



EU Outlook on Wind Energy Research: A Case for Circularity

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Virtual Event

EU Biodiversity Strategy for 2030

Offshore Renewable Energy Strategy

European Climate Pact

Action Plan on Critical Raw Materials

Methane Strategy

Renovation Wave

Climate Law

European Bauhaus

Chemicals Strategy for Sustainability

Circular Economy Action Plan

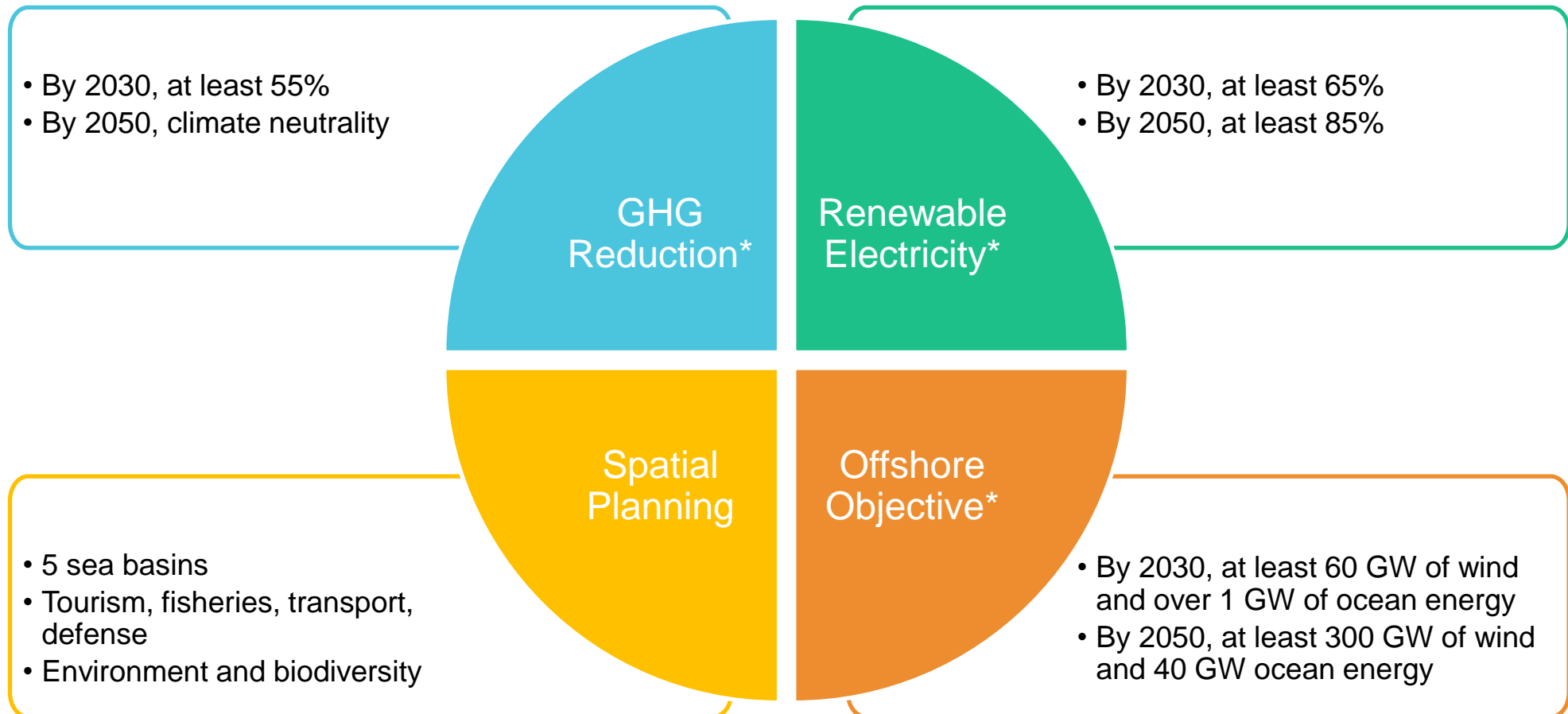
**GREEN
DEAL**

Offshore Strategy lights the way.

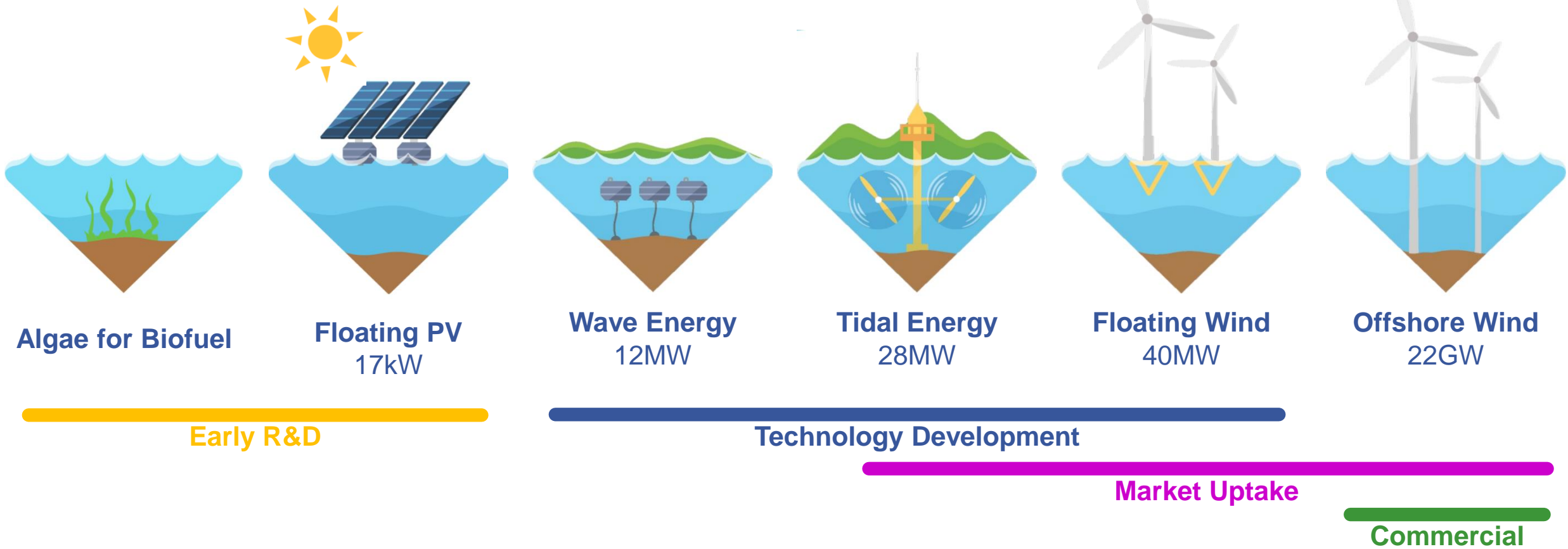
*“The clean energy transition should involve and benefit consumers. Renewable energy sources will have an essential role. **Increasing offshore wind production will be essential**, building on regional cooperation between Member States.”*

*“This will include ways to manage maritime space more sustainably, notably to help **tap into the growing potential of offshore renewable energy**.”*

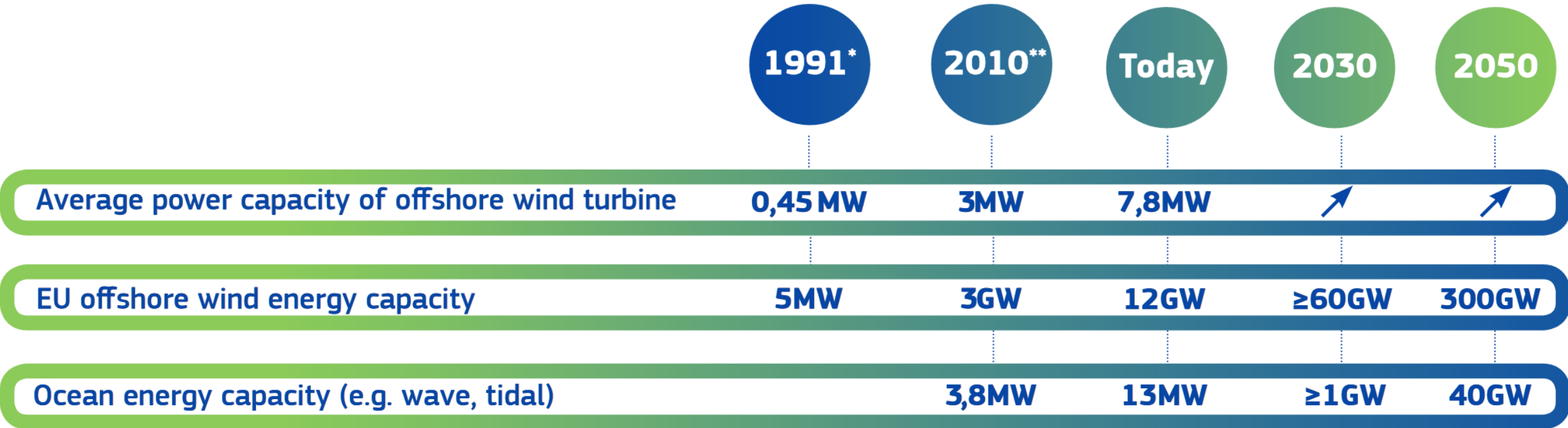
Why an Offshore Strategy?



Wide Range of Offshore Technologies.



A Challenging Way Forward.



* First offshore wind farm: Vindeby, Denmark.

** Including UK

The Offshore Strategy in 4 Acts.



Investment

- ▶ Encourage the necessary investment to effectively develop offshore renewable technologies
 - estimated at almost €800 billion between now and 2050
- ▶ Increase certainty for investors and smooth the path for investments, ease bottlenecks, and find the best combination of public and private finance



Regional Cooperation

- ▶ Promote cross-border cooperation, in particular in the North Sea, Baltic Sea, Mediterranean Sea, Black Sea, Atlantic Ocean, and outermost regions and overseas territories
- ▶ Promote a pan-European supply chain involving multiple regions, in coastal and inland areas
- ▶ Enhance maritime spatial planning for a successful large-scale deployment of offshore renewable energy and the sustainable use of our sea space and resources



Predictable Legal Framework

- ▶ Promote innovative projects that will ensure a cost-effective deployment of offshore renewable energy
- ▶ Give certainty to promoters and reduce risk for investors



Strengthening Supply Chains and Supporting Continuous Innovation

- ▶ Maintain and develop European technological and research leadership
- ▶ Upgrade port infrastructure to support deployment and connection of offshore energy
- ▶ Boost the full industrial value chain in Europe, including skills and labour support

Sustainable Growth

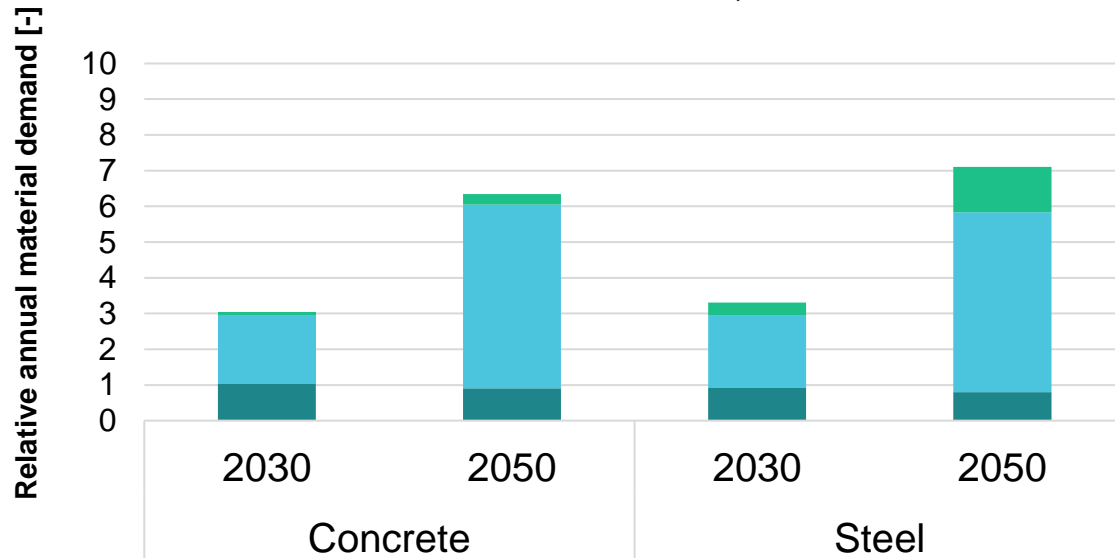
Circularity as a mean to reach 300 GW.

Growth in Material Demands

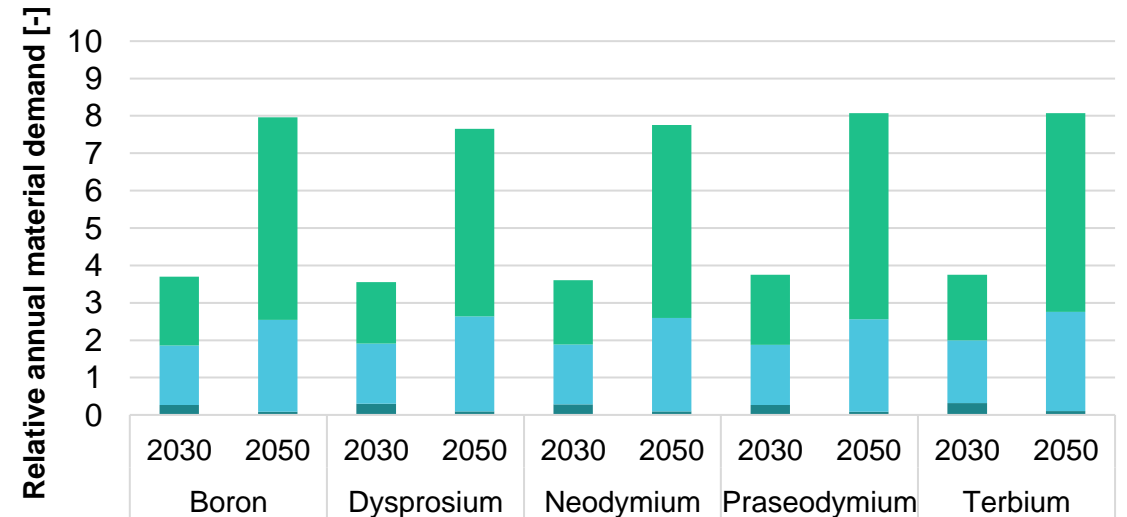
The consumption of raw materials for offshore wind turbine will likely increase in the future, both concerning structural and technology specific materials.

The EU is almost completely dependent on third countries for import of those materials.

Detail of structural materials, 2030 and 2050



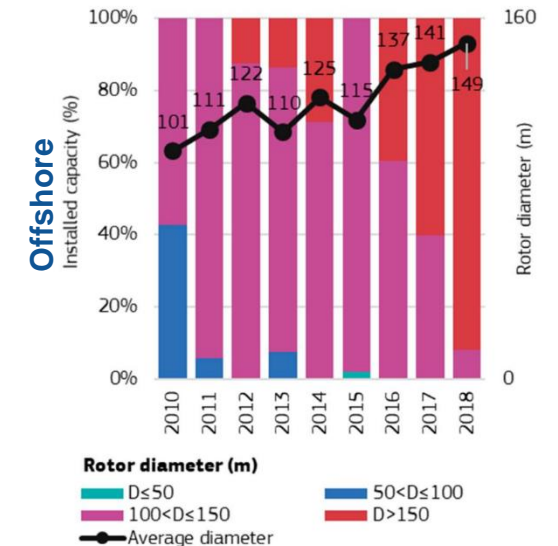
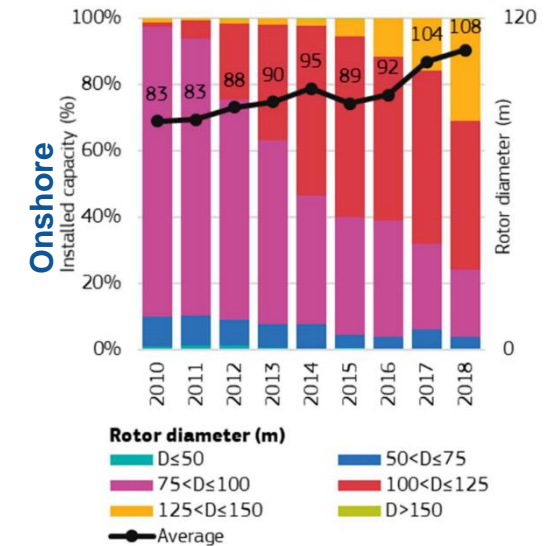
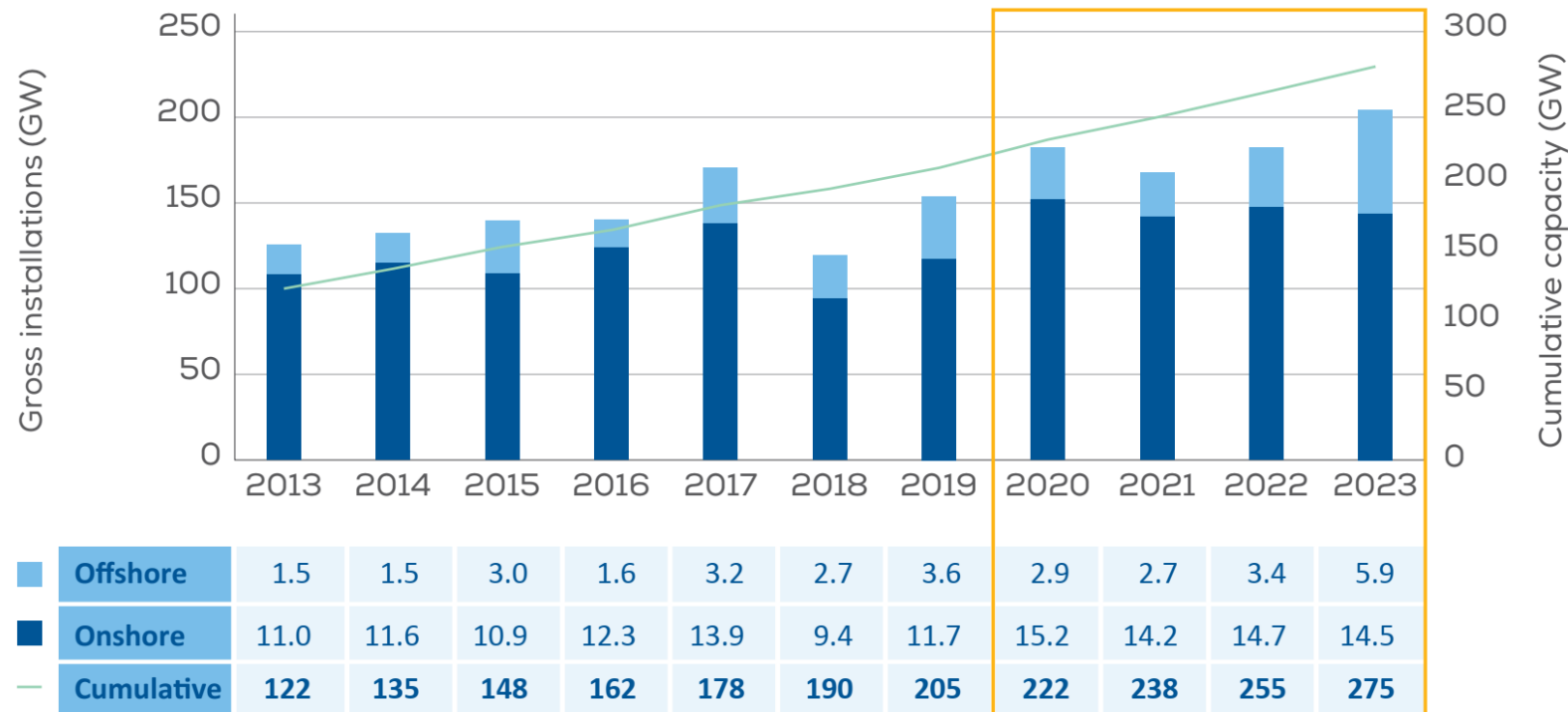
Detail of technology specific materials, 2030 and 2050



■ Low Demand Scenario ■ Medium Demand Scenario ■ High Demand Scenario

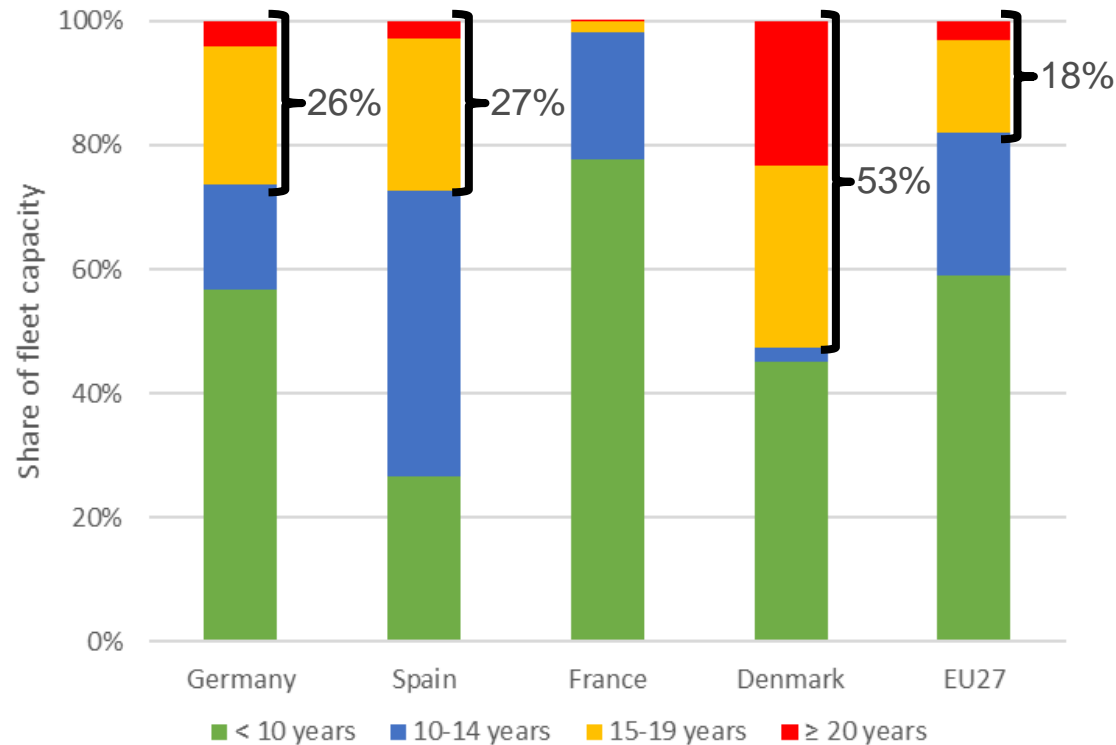
Trending Towards More and Larger Blades

Gross annual installations in Europe



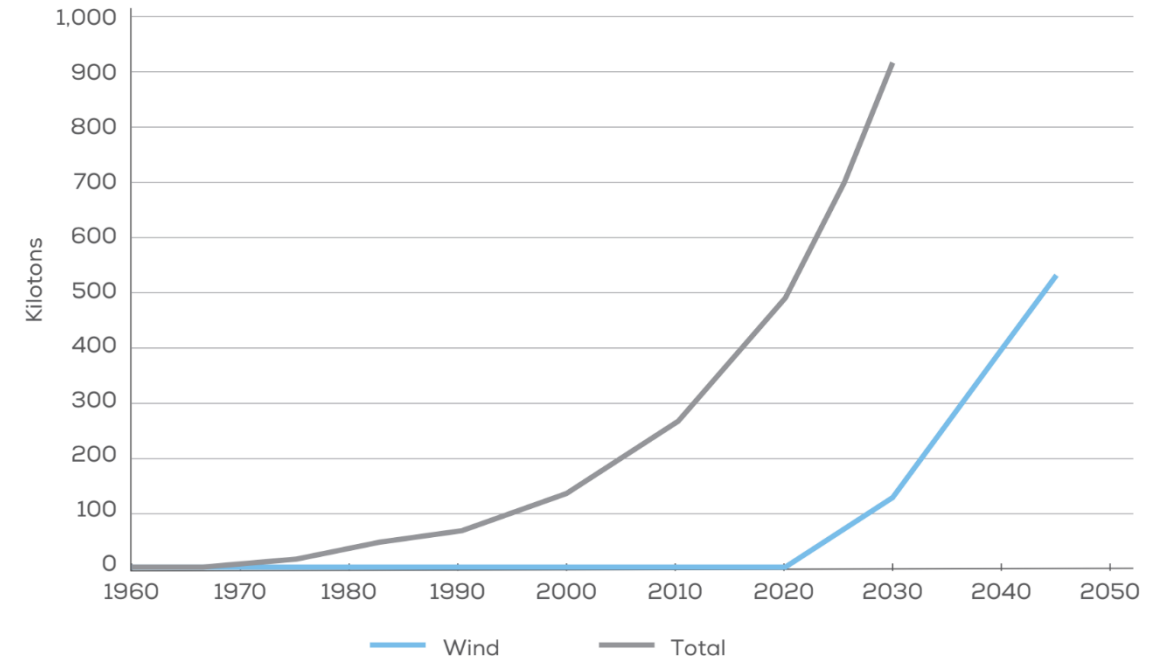
Blades & Waste: An Upcoming Circularity Issue

Turbine fleet age structure – onshore



Leading countries in wind deployment face an ageing wind fleet.

Composite waste generation – sector trends (ktons/year)



Composite waste generation is on the rise.

How to Avoid This?



Fragments of wind turbine blades await burial at the Casper Regional Landfill in Wyoming.
Photographer: Benjamin Rasmussen for Bloomberg Green

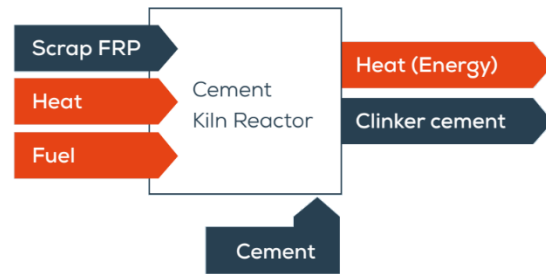


European
Commission

Recycling. Repurposing.

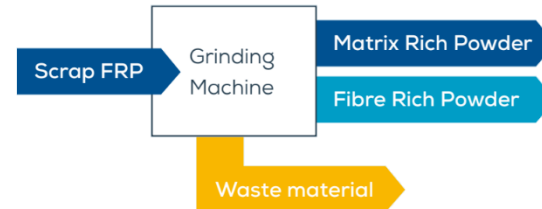
Co-Processing

Current TRL 9



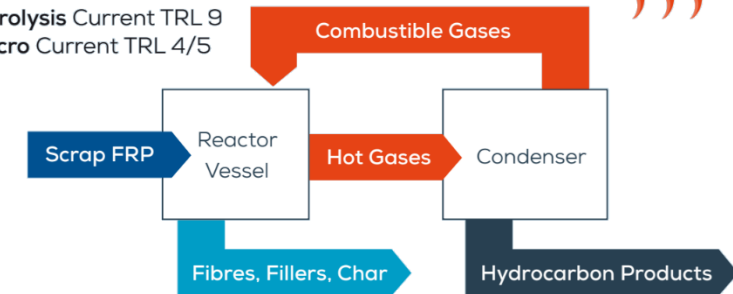
Mechanical Grinding

GFRP Current TRL 9
CFRP Current TRL 6/7



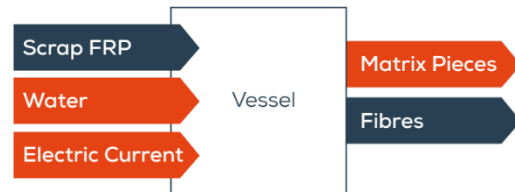
Pyrolysis

Pyrolysis Current TRL 9
Micro Current TRL 4/5



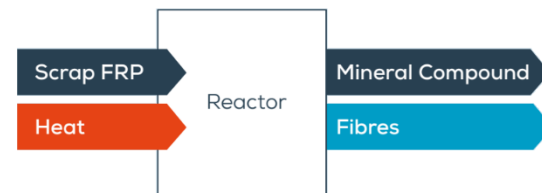
High Voltage Pulse Fragmentation

Current TRL 6



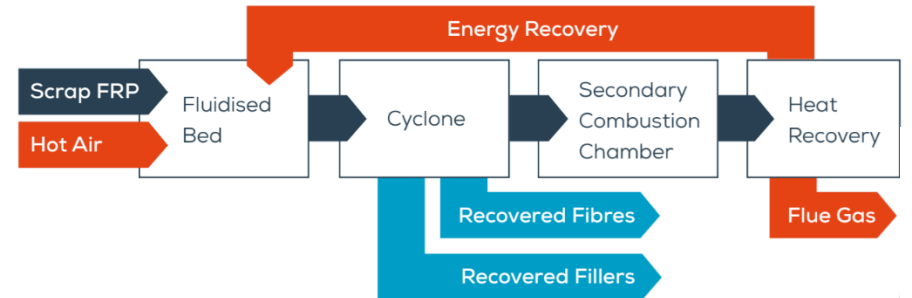
Solvolyis

Current TRL 5/6



Gasification (Fluidised Bed)

Current TRL 5/6



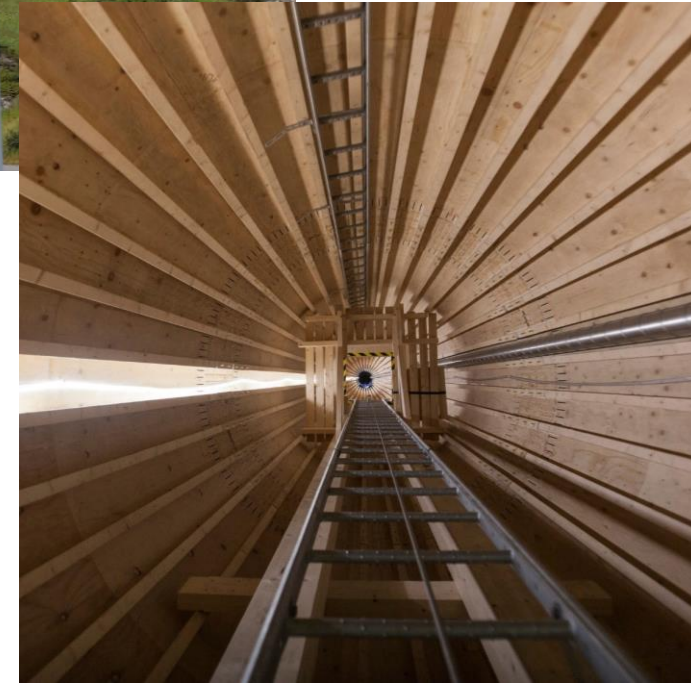
EU Projects: MODVION

Bring to market the first ever modular wind turbine tower made from **laminated wood** (LVL).

As a system made of wood, the turbine tower holds the CO₂ captured by trees during their growth & trapped in the tower and can cut 2,000 tons of CO₂ per 150m tower when replacing a traditional steel tower.

The tower can go well **beyond 150 meters in height** and can support a 350 tons heavy nacelle and turbine.

This technology has the potential to outperform existing solutions on the market, such as steel and concrete wind towers, in terms of specific strength, operational costs, maximum height and many more.



EU Projects: MAREWIND

MAREWIND will work on solutions to help building a next generation of large offshore wind energy- and tidal power generators by tackling the current challenges related to materials, coatings and multi-material architectural performance.

By enhancing the materials' **durability, recyclability, and reduce maintenance** in offshore structures, the project will contribute to a more economic and sustainable model of the offshore wind sector.

The work will address these main aspects:

1. **Scalable manufacturing technologies** and easy to repair solutions;
2. **Safer-by-design materials** avoiding environmental concerns and ocean impacts;
3. Standardisation aspects for effective European deployment of marketable and usable technologies.



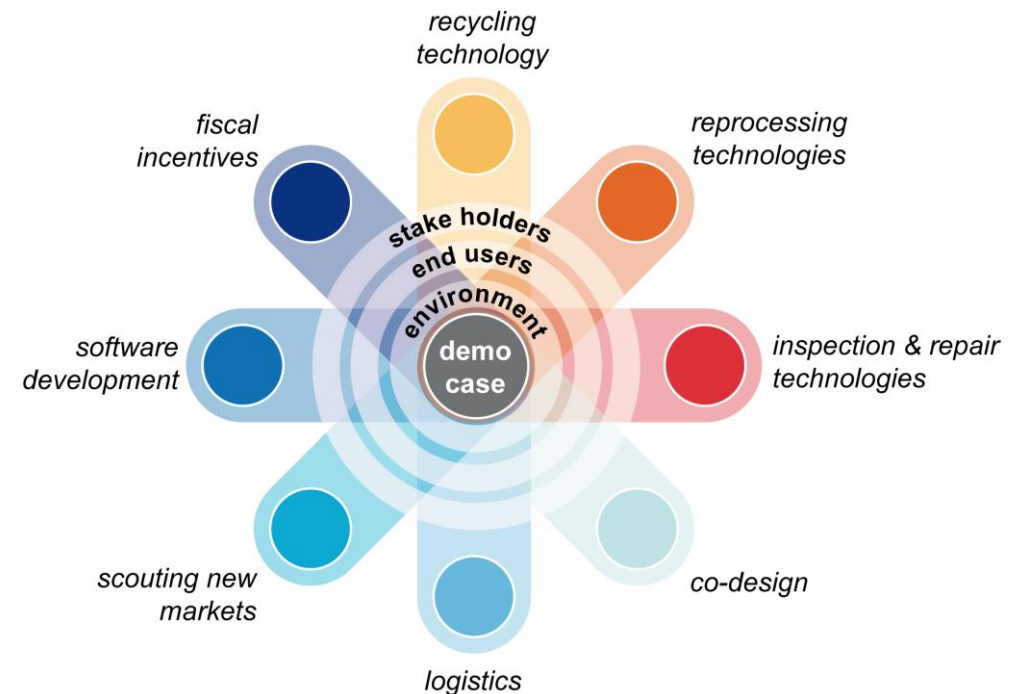
EU Projects: FiberEUse

Although glass and carbon fiber reinforced polymer composites are increasingly used as structural materials in many manufacturing sectors due to their lightweight and corrosion resistance, composite recycling is a challenging task.

Mechanical grinding and pyrolysis reached a quite high TRL but landfilling of EoL composites is still widespread since no significant added value in the re-use and remanufacturing of composites is demonstrated.

The FiberEUse project aims at integrating an approach aimed at **enhancing the profitability of composite recycling and reuse in value-added products**.

FiberEUse aims to support industry in the transition to a circular economy model for composites, and had developed a **series of use-cases**, including one in the wind sector.



EU Projects: R3FIBER



Composite materials are the construction materials of the future. Due to their excellent properties (light weight and high mechanical performance), composites are becoming the material of choice for industries such as aerospace or wind energy. Market drivers such as regulations on CO2 emissions reduction or increased energy efficiency guarantee this rising trend.

However, a new environmental problem is arising since **no industrial process exist that allows for material recycling** or valorisation. End-of-life composite materials, already considered as an emerging waste, are currently landfilled, the last disposal option in the Waste Directive.

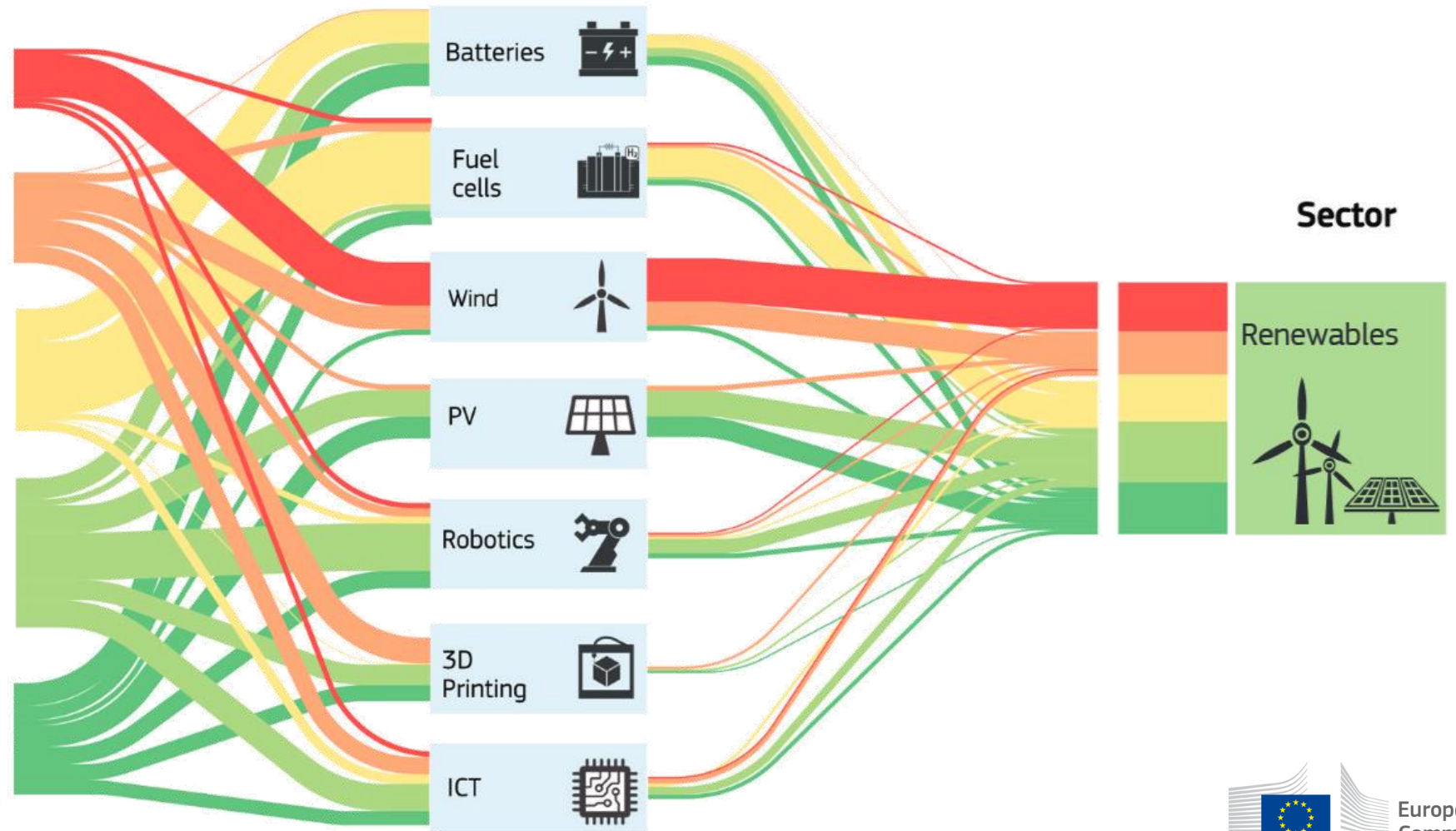
The project aims to industrially develop, exploit and **commercialise a technology for the recycling of composite materials**, allowing for complete valorisation of mass, energy and materials in a zero-residue process. The R3FIBER process, validated at pilot plant scale, provides a disruptive solution to recycle wind turbine blades and other composites, obtaining high quality glass and carbon fibres, heat and energy in a clean and energy-efficient, self-sustained process.

Circularity as a Strategy

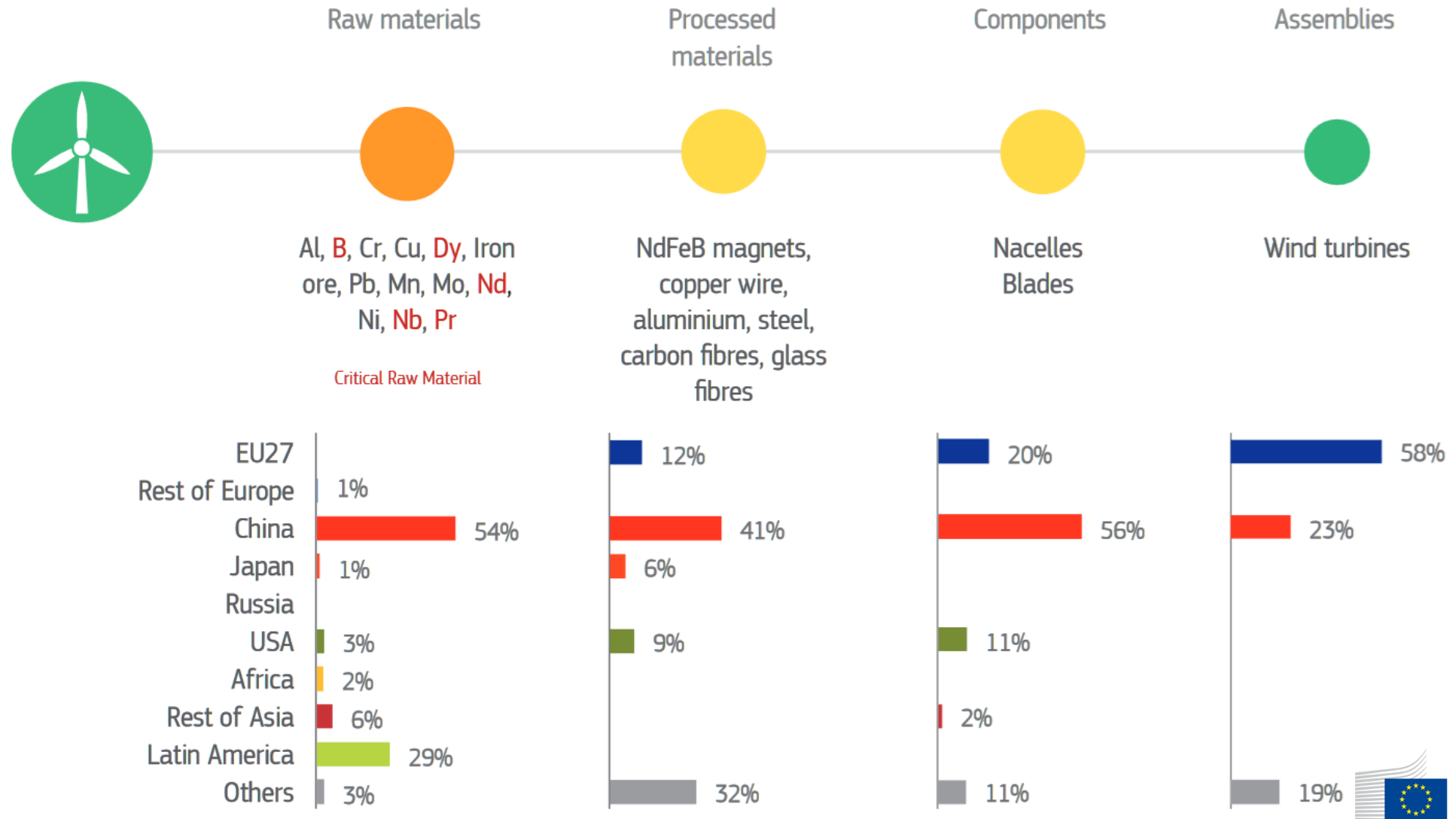
Supply Risk

(sorted largest to smallest)

Very high	LREEs HREEs
High	Magnesium Niobium Germanium Borates Scandium
Moderate	Strontium Cobalt PGMs Natural graphite
Low	Indium Vanadium Lithium Tungsten Titanium Gallium, Hafnium Silicon metal
Very low	Manganese Chromium Zirconium Tellurium Nickel, Copper

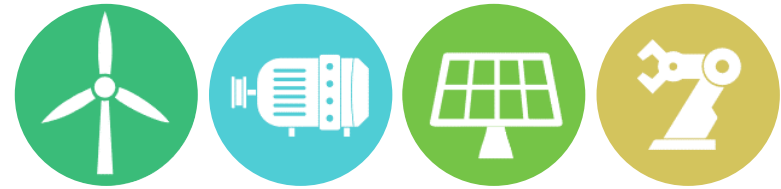


Circularity as a Strategy



Future Directions

- Strong policy interest:
 - Circular Economy Action Plan;
 - Action Plan on Critical Raw Materials;
 - Offshore Renewable Energy Strategy;
 - EU Chemicals Strategy for Sustainability;
- Supporting actions:
 - Horizon Europe (€95B)
 - Global Challenges
 - Development and scale up of composite recycling technologies, such as large-scale demonstration facility;
 - Circular- or recyclable-by-design new materials for blades and other sectors;
 - European Missions: Result-driven actions on e.g. clean oceans;
 - Innovation Fund (up to €10B)
 - Large- and small-scale projects, at the upscaling stage, focused on GHG avoidance;
 - Support of recycling-friendly regulatory framework;
 - Development of a pan-European market for recycled composites.



Sneak Peek into Horizon Europe...

- Demonstration of innovative materials and recycling technologies to increase the circularity of wind energy technology and to reduce the primary use of critical raw materials
 - Policy context: Circular Economy Action Plan, Action Plan on Critical Raw Materials, Offshore Strategy, Circularity-by-Design
 - Two-pronged approach:
 - Forward-looking:
 - Clear and decisive actions now to assure sustainable and circular wind farms
 - Development of alternative solutions to replace/substitute critical raw materials
 - Improving efficiency of sourcing processes
 - Backward-looking:
 - Technological development approaches to fully recycle current wind farms
 - Large-scale industrial demonstration of composite material recycling technologies
 - Knowledge hub involving other composite-heavy sectors



HOW WIND IS GOING CIRCULAR

blade recycling

etipwind.eu

ETIP Wind
EUROPEAN TECHNOLOGY & INNOVATION
PLATFORM ON WIND ENERGY



**European
Commission**

Thanks. Danke. Merci. Obrigado.

More info at:

<https://ec.europa.eu/research/>
<https://ec.europa.eu/energy/>