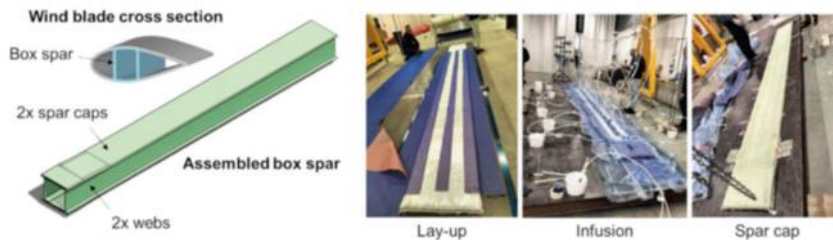


# Eco-design approaches for circular wind blades

Italian research and technology organisation CETMA is developing eco-design strategies for two European projects.



Thermoplastic wind blade components developed by CETMA and ÉireComposites within the Marewind project.

The end-of-life (EoL) approach covers circular economy strategies focused on existing products reaching the end of their service life today, in order to recover energy, materials (recycling) or components (re-use) from them. On the other hand, the most preferred option in the well-known waste hierarchy would be the prevention of tomorrow's waste. This can be achieved by means of a proactive approach known as eco-design. Eco-design strategies include a range of approaches designers may take to improve the environmental performance of their products.

CETMA is working on both of the above approaches in the framework of two European projects focused on the wind energy industry, which covers a significant slice of the whole composites market. Wind turbine blades represent a challenge at EoL due to the materials used, especially thermoset resins, and their complex composition.

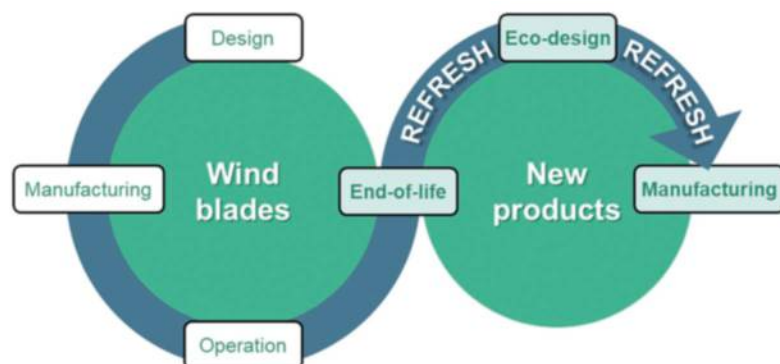
## European projects

The MAREWIND H2020 project (2020-2024) is dealing with the development of new materials for future blades with improved performance in circularity. Novel materials with higher recyclable potential in respect to traditional thermosetting resins have been studied, e.g. reactive thermoplastics and cleavable epoxies, along with the related recycling methods, a thermo-mechanical procedure in the first case and a solution-based chemical protocol in the second one.

Based on preliminary lab scale results, reactive thermoplastics were identified as the most promising innovation able to match the project expectations in terms of both material properties and industrial

scalability of the recycling process. Then, CETMA together with the partner ÉireComposites (Ireland) developed and manufactured a full thermoplastic wind blade box spar section to validate the new materials and processes.

reprocessing of the material thereof i.e. thermoforming and further recyclability (patent pending). A small demonstrator manufactured with such a method (see picture) is based on mixed glass and carbon composites recovered from a wind blade. First, a semi-finished flat laminate was produced, then thermoformed on a mild curvature mould to demonstrate thermal reprocessing of the material due to the addition of the thermoplastic binder. The mechanical performance of the recycled material was measured and found to be in very good agreement with traditional thermoset bulk moulding compounds commonly used in the automotive industry, but a number of further applications are under evaluation.



Eco-design approach developed by CETMA in the REFRESH project.

On the other hand, the REFRESH Horizon Europe project (2023-2026) is developing and demonstrating a novel circular, smart system enabling improved recycling (mechanical, thermal, chemical) of fibre reinforced composites derived from wind turbine dismantling. REFRESH has also the opportunity working on eco-design by applying this approach to a wide range of new marketable products from EoL wind blades.

The eco-design strategies CETMA is mainly working on are new concept development, selection of low-impact materials, and optimisation of end-of-life systems (e.g. design for disassembly).

Moreover, CETMA has developed a novel composites recycling procedure using a thermoplastic binder and then allowing



Material demonstrator of the novel composites recycling procedure developed by CETMA.

It is a long road to a fully circular wind energy supply chain. With the above activities and results CETMA aims to bring the sector a few steps closer.

### Further information

- CETMA: [www.cetma.it](http://www.cetma.it)
- MAREWIND: [www.marewind.eu](http://www.marewind.eu)
- REFRESH: [www.refresh-project.eu](http://www.refresh-project.eu)