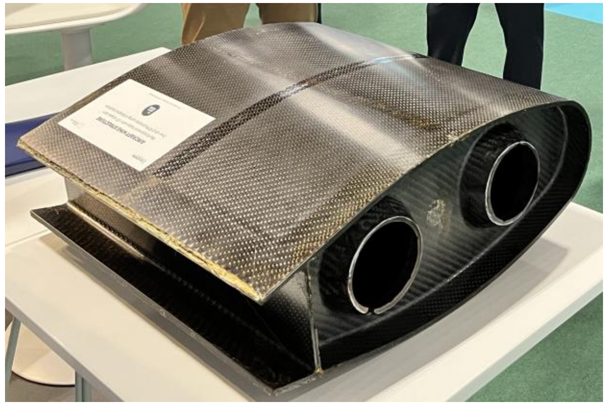
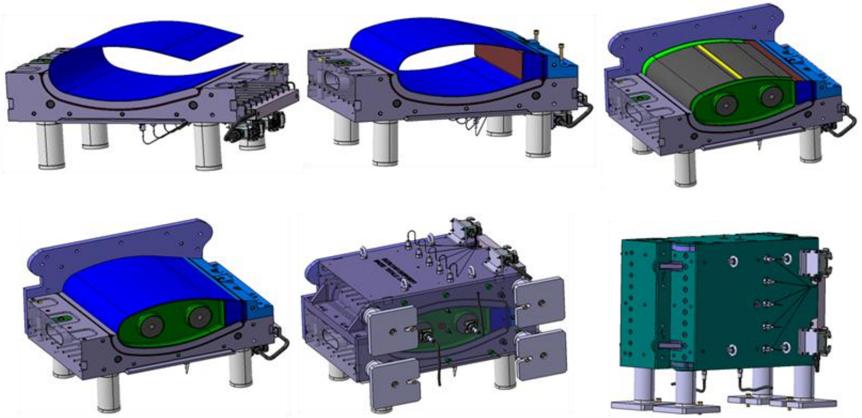


Illustration of classical architecture with constitutive parts



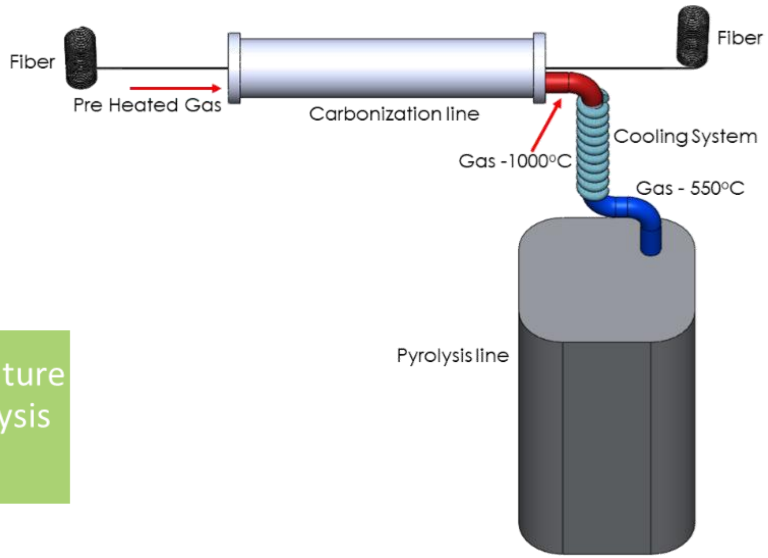
Fast Processing/curing of sandwich structures

One-shot manufacturing of complex hollow structures

Low-energy recycling processes

Gases from carbonization process

- Semi-inert gas needed for pyrolysis (Nitrogen and mono-/dioxides)
- Required temperature to heat the pyrolysis chamber



Pyrolysis using exhaust gases from carbonisation process

Solvolysis process to reclaim monomers

SUSPENS

Conclusions – Next Steps

Results so far:

- Recycled Glass fibre production is succesful – 100% recycled from EoL wind blades (scaling up is still a challenge)
- Recycled Carbon fibre (20kg) – mechanical assessment underway!
- Demonstrators under fabrication with bio-sourced & recycled materials
- Possible to produce bio-based resins for composite application – track recorded
- Cabon fibre from lignin/PA-blend was not succesful (poor carbonisation behaviour)

Next steps:

- Need industrial scale-up to make it competitive against petrol based **materials**
- Need to pursuivre development for **processability** into large composite structures
- *Eco-composite Cluster – **ECCM Oslo June-26***

SUSPENS
Design sustainable composites

IRT JULES VERNE

Contact

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Mehdi Marin

Mehdi.marin@irt-jules-verne.fr

in @SUSPENS_Project

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BLADES2BUILD

Recycle, repurpose and reuse end-of-life wind blade composites – a coupled pre- and co-processing demonstration plant

Maria Kosarli
Senior R&D Project Manager,
Global Consulting Sustainability AS

4th Eurecomp Workshop, 20 March 2026

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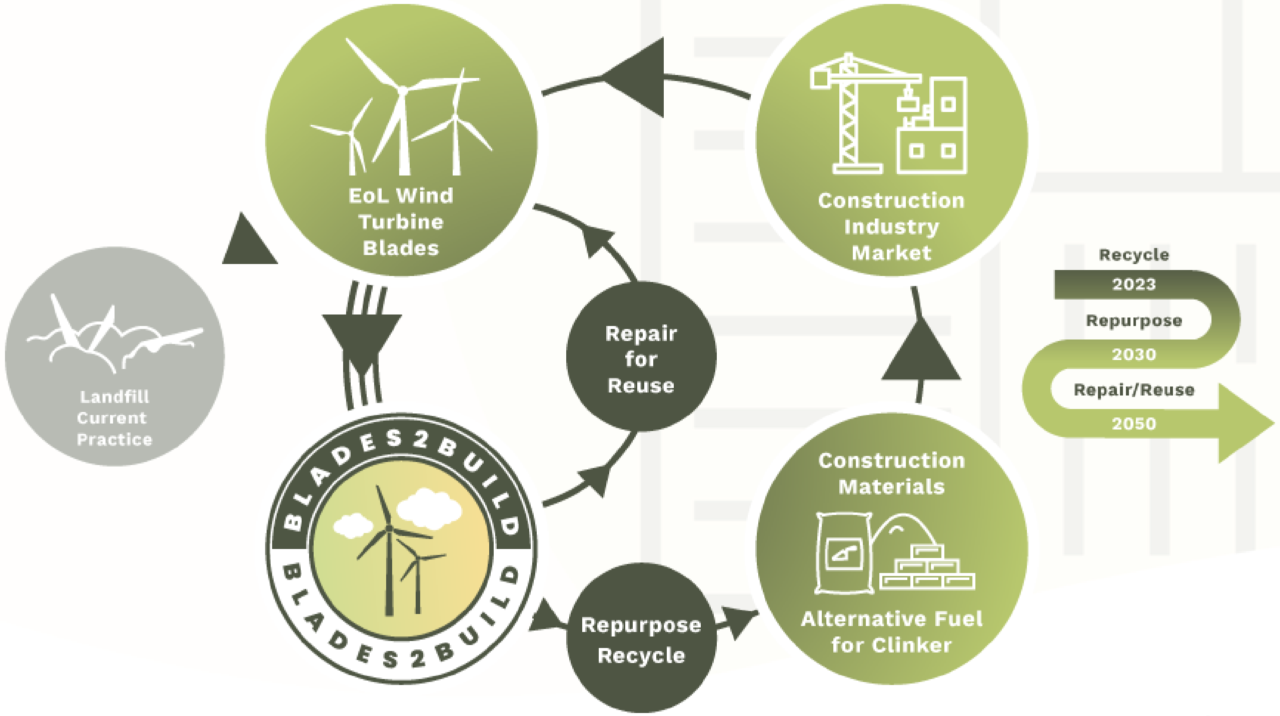
Concept

The aim of BLADES2BUILD is to improve and support circularity options of end-of-life wind blades by exploring three different circular stages:

• Direct re-use of the EOL wind blades with minimal refurbishment or processing.
• Re-purpose of individual materials constituents of the blades.
• Recycling the blade and glass fibre textiles scraps from the wind blade manufacturing in cement/clinker co-processing as an alternative fuel.



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Ambition of the project

Implement a demonstration plant for the circular use of end-of-life wind turbine blades (WTB) based on three options of circularity

Repair (R4) EOL wind blades with minimal refurbishment or processing for re-use

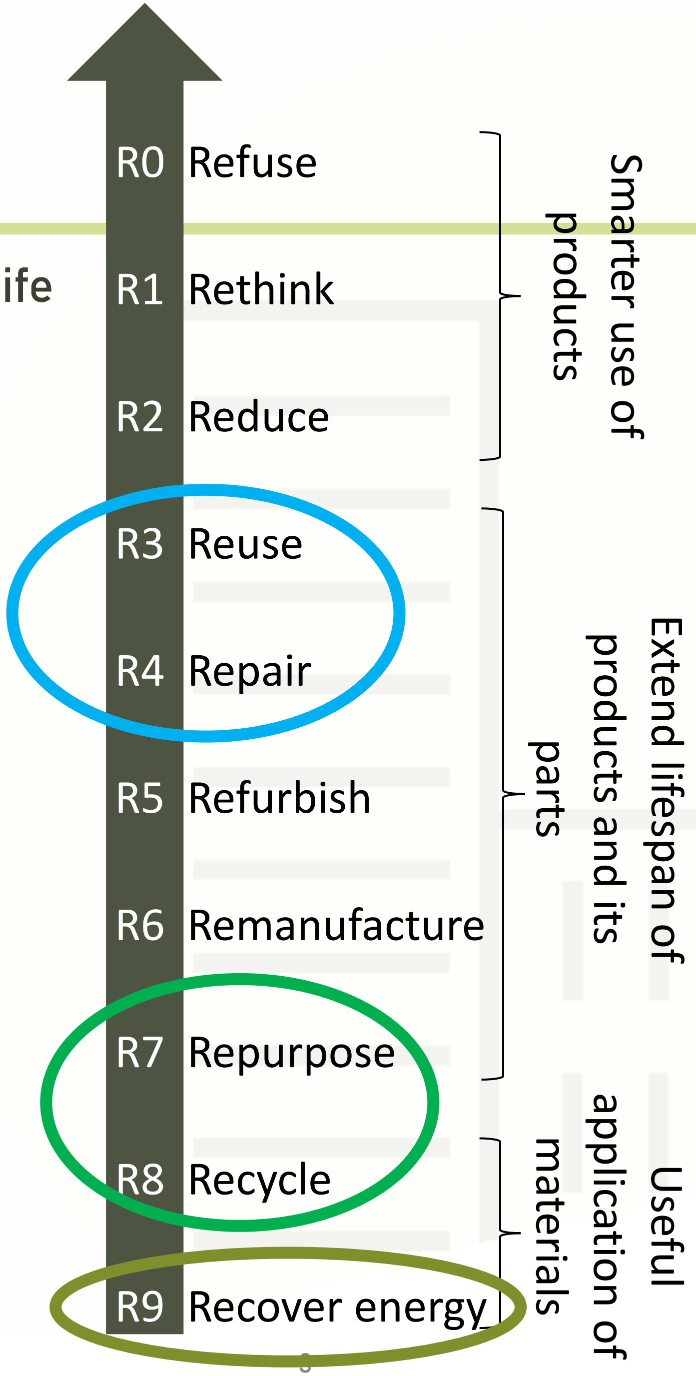
- R3/R4

Re-purpose of individual materials constituents of the blades in construction products, like concrete and asphalt mixtures

- R7

Recycling the blade and glass fibre textiles scraps from the wind blade manufacturing in cement/clinker co-processing

R8/R9



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The consortium

Universities

Industry

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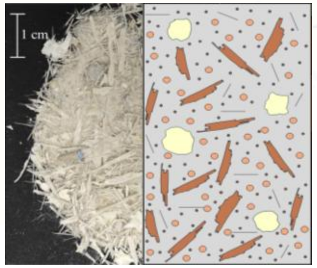
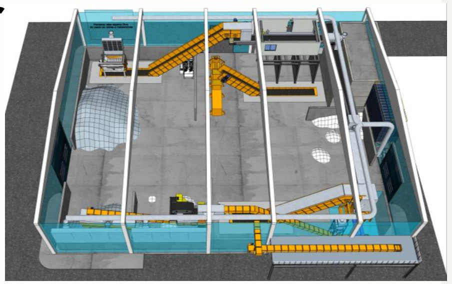
Workflow

Characterisation of the WTB wastes and developed methods on solvosisys of WTBW



Developed circular building materials with WTB waste



Construction of demonstration plant to recycle end-of-life wind turbine blades

Industrial Scale Concrete Pavements Demonstrators

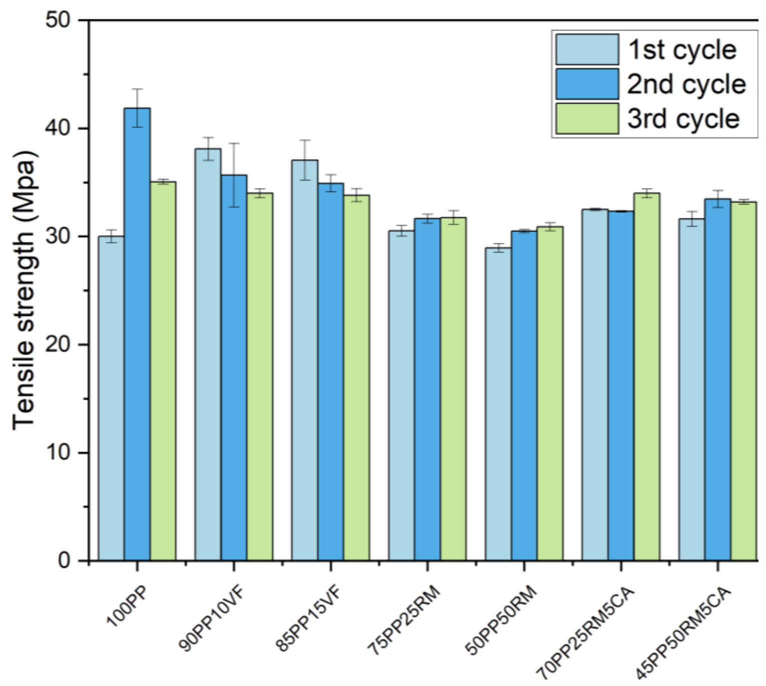
Funded by
the European Union

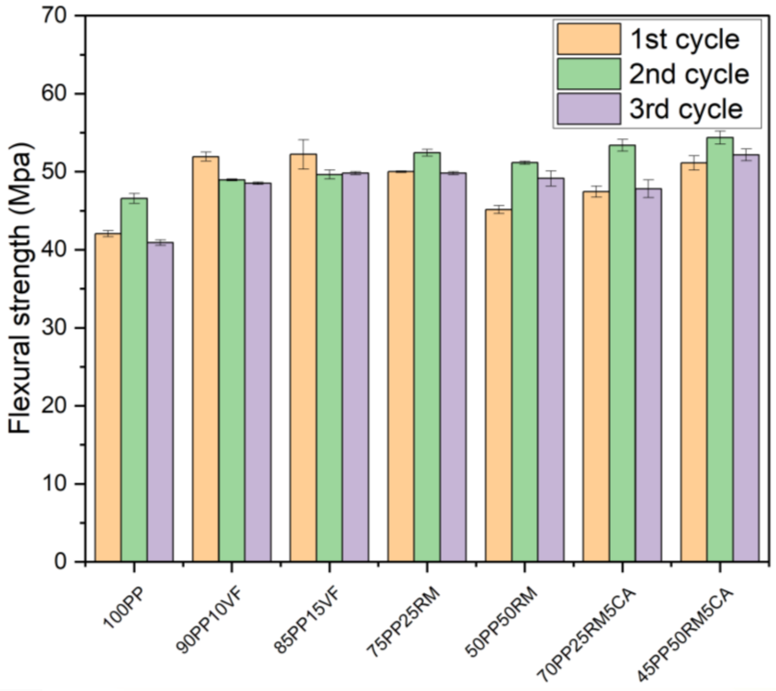
Polymer-based composites: aspects of circularity

Tensile and flexural strength of different composites for three reprocessing cycles

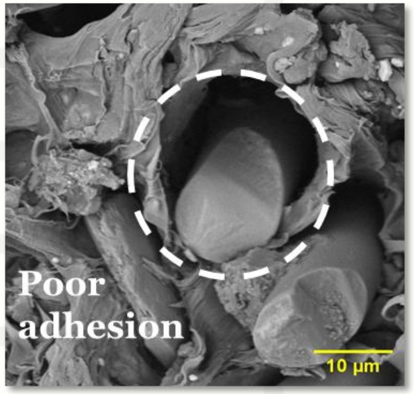
Mechanical properties of 3 cycles

PP- polypropylene, RM (recycled wind turbine blades waste) < 20 mm;
VF – virgin glass fiber; CA- coupling agent

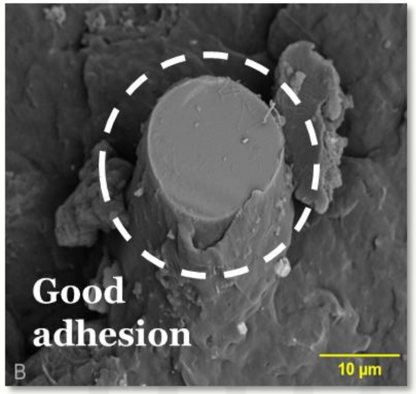




Without coupling agent (CA)



With coupling agent (CA)



- Positive influence of coupling agent (CA)
- Recycled composites with CA have similar performance in mechanical, thermal and rheological properties compared to virgin composites, even after 3 reprocessing cycles
- 10-15 wt% of virgin GFs can be replaced by 25-50 wt% of recycled materials from wind turbine blade waste

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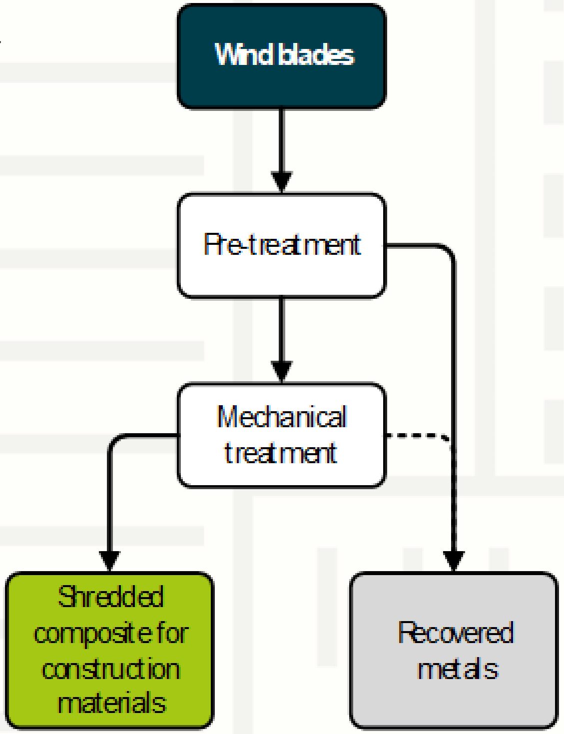
BLADE2BUILD Demonstration Plant

- The plant aims to enable the circularity of wind turbine blades by converting them into secondary raw materials primarily intended for the construction industry.
- The shredded composite will be used as recycled aggregate in construction materials such as low-strength concrete, asphalt, insulation materials, and dry mortars.
- In addition, other materials recovered during pre-treatment—such as steel, aluminium, and copper—will be sent to authorized waste managers for recycling



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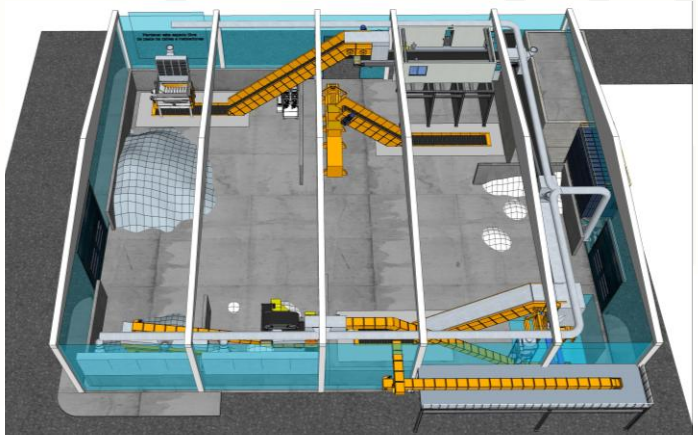
BLADE2BUILD Demonstration Plant

1. Reception and weighing: Wind turbine blades, previously cut into 5 to 6-meter sections, arrive at the plant and are stored in an outdoor area. The truck is weighed upon entry and exit to determine the weight of the unloaded blades.

2. Pre-treatment: The blade sections are transferred inside the plant, where a hydraulic shear removes metal components (cables, profiles, and other elements), separating as much fiberglass composite as possible from other materials such as wood or foam.

3. Mechanical recycling: The separated composite is shredded using specialized equipment. The shredded material is then processed to meet the final user's specifications and stored for shipment. The resulting shredded composite will be mainly used in construction materials currently under research, development, and testing within the BLADES2BUILD project.



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BLADE2BUILD Demonstration Plant

- Demonstration plant:
  - Location: Tudela del Duero (Valladolid – Spain)
  - Capacity: 6.000 tones/year
  - Construction started: June 2025
  - Main equipment assembly completed: December 2025
  - Currently status: final touches
  - Commissioning: scheduled for April 2026

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BLADES2BUILD

Recycle, repurpose and reuse end-of-life wind blade composites – a coupled pre- and co-processing demonstration plant

The BLADES2BUILD Demonstration Plant is now a reality!

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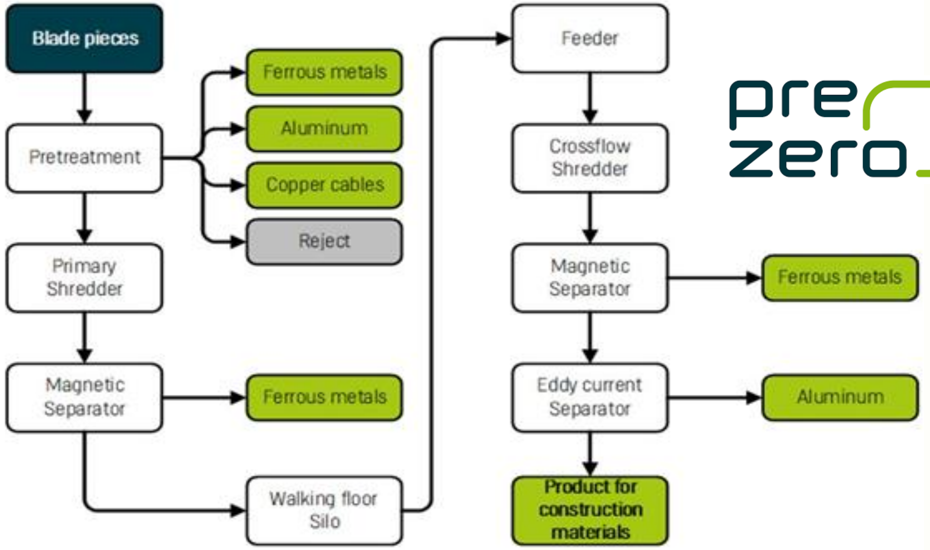
Industrial trials

FROM OLD TURBINE BLADES TO RECYCLED AGGREGATES REPLACING NATURAL AGGREGATES

- The old turbine blades are cut into transportable sections and delivered to a crushing facility. There, the composite material is milled into an alternative aggregate
- Through this process, the 0/10 mm and 0/40 mm aggregate were manufactured.
- The Holcim Innovation Center (France) and Holcim Spain Concrete Laboratory created a pioneering formulation incorporating recycled fibers from wind turbine blades under ECOCycle brand

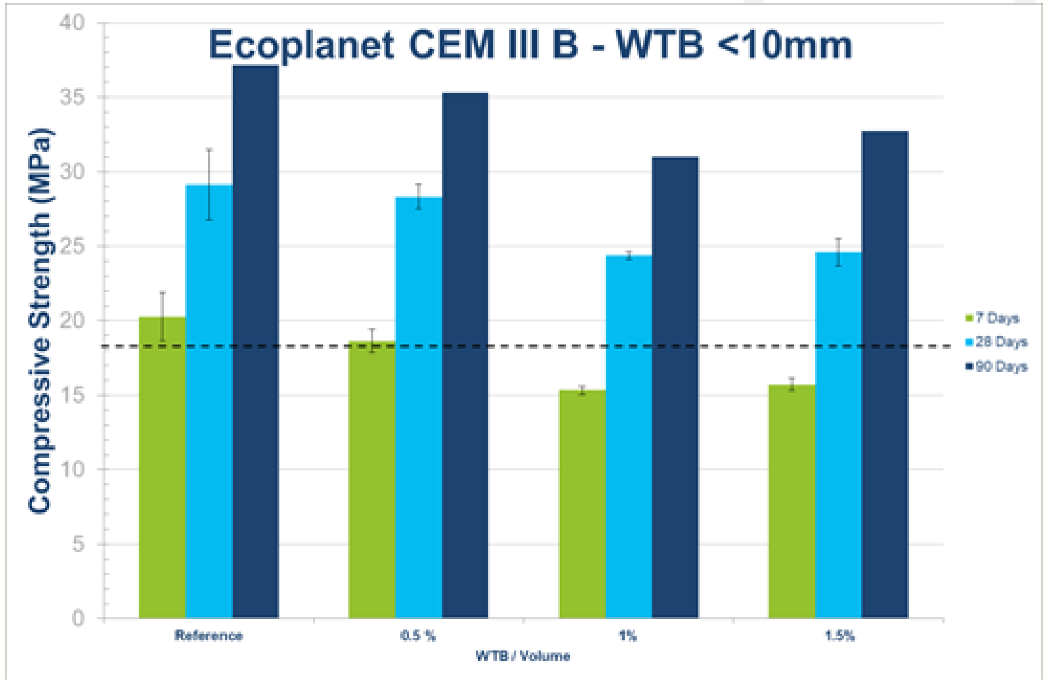


Funded by the European Union

Industrial trials

INDUSTRIAL SCALABILITY TRIAL

- Recycled Content: The final concrete dosage incorporated 10% of recycled material using Holcim's ECOCycle Technology expertise
- Adding the material to the concrete can affect workability and strength, which has been resolved due to Holcim's mix design expertise
- The biggest challenge right now remains how to incorporate this recycled material into concrete on an industrial scale (automatic dosing and introduction into the mixer)



ECOCYCLE

HOLCIM

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Industrial trials

ENDESA DEMONSTRATOR

Endesa and Holcim have conducted an industrial trial during the **repowering of Endesa's wind farm** in Aldeavieja (Ávila), using concrete that integrates crushed fibres from dismantled wind turbine blades

ECOPact Concrete range (low carbon- **~30% CO2** vs. Standard Concrete)- C30/37 S4 to make a 44m^2 slab for on-site waste park.

First wind farm in the EU reusing its own structural waste to build new infrastructure.

Funded by
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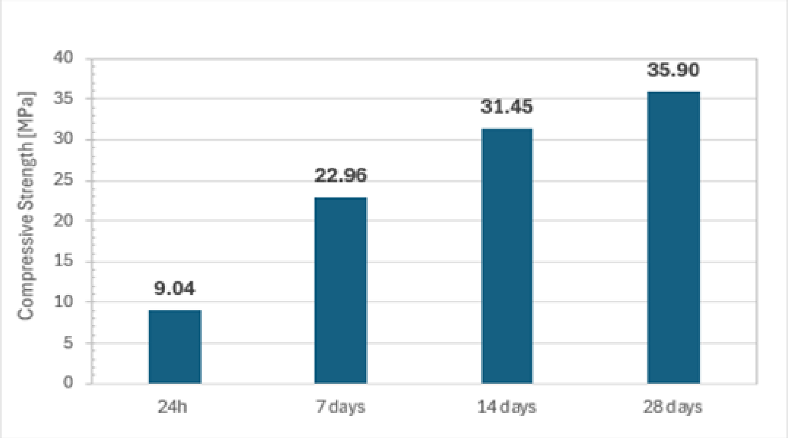
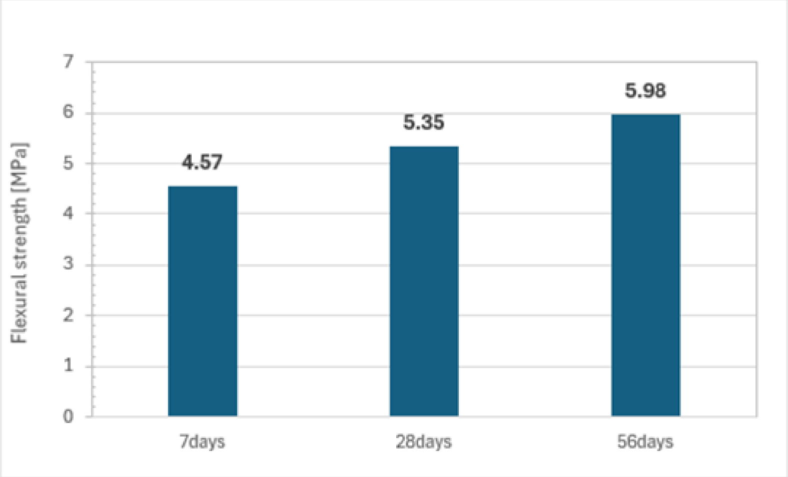
HOLCIM

Industrial Scale Concrete Pavements Demonstrators

The new material is based on Holcim's **ECOPact** concrete with **ECOCycle® technology**, which incorporates 11% recycled content made up of recycled aggregates and, as a novel feature, material from the crushing of wind turbine blades. Additionally, the prototype includes **ECOPlanet CEM V/A (Q-S)** 42.5N cement with a low carbon footprint, thanks to its reduced clinker content, resulting in a **49% reduction in CO_2 emissions compared to the reference cement** (sectoral EPD CEM I).





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Public activities

- Joint Special Session at the 4th International Conference on Sustainable Building Materials
- BLADES2BUILD and CIRCULess Summer School, “Developing Circular Construction Materials”
- BLADES2BUILD Innovation Industry Day, “Towards Tomorrow’s Industry: Sustainable Materials & Emerging Technologies”

Outstanding Innovation Award (OIA) 2025
from EUPAVE, the European Concrete Paving Association to B2B real-world validated demonstrators:

“Turning End of Life Wind Turbine Blades into Concrete Roads and Structures: A First European Experimentation.”

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