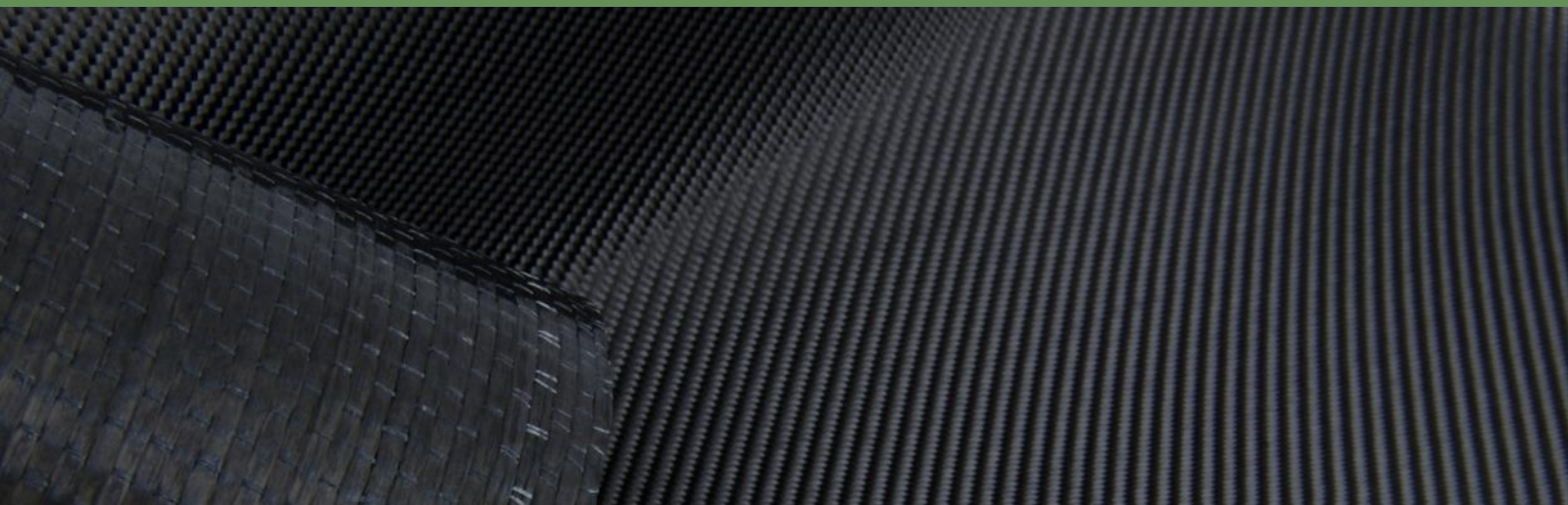




**Multi-level Circular
Process Chain for Carbon
and Glass Fibre Composites**

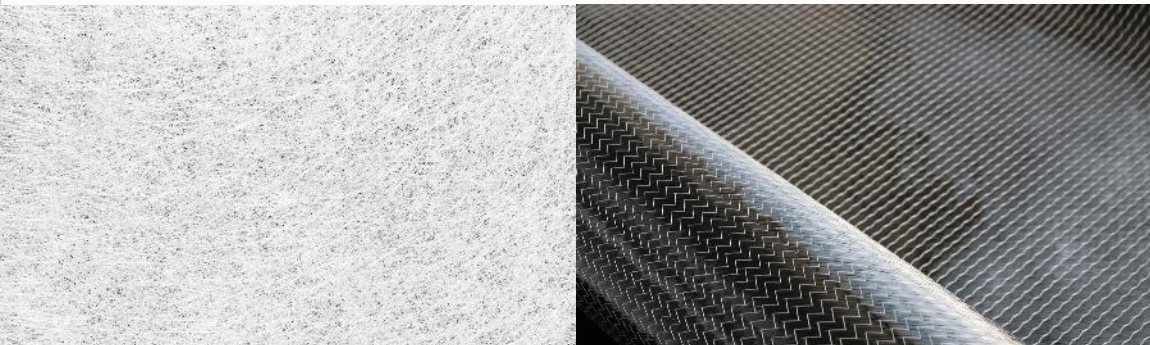
MC4 – General presentation



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Multi-level Circular Process Chain for Carbon and Glass Fibre Composites



Context

**Recycling CF and GF
composites**

Conclusions



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Context



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Carbon and glass fibre composites



147.000 tons of carbon fibre²

4.500.000 tons of glass fibre are used each year worldwide³

Highly-
functional

Lightweight

In the aircraft industry, **each kg of weight saved in a plane will reduce CO₂ emissions by 16t per plane per year.**

Environmental impact of current carbon and glass fibre composites value chains

98%

of CF and GF composites end up in **landfills** at the end of their life¹

40%

of CF is **wasted** during the production process

6-8000

aircrafts will come to the end of their lives by 2030, with OEMs aiming to recycle at least 90% of the constituent materials

+10.000

wind turbines blades made of GF composites cannot be recycled today



Regulations

Are evolving: Since 2015, EU regulations have required **recycling of at least 85% of end-of-life materials in the automotive industry**
The EU industrial strategy includes a growing number of actions for sustainability, recycling and circular economy (transports, textiles...)



Growing need to find **solutions for the recycling or re-use of CF and GF composite parts**

Raw materials

80%

of virgin carbon and glass fibre manufacturing done **outside of Europe**⁴

Technologies

When the manufacturing is done in Europe, the technologies are often **licenced from foreign countries**⁴



Growing need to **find solutions for the independence of the EU industry**

To establish a **multi-level circular process for carbon and glass fibre composites**

To develop **performant and economically realistic processes** that are adapted to the specificities of the two value chains

To give to to the European industry the means to **master and own its patented manufacturing processes** of recycled materials



7M € budget

MC4 gathers **16 partners from 9 different European countries**, covering the whole value chains: process developers, material manufacturers, end users manufacturing the composite parts. The consortium is led by Profactor (Austria).



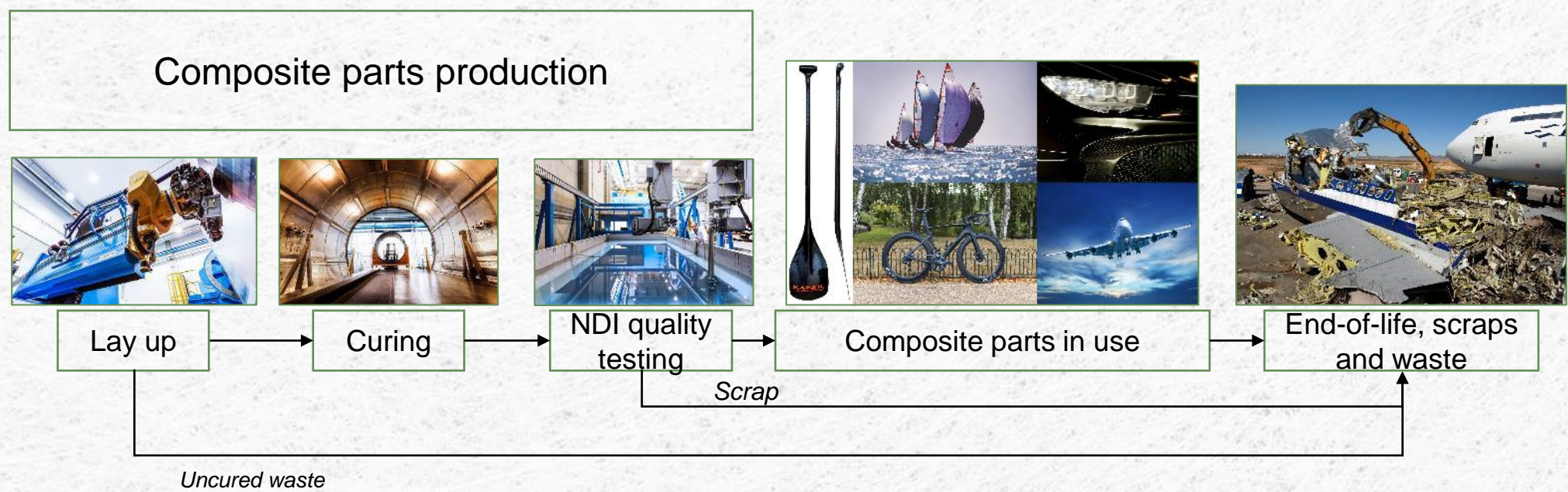
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Recycling CF and GF composites



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2 time frames

Short term

Long term

2 composite value chains

Carbon fibre

Chemical matrix/fibre
separation

Glass fibre

New type of resin for direct
re-use of the composite part

Carbon and glass fibre have substantially **different costs** and this needs to be taken into account when developing **economically feasible recycling procedures**.

CF

The re-use of uncured carbon fibre scrap material directly in the production line to reduce the amount of scrap generated during manufacturing as a short-term solution

Short term

Chemical recycling as a long-term pathway to regain valuable carbon fibre from end-of life parts and convert them into yarns, fabric and nonwoven material for new parts

Long term

GF

The shredding of glass fibre composites and the re-used in new parts, which will in the short term reduce the amount of virgin material needed for such parts.

Short term

The application of dynamic resin, which enables the reshaping of parts at their end of life and provides a long-term solution for glass fibre end-of-life parts

Long term



Sorting of end-of-life parts

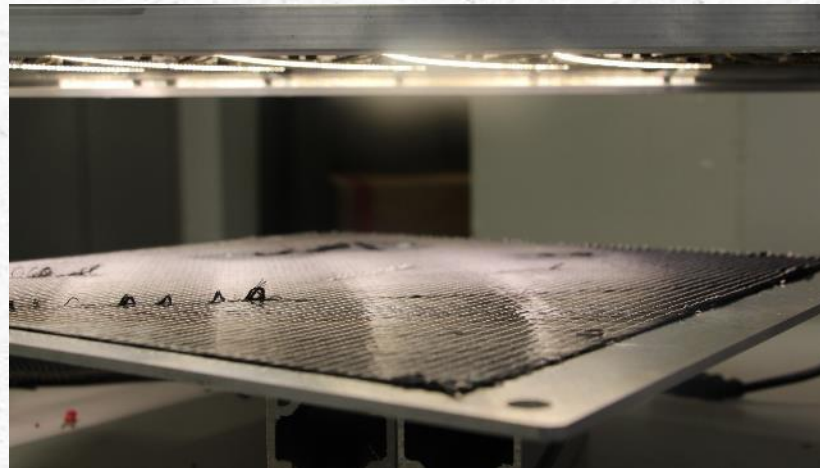
- **More targeted**
- **Less damaging** recycling processes

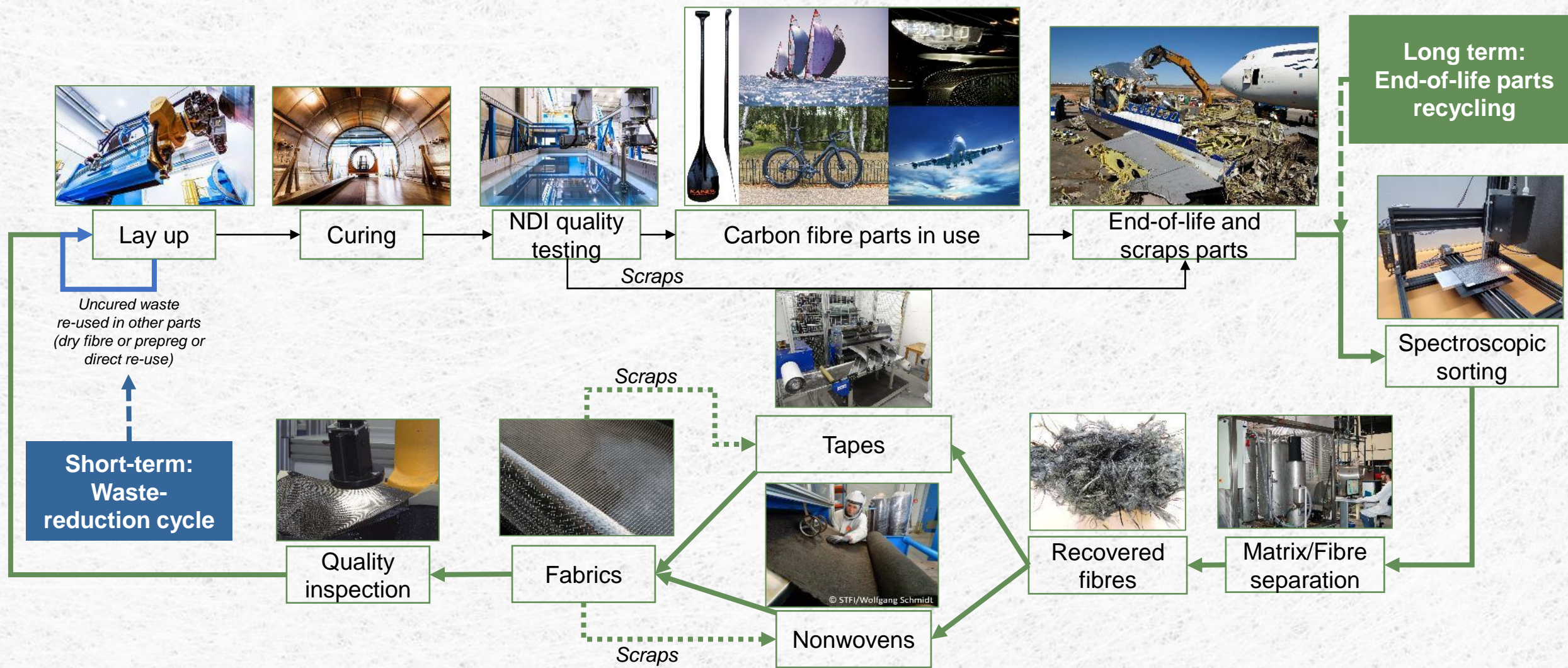
Enhanced quality control methods

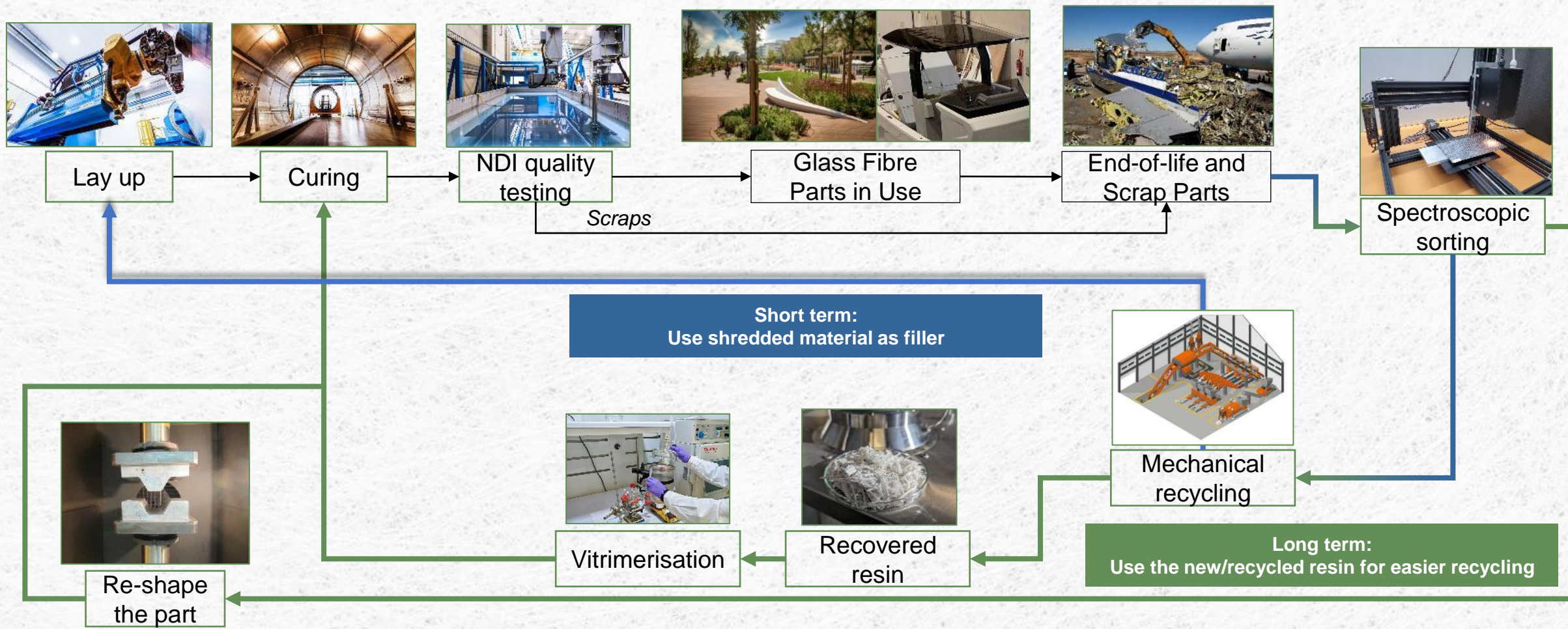
- Deal with the **higher variability** of recycled materials
- Assess the **suitability** of the material for specific applications

Industrial-sized installations

- Process the incoming **vast quantities** of waste







Conclusions



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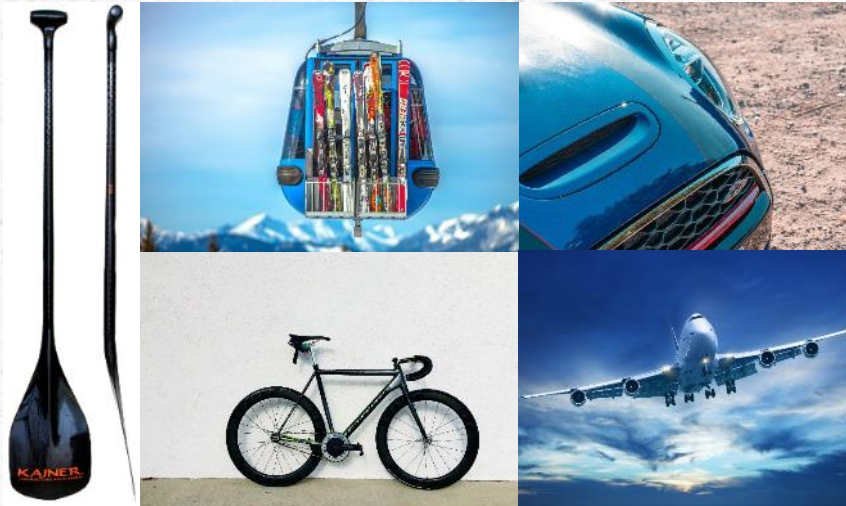
Expected benefits of the multi level recycling processes

60% recycling rate within the supply chains

Use of recycled materials in different applicative domains

Higher raw material independence for the EU

Higher technological independence for the EU



Contact and acknowledgements



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Multi-level Circular
Process Chain for Carbon
and Glass Fibre Composites

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The partners of MC4 are:

Profactor (Austria, coordinator)

FIDAMC (Spain)

GAIKER (Spain)

CIDETEC (Spain)

STFI (Germany)

3B Fibreglass (Belgium)

VDL Fibertech Industries (The Netherlands)

CEA (France)

Techtera (France)

Amura (Spain)

Managing Composites (Spain)

IRES (Greece)

LAB23 (Italy)

Chomarat (France)

i-RED (Austria)

NOMA RESINS (Poland)



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Reference	Source
1	https://www.materialstoday.com/composite-processing/features/new-lease-of-life-for-cfrps/ , last checked August 2021
2	Carbon fibres: history, players and forecast to 2020, JEC Composites Publications
3	https://www.statista.com/statistics/759404/worldwide-glass-fibre-demand-and-capacity/ , last checked August 2021
4	Carbon fibre 2020 (Knoxville, Tenn, US) Preconference seminar by Tony Roberts, AJR Consultancy