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smart dismantling, sorting and REcycling of glass Fiber REinforced composite from wind power Sector through Holistic approach

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Photo by Nicholas Doherty on Unsplash

REFRESH Consortium

Horizon Europe
101096858

11 partners from 5 different countries:

- Waste recycling and remanufacturing companies
- Engineering and consulting companies
- Research and development companies
- Access to stakeholders in the composites sector manufacturers

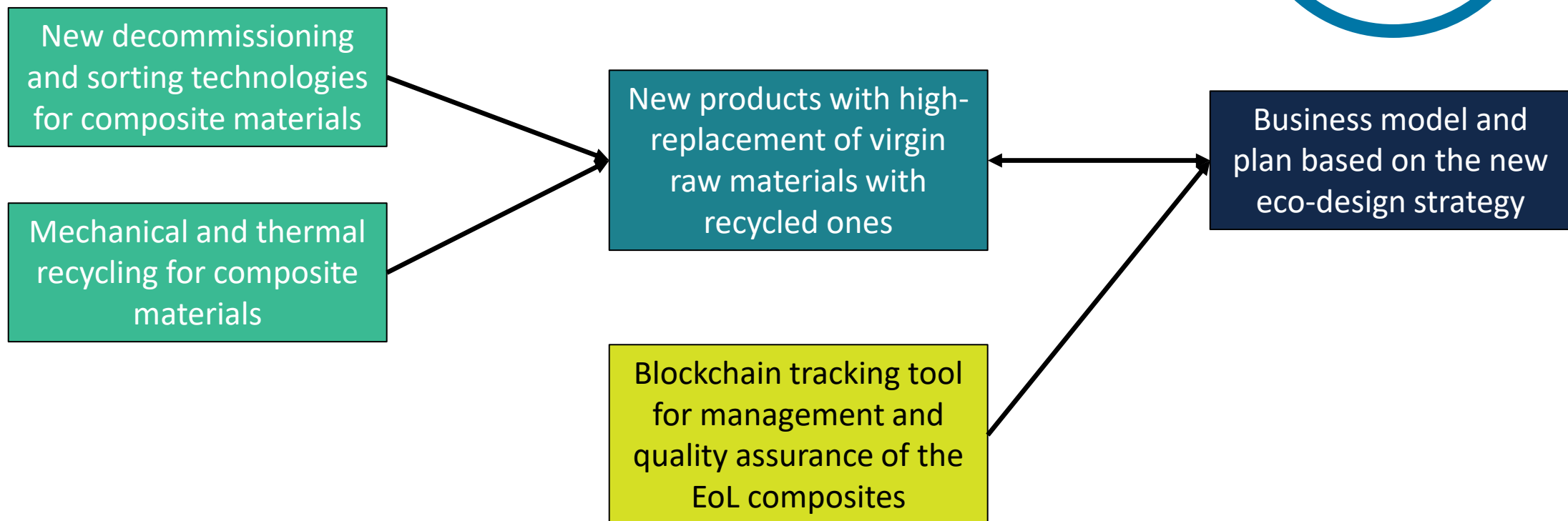
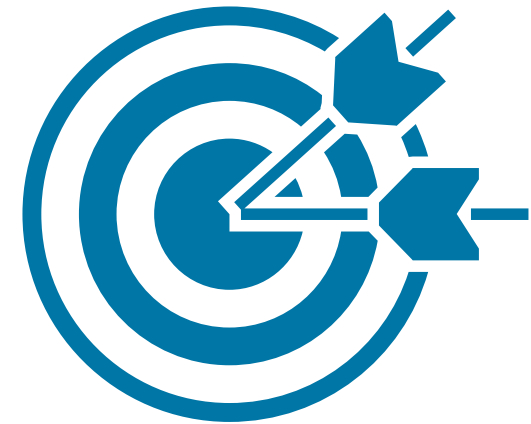
RINA is the project coordinator.

REFRESH results are shared and promoted by **EuCIA** through their communication channels.

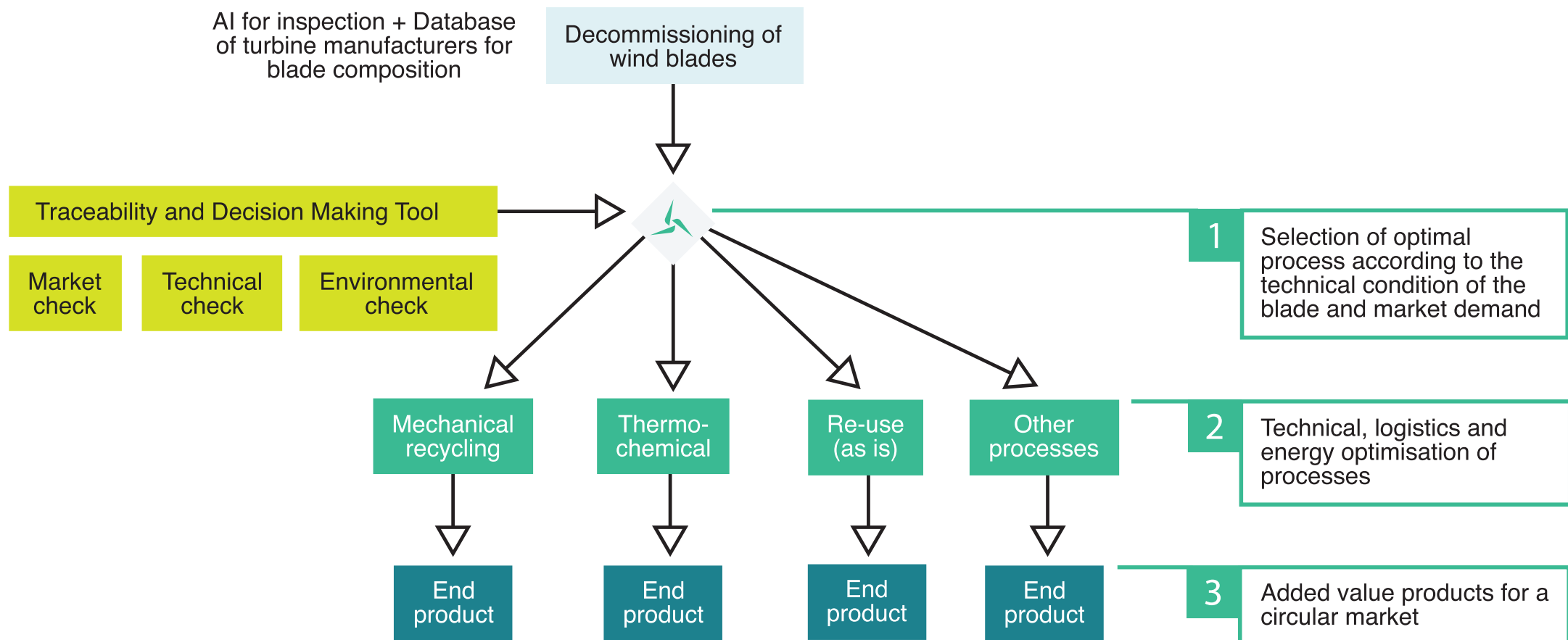


Objectives and Scope

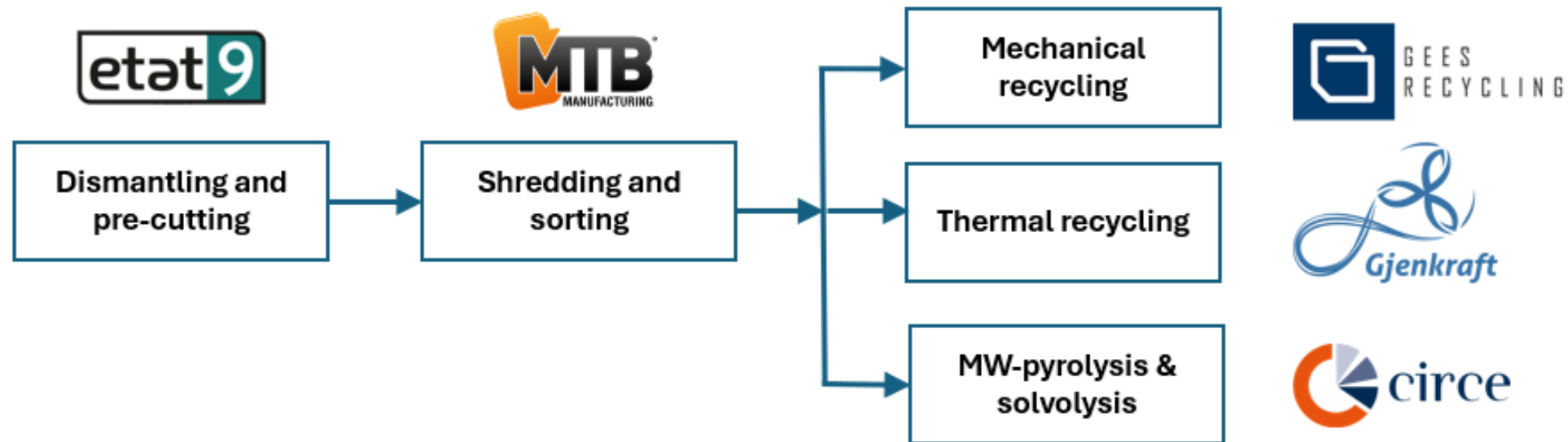
REFRESH aims to develop and demonstrate a novel circular, smart system for an improved **recycling of glass fiber-reinforced composites** derived from wind turbine dismantling or re-blading, with **high purity level**.



Methodology – The REFRESH Concept



Methodology – REFRESH technical Work-plan

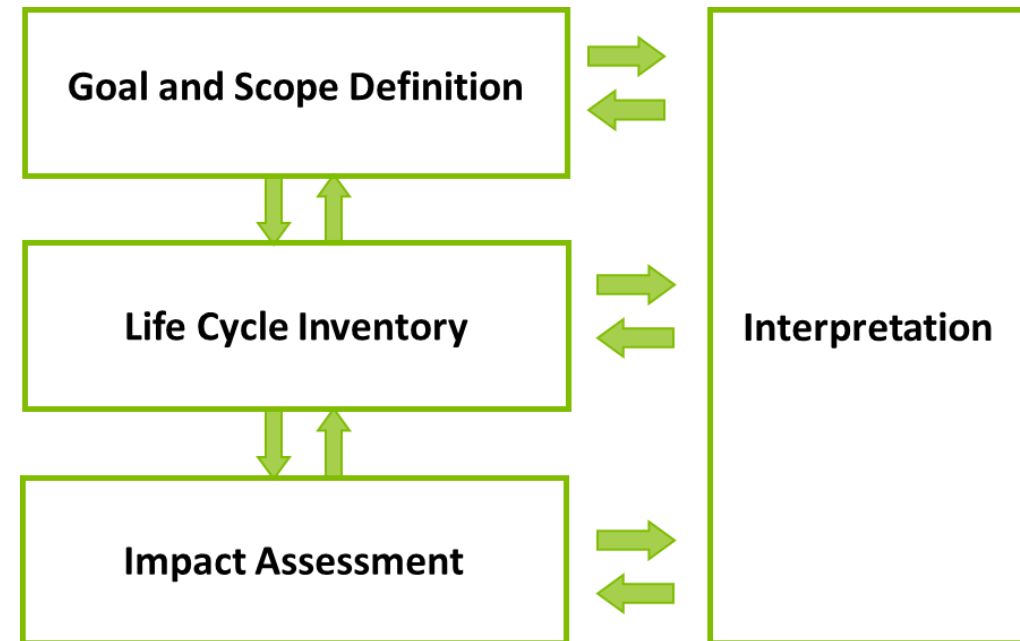


Methodology – Environmental assessment: LCA (RINA-C)



The **Life Cycle Assessment (LCA)** is a structured, comprehensive and internationally standardized method quantifying all relevant emissions and resources consumed and related impact on environment, human health and resources associated with any good or service.

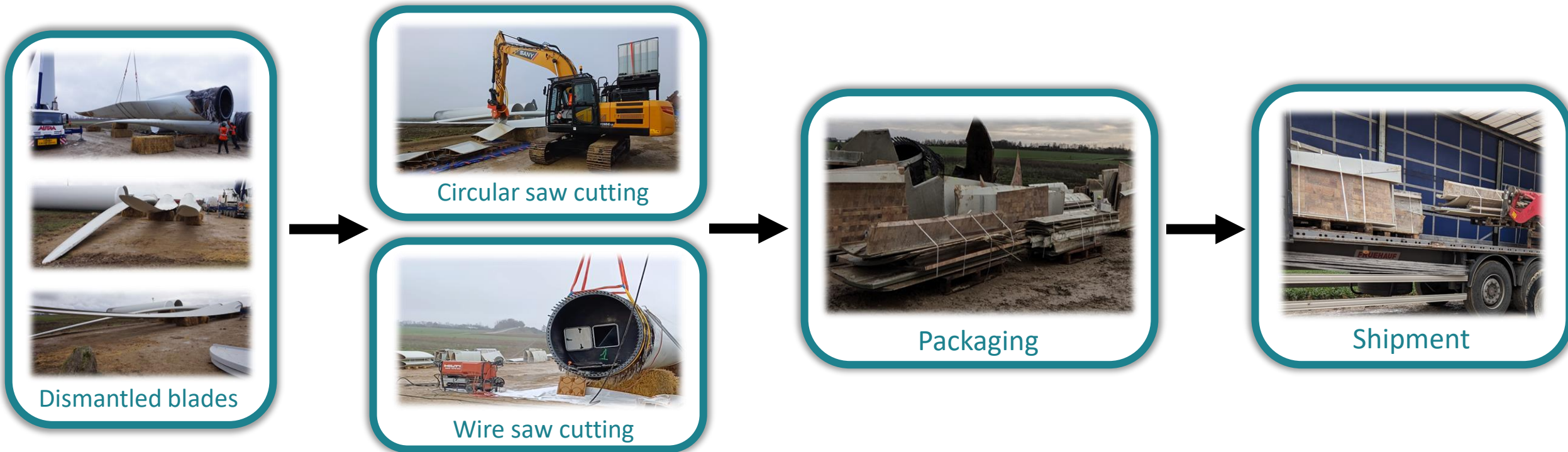
Framework	Title
ISO 14040:2006	Environmental management -- Life cycle assessment -- Principles and framework
ISO 14044:2006	Environmental management -- Life cycle assessment -- Requirements and guidelines
ILCD handbook International Reference Life Cycle Data System	General Guide for Life Cycle Assessment – detailed guidance



Life Cycle Assessment framework

Dismantling and pre-cutting activities (ETAT 9)

ETAT 9 activities focus on the **pre-cutting of blades** to be shipped to MTB for shredding and sorting.



Shredding and sorting activities (MTB)

MTB feed the dismantled and cut wind blades from ETAT 9 into a **shear shredder**. The shredded pieces are downsized to be carried to the **sorting process**.



MTB shear shredder machine



Composite « gross » mix
87% glass fiber composite
10% carbon fiber composite



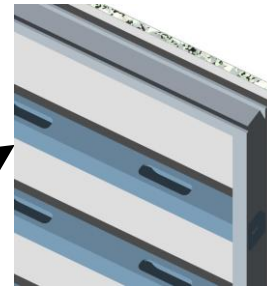
Composite « medium » mix
67% glass fiber composite
29% carbon fiber composite



Composite « fine » mix

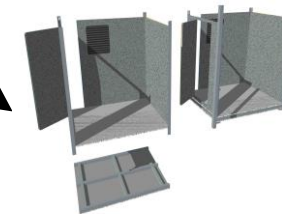
Mechanical recycling (GEES Recycling)

Gees Recycling has developed a **mechanical recycling process** for composites of any kind, rigid foams, core materials. Currently **>1800 t/y** are processed; in the REFRESH project this number will be brought to **>5500 t/y**.



Formwork panels

- Resistent to water, weather, corrosion
- Not conductive
- Price competitive

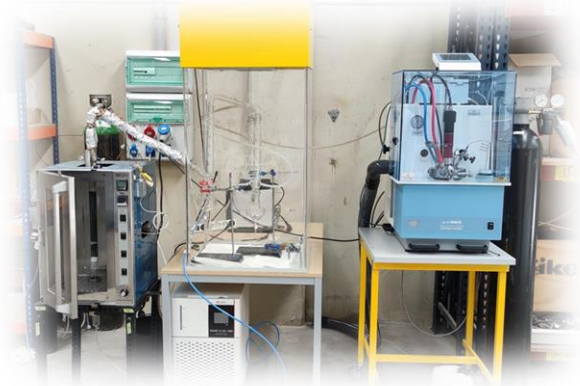


Equipment Shelter

- Resistent to water, weather, corrosion
- Not conductive
- Insulated in the inside
- Price competitive

MW-pyrolysis and solvolysis (CIRCE)

CIRCE develops two alternative energy-efficient thermochemical routes for the valorization of wind blade waste based on **microwave-assisted pyrolysis** (MW-PYR) and **microwave-assisted solvolysis** (MW-SOL).



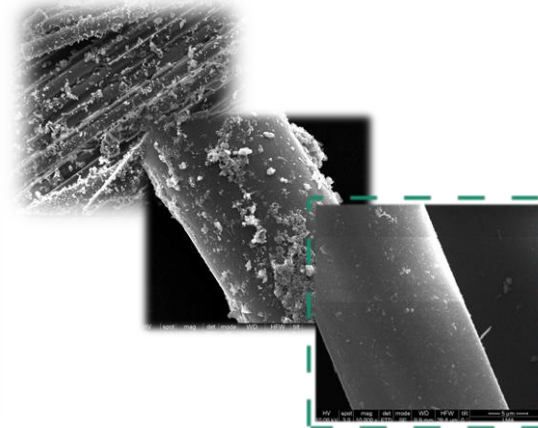
MW-reactors set-up



Shredded wind blade
fibre-reinforced
composites



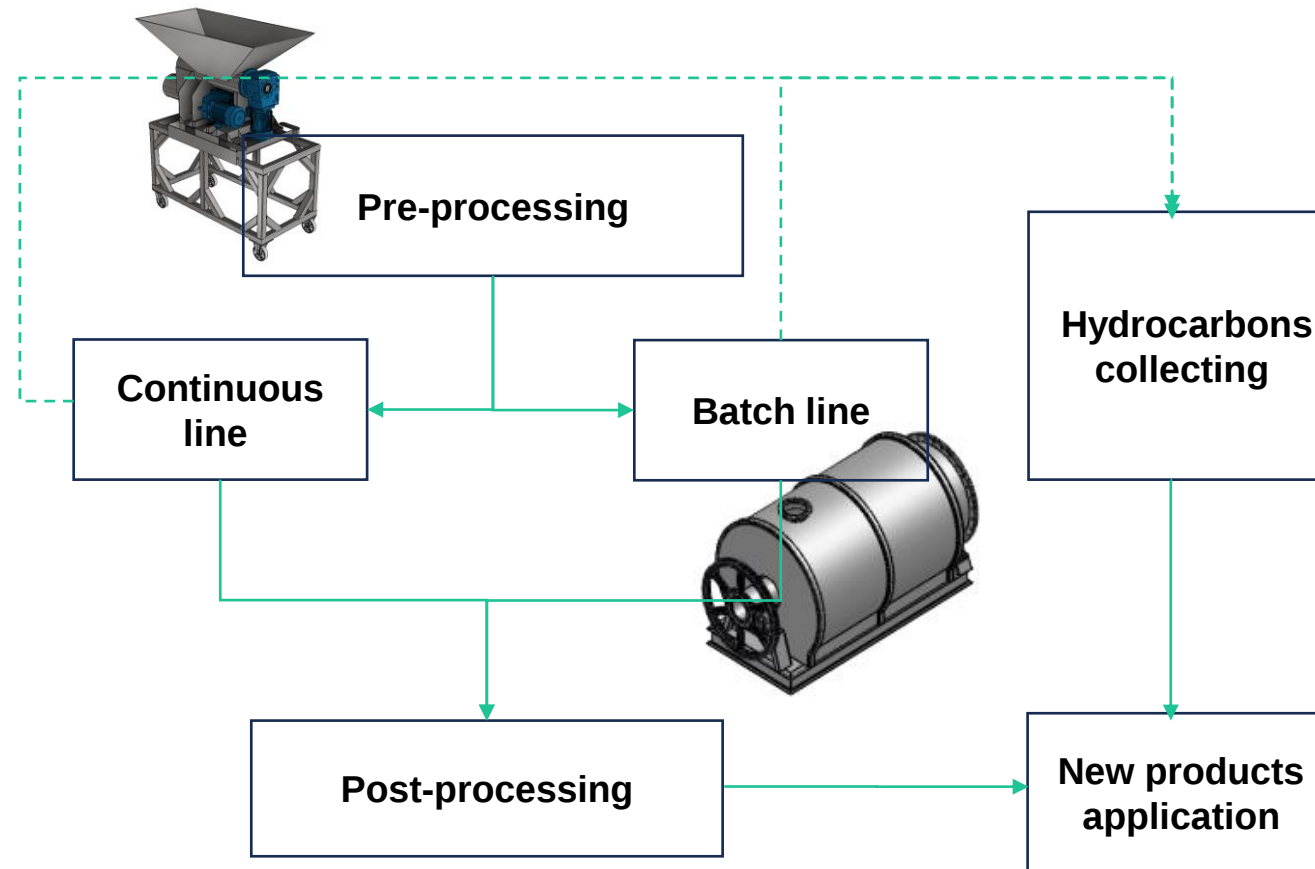
Recovered clean glass fibers
without textural damage



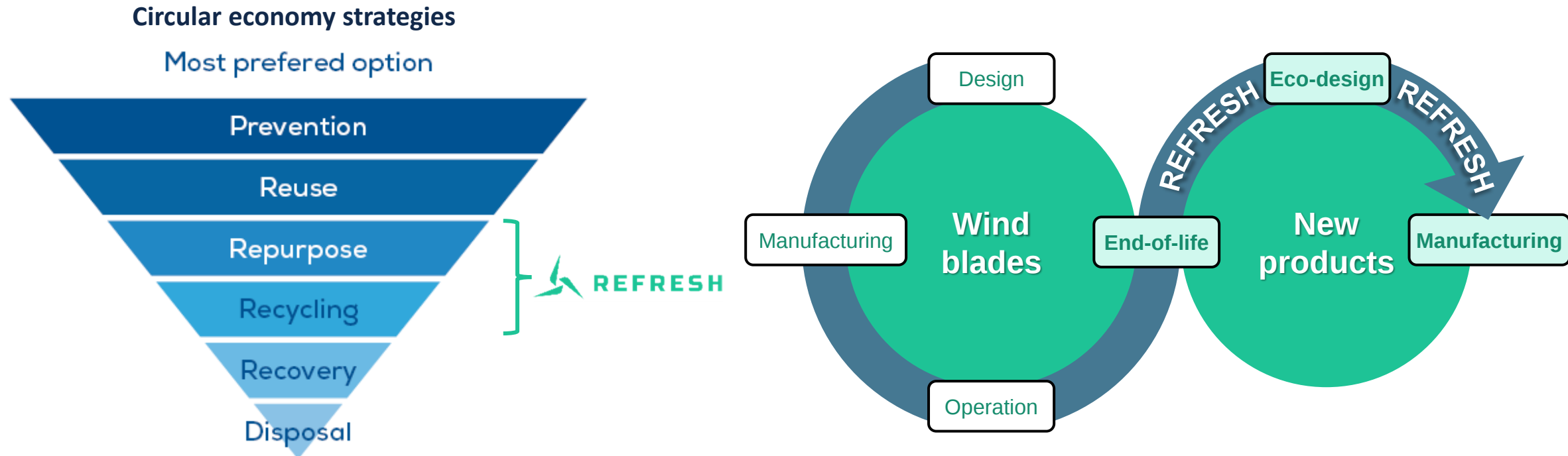
Pyr-oils and syn-oils
preserving building
blocks

Thermal recycling (Gjenkraft)

Gjenkraft develops a thermal recycling process based on **electrical pyrolysis**. Fibers are recovered and additionally cleaned from soot and ash residues.



REFRESH Eco-Design strategy (CETMA)



- ❑ Deployment of recycling technologies and repurposing strategies
- ❑ Development of recycled / repurposed products and markets

Main project solutions and exploitation perspective after project end

Solutions	Partners	How	Time to market
Decommissioning and advanced sorting technology	 	Portable system for dismantling and shredding of wind blades	4 years after the conclusion of further demonstration activities
Mechanical recycling		Technology and formulation for secondary raw materials recycling	2 years after the conclusion of further demonstration activities
MW-assisted thermal cracking system		Technology to obtain chopped glass fibres	3 years after the conclusion of further demonstration activities
Electric thermal cracking system		Technology to obtain chopped glass fibres and added value chemicals	3 years after the conclusion of further demonstration activities
Cloud Traceability Platform (CTP)	 MEMBER OF BASQUE RESEARCH & TECHNOLOGY ALLIANCE	Traceability services based on blockchain	3 years after project end
Eco-design strategy	 TECHNOLOGIES DESIGN AND MATERIALS EUROPEAN RESEARCH CENTRE	Strategy for product manufacturing	Just after project end
Optimised composite materials for infrastructure applications		Structural and non-structural components for infrastructure	5 years after project end

Expected future impacts

Reduced use of virgin raw materials

	Potential Virgin Raw Material Savings				
REFRESH Product	Benchmark Products	PENETRATION RATE OF 5% - 5 Y FROM PROJECT END		PENETRATION RATE OF 12% - 8 Y FROM PROJECT END	
Products manufactured with mechanically recycled G-FRC					
Rigid Panels	solid surface raw materials	5.5	Mton	13.3	Mton
Composites structures and components	GFRC	5.5	Mton	13.3	Mton
	Polyurethane	1.5	Mton	3.6	Mton
Indoor acoustic panels	wood panels fiber	3.5	Mton	8.5	Mton

Increased amount of recycled composite materials from wind power sector

	PENETRATION RATE OF 5% - 5 Y FROM PROJECT END		PENETRATION RATE OF 12% - 8 Y FROM PROJECT END	
GFRC	22	Mton	53	Mton
Insulation	5	Mton	12	Mton

New job opportunities in:

- waste management
- eco-design
- digital
- re-manufacturing

	New Jobs
2029	173
2030	1477
2031	2307
2032	4806



Thank you for your attention!

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Views and opinions expressed here are those of the authors(s) only and do not necessarily reflect those of the European Union. The European Union cannot be held responsible for them.

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