

# End-of-Life Solutions for FRP Composites

## Overview

The use of composite materials in manufacture of products in all sectors is growing. Inevitably the amount of waste is also growing, though in some areas advances in manufacturing are leading to leaner processes with less manufacturing waste. The “composite” nature of these materials and the predominantly cross-linked matrices used give them excellent stiffness, strength and durability. This makes them difficult to recycle, but solutions have emerged and continue to be improved for gaining value from end-of-life composite materials, contributing to a circular economy.



## Carbon Fibre Composites

Several companies now exist to recycle carbon fibre composite waste. These include:

- [ELG Carbon Fibre](#), UK
- [CFK Valley Stade Recycling](#), Germany
- [Carbon Conversions](#) (formerly MIT-RCF), South Carolina USA
- [Karborek](#), Italy

These all use variations of a pyrolysis process which thermally decomposes the resin, leaving clean carbon fibres. Applications are mainly in milled and chopped fibres, typically compounded with thermoplastics for strength and electrical conductivity. Increasing quantities are being used in mats and sheet moulding compounds which can be pressed into parts, e.g. for automotive panels.

## Glass Fibre Composites

There are several potential routes for glass reinforced plastic (GRP) waste, though recycling is more challenging, because the material value is an order of magnitude less than carbon fibre.

- **Cement kiln processing:** Composite waste can be co-processed with other wastes as solid recovered fuel (SRF) in cement kilns. This recovers energy from the organic part, and mineral fillers and glass become feedstock for cement clinker.

- **Incineration:** GRP can be sent to energy from waste (EfW) plants. Energy is recovered from the organic fraction. The incinerator bottom ash may be processed into aggregates or used in construction applications, though in some cases it is still landfilled.
- **Mechanical recycling – fine filler:** GRP can be ground to a fine filler, and this is done in some cases in-house with manufacturing waste. However, it is not generally economical, since the energy input is not viable to grind to a filler which replaces a low value product such as calcium carbonate.
- **Mechanical recycling with fibre retention:** GRP can be ground to a lesser degree, leaving bundles of fibres which have reinforcing properties. This uses less energy and provides a more valuable product than fine filler. This is done in-house to a small degree, but there is potential for higher volume applications for GRP regrind in UK, e.g. in infrastructure products with recycled mixed plastics.

Numerous research projects are seeking to gain more value from recycle, particularly using chemical and thermal processes. For a fuller discussion, see the report [Composites Recycling – Where are we now?](#)<sup>1</sup>

## Contact

## End-of-Life Solutions for FRP Composites

### Legislation

Landfill tax now stands at £84.40/tonne (2016-2017 rate), making the cost of landfill, including gate fees and transport, typically £120 to £130 per tonne. While sharp increases in landfill tax are not expected, Germany and several other European countries have already largely banned landfill. The European Commission's Circular Economy Package seeks to increase recycling rates and reduce the amount of municipal waste that can go to landfill to 10% by 2030. It is not yet clear how this will affect industrially derived and construction waste other than packaging (75% must be recycled by 2030).

The European Waste Framework Directive (2008/98/EC) sets the basic concepts and definitions related to waste management and develops a "polluter pays" principle known as extended producer responsibility. It requires EU Member States to apply the waste management hierarchy: Prevention, Re-use, Recycling, Recovery, Disposal. Article 11.2 stipulates that "by 2020 a minimum of 70% (by weight) of non-hazardous construction and demolition waste... shall be prepared for re-use, recycled or undergo other material recovery"<sup>iii</sup> (including backfilling operations using waste to substitute other materials).

The End-of Life Vehicle Directive (ELV, 2000/53/EC) sets targets which currently (as of 1 January 2015) require 85% by weight of vehicles to be reused or recycled, and 95% to be reused, recycled or recovered. ('Recovered' here means burnt for energy recovery.) Similarly the Waste Electrical and Electronic Equipment Directive (WEEE, 2012/19/EU) sets collection, recycling and recovery targets for electrical goods.

### Summary

In sectors other than automotive, construction and electrical/electronic there is, as yet, no regulatory requirement limiting the landfill of composite materials, but the increasing cost of landfill, the drive to a more circular economy and the increasing use of composites all provide increasing drive to recycle.

The carbon fibre recycling industry is now established, though the rapid market growth is such that demand outstrips capacity at present, and more markets for recycle are needed. GRP recycling is more challenging economically, but incineration or partial recycling routes such as the cement kiln process are acceptable. UK industry would welcome a higher value recycling route such as mechanical recycling with fibre retention, and some have indicated an intention to set up such a facility in UK.

### Disclaimer

*Whilst Composites UK has endeavoured to ensure the information in this document is accurate, Composites UK makes no warranties or guarantees, actual or implied, and bears no responsibility for the use of information from this document. Composites UK cannot accept any liability for any loss or damage, whether direct, indirect or economic, as a result of the use of information in this document.*

### References

<sup>i</sup> Job, S., Leeke, G., Mativenga, P., Oliveux, G., Pickering, S. and Shuaib, N., (2016). 'Composite Recycling: Where are we now?', Composites UK Ltd, <https://compositesuk.co.uk/recyclingreport>

<sup>ii</sup> EC Press release, Brussels, 2 December 2015; Closing the loop: Commission adopts ambitious new Circular Economy Package to boost competitiveness, create jobs and generate sustainable growth, [http://europa.eu/rapid/press-release\\_IP-15-6203\\_en.htm](http://europa.eu/rapid/press-release_IP-15-6203_en.htm)

## Contact

Email: [info@compositesuk.co.uk](mailto:info@compositesuk.co.uk)

Web: [compositesuk.co.uk/construction-sector-group](http://compositesuk.co.uk/construction-sector-group)