The ReCoVeR Project

Towards a Cost-Effective Recycling Process for End-Of-Life GRP and GRP Manufacturing Waste

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ETIP Wind workshop,
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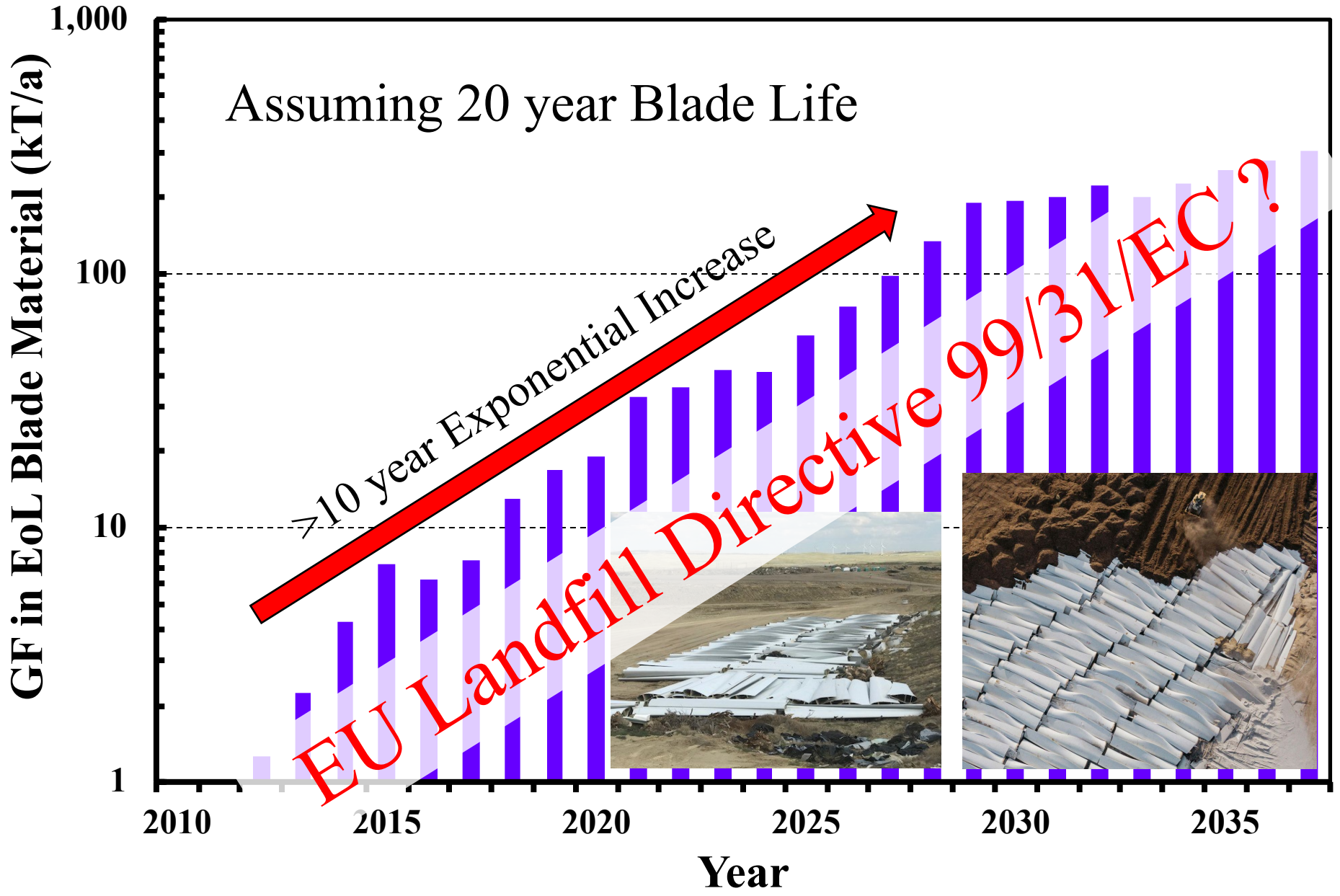
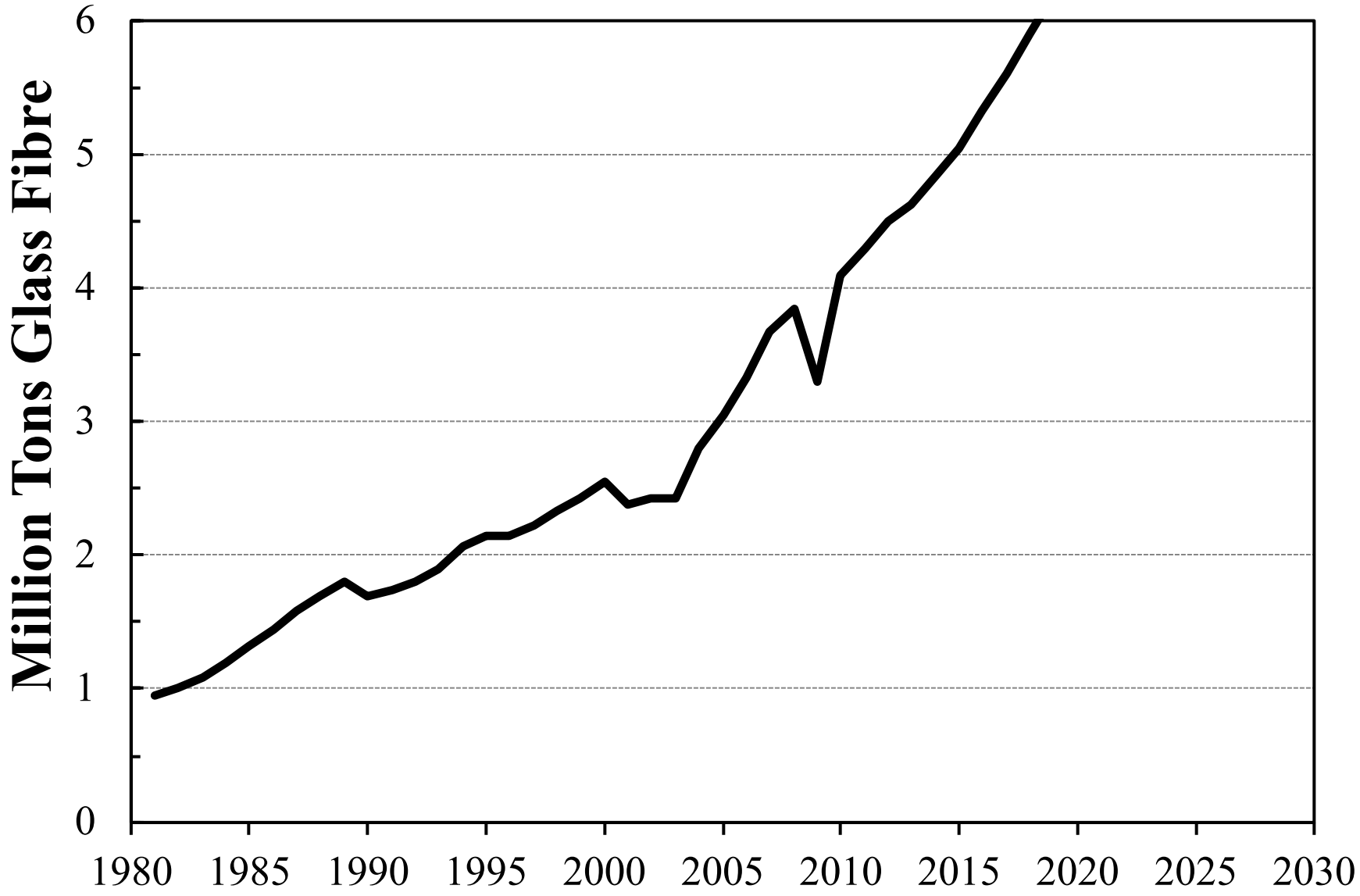
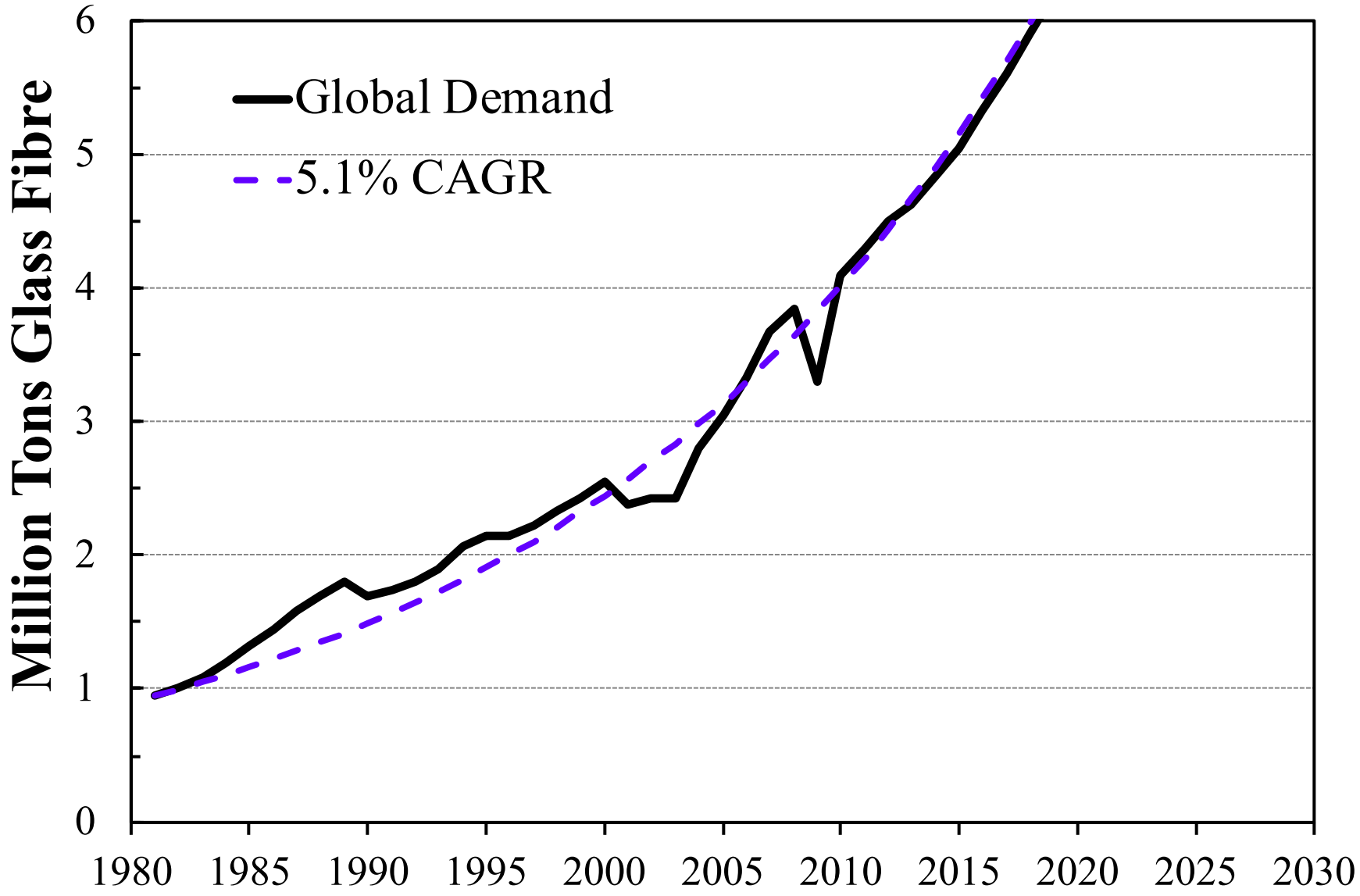
Global End-of-Life Blade Material



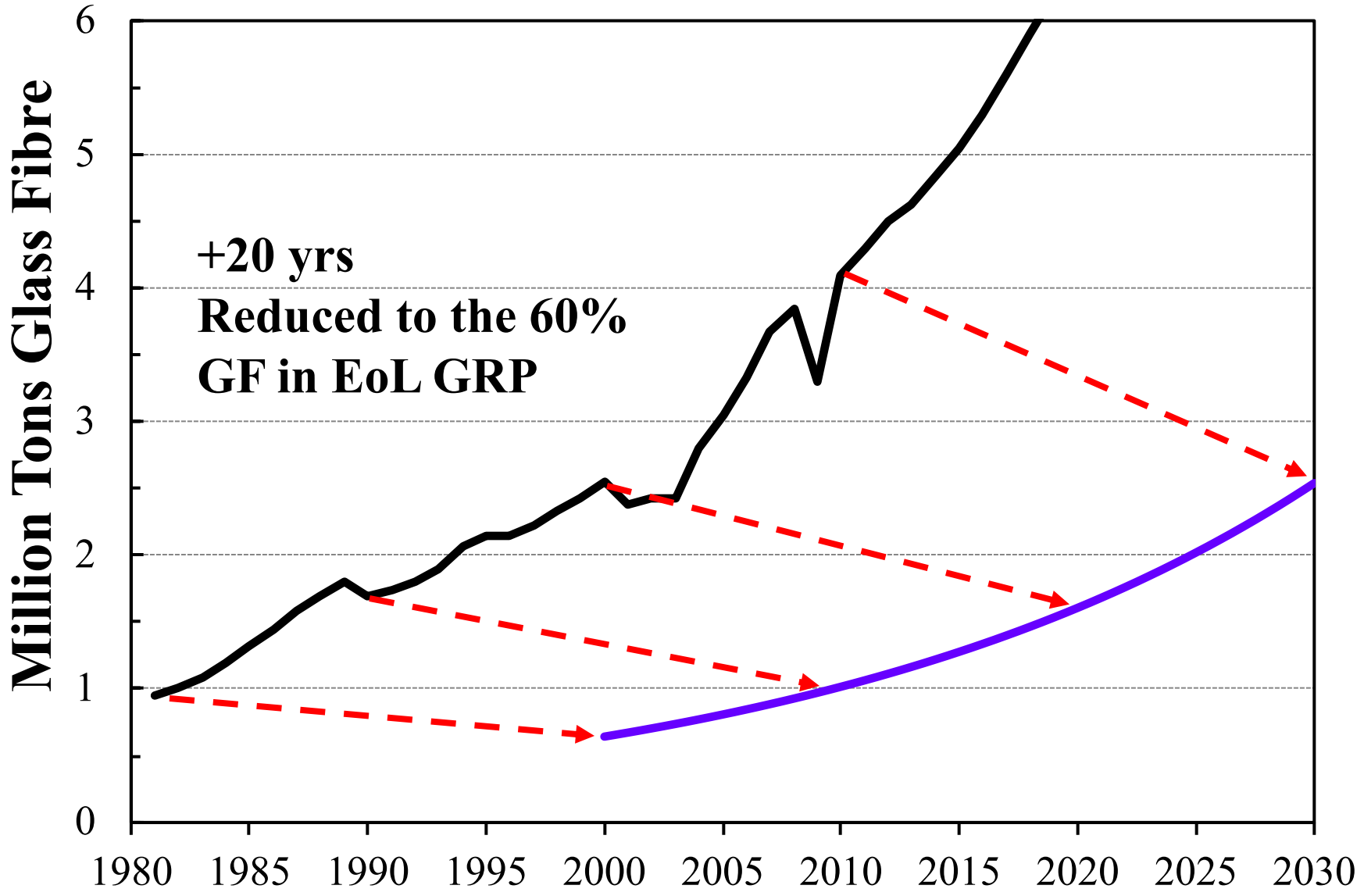
Reinforcement Glass Fibre Global Demand



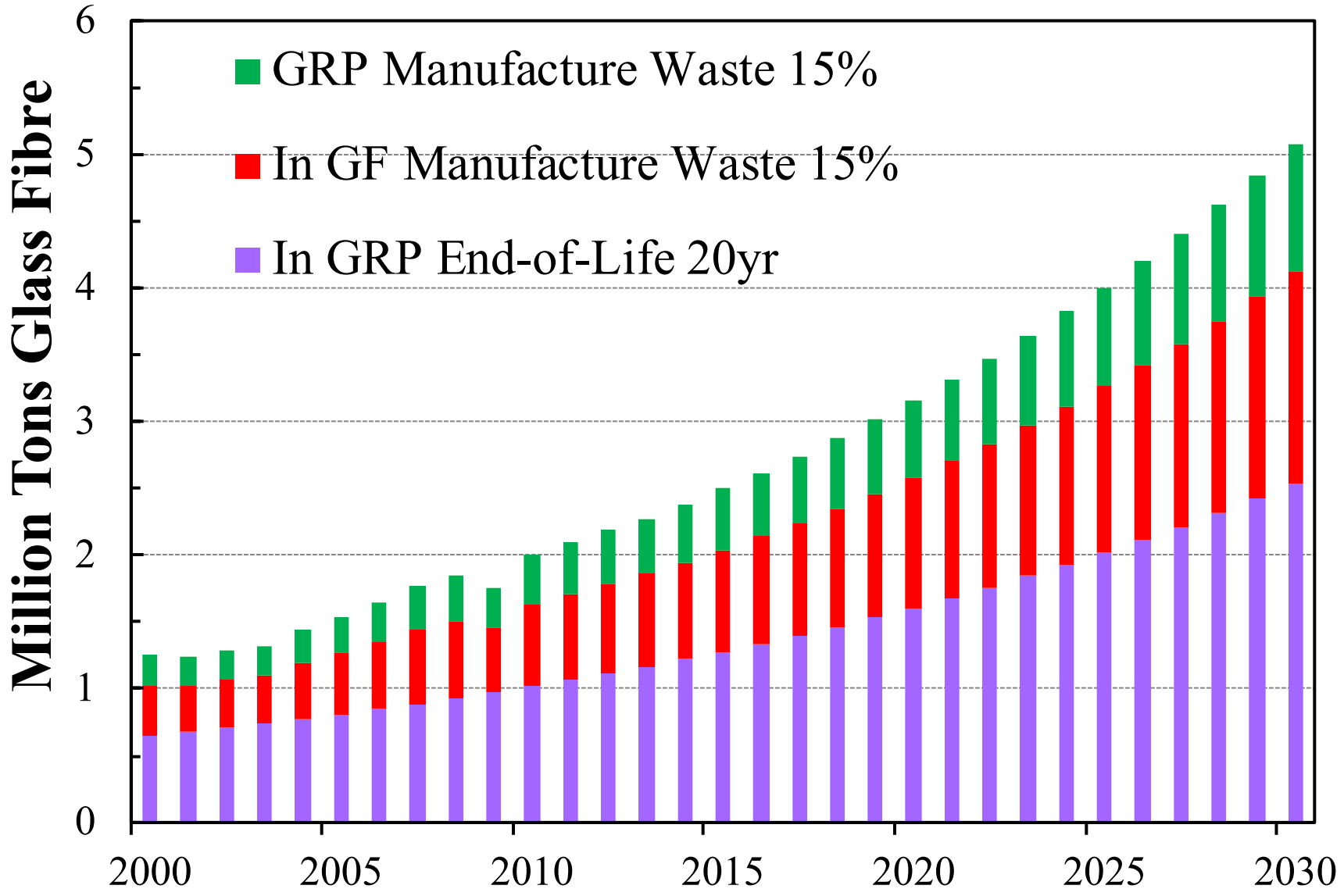
Reinforcement Glass Fibre Global Demand



Available ReCoVeRable Glass Fibre in GRP?



Total Available ReCoVeRable Glass Fibre ?



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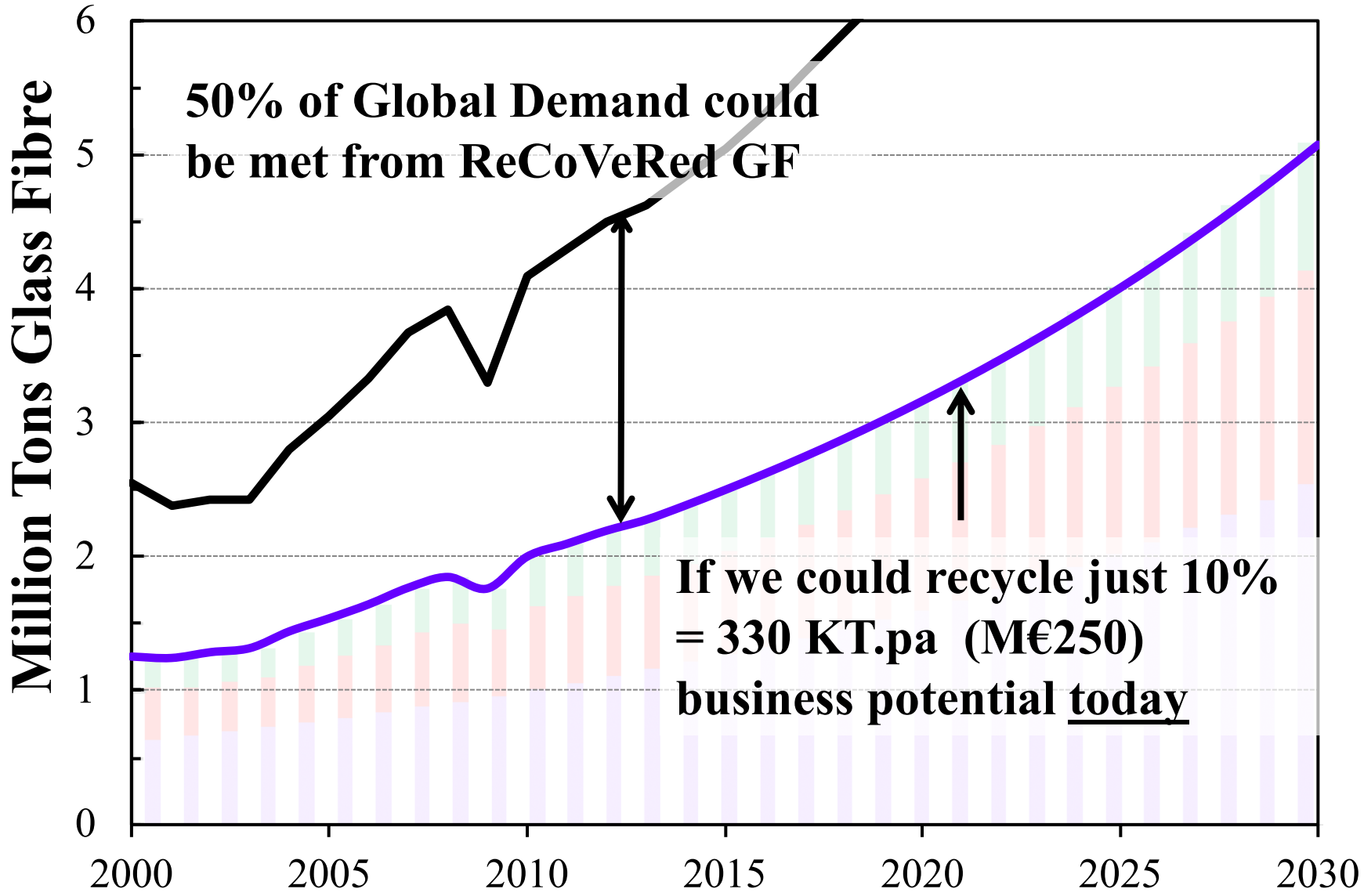
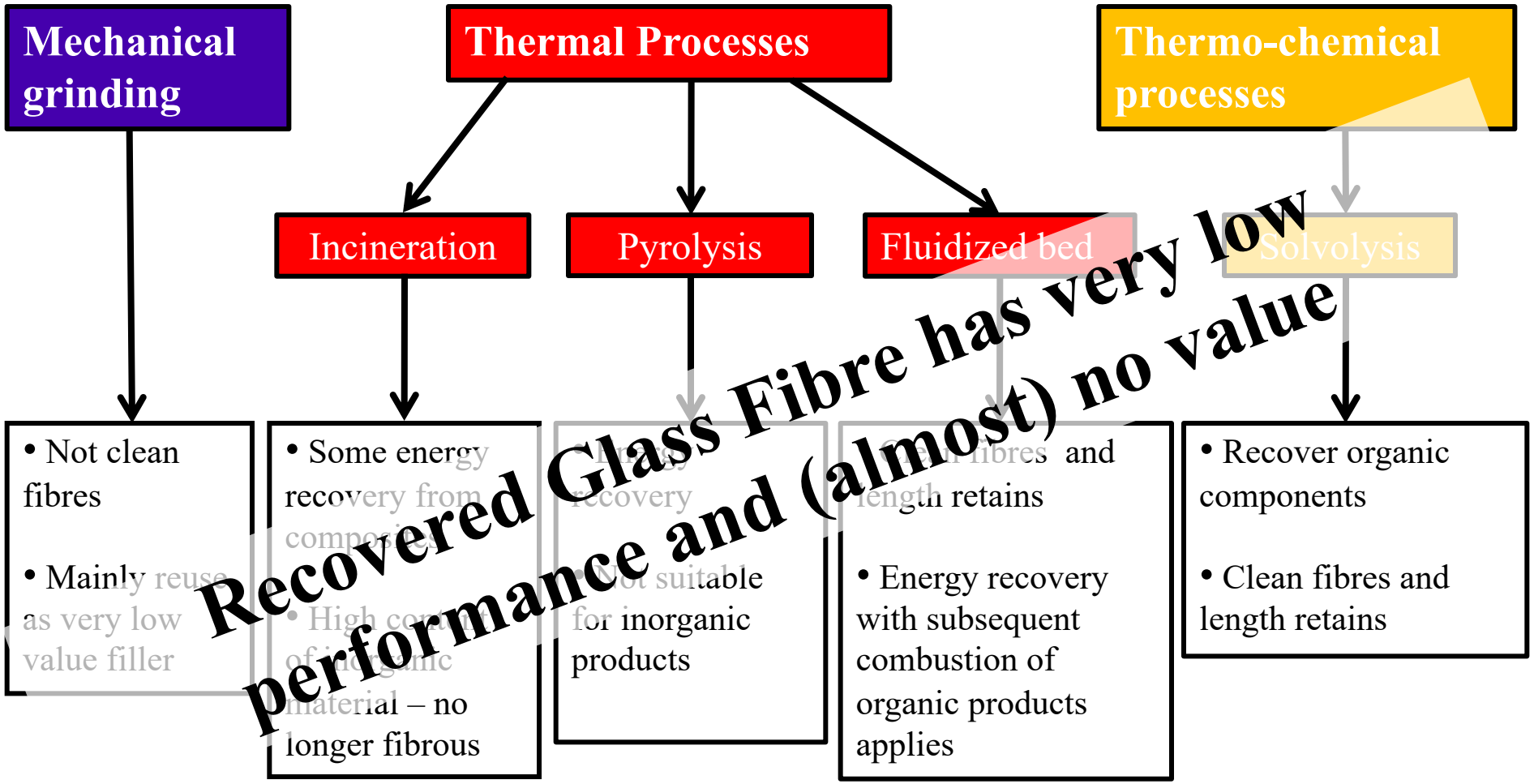
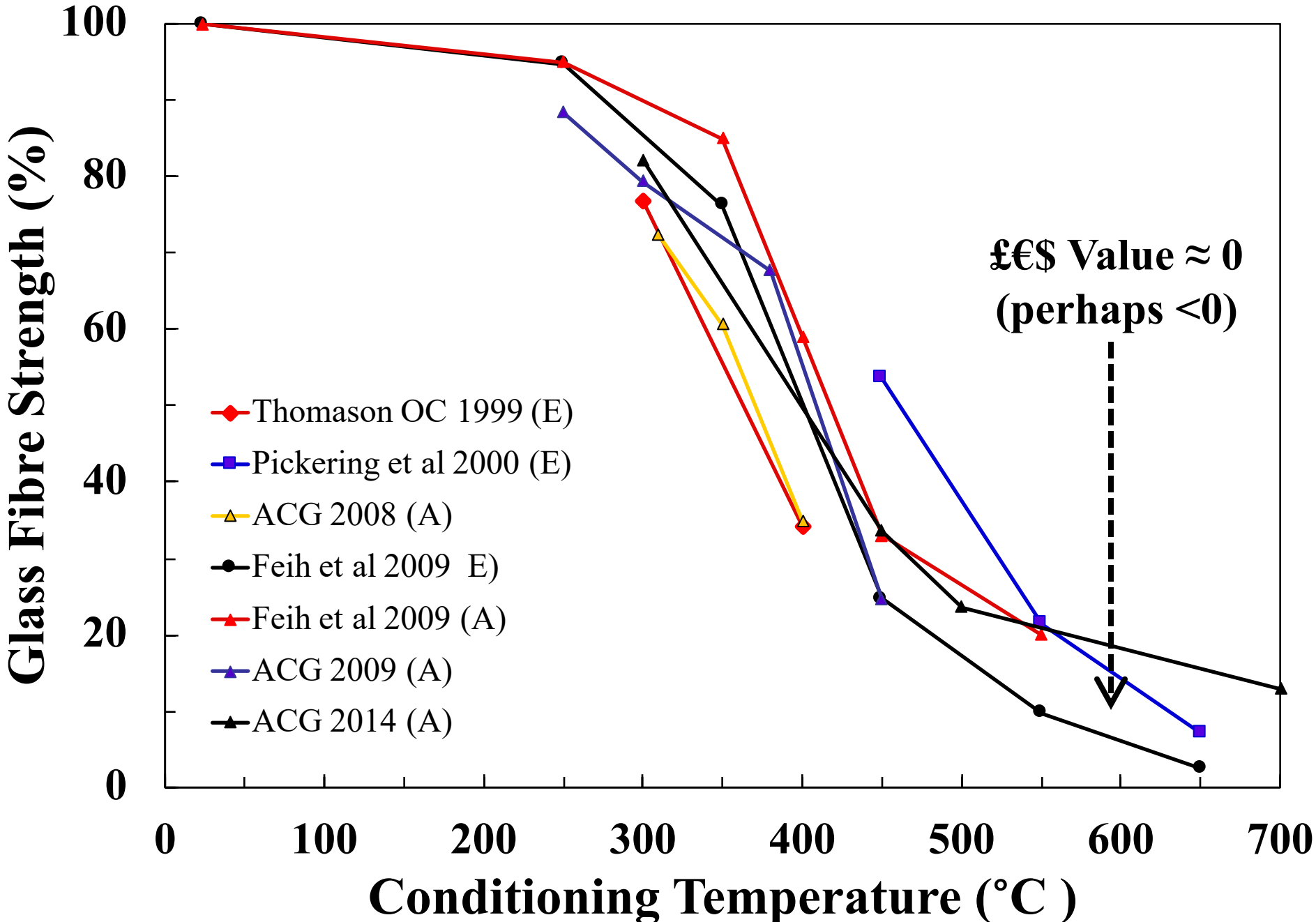


GRP Recycling Techniques



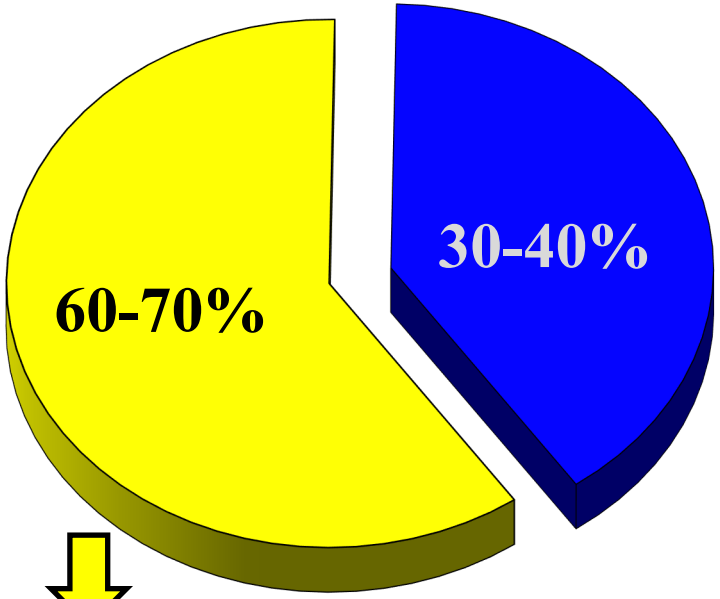
Recovered Glass Fibre has very low performance and (almost) no value

GF Strength (*Value*) after Thermal Recycling



The ReCoVeR Vision

Global Glass Fibre Use



Mainly to chopped fibre **thermoplastic** *composites. Intrinsically recyclable*

ReCoVeR and "drop into" existing chopped fibre applications

Landfill no longer acceptable – but very difficult to recover continuous fibre

Mainly to continuous fibre **thermoset** *composites*

At end-of-life -challenging to recycle - so = **landfill** *? (or zero value filler)*

The ReCoVeR Project

EPSRC
Engineering and Physical Sciences Research Council

Regenerated Composite Value Reinforcement

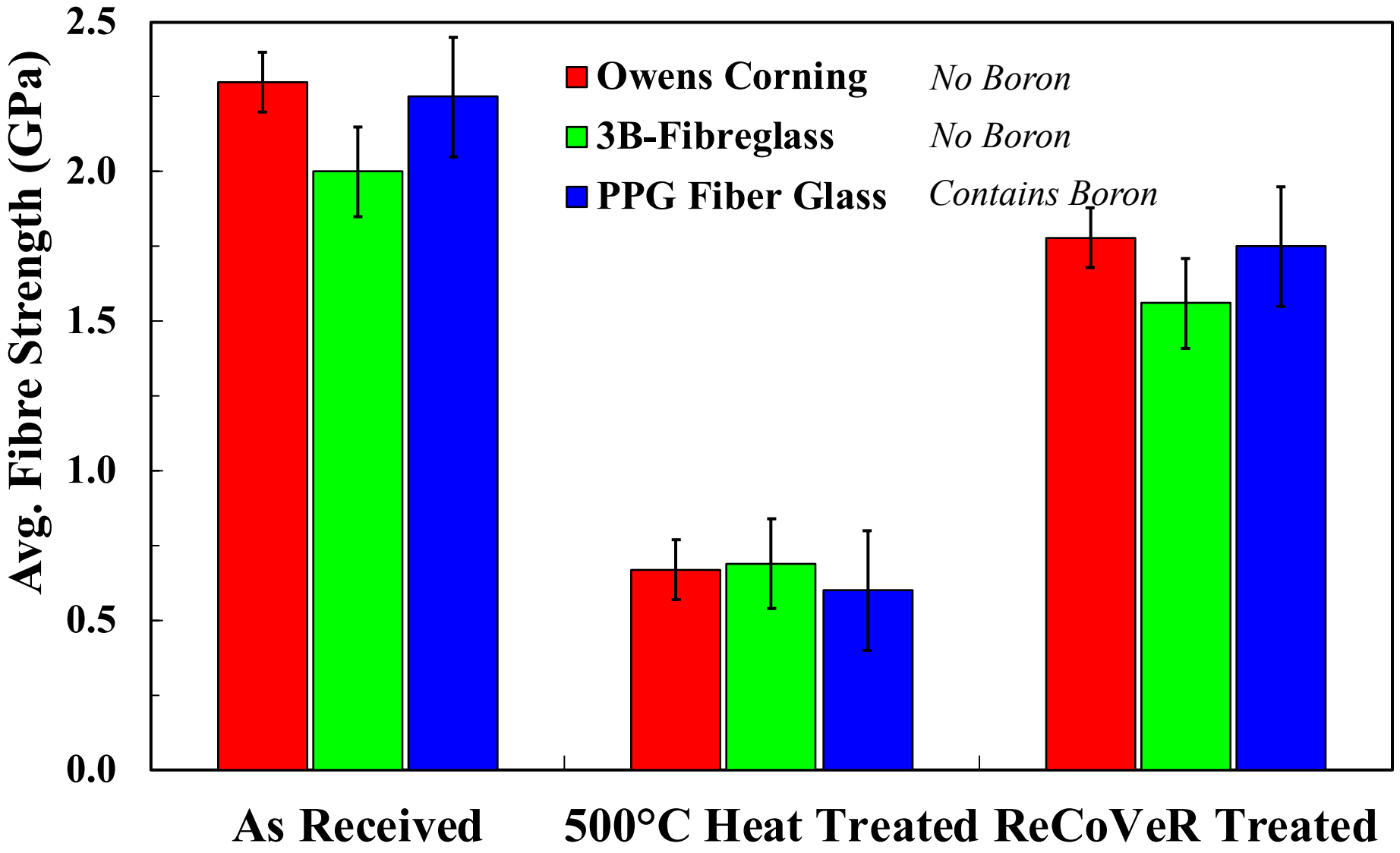
The ReCoVeR Mission 2010-2018

Enable the development of cost-effective, *drop-in*, glass fibre and composite products based on recycled glass fibres with regenerated mechanical performance

The ReCoVeR Goals

- ***Research fundamentals of (300-600°C)RGF property changes***
- ***Cost effective treatments to regenerate RGF performance ?***
- ***Develop in-house fluidised bed recycling technology***
- ***Produce examples of GF or composite products using RRGF***

ReCoVeR and E-Glass Formulation



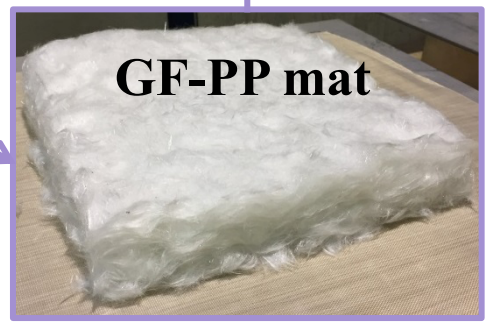
Example of GRP Circularity

Waste GRP

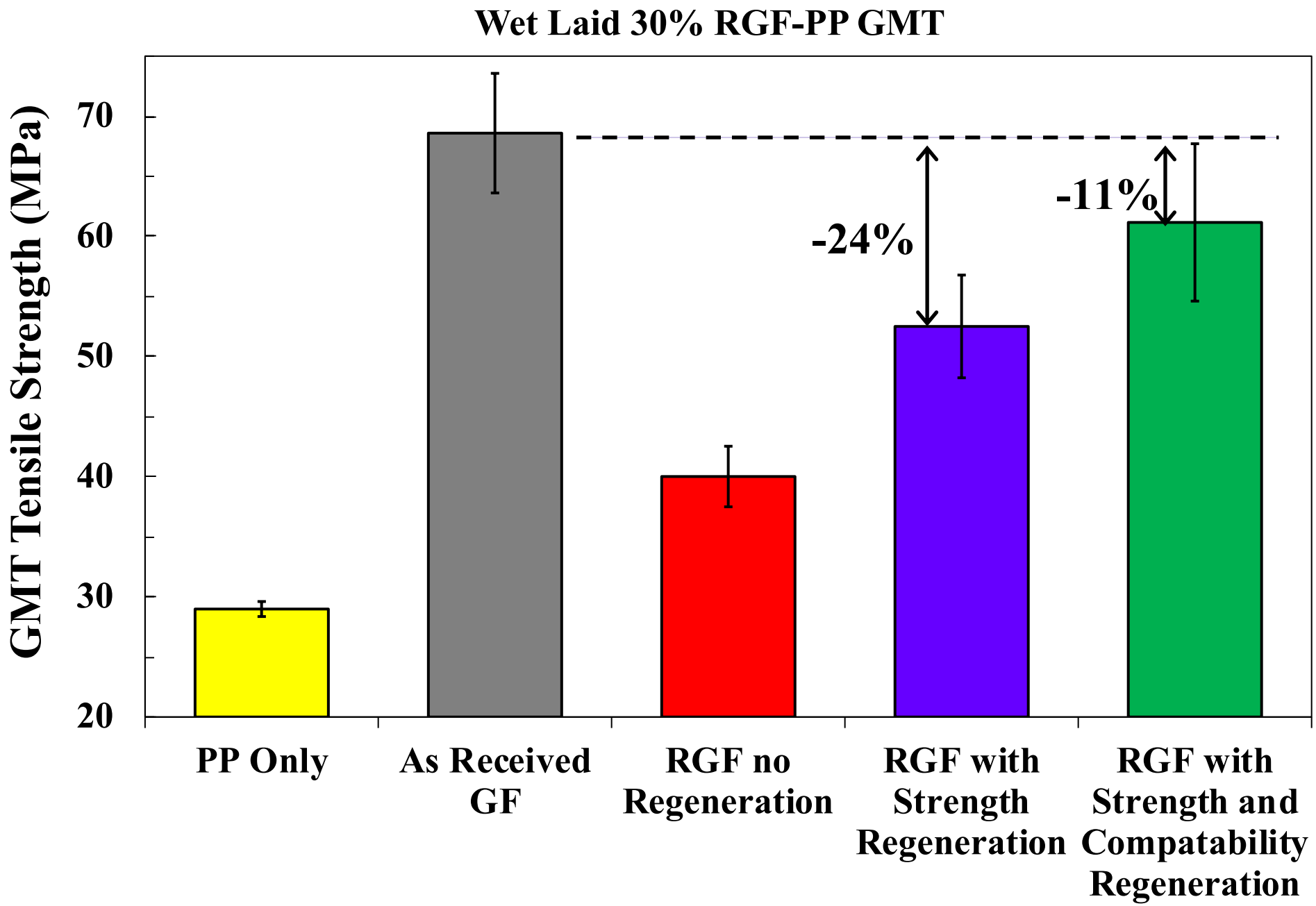
Downsized GRP

Recovered glass fibres

Wet mix with PP fibre



ReCoVeR Composite Performance



Results on ReCoVeR Fibres in 30% RGF-PP Composites

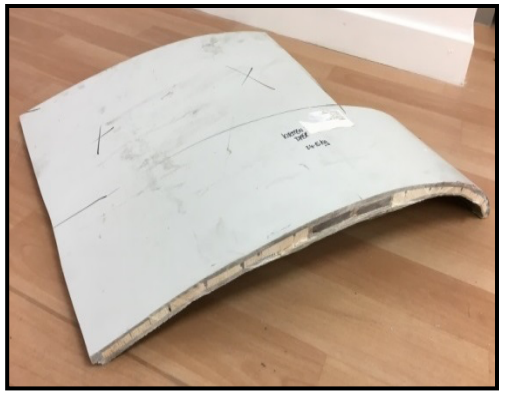
89% ReCoVeRy of Composite Tensile Strength

87% ReCoVeRy of Unnotched Charpy Impact

- Non-optimized sizing on ReCoVeR fibres
- Higher potential ReCoVeRy performance to come
- Patent Application submitted

Example of Wind Blade Recycling and Reuse

End of life GRP blade material



New 3kW turbine blade

Commercial wind blade, wt. = 1.93 kg

RGF blade prototype, wt. = 1.82 kg

RGF blade prototype from wind blade scrap

Commercial blade supplied by Kingspan Wind

Bending test showed RGF blade behaved similarly to commercial blade

Conclusions

- **The composites community needs an environmentally and economically acceptable solution to deal with GF and GRP manufacturing waste and end-of-life GRP**
- **Glass fibres lose their strength if heated above 400°C**
- **Thermal conditioning of fibres during recycling also drastically reduces end-use composite performance**
- **The ACG is developing treatments to ReCoVeR the strength (*and value*) of thermally recycled glass fibres**

Future Outlook

- ACG is developing cost-effective composites recycling technology and continues the technology development
  - Catalysed removal of matrix at reduced temperatures
  - Recovery of matrix polymer value - Dynamic Hybrid Pyrolysis (DHP)
  - Research better/cheaper treatment options
  - LCA of ReCoVeR process
  - Economic analysis

Future Outlook

- **Integration of ReCoVeR technology into full recycling/regeneration/reuse process - requires**
  - **Formation and funding of consortium of vested interests**
  - **Scale-up to pilot facility**

PRoGrESS

(Products from Recycled Glass fibre at Economic and Sustainable Scale)

https://www.strath.ac.uk/engineering/mechanicalaerospaceengineering/advancedcompositesgroup/

ACG Advanced Composites Group

University of Strathclyde Engineering