

Abstract:

Currently 85% of a turbine is recyclable and it is the **composite blades that present challenges**. There is no infrastructure and no truly viable processes to recycle these blades. Most blades are cut into moveable pieces and simply buried or incinerated rather than be recycled or reused at all due to a lack of regulation and economically viable options. Through this project we were able to determine that **the best use of current blades is reuse and remanufacture** but moving towards the future new blades must be manufactured using **removable resins to allow for recycling**.



Image 1: Wind turbine landfill.

Resin Redesign using Thermoplastics:

- Resin easily removed with heat and acid bath
- Manufacturing is much easier due to simpler and easier techniques, like plastic welding
- Many new resins drop in implementable in factories
- Blades are stronger and more durable, as well as easier to repair, leading to longer life spans
- Manufacturing costs expected to be about **5% lower**

End of Life Option Comparisons:

Method	Price effectiveness	Fiberglass can be reused	Low energy demand	Does not release pollutants
Pyrolysis	✗	✗	✗	✗
Solvolytic	✗	✗	✗	✗
Landfill	✓	✗	✓	✗
Mechanical Grinding	✓	✗	✗	✗
Reuse	✓	✓	✓	✓

Reuse and Remanufacture:

- Refurbishing and reusing blades prolongs lifespan for cheap
- Remanufacture utilizes and preserves strength and shape

Ideas for Reuse:

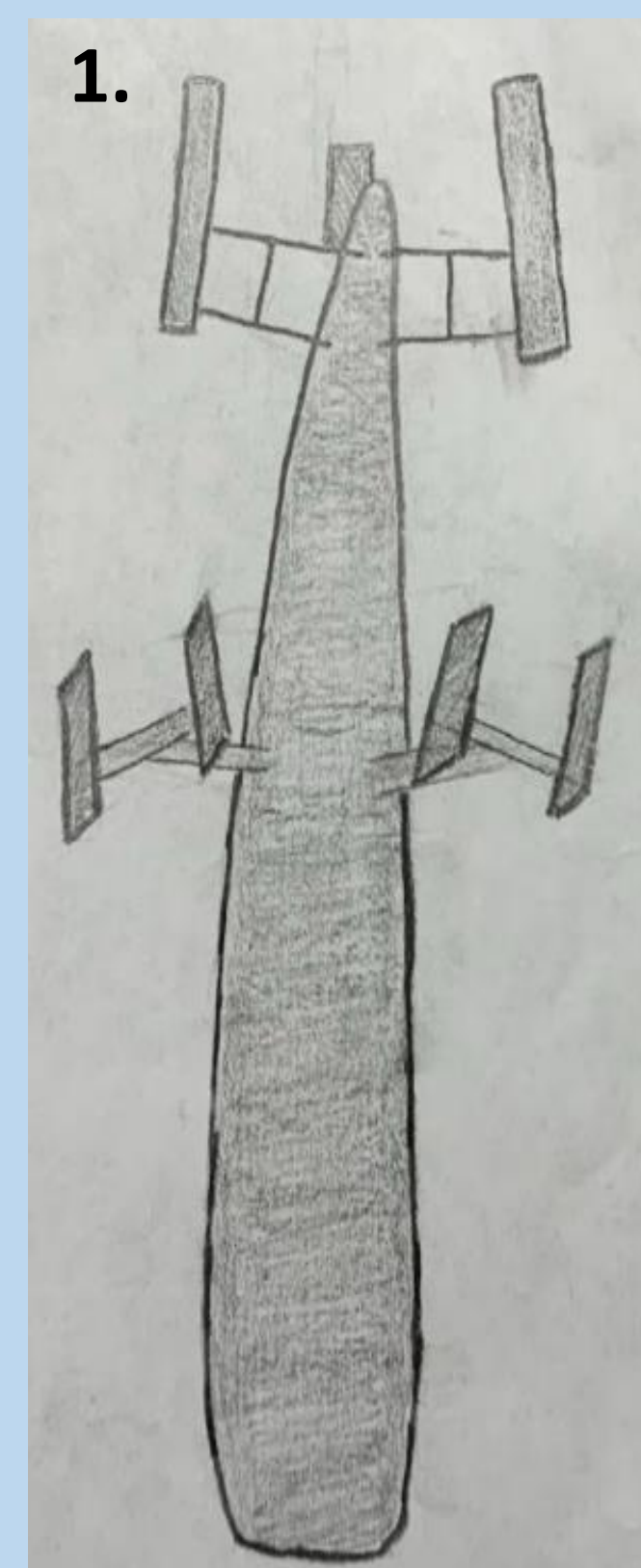


Figure 1: Model of a cell tower using a wind turbine blade

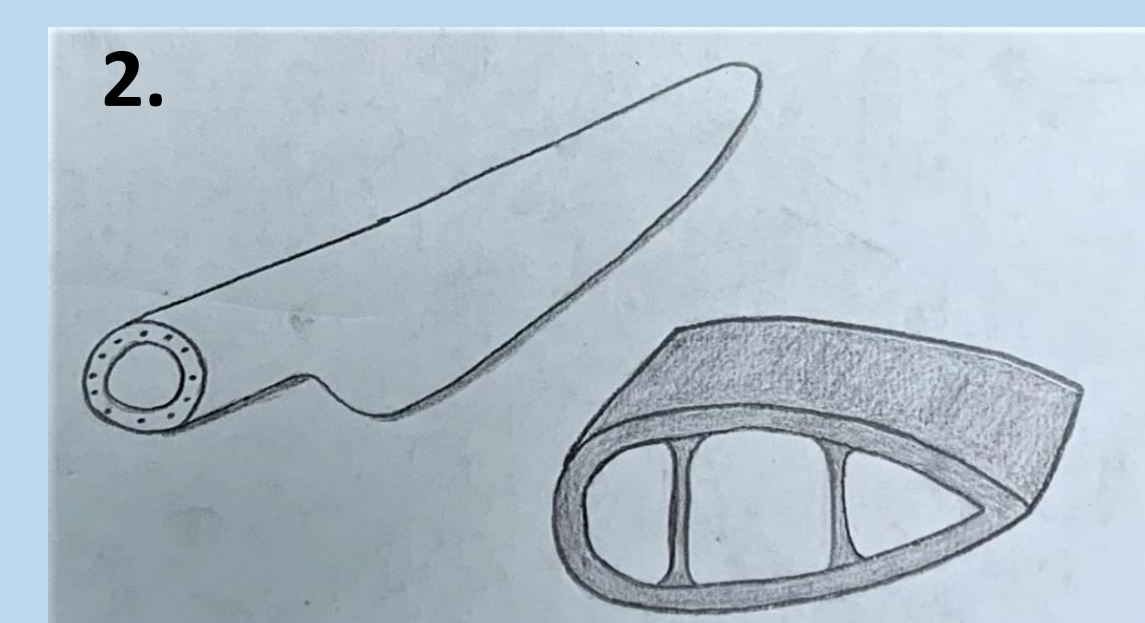


Figure 2: The inside of a typical wind turbine blade

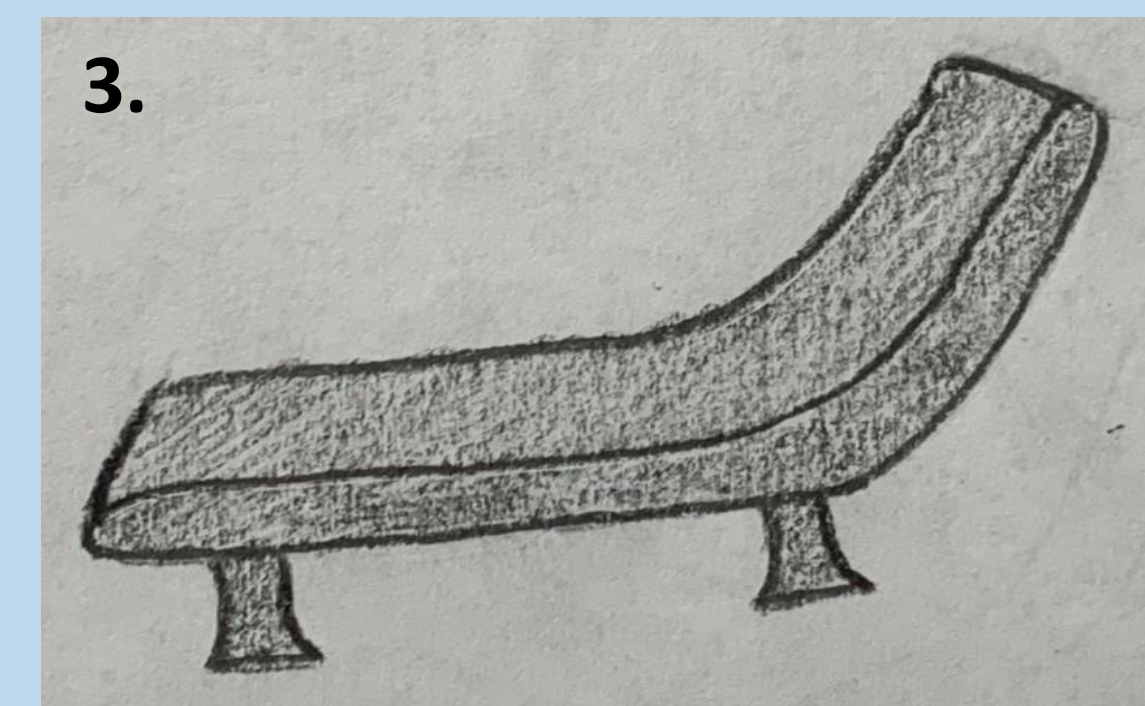
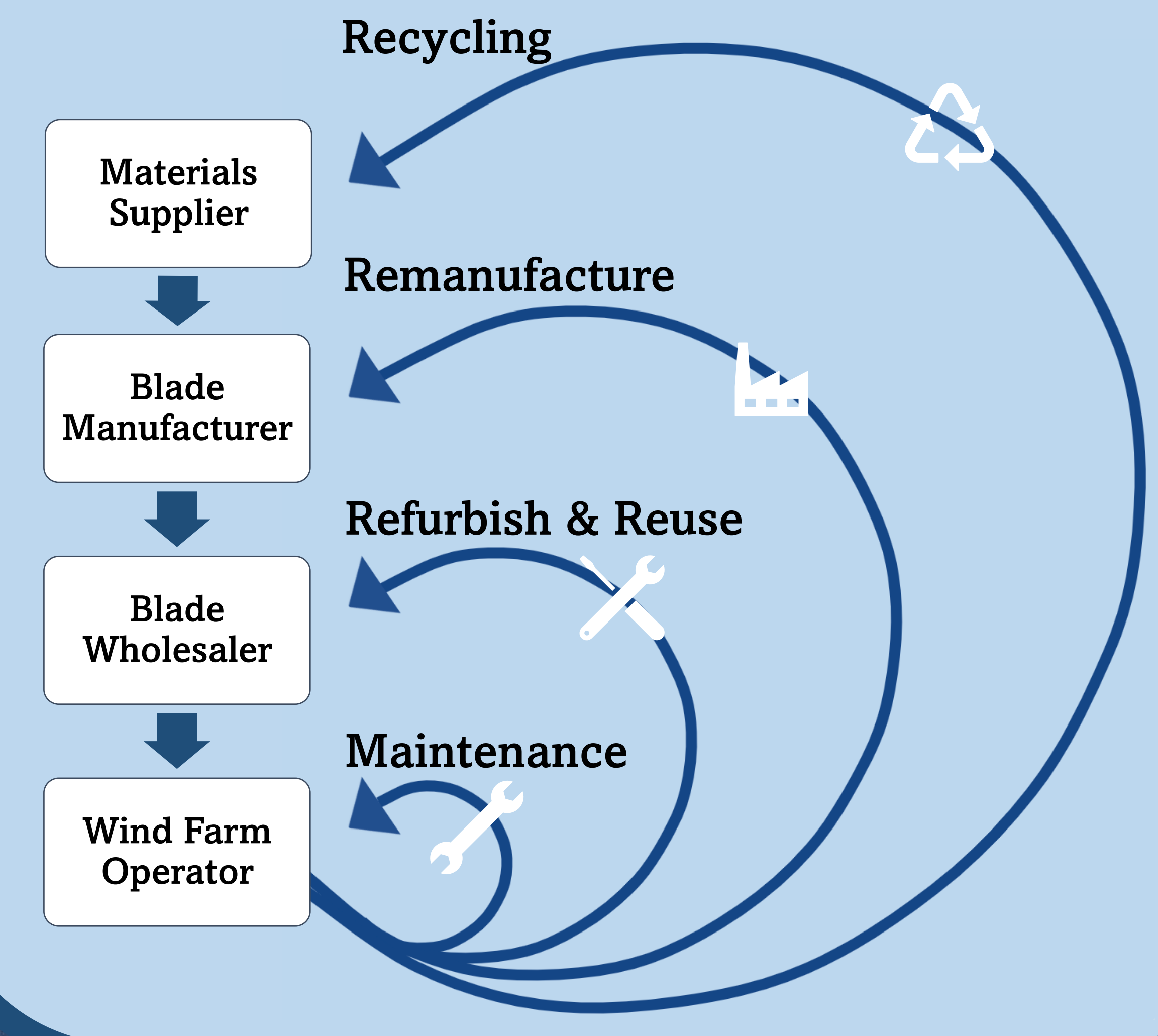


Figure 3: Design of a lounge chair using a cut up wind turbine blade



Scan this QR code to vote for your favorite idea for reuse of the blades!

Circular Economy Diagram:



Conclusion:

- Prioritize increasing longevity of blade life and reuse of blades directly
- Future blades produced using thermoplastic resins to advance properties and allow for recycling
- Secondary markets create extra revenue, lowering the cost of green energy

Bibliography:

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