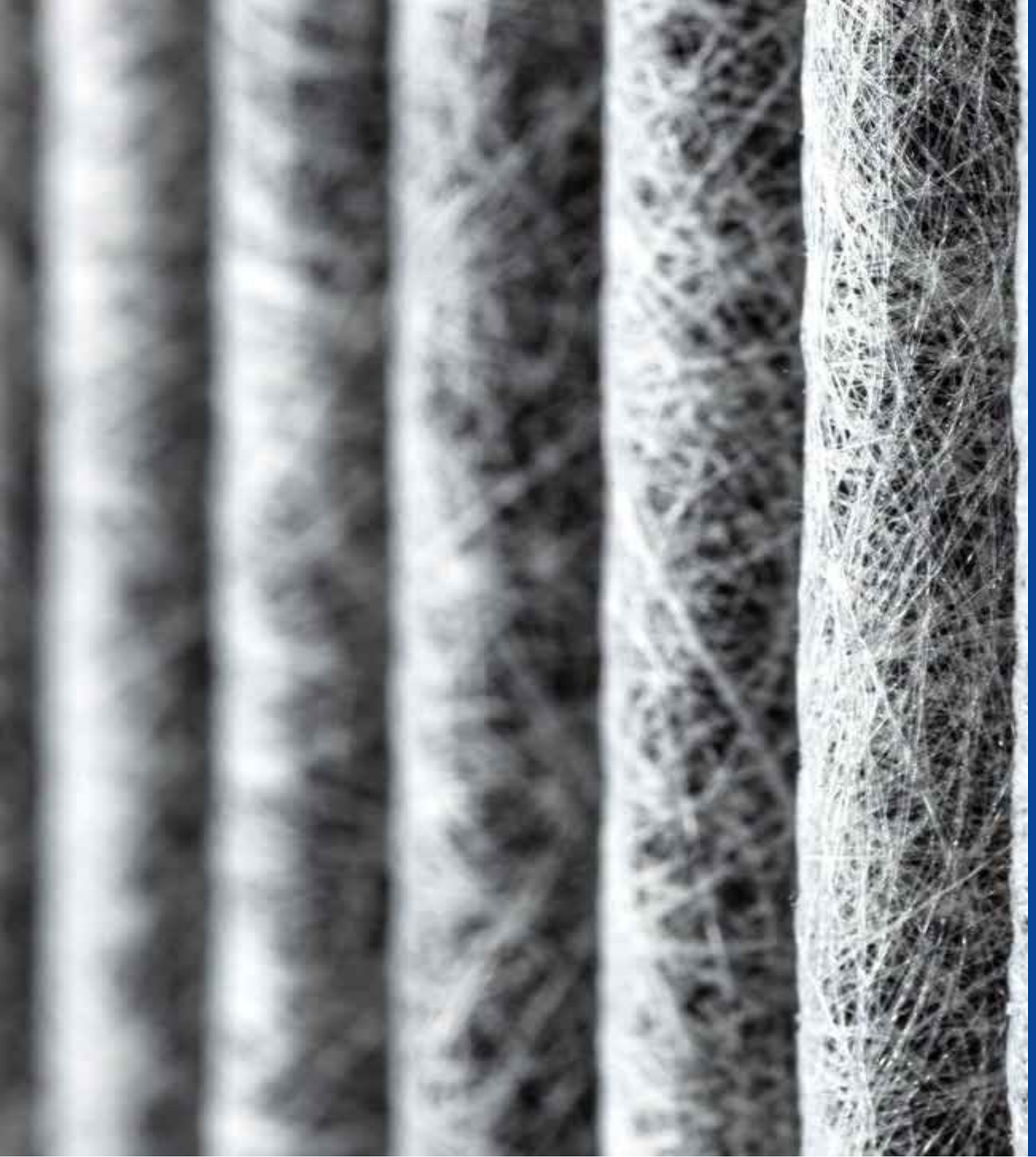

Treatment and recovery of end-of-life composite materials; state of the art and future developments

Dr. Luigi De Rocchi

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ASSOCOMPOSITI
Associazione Italiana Compositi & Affini

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Cobat Compositi

Cobat Compositi is the first voluntary Consortium in Italy ensuring the correct management of end-of-life composites.

The Consortium works in the nautical, automotive, naval, aeronautical, construction, and general component sectors.

In accordance with European standards, the Consortium ensures full compliance with all sector-specific regulatory requirements, thanks to its certified structure.

SISTEMI DI GESTIONE CERTIFICATI
CQY CERTIQUALITY
UNI EN ISO **9001:2015**
UNI EN ISO **14001:2015**

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Consorzi cobat

A system of excellence supporting the Circular Economy

Cobat Compositi is one of the **Consorzi Cobat**.

Consorzi Cobat offer companies integrated and personalized services for collection, treatment, and recycling of end-of-life products, according to national and international best practices, optimizing costs, and reducing environmental impact.

Consorzi Cobat guarantee economic and environmental sustainability to producers (manufacturers, importers) who have to comply with **Extended Producer Responsibility** (***EPR***) for the products they put on the market.

Consorzi Cobat provide indemnity from waste management responsibilities, ensuring the highest standards of environmental sustainability.

The mission

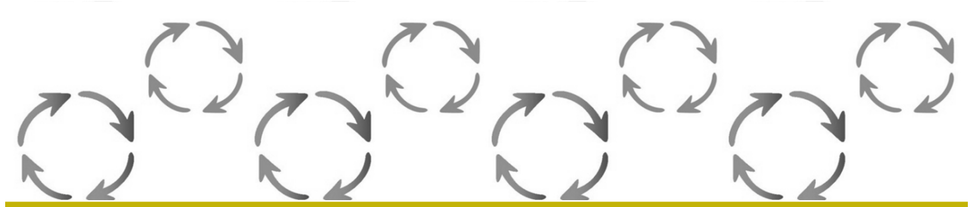
The Consortium was founded to empower stakeholders in the composites supply chain to play a leading role in sustainable development, bringing benefits to the environment and the national and European economic system.

- Collection optimization by promoting recovery and recycling operations
- R&D focused on of advanced recovery and recycling technologies
- Creation of a circular and sustainable supply chain for composites, welcoming the involvement of all stakeholders, ranging from treatment facilities to producers.

OUR OFFER

COLLECTION

With a widespread network of logistics operators, the Consortium guarantees scheduled pickups of composite waste or scraps, of any volume and size.



TREATMENT

In line with a circular economy approach, the Consortium aims to establish a virtuous cycle by ensuring the recovery of composite materials and avoiding their disposal in landfills.

ADDITIONAL SERVICES

- Volume reduction of large products for efficient transportation
- Collection and recovery initiation of other materials associated with composites disposal
- Environmental remediation project
- Customized solutions for the management of specific products

TRAINING AND CONSULTING

Cobat Compositi also offers environmental consulting services, training courses (both in-person and via streaming), and customized corporate training projects tailored to meet the specific needs and requirements of the client.

Target market

We target all economic operators who incorporate fiberglass or carbon fibers into their production processes, as well as wind farm operators and/or owners, aircraft manufacturers, shipyards and construction industry.

WASTE PRODUCERS

Wind Power Industry
Owner / Administrator

Naval Industry
Port manager

Aerospace Industry

Construction Industry

PRODUCERS OF WASTE AND PROCESSING SCRAPS

Wind Power Industry
Wind Blade Manufacturers

Naval Industry
Shipyard

Aerospace Industry
Aircraft manufacturers

Construction Industry

EWC CODES: ***07 02 13 | 17 02 03 | 10 11 03 / 12 01 05 | 16 02 16***

IN SITU OPERATIONS

Dismantling operations

Cobat Compositi offers a holistic service which comprehends the complete **dismantling** of big composite products, as **wind blades** and **boats**.

- **Cut** and reduction **of sections** suitable for transportation.
- Volatile **powder management** and collection
- **Optimized logistics** exploiting roll-off containers and walking floors.
- Further **size reduction in** authorized **plants**.

IN SITU OPERATIONS

Dismantling operations

Cobat Compositi offers a holistic service which comprehends the complete **dismantling** of big composite products, as **wind blades** and **boats**.

Cement Co-Processing

PLANT TREATMENT

Currently, the main recovery process implemented by COBAT COMPOSITI for the valorization of waste, scraps, and/or residues in fiberglass is the production of **RDF (Refused Derived Fuel)** carried out in compliance with **Italian Ministerial Decree 22/2013**, which establishes the End Of Waste criteria for RDF.

When RDF complies with **Italian Ministerial Decree 22/2013** criteria, it is no longer waste and becomes a **new product** for energy recovery (secondary solid fuel).
The transition to the product regime is certified by the "declaration of conformity," issued directly by the plant.

RDF can be delivered to cement plants and/or thermal power plants with authorization to which use it as a fuel.

The M.D. 22/2013 established the Control Committee for RDF within Ministry for Environment, Land and Sea Protection as a monitoring mechanism.

Cement Co-Processing

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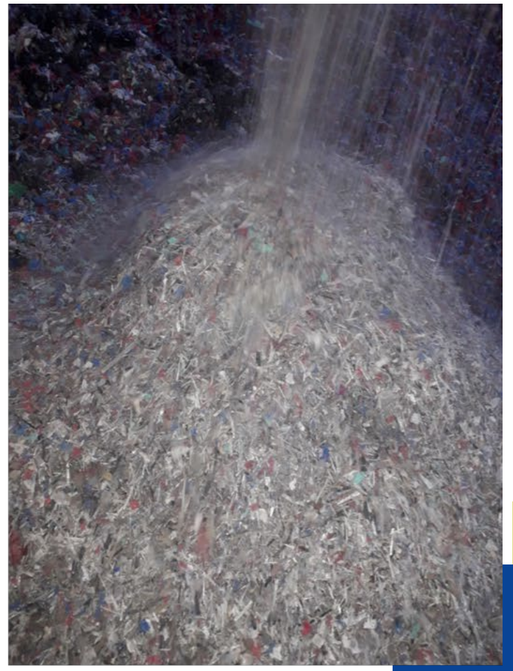
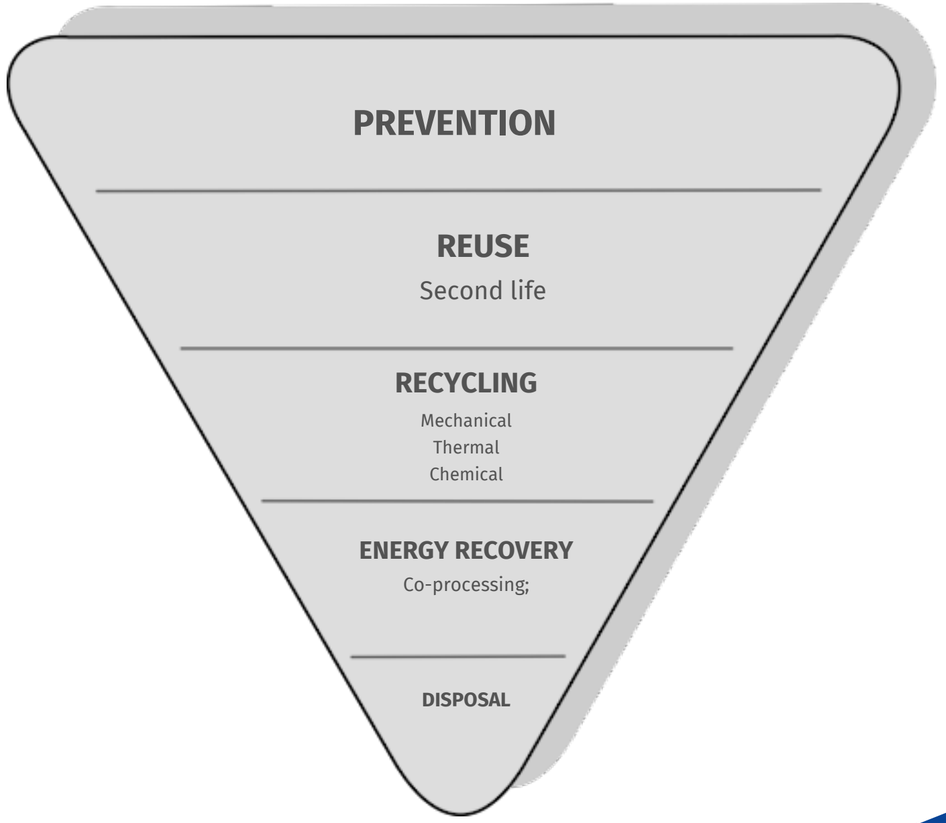
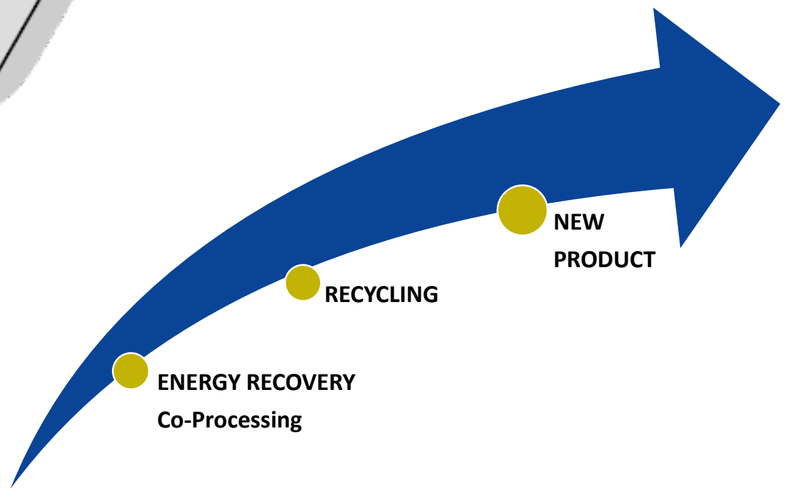


R&D



Cobat Compositi is working to develop a more sustainable approach than cement co-processing, following the European waste hierarchy model.

Cobat Compositi has initiated several collaborations to develop material recovery technologies, enabling the reuse of composite material waste for the creation of new products.



Cobat Compositi is a **RECREATE** project partner.

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

R&D

The material-recovery-based technological and value chain approach

Cobat Compositi has initiated several collaborations to develop material recovery technologies, enabling the reuse of composite material waste for the creation of new products.

Consolidating the consortium’s end-of-life composite material flows

Identifying technology providers that can provide suitable grinding and recycling technologies

Collaborating with subjects already active in the manufacture of semi-finished and finished composite products, and defining the technical specifications of the secondary raw material that they can use

Ricerca & Sviluppo

Regulatory domain activities

Cobat Compositi participates in several technical working groups to adapt the current regulatory apparatus to new technical scenarios of the market.

Notable is the initiative taken with **Uniplast** and **Assocompositi** to renew UNI 10667-13.

The renewal of the standard is aimed at defining the technical specifications of second raw material obtained from the grinding of industrial waste and post-consumer waste for its subsequent reuse.

UNI 10667-13:2013

Materie plastiche prime-secondarie - Cariche ottenute da macinazione di scarti industriali e/o da post consumo di compositi di materiale plastico - Parte 13: Requisiti e metodi di prova

RECREATE Project

Funded by the European Union

The purpose of the project is to develop a set of innovative technologies for the valorization of complex composite waste (fiberglass and carbon), focusing on refurbishing and reusing composite structures, recycling fibers, and developing reversible green resins for reuse.

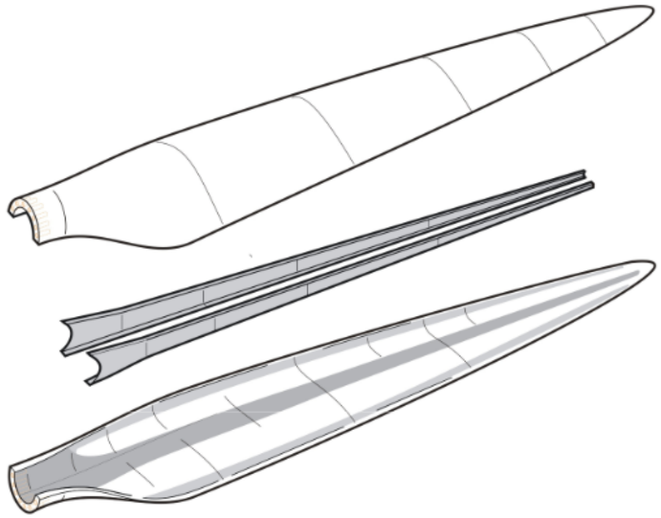
In the project, COBAT COMPOSITI is responsible for developing a logistic network for the collection of composite waste and establishing guidelines to overcome legislative barriers preventing the application of technological advancements for circularity in composites.

COBAT COMPOSITI is also responsible for validating the innovative technical solutions developed as part of the project.

For further information: https://www.recreatecomposites.eu/

The reference market and volumes

Example of the wind energy sector

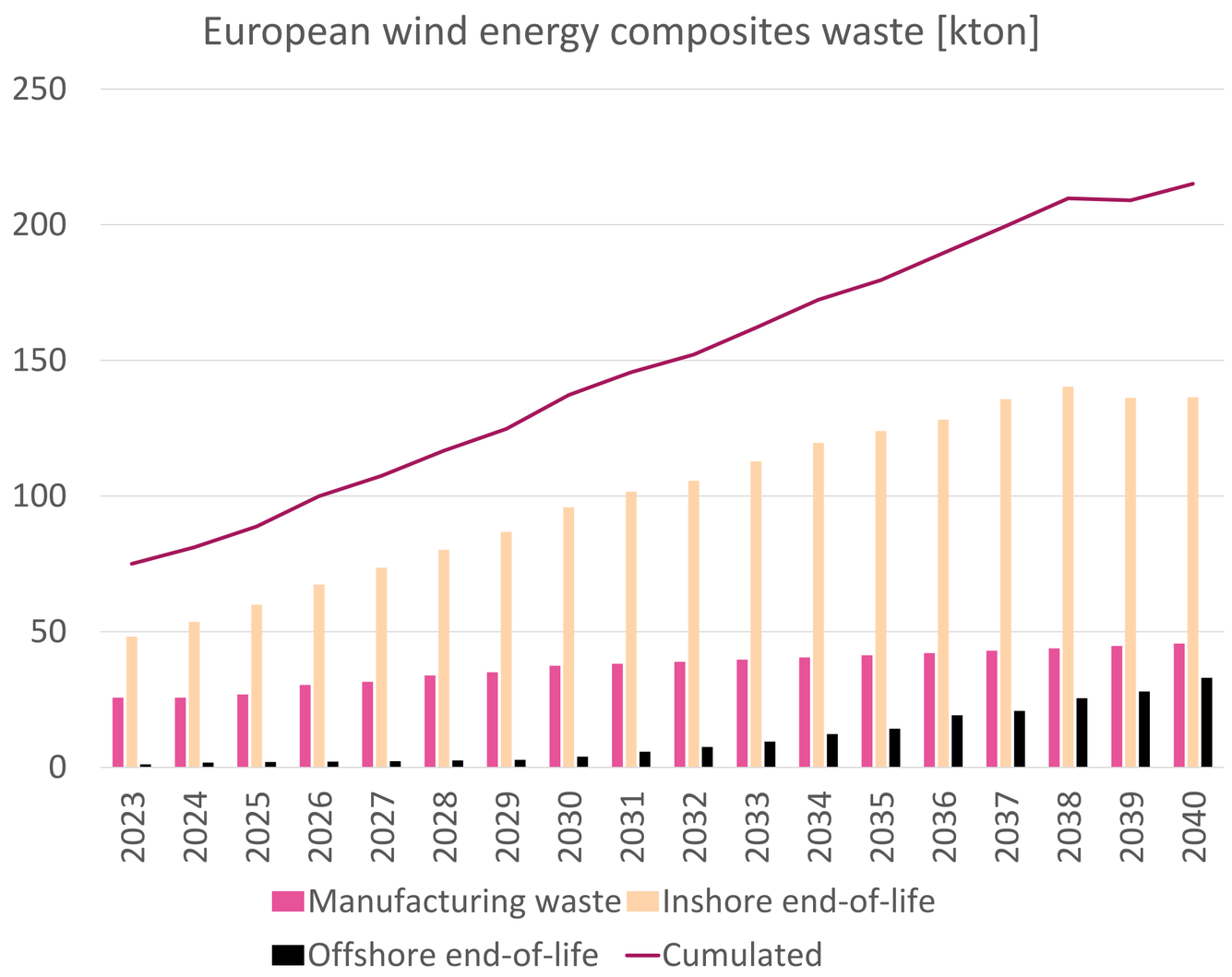


According to (*Ierides and Reiland, 2019*), it is possible to roughly estimate the quantity of composite materials installed in a wind farm in function of its capacity, with an approximate conversion factor of **1 MW = 12 to 15 tons of composites**.

	Material by weight
CF/GF fabric	60.4%
Resin	32.3%
Steel	1.1%
Copper	0.6%
Balsa	2.3%
Foam	1.7%
Paint	0.9%
Putty	0.7%

The reference market and volumes

Example of the wind energy sector



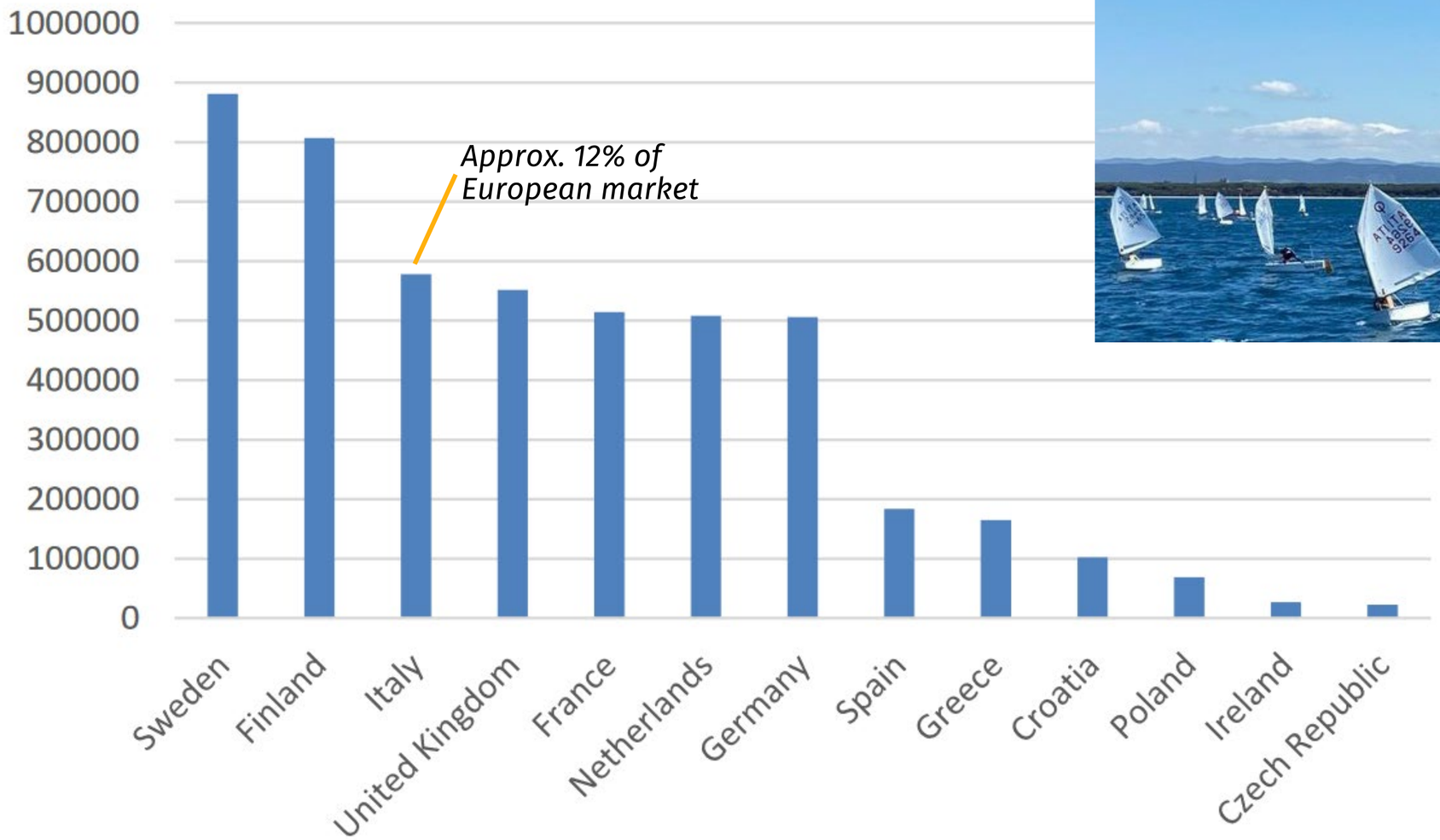
- **Yearly return volumes** in the next decades will reach **more than 200 kton**, summing up the manufacturing waste and dismantled turbines streams.
- **Inshore end-of-life** turbines represent the **main composites waste channel**, both present and in the future.
- **Manufacturing waste** volumes are expected to remain **rather constant** through the years, following the gradual expected market growth.

Italy: ~6% of EU27 total installed capacity

The reference market and volumes

Example of the naval sector

The European recreational boats fleet is populated by 6 to 6.5 million crafts. Composite hulls boats are estimated as 40% of the total fleet.



Size	
<7,5 m	74%
7,5-12 m	21%
12-24 m	5%

The reference market and volumes

Example of the naval sector

Size class	Size median value [m]	Composites content per boat [kg]	Percentage of boats	Number of boats	Weight of composites [kton]
<7,5 m	5	320	74%	1’924’000	615,68
7,5-12 m	9,75	700	21%	546’000	382,2
					998

An average lifecycle of a FRP small craft is usually between 30-50 years, and it can last even longer in particularly compliant environments.

It is estimated, that around **6% of the total European recreational boats** fleet is in EoL conditions but is **not dismantled** by the owner for economic inconvenience.

Moreover, (*International Maritime Organization and London Convention/Protocol and Ocean Affairs, 2019*) estimates a **yearly decommissioning of 1.5% of recreational vessels stock** (currently partially uncontrolled).

Composites manufacturing wastes are estimated as 5% (standard quote) of the totality of boat hulls entering the market.

The stock of EoL boats represent a **~70 kton bubble** of available composites.

Composites in **yearly decommissioned** European recreational boats: **~15 kton**

Yearly manufacturing waste **~1 kton**

Legislative framework

The incremental abandonment of landfills

Directive (EU) 2018/850 (Landfill Directive) has significantly amended the Italian legislation on landfill referred to in d.Lgs. 36/2003.

The new law is based on the prohibition, from 2030, of the landfilling of all waste suitable for recycling or recovery except for waste for which the placing in landfills produces the best environmental result in accordance with the principles of the hierarchy of waste formalized in art. 179 of Legislative Decree No. 152/2006. The reform intervention of 2018 is progressively producing concrete effects both in the nautical and wind sectors.

The regulatory focus is on achieving sustainable management of end-of-life boats and wind turbines.
The **EBI (European Boating Industry)**, based on the work launched in 2018 by the *Directorate-General for Maritime Affairs and Fisheries* of the European Commission, published in March 2023 its **roadmap for the implementation of a circular economy for end-of-life vessels**, highlighting how the disposal of composite materials at end-of-life is a waste of resources in Europe as they still retain value if they can be reintegrated into the economy circulate.

On the other hand, at **national level**, in May 2022, a proposal was presented to the Chamber of Deputies Proposal for a law to introduce processes to improve disposal and Recycling of fibreglass vessels.

Conclusion

Production waste and post-use **waste in composite materials** generate very **high annual volumes**, even targeting individual supply chains.

Landfill will not be an option soon.

The production of **RDF for cement co-processing is a temporary alternative**, not sustainable in the long term.

It is necessary to build circular supply chains based on **material recovery**, working to bridge the technological and systemic gaps of the current industrial state-of-the-art.

Regulatory frameworks, based for example on the principle of ***Extended Producer Responsibility***, would provide adequate support to technical challenges related to the introduction of circularity in composite industries.

GRAZIE.

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