



Novel circular resin development for composite structures in wind energy applications

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RECREATE Conference: Made in the EU – Creating Markets for Circular Composites

23.04.2026



Funded by
the European Union

This project has received funding from the European Union's Horizon Europe research and innovation programme under Grant Agreement No. 101148066.

Project Overview



Project number: 101148066

Project coordinator: Gaiker Technology Center, Spain

www.ecoreswind.eu



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Consortium Overview

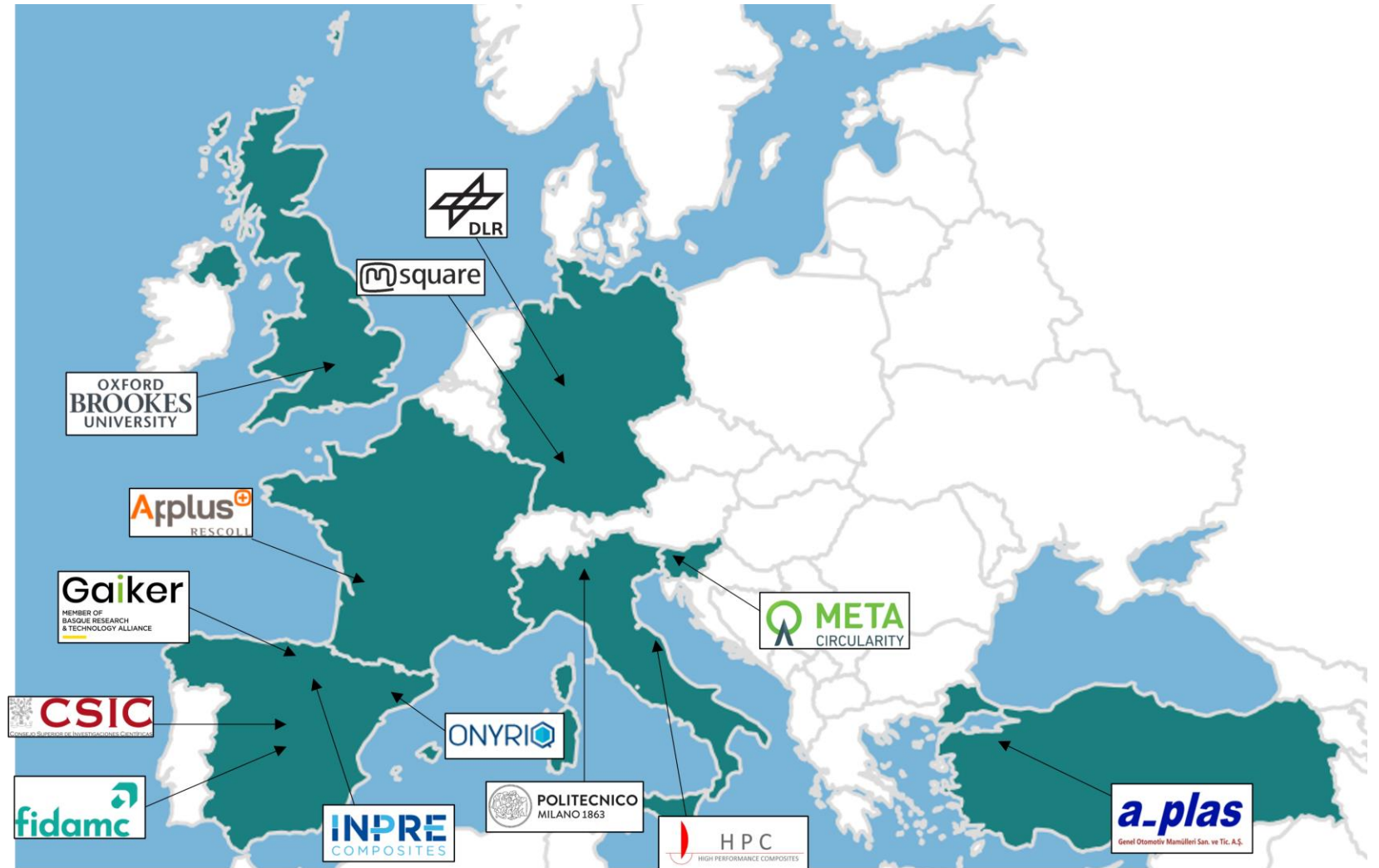
- 13 Partners

4 RTO

2 HEIs

4 SME

3 LEs



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Challenges & Solutions for Wind Energy Systems

Non-recyclable epoxy resins impacting EoL management

ResD1:
Recyclable thermoplastic-acrylic system

ResD2:
Biobased epoxy systems as reversible matrices

ResD3:
Recyclable epoxy systems for multiple recycling cycles

Lack of reliable design methods when introducing new materials

New specific modelling techniques and analysis methods

Decommissioning & Disassembly difficulties at deconstruction site

Disassembly strategies utilizing reversible bonding systems

2nd life and recycling limitations

Chemical recycling to recover fibers and monomers

Reshaping process/Mechanical recycling

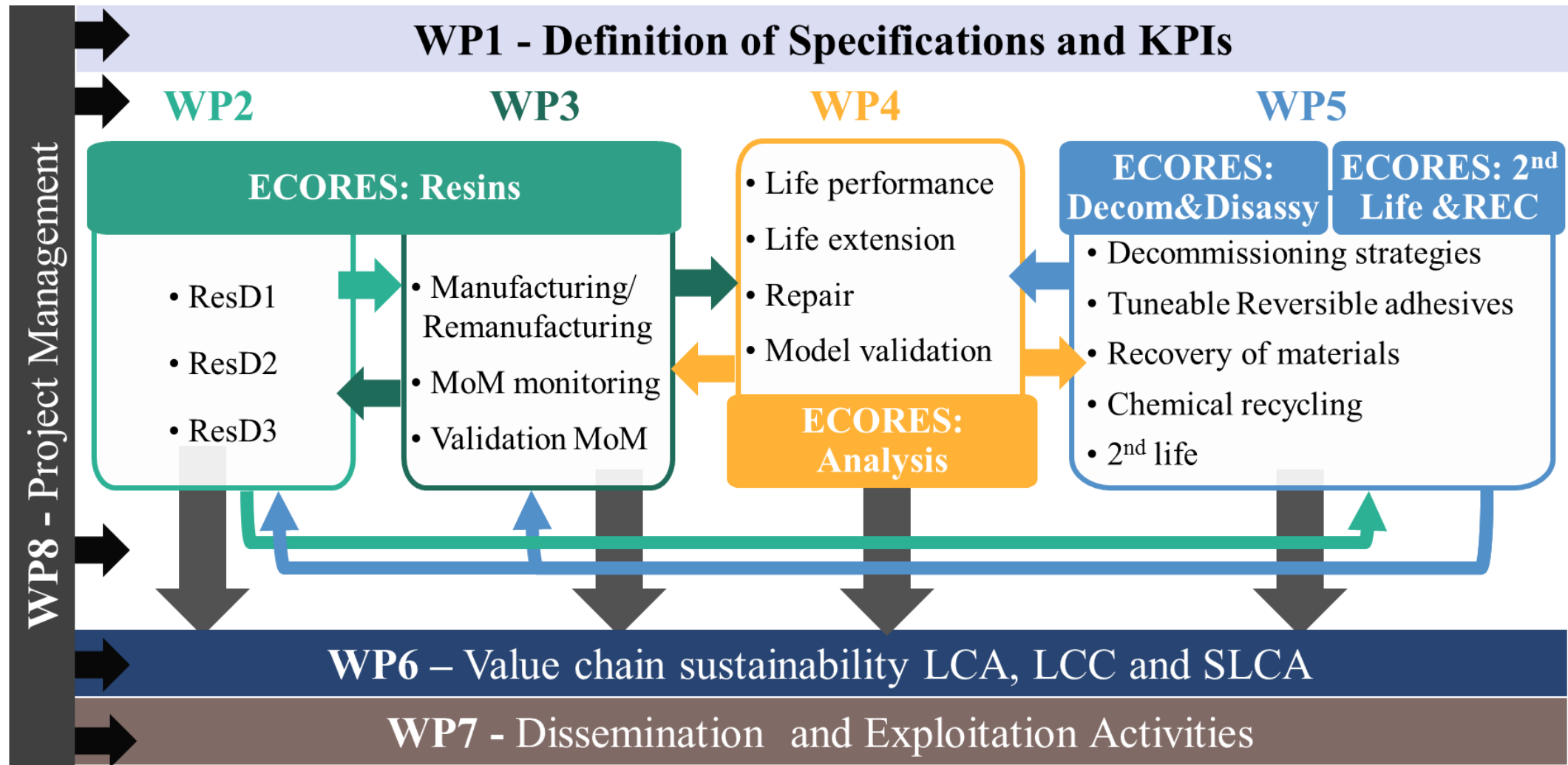


Objectives and ambition

- Development and validation of **recyclable**, **repairable**, and **reusable** resin systems for wind turbine blades and other components.
- Introduction of **reversible adhesives** and **life prediction techniques** to facilitate disassembly and decommissioning of wind turbines.
- Integration of advanced digital tools to **assess the circularity**, environmental, and economic performance of new materials.
- Collaboration with industry partners and educational organisations to create **digital learning resources** for future workforce training.



Workplan Overview

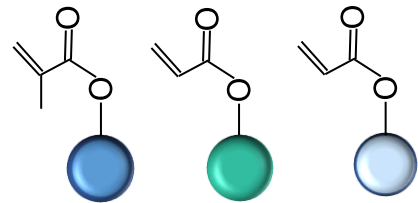


New resins

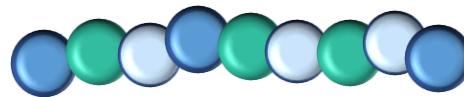
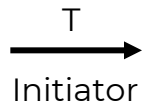


ResD1

Acrylic thermoplastic resin



Mixture of acrylic monomers

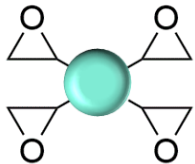


Acrylic resin



ResD2

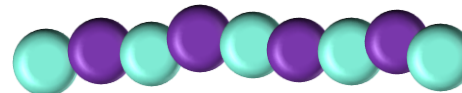
Reversible bio-based epoxy resin



Epoxide groups



Hardener (anhydride)



~100% biobased epoxy resin



ResD3

Recyclable epoxy resin



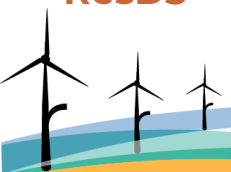
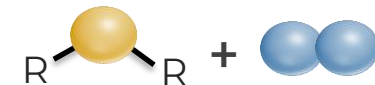
Cleavable Unit



Cleavable Hardener



ECORES WIND
Epoxy Resin System
(ERS)



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ECORES - RESINS

ECORES - MoM

ECORES - Decommissioning & Disassembly

ECORES - 2nd Life and Recycling



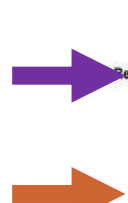
ResD1



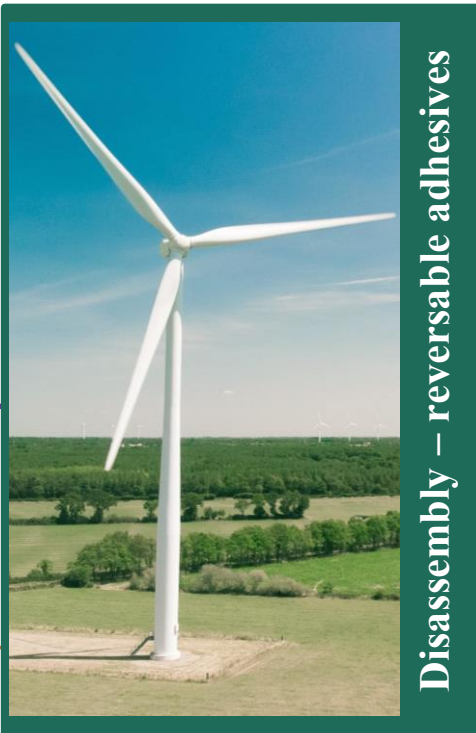
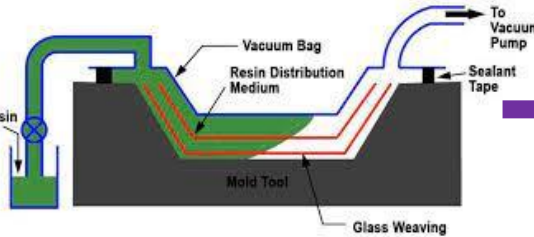
ResD2



ResD3

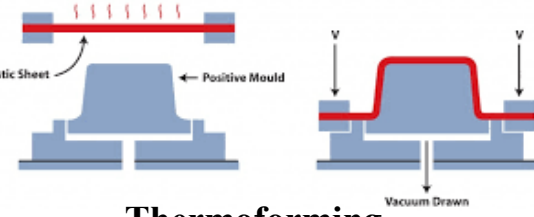
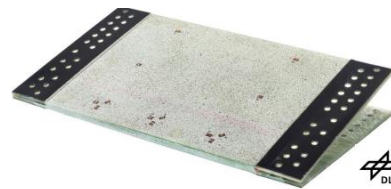
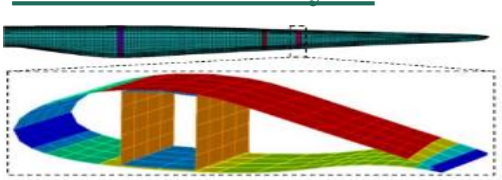


Infusion

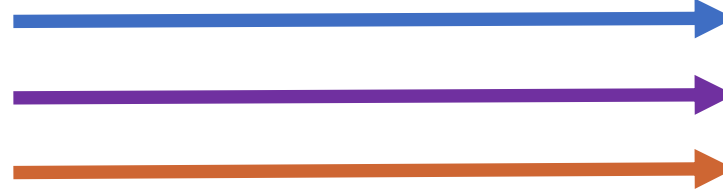


Disassembly - reversible adhesives

ECORES - Analysis



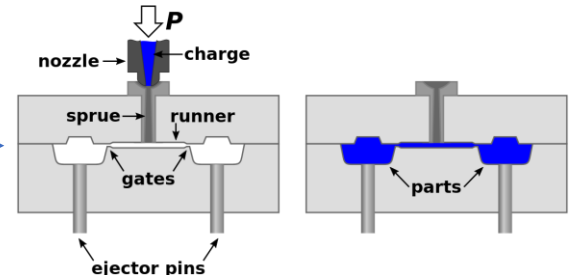
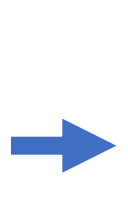
Thermoforming



Chemical



Recycling



Injection moulding



ECORES - Value chain sustainability



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Acrylic thermoplastic resin

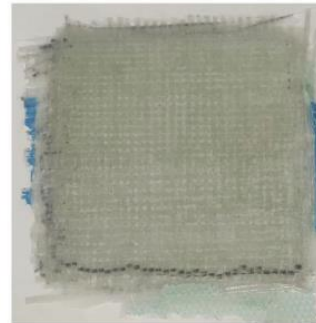


ResDI

- ↑ Exploration of chain extenders and cross-linkers to increase T_g up to 130°C
- ↑ Analysis of the recyclability of the comonomer ongoing



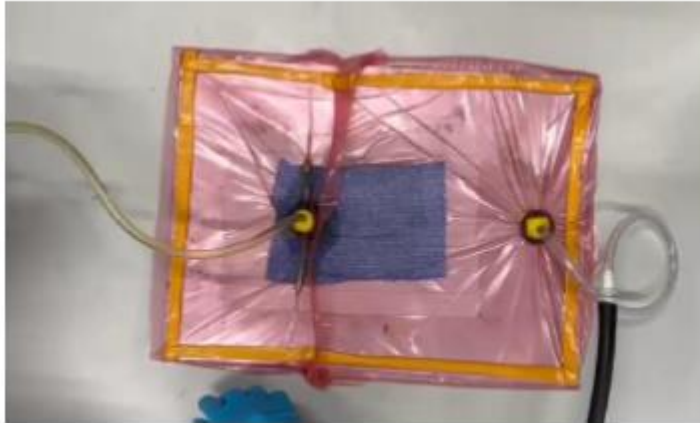
4 layers, 70°C for 2h
Porosity: $< 2\%$ (ASTM D2734)



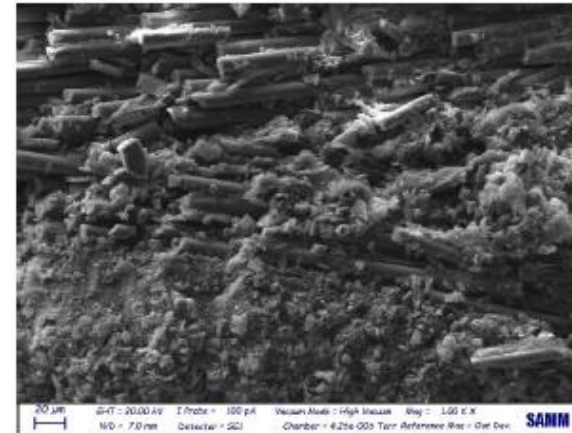
Reversible bio-based epoxy resin



- ↑ Catalyst-free formulation
- ↑ Tg 80-90°C
- ↑ Long-term stability (> 110min) at 200°C
- ↑ Suitable viscosity for infusion/lay-up at mild temperatures



Infusion at 70-90°C, 30%wt of GF



Good fiber impregnation and matrix adhesion



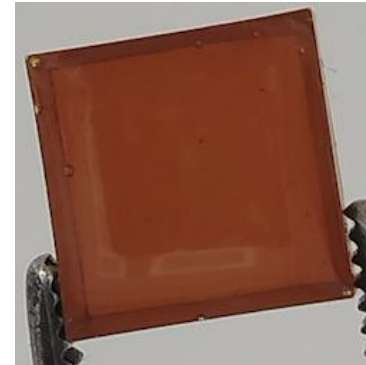
Recyclable epoxy resin ONYRIO



- † Synthesis of liquid Cleavable Hardener needed → addition of commercially available additives (Ad1 & Ad2)
 - With Ad2 lower viscosity → appropriate for infusion
- † Define proper curing conditions
- † Study of the effect of adding additives on the mechanical properties



Casting process



20% Ad2, casting 16h – 50°C



Next steps

- Studying a pathway to **scale up** resins production
- Manufacturing of composite materials for **testing, validation** and **process control**
- Studying the **circularity** of the resins by thermoforming, chemical recycling and/or IM
- Development of new materials to facilitate the **decommissioning** and **disassembly strategies**
- Validate the novel resins for the manufacture of **wind turbine blades**



Webpage



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Innovative circular economy for reuse of wind turbine components

Our initiative stands for the increase of circularity, particularly through the reuse and recycling of components of complex products such as of wind turbines by developing innovative circular resins and adhesives and facilitating their use leveraged by modular design of composites parts.

Learn more →

Follow us to stay updated on the project's progress 😊

ecoreswind.eu

Follow us



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Thank you.

GAIKER

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