A roadmap on the implementation of the circular economy for end-of-life recreational boats

EBI

European
Boating Industry

CONTENTS

1. BACKGROUND

These recommendations were developed by the European Boating Industry (EBI) following the work of the Stakeholders' Group on end-of-life recreational boats set up in 2018 by the European Commission (Directorate-General for Maritime Affairs and Fisheries). Based on a co-creation process, the Stakeholders' group was composed of national authorities of the Member States and key stakeholders (industry, users, academia, and related industries) and chaired jointly by DG MARE & EBI. A series of regular structured exchanges laid down the basis for this document. The aim of this document is to present the status quo for composite materials from end-of-life/end-of-use boats at EU level and provide recommendations on how to fully implement a circular economy approach in line with the ***European Green Deal***[1].

[1] EUR-Lex - 52019DC0640 - EN - EUR-Lex (europa.eu)

2. EU POLICY PERSPECTIVE

The recommendations primarily concern recreational boats under 24m in line within the scope of EU Recreational Craft Directive 2013/53/EU. They should be applied to fully implement a circular approach. The aim is to coordinate the current national approach in tackling the issues of recreational boats reaching their end-of-life and implementing circular economy principles following the 2030 and 2050 targets. A circular approach, including in design, production and end-of-life treatment, should avoid potential negative environmental impact, abandonment in the natural environment or marina/yard and increase proper waste management, including material re-use and up-cycling. This should at the same time advance the EU's international competitiveness in boat-building.

The recommendations in this document support implementation of a number of key EU policy goals, namely the ***New approach for a sustainable blue economy in the EU Transforming the EU's Blue Economy***[2]***,*** the ***Circular Economy Action Plan***[3] and ***Zero Pollution Ambition***[4]***,*** part of the overarching framework of ***EU Green Deal***. In addition, the ***European Strategy for more Growth and Jobs in Coastal and Maritime Tourism***[5] and ***Staff Working Document on Nautical Tourism***[6] include end-of-life boats as priority areas. Previous work has also been carried out by the International Maritime Organisation in the framework of the London Protocol[7] and by the Baltic Marine Environment Protection Commission[8]. A study for the European Commission also looked at the topic and developed policy options[9]. Currently, there is no common EU approach towards the management of end-life recreational boats, including their dismantling and preparation for re-use or recycling. Action at EU level and better coordination of Member States would provide significant added value and support solving the issues identified.

3. SCOPE OF THE ISSUE

The Composite materials, particularly Glass Fibre Reinforced Polymer (GFRP) have been used for the manufacturing of boats since the 1950s and increased substantially since the 1970s. The material properties, lightweight nature, and durability make it well-suited for boat-building. Recreational boats using composite have a lifetime of up to 50 years and even much longer when well maintained. This is positive for life cycle environmental impact. Critical is the point of end-of-life as there are currently only a few specialised dismantling sites available

[2] https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=COM:2021:240:FIN

[3] https://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1583933814386&uri=COM:2020:98:FIN

[4] https://ec.europa.eu/environment/pdf/zero-pollution-action-plan/communication_en.pdf

[5] https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52014DC0086

[6] https://ec.europa.eu/oceans-and-fisheries/system/files/2021-03/swd-2017-126_en.pdf

[7] https://wwwcdn.imo.org/localresources/en/OurWork/Environment/Documents/Fibre%20Reinforced%20Plastics%20final%20report.pdf

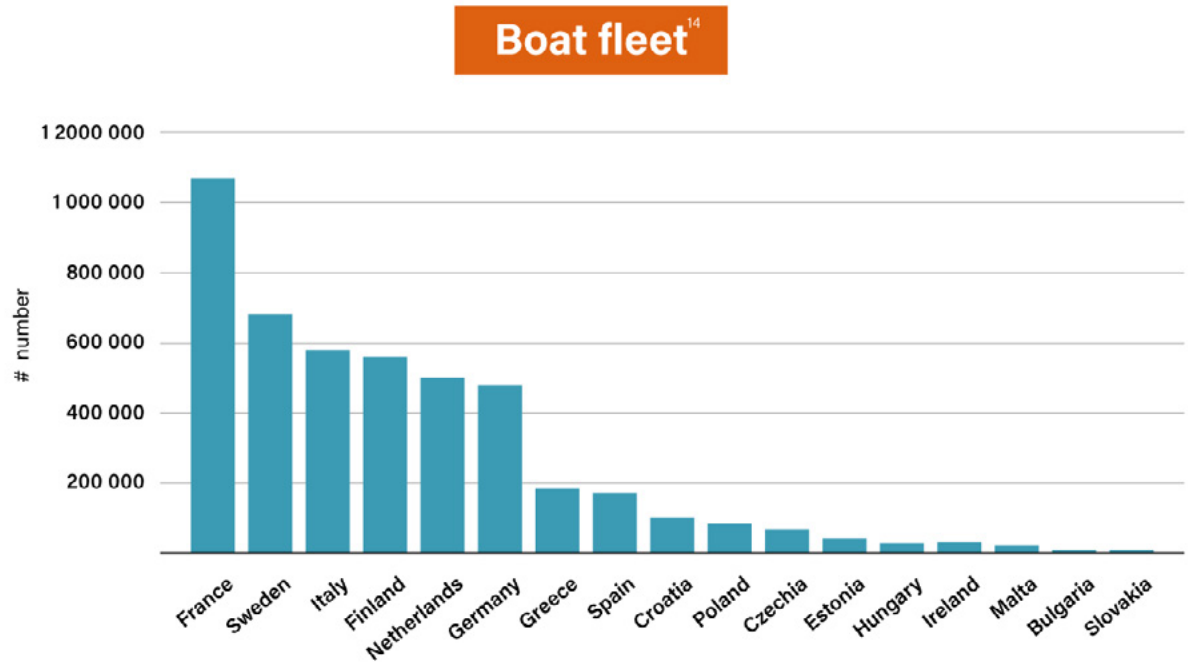
[8] https://portal.helcom.fi/meetings/PRESSURE%2010-2019-549/MeetingDocuments/3-6%20HELCOM%20RAP%20ML,%20RS1%20Development%20of%20best%20practice%20on%20the%20disposal%20of%20old%20pleasure%20boats.pdf

[9] Study on the competitiveness of the recreational boating sector, Ecorys, 2015 for the European Commission

across Europe and very limited recycling options available at large and commercial scale. The need to scale up dismantling and recycling is clear given the increase in number of composite boats built since the 1970s that may be reaching their end-of-life in the near future. It should be noted that 72% of the waste from the dismantling of boats is subject to recycling or energy recovery (wood, metal, and composite)[10].

Within the European composite market, marine (including commercial) uses about 72 kilotons of composite in 2019[11], which is about 2-3% of the total composite sector in Europe. The largest use sectors are transportation, construction with wind energy gaining in importance.

It is estimated that there are over 6.5 million boats in European waters, mostly smaller than 7.5 m[12]. The majority of the fleet is composed of motorboats, followed by sailboats and inflatables. Some countries make up a large part of the overall fleet (see chart below). Besides, EU fishing fleet register lists 81,167 active vessels, where 51,861 vessels are in a length category 0-8 m, and majority made of plastic[13]. However, it should be noted that there is a lack of consistent classification and lack of boat registers in some countries and differences in the registration requirements of Member States, with some starting at a certain length or engine power. Therefore, making a precise estimation of the fleet size, types of craft and further indicators is difficult.



[10] Data from APER

[11] JEC market report 2019

[12] ICOMIA Recreational Boating Industry Statistics

[13] Fleet Register (europa.eu)

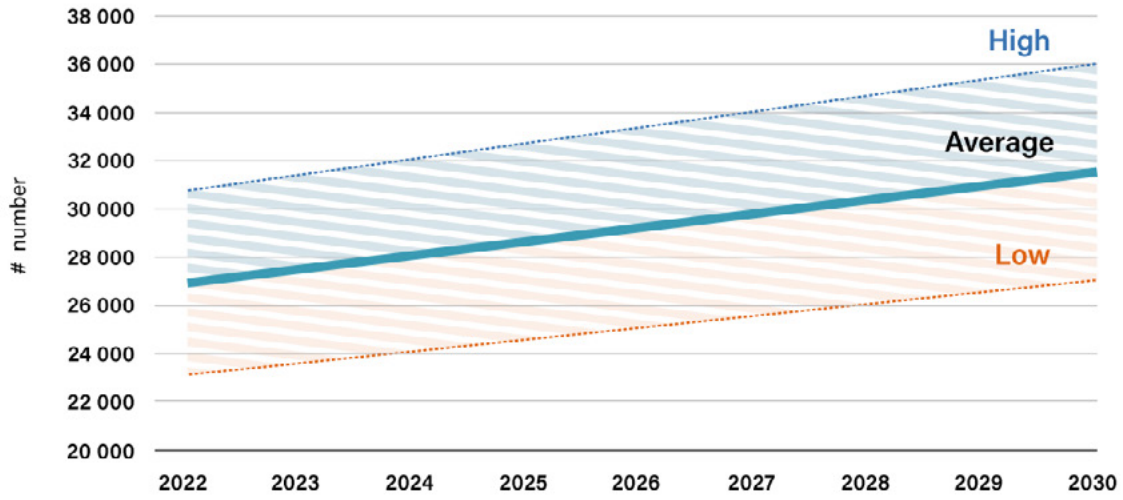
[14] The figure of 1.1 million boats in France corresponds to the registration figures of the administration. The actual fleet is lower as until 2019, deconstructed boats were very rarely deregistered. The real figures is likely to between 800,000 and 850,000 units

Previous studies and the Staff Working Document on Nautical Tourism have indicated that 1-2% of all boats likely reach their end-of-life/end-of-use each year, equalling to around 65-130,000 boats per year in the EU. The practical experience of several countries, in particular the French APER[15] system, shows however that theoretical estimates are usually not achievable[16]. Based on previous studies, APER's initial aim was to dismantle 20-25,000 boats in the period 2019-2023, but current theoretical estimations stand at 10-15,000 boats by the end of 2023. The reasons for this are varied but include emotional attachment of the final owner, high transportation cost, a thriving used boat market, as well as the potentially longer life-time of recreational boats. It can therefore be estimated that the real number reaching their end-of-life each year and available for dismantling would be 30-40 000 boats in the EU until around 2030.

An estimation can therefore also be made on the potential volume of composite waste from end-of-life boats. According to APER, the average volume of composite waste per boat dismantled is 0,77 tonnes. This would result in 23,1000 – 30,800 tons per year at European level. It can be estimated that this will grow by 1-2% every year with increasing awareness among boaters and more dismantling sites becoming available.

To achieve a full picture, other composite use sectors should be compared, in particular wind turbines. According to the sector's association WindEurope, 67 GW of wind energy will reach the end of its designed lifetime by 2030. These turbines of the first generation are almost exclusively built onshore. Most of the turbines will first be decommissioned in Germany and Spain, with some as well in Denmark. They account for 80% of the waste material in the first years. Towards 2030, Italy, France and Portugal will also decommission large amounts of blades.

Estimate of potential composite boat waste (weight)



[15] Association pour une Plaisance Eco-Responsable

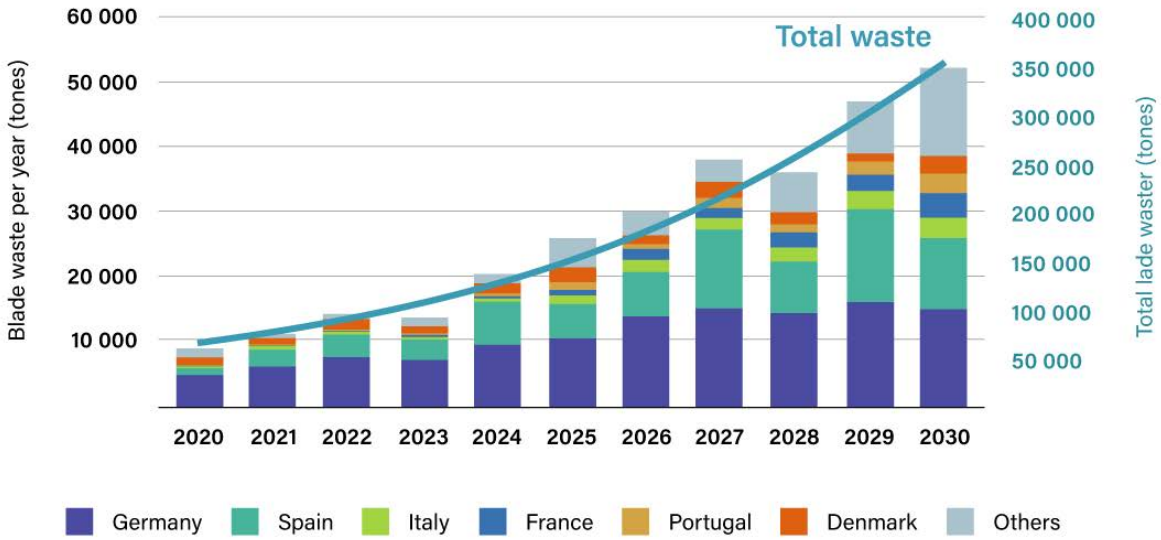
[16] https://www.ecologie.gouv.fr/bateaux-plaisance-ou-sport

The wind sector will have produced about 15,000 tonnes of blade waste in Europe each year in the period 2020-2023. By 2025 this would be 30,000 tonnes per year and by 2030 more than 60,000 tonnes per year. Cumulatively this would be more than 400,000 tonnes of waste from decommissioned blades that will need to be treated by 2030.

It shows that the boating industry and wind energy sectors face similar challenges related to composite material use and are logical partners in driving forward recycling solutions of composite materials at their end-of-life.

However, compared to the boating sector, the wind energy sector has more precise knowledge about the amounts of composite materials to be decommissioned each year. This visibility on composite waste volumes makes the wind sector a prime mover in supporting the establishment of a business plan for the industrialisation of composite recycling/upcycling. This is less the case for the nautical sector, as there is no certainty on the amount of composite that will be dismantled in the future at national or EU level. Nevertheless, the two sectors are working together to advance composite waste recycling.

Decommissioned blade weight (including repowering)



[15] Association pour une Plaisance Eco-Responsable

[16] https://www.ecologie.gouv.fr/bateaux-plaisance-ou-sport

4. FINANCING

A key element is the implementation of a financing system to allow setting up a permanent structure and fund to collect, treat and dismantle end-of-life boats. It should be considered that the last owner of a boat usually cannot afford the high costs of proper disposal and affordable solutions are therefore needed to incentivise proper dismantling. Several different approaches can be envisaged, which are in place across Europe or being considered:

EU approach (as included in the Waste Framework Directive)

- **Extended Producer Responsibility** scheme with an eco-contribution from companies placing the boat on the market and subsidies from existing sector-specific registration fees or taxes (such as France, APER)

In addition, other options for financing could be:

- **Public subsidies** throughout the year or based on specific campaigns (such as Sweden, BÅTRETUR/Swedish Agency for Marine and Water Management)[17]
- Inclusion in **insurance premiums** or in **marina fees**
- **Private system** with payment by final owner, marina, or local authority

A simple and unbureaucratic and financially sustainable approach needs to consider the specificities of each Member State in relation to the number of boats, geographical features (primarily inland or coastal waters), maturity of the market and boat fleet, number of new compared to old boats, the historical stock and other factors. Specific consideration needs to be placed on the differences for financing for the existing boats on the market and new boats. EU funding can be useful to support and kickstart regional projects or campaigns to identify, dismantle and recycle end-of-life boats.

RECOMMENDATIONS

- Member States: Cooperation of neighbouring Member States or regions to set up joint dismantling systems
- EU: Provision of funding for setting-up of boat dismantling systems in EU countries (BlueInvest, Horizon Europe, LIFE, EIB, EMFAF) & provision of funding for pilot projects in regions to identify appropriate funding system

[17] The public subsidies are only a complement to other solutions that will be phased out in the long run. There is now a government assignment with the aim to dismantle end-of-life boats, but at the same time find other solutions to tackle the financial perspective (including EPR).

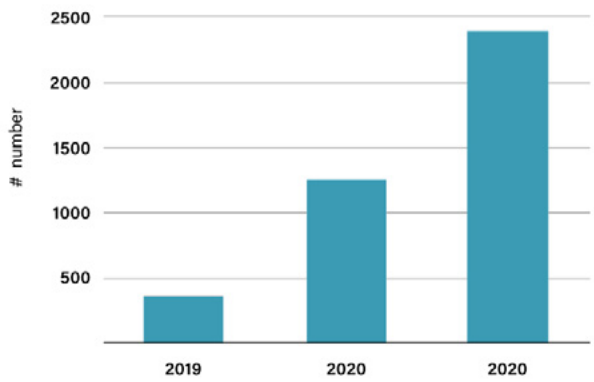
5. DISMANTLING & TRANSPORT

A key aspect for the circular approach is the availability of dismantling centres in proximity to the locations of end-of-life boats (e.g. boating hotspots, marinas) to which they can be easily transported and dismantled. Composite material of end-of-life boats is often worn out and has likely been treated with antifouling paint, requiring specialised knowledge and common guidelines. A basis could be the Italian UNI Standard on "End-of-life treatment of pleasure craft, small vessels" (UNI 11509: 2013) finalised in 2013[18].

The cost of dismantling increases with the size of the boat. It has been quoted as 15 €/metre for boats under 6 metres long. Individual dismantling was estimated to cost about 1163€ for a 6-metre motorboat and 989€ for a sailboat (Belgium[19]). According to APER that relies on the largest base of dismantled boats, the dismantling costs per boat is an average of 600€ with wide variance from 120€ to 6,000€ for large boats.

Using European average, the cost of dismantling for the smaller range of boats alone,

Boat dismantling (APER, France)



without taking other costs into account, will therefore be at least 18-24 million € per year for the EU. This could be much higher depending on the length and types of boats ultimately brought to dismantling. Further costs for administration, communication, and importantly transport need to also be taken into account. Also, there is a possibility to consider using such funding for R&I.

A key cost driver is transport, which increases with distance to the dismantling site, length of the craft and need for exceptional transport and special permits. In France, the AGEC law (anti-waste and circular economy) provides that from 2023, sectors covered by the EPR scheme must organise and finance not only deconstruction but also the collection and transport of waste to treatment centres. The cost of transport is as high as the cost of deconstruction and the new obligation therefore leads to a doubling of unit costs per boat, which puts the economic balance of the APER system at risk. APER is conducting an experiment to cover transport costs in the second half of 2022 in the Brittany region. The objective is to measure collection and transport costs and to observe the effect of free transport on the number of requests. The first results show that the land transport costs for the boats is between €250 for a boat of less than 6m close to a dismantling centre and more than €10,000 for the largest units. These prices do not include the costs of refloating, hauling out and loading.

A potential solution to the high transport costs and in countries with a smaller boat fleet, could be the use of mobile dismantling units that can access boat yards or marinas for direct on-site dismantling. Importantly, these locations should be able to apply for

[18] https://store.uni.com/p/UNI21012702/uni-115092013-231697/UNI21012702_EIT

[19] Marina VYNieuwpoort

a license based on suitable protocols. However, this is currently not possible due to the provisions in the EU Waste Framework Directive that should be considered in the current revision. This is common practice in the wind energy sector. Very often decommissioned blades are already cut on-site with all necessary environmental precautions.

In addition, end-of-life boats and composite waste are not included as a specific category in the European Waste List. The European List of Waste provides common terminology for classifying waste across the EU, crucial for waste management, recycling, and statistics. This makes composite waste hard to track and transport once labelled. It thereby prevents the pooling of composite waste from different sectors needed for recycling and its pre-treatment with recycling companies unable to source enough and consistent composite material waste. In a supporting study[20] for the last revision of the EU waste list, it was suggested to create a new entry on "waste from end-of-life ships and other means used for the maritime transport". However, this was never implemented in the final EU Waste List and should be reviewed in the context of this document and the upcoming revision[21]. To enhance pooling of composite waste, an entry on 'composite waste' with sub-headings/categories for 'composite waste from end-of-life boats', 'composite waste from end-of-life blades', 'composite waste from manufacturing', and further for each major use sector should be implemented.

Specific concerns exist for abandoned boats, either within marinas or in the natural environment, when the owner cannot be identified or is unwilling to act. In this case, special procedures need to be implemented to allow for the boat to be confiscated and dismantled. Boats abandoned in marinas also occupy valuable space. An approach being discussed in Spain is that in case of abandoned boats in marinas, a notary can declare the boat abandoned and remove ownership rights. Abandoned boats are defined as those that do not pay the mooring fees for more than one year or exceptionally for six months if the boat is polluting or close to produce pollution or is a danger for other boats. Once this notary declaration has been made, the marina or other site can sell the boat or start the dismantling procedure. The use of a notary provides legal security to the marina or other site. This approach should also be considered at Member State level or adapted to the national legal framework.

RECOMMENDATIONS

► Member States & EU: Alignment of data collection on end-of-life boats (number, volume, locations) and consolidation at EU level

cont.

[20] https://ec.europa.eu/environment/pdf/waste/low_review_oekopol.pdf

[21] https://ec.europa.eu/info/law/better-regulation/have-your-say/initiatives/13225-Environmental-impact-of-waste-management-revision-of-EU-waste-framework_en

► Member States: Setting up a funding (based on EPR or other suitable approach) and dismantling system for end-of-life boats in co-operation with stakeholders by 2030

► Waste dismantling industry: Adoption of procedures to allow for dismantling of end-of-life boats in existing waste facilities

► EU: Within current revision of Waste Framework Directive, the following should be considered:

▷ Dedicated waste code for composite waste in European Waste List with sub-codes for end-of-life recreational boat composite waste and other use sectors.

▷ Ensure EU waste shipment regulation allows for cross-border transport of composite material waste in various stages of treatment.

▷ Addition of permission for dismantling outside of waste centres for end-of-life boats, such as in marinas or boat yards with specific light-touch license for occasional use and use of mobile dismantling units.

► Member States & Marinas: Change of internal rules and procedures to allow for easier removal of abandoned boats and adoption of specific procedure to seize abandoned boats

6. RECYCLING

Recycling/upcycling of composite waste is a major cross-sectoral issue[22]. Currently, there are no commercially viable recycling solutions due to high energy and other costs involved with the final product not able to be sold at profit. The aim for recycling/upcycling should be the conversion into new materials and products used in the manufacture of new composite products, enabling a circular approach within the composite sector. Currently, composite waste, regardless of the source, is used for energy recovery and landfill. According to APER, 40% of composite waste is stocked in classified locations with 60% used for energy recovery.

Cement kiln co-processing, while costly, is the treatment technology that is already available and that could be increasingly used within the next years to transition to the circular economy approach. Glass fibre can be a source of silica that is needed in the cement production. One ton of com-

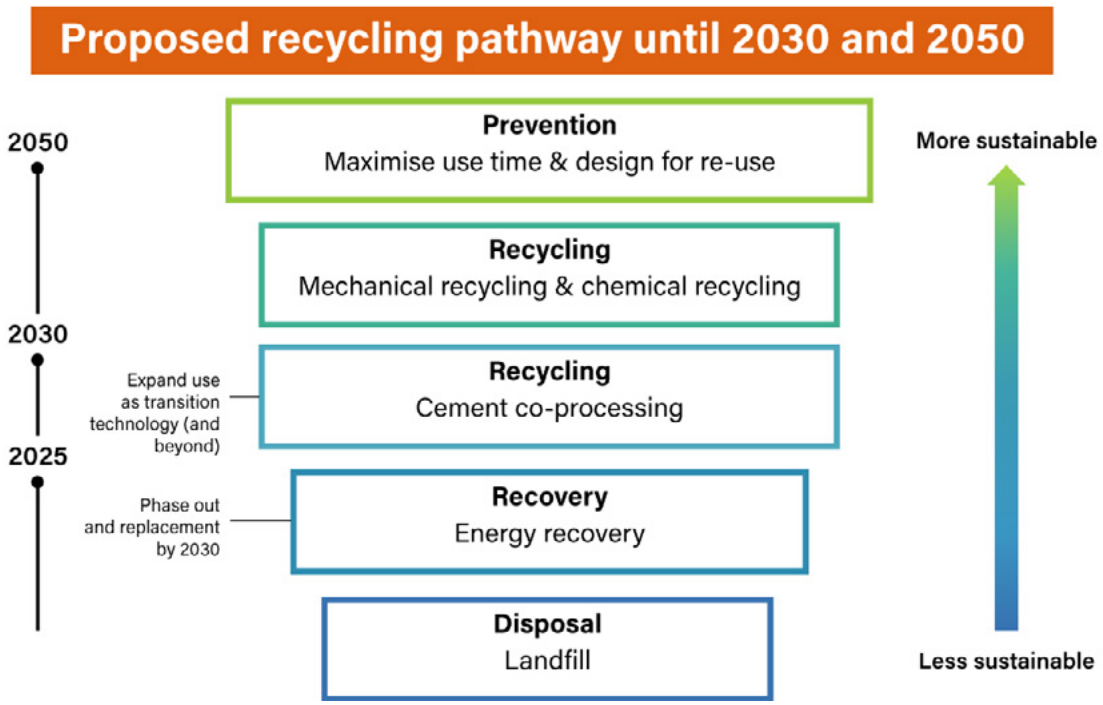
[22] https://ec.europa.eu/environment/pdf/waste/low_review_oekopol.pdf

[21] https://ec.europa.eu/info/law/better-regulation/have-your-say/initiatives/13225-Environmental-impact-of-waste-management-revision-of-EU-waste-framework_en

posite material leads to the saving of 460 kilograms of primary raw material (such as sand). Polymers can be used to produce energy. The high efficiency and lower CO_2 emission factor, reduces the total CO_2 impact of the cement production process. One ton of composite can save approximately 110 kilograms of CO_2[23] compared to fossil fuels. In 2021, only one cement plant was accepting composite waste. However, this single facility could take the entire existing combined annual composite waste of both the boating and wind energy sector. Given its immediate availability and cement sector's need to replace sand and lower GHG emission, cement co-processing can act as a recycling technology for composite waste and continue to be used alongside other technologies. The approach for new recycling solutions has to be technology-open to identify the most suitable approach for all composite use industries.

Other recycling solutions, such as mechanical and chemical composite recycling, have been developed. While proven to be successful at pilot scale, scale-up and commercialisation is key in the next few years. This requires investment and support from public funding. The recreational boating industry alone can be considered as too small and insufficiently certain to produce the stable composite waste stream to create a recycling market and must work with other industries such as wind energy, construction, and automotive to find common solutions at industrial scale. A stand-alone recycling system for end-of-life recreational boats is not feasible. Central recycling hubs in regions, even cross-border, may be crucial to reduce transport costs from waste dismantling to recycling. Given that boats made from composite will dominate the stock of end-of-life boats for the coming decades, recycling of composite waste will be required.

In addition, the re-use of boats needs to be encouraged as much as possible as



[23] Data from Geocycle

this can prevent waste effectively. Boats can be refitted and their lifetime extended again. This could benefit from cross-border cooperation by identifying use of end-of-life boats in other EU countries. An important aspect would be to design and manufacture boats with reuse and recycling in mind. The Swedish Båtskroten system, for instance, puts customers in contact with owners of end-of-life boats. This has resulted in reusing approximately 650 components from boats dismantled in 2022 (including mainsheets, anchors, tiller fittings, lanterns, compasses, sails, rudder). Some boats that come in are fully functional boats that could be used for many more years. Båtskroten has received some requests to export entire boats to Estonia, Latvia, Lithuania and Poland for upcycling.

RECOMMENDATIONS

► Industry (commitment taken by EBI): Phase out landfilling and energy recovery by 2030, expand use of cement kiln route from 2025 (and beyond) and adoption of additional recycling/upcycling solutions from 2030 in coordination with other composite use industries (based on a cross-sectoral and technology-neutral approach)

► Composite use industries: Cooperation across the major composite use industries to set up common recycling pathways

► EU: Focus of funding opportunities of upscaling and commercialisation of recycling solutions for composite waste and identification of approaches to encourage reuse and upcycling of end-of-life boats

7. RESEARCH & INNOVATION

Besides the implementation of recycling solutions for existing end-of-life boats and funding to support their transition from pre-industrial to real-life application, the identification of new fibres and resins is needed that are sustainable and less CO_2-intensive. Basalt, flax, and hemp are being trialled and may become part of the material used in boat building. Their further implementation requires proof of durability, as well as life cycle analysis comparisons with existing materials. While being currently still in early adoption phase, these may offer part of the solution to reduce environmental impact and reduce CO_2 emissions. Other innovation, such as 3D printing, can also support a circular approach. Further Research & Innovation is therefore needed to support the future development of composite materials used in boat-building. Life Cycle Analysis (LCA), if standardised, can also be an important tool to evaluate effective reduction of environmental impact across all phases of the life cycle taking a strong material perspective.

RECOMMENDATIONS

► EU: R&I funding for development of new high-performance materials with enhanced circularity (design for longer lifetime, eco-design, reuse/repurpose approach)

► EU: R&I funding for boat manufacturers to apply new materials in boat-building

► EU: Consideration of mandatory use of LCA-proven sustainable composites/recycled content in non-structural applications through Recreational Craft Directive based on eco-design approach by 2030 in next revision of RCD

8. CONCLUSION AND SUGGESTED IMPLEMENTATION

The experience of the Stakeholder Group has shown a clear need to discuss and coordinate activities at EU level and identify and implement common solutions. This should be continued for the implementation phase of the roadmap. It is suggested to set up a coordination group/Network for countries with a dismantling system in place as well as those wanting to develop it. Members should be the national authorities, national associations of the boating industry, and association of boat users. It should be led by the European Commission (DG MARE) and European Boating Industry (EBI). This group would oversee follow-up and implementation of the recommendations identified in this roadmap.rently still in early adoption phase, these may offer part of the solution to reduce environmental impact and reduce CO_2 emissions. Other innovation, such as 3D printing, can also support a circular approach. Further Research & Innovation is therefore needed to support the future development of composite materials used in boat-building. Life Cycle Analysis (LCA), if standardised, can also be an important tool to evaluate effective reduction of environmental impact across all phases of the life cycle taking a strong material perspective.

RECOMMENDATIONS

► Set up an EU Network on end-of-life boats (national dismantling schemes + stakeholders) co-chaired by DG MARE and EBI with at least yearly meetings from 2023

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