



CARBON RIVERS

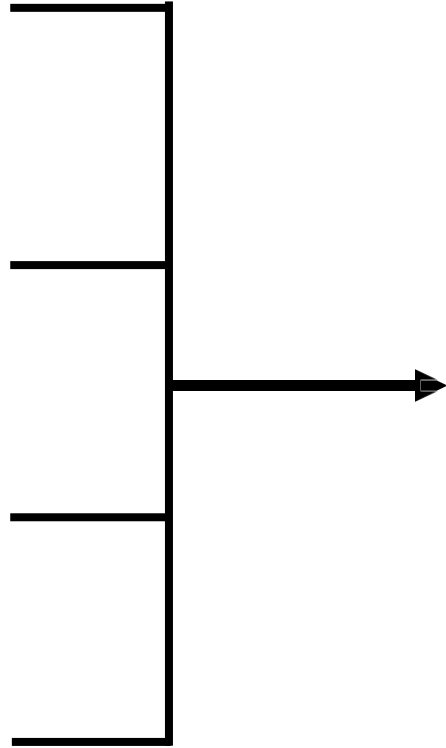
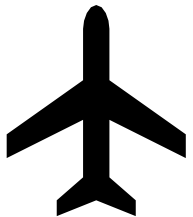
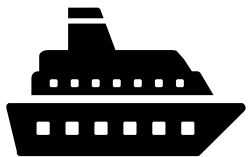
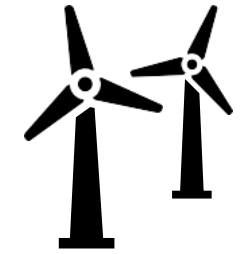
G2G+

**THE WORLD LEADER IN FIBERGLASS
COMPOSITES UPCYCLING SOLUTIONS**

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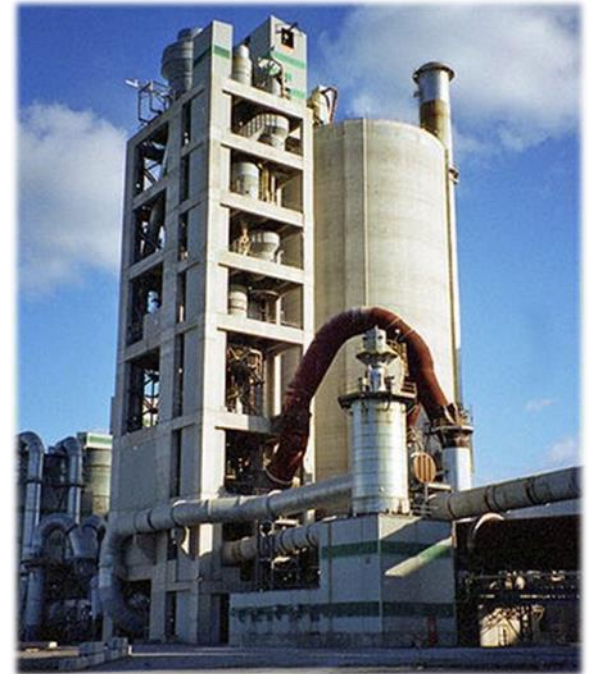
UNAUTHORIZED DISTRIBUTION OR REPRODUCTION PROHIBITED WITHOUT EXPLICIT PERMISSION FROM CARBON RIVERS INC

STATUS QUO: WHAT HAPPENS AT END-OF-LIFE?



Landfill

OR



Cement kiln incineration

~100,000 tons/year
by 2030

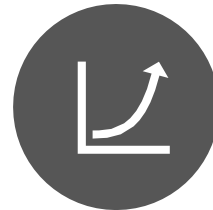
**No current market option offers true, sustainable recycling for composites.*



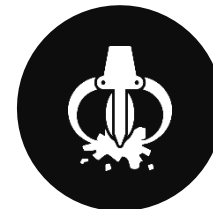
WASTE IS NOT THEIR ONLY PROBLEM. SO IS SUPPLY.



Global glass fiber capacity was 12.9 billion pounds in 2021 with factory utilization rate climbing from 85% in 2020 to 91% in 2021 and expected to reach 95% in 2022. With demand growth in all end use industries, there is a clear need for increased fiberglass production.



For example, the Center for Automotive Research projects a ~67% increase in plastics/composites used for average vehicle structures (body-in-white & closures) by curb weight by 2040. The US fiberglass market for marine grew by 18% in 2021. Meanwhile in wind energy, S&P Global Market Intelligence estimates 27 GW of wind energy to come online in 2022 smashing 2020's previous record of 16 GW and continuing to grow each year.



Our own searching around production scrap has begun to anecdotally support this with some Tier 2 level manufacturers having significantly less scrap than originally anticipated due to factory idling from lack of raw materials / supply chain issues.

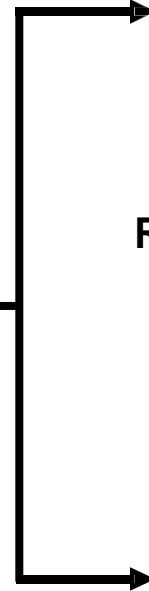
THE G2G SOLUTION: PYROLYSIS-BASED RECYCLING



End-of-Life Waste & Production Scrap



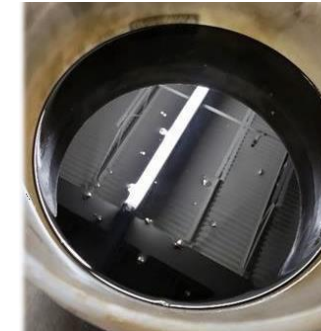
Composites Recycling



Reclaimed Fiberglass



**Return to
Composites
Supply Chain**



Fuels & Petrochemicals



**Return to
Oil & Gas
Supply Chain**

EXAMPLE REINFORCED COMPOSITE PRODUCTS WE ALREADY RECYCLE



AUTOMOTIVE PARTS



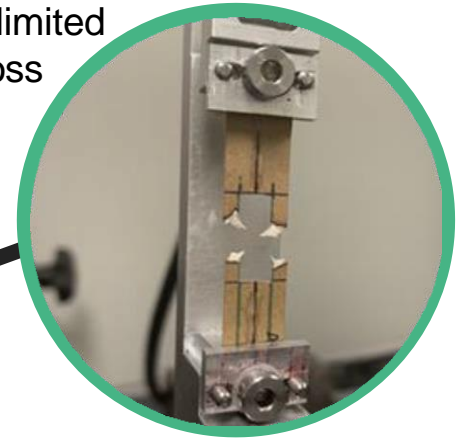
WIND TURBINE BLADES



COMPOSITE WINDOW PARTS



Fiber degradation limited to ~10-15% loss



Purity greater than 99.9%

~50% less CO2 & ~80% less embodied energy



****Fiberglass recycled from composites can now be upcycled into new composites for a true domestic circular materials economy.***

POTENTIAL SELLABLE PRODUCTS WE HAVE DEMONSTRATED



RAW STAPLE FIBER



- Est. Market Size: \$13.2 Billion USD
- Fiber can be sold as-is with lengths +2" to 1/2" for fabric/textile applications
- Glass can also be milled for thermoplastic compounding or remelt

NONWOVEN FABRICS



- Est. Market Size: \$1.3 Billion USD
- Can be pure fiberglass or comingled with thermoplastic (or other) fibers for automotive, marine, wind, etc. applications
- Can do heavier mats at 100-400gsm or veils ~30-50gsm

COMPOUND PLASTICS



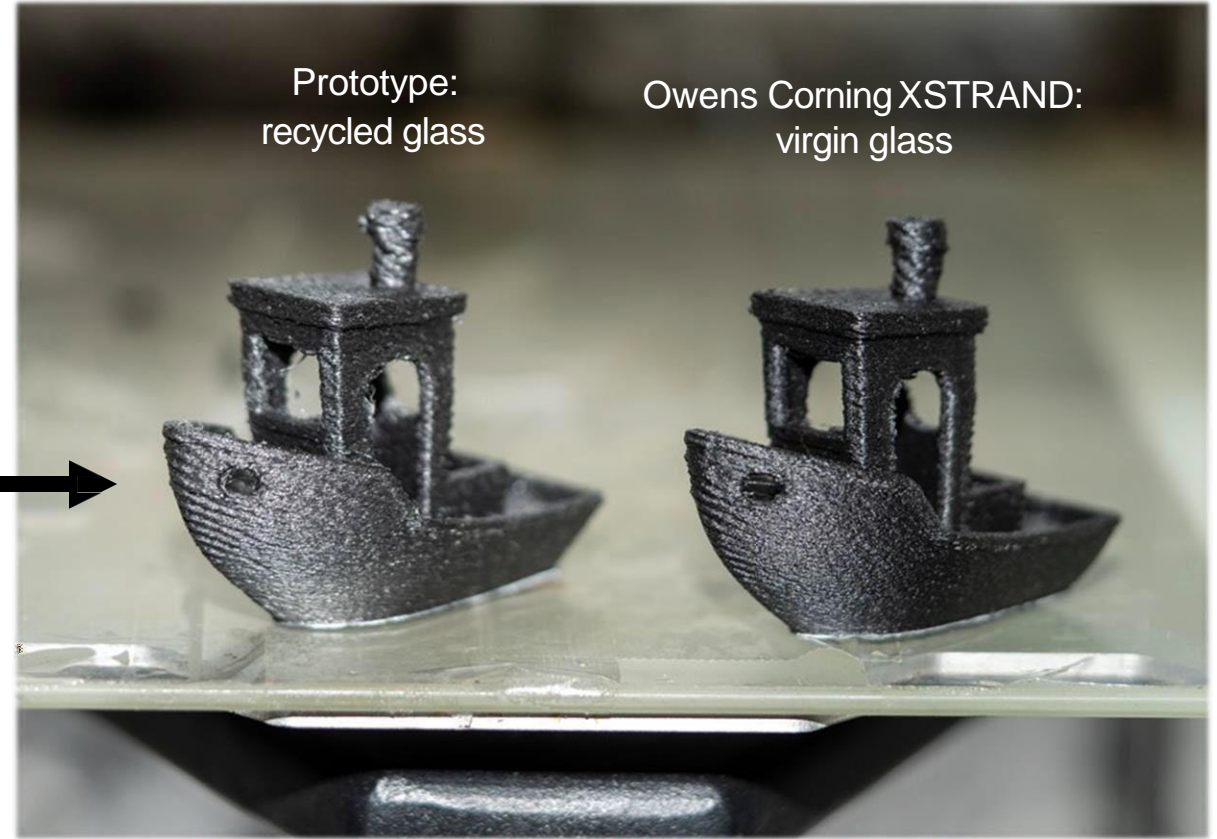
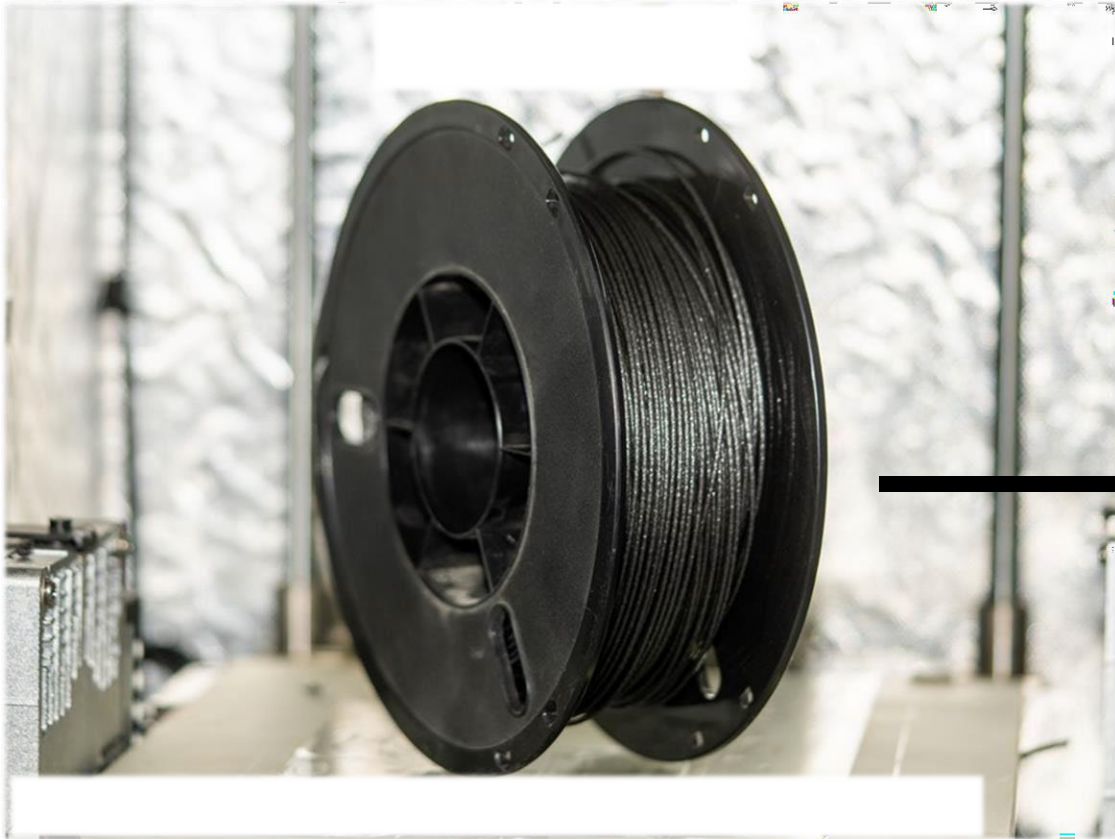
- Est. Market Size: \$24.1 Billion USD
- Able to compound fiber with common plastics such as polypropylene and nylon for AM or injection molding
- Currently able to compound up to 30wt% fiber loadings with existing equipment

ADDITIVE MANUFACTURING FILAMENT MADE WITH RECYCLED FIBERGLASS

ON THE REEL



PRINTING COMPARISON



* rGF/Polypropylene prototype AM filament

*Thanks to our process and the power of 3D printing, wind blade waste can now become almost anything.



Thermoplastic Materials

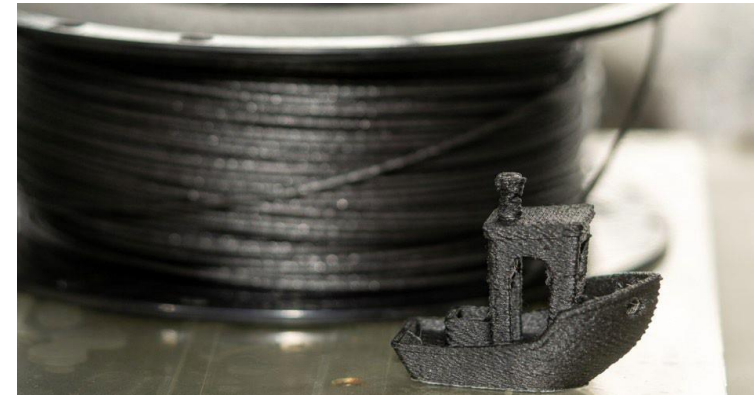
Carbon Rivers has Experience Using Graphene in the Following Materials:

PP
ABS
HDPE
PA 6,66, 12
Ultem 1010
PPS
PPSU
PEEK



Carbon Rivers has Experience Using The Following Processes

- Extrusion Compounding (Twin and Single)
- Injection Molding
- 3D Printing (FDM) - Graphene Coated Filaments Lead to Improved Print Strength



Practical Industry Experience Leads to Graphene Success.



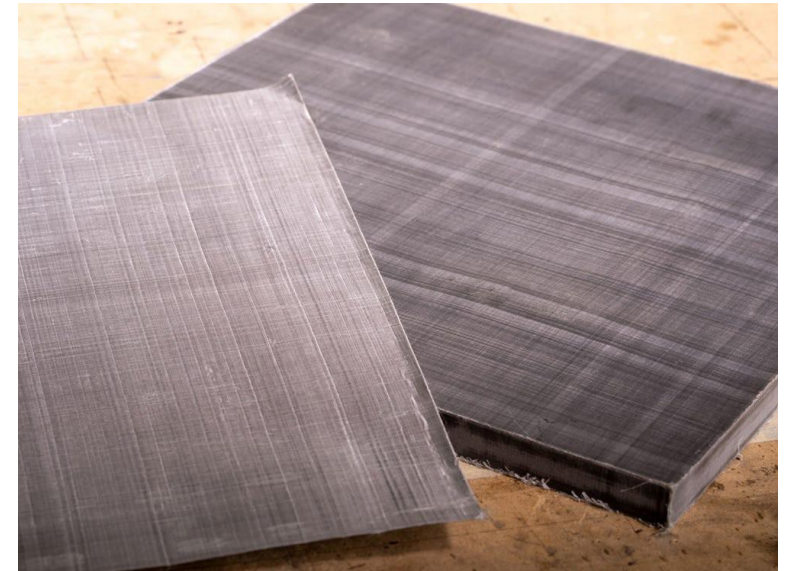
Ballistic Materials

Graphene Reinforced Resins Strengthen Thermoformable Rigid Armor Systems

- Graphene Strengthens Castable Acrylic Thermoplastics and Epoxies
- Improvements to Impact Strength
- Only NIJ Certified Nanomaterial allowed

Graphene Reinforced UHMWPE Competitive With Industry Leaders (Spectra, Dyneema)

- Graphene reinforced UHMWPE offers competitive properties at lower prices
- Spun into fabrics that become industry leading flexible body armor
- ONLY NIJ Certified Nanomaterial allowed
- UL 94 fire rated





UPCYCLING TODAY'S WASTE FOR TOMORROW'S FUTURE

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