



**Interreg**  
Baltic Sea Region



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CIRCULAR ECONOMY

**GlassCircle**

# Hackathon

on residue glass fiber material circular use

**SUMMARY OF FINAL PITCH PRESENTATIONS**

## Content

Team 1: Transforming wind turbine blades into practical objects

Team 2: Locker out of glass fibers

Team 3: GLASS FIBER ENVIRONMENTAL PROJECT

Team 4: EcoFlight Component. Housing for different IoT and Remote control toys

Team 5: Reuse of Glass fibers – home furniture

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10 – 12 MAY, 2023



A landscape photograph showing a row of white wind turbines on a hill. In the foreground, there is a field of golden-brown grass with several large haystacks. The background features a dense forest and a body of water under a blue sky with light clouds.

# Transforming wind turbine blades into practical objects

Pavel Chvojka  
Marks Zubovičs  
Kristaps Kancāns



# Issue of pilling up wind turbine blades

**Wind industry calls for Europe-wide ban on landfilling turbine blades by 2025**



**Vattenfall commits to landfill ban and to recycle all wind turbine blades by 2030**

**Ørsted commits to either reuse, recycle, or recover all of the wind turbine blades in its global portfolio of onshore and offshore wind farms upon decommissioning**



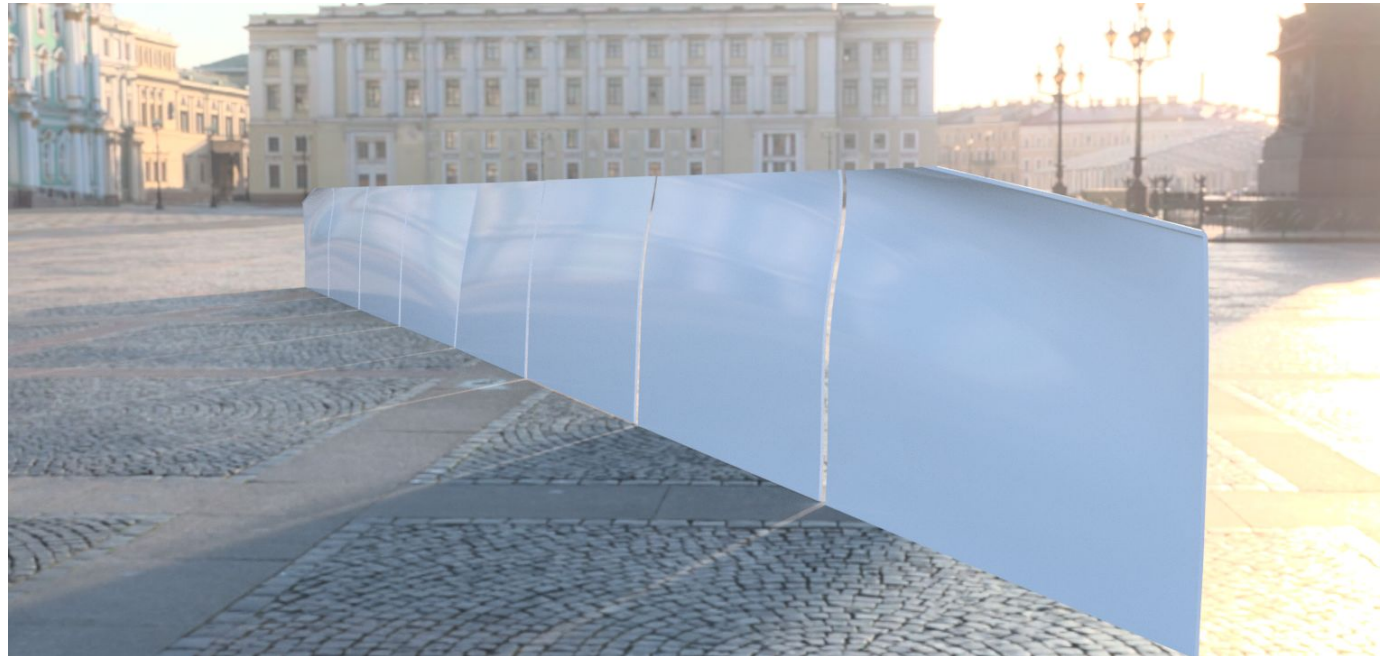
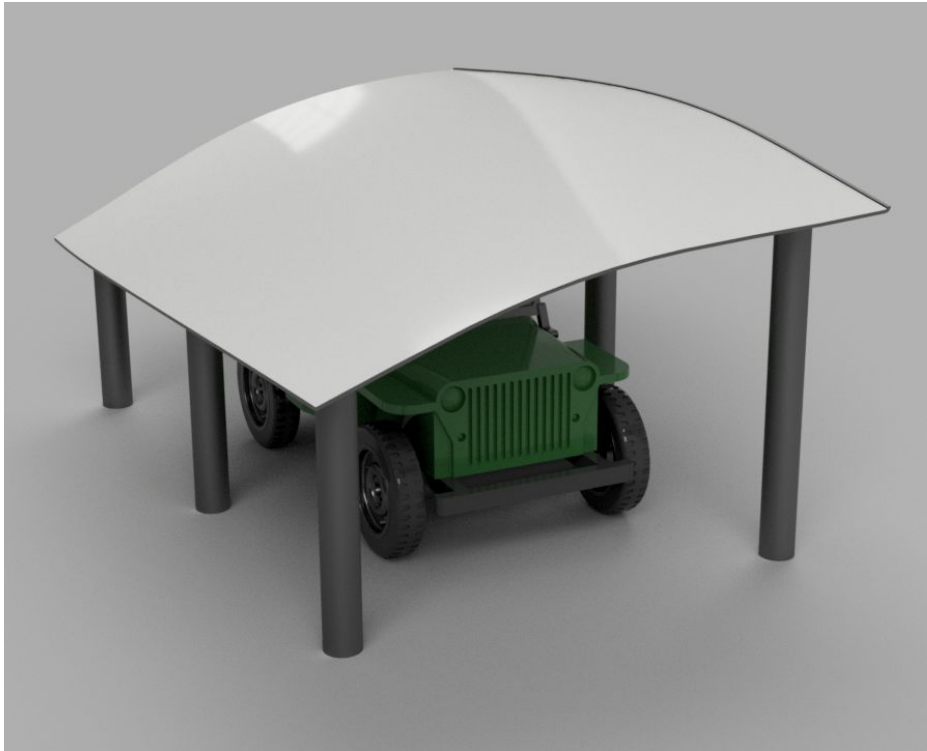


## Presentation Overview

- Problem Statement
- Structures from Blades
- Re-directing Flow
- What to do with Sawdust?

# Functional roofs and fences

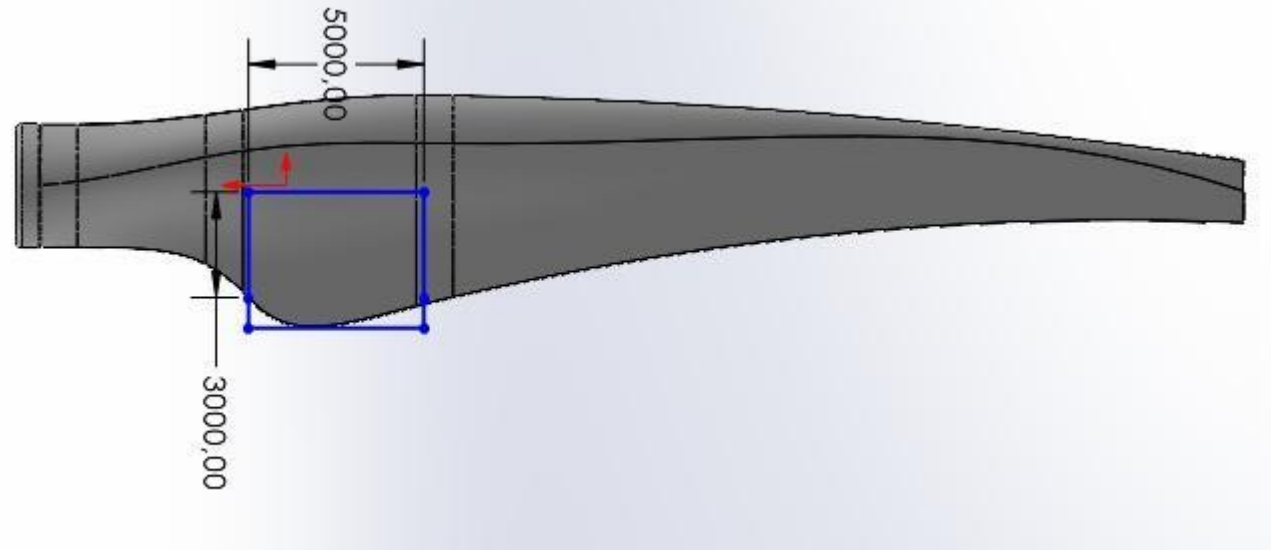
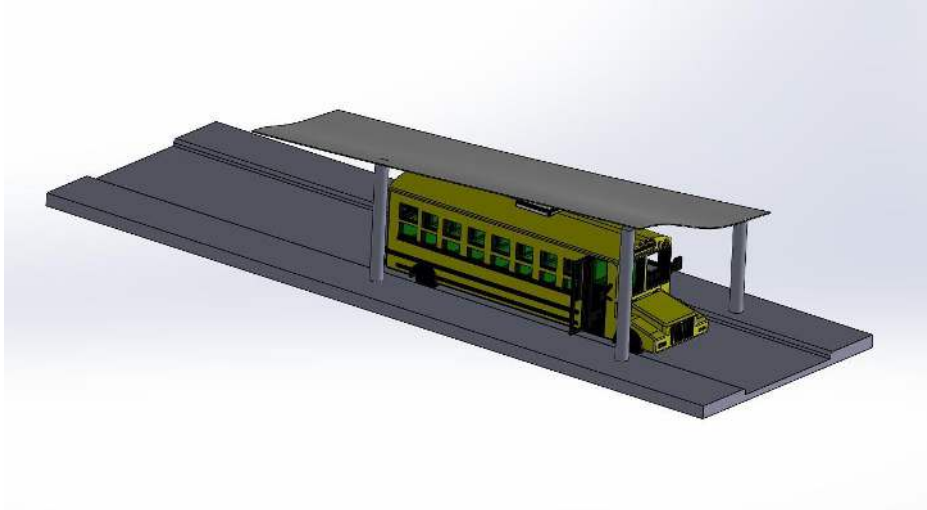
- Different parts of the blade will be cut out and processed to be used as roofs and fences
- Allows for a wide range of sizes
- Advantages include high lifetime due to no corrosion, good structural rigidity, stackable, and modular





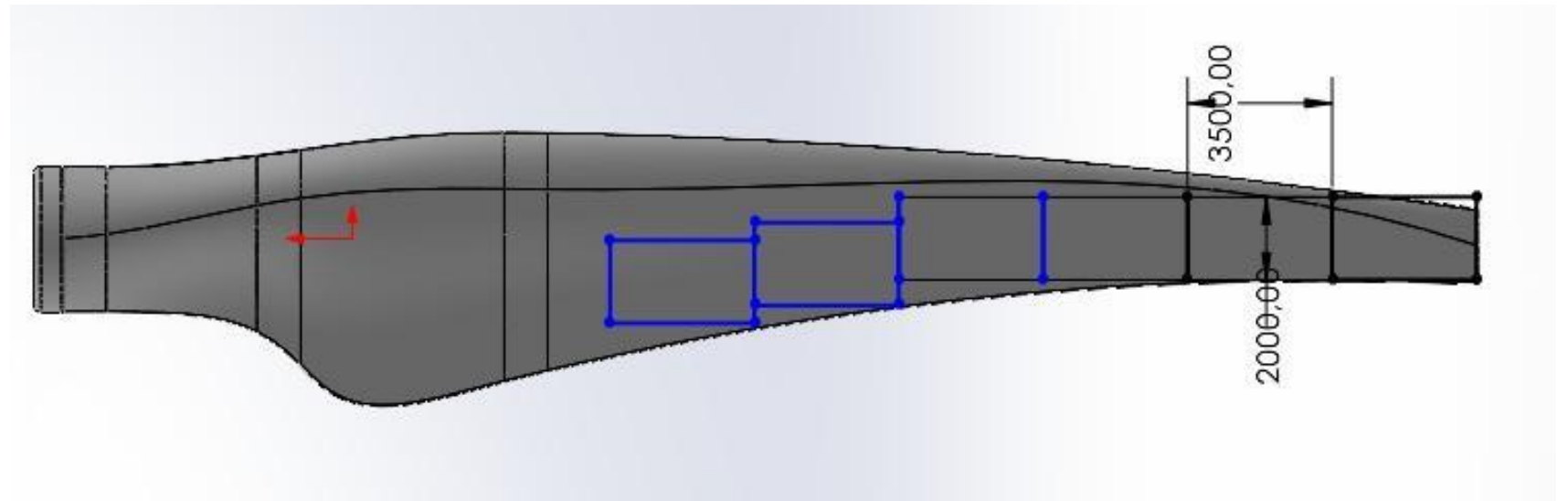
# Cut roofs

- Cutting out a piece at different locations allows us to get different lengths of roofs.
- Natural slope allows for snow and rain water to slide off.



# Cut fences

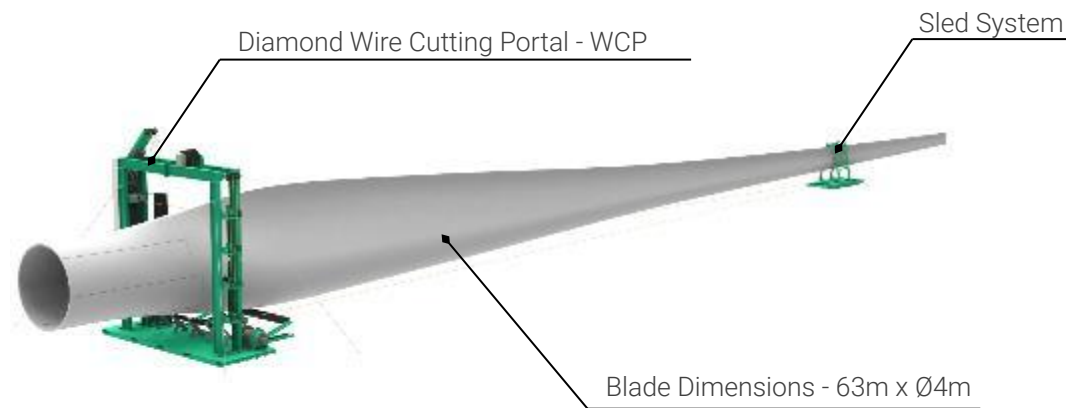
- Prototype has fences long 3.5 meters, high 2 meters and thickness of ~3.5cm
- Fences can have a continuous flow and fit together
- Or you have the same cuts from multiple blades, allowing you to have the same dimensions and “sets”





## How can we achieve this?

- Wind turbine farms usually have only one model type
- The Blade Cutter from Advantis can allow us to repeatably cut pieces of blades into standardized cuts
- A single 35 meter blade when cut can potentially give us 2 roofs and 40-45 meters of fence
- One wind farm of 25 turbines gives us a total of 50 roofs and 1000 meters of fence.





Design  
Inspiration



## Market

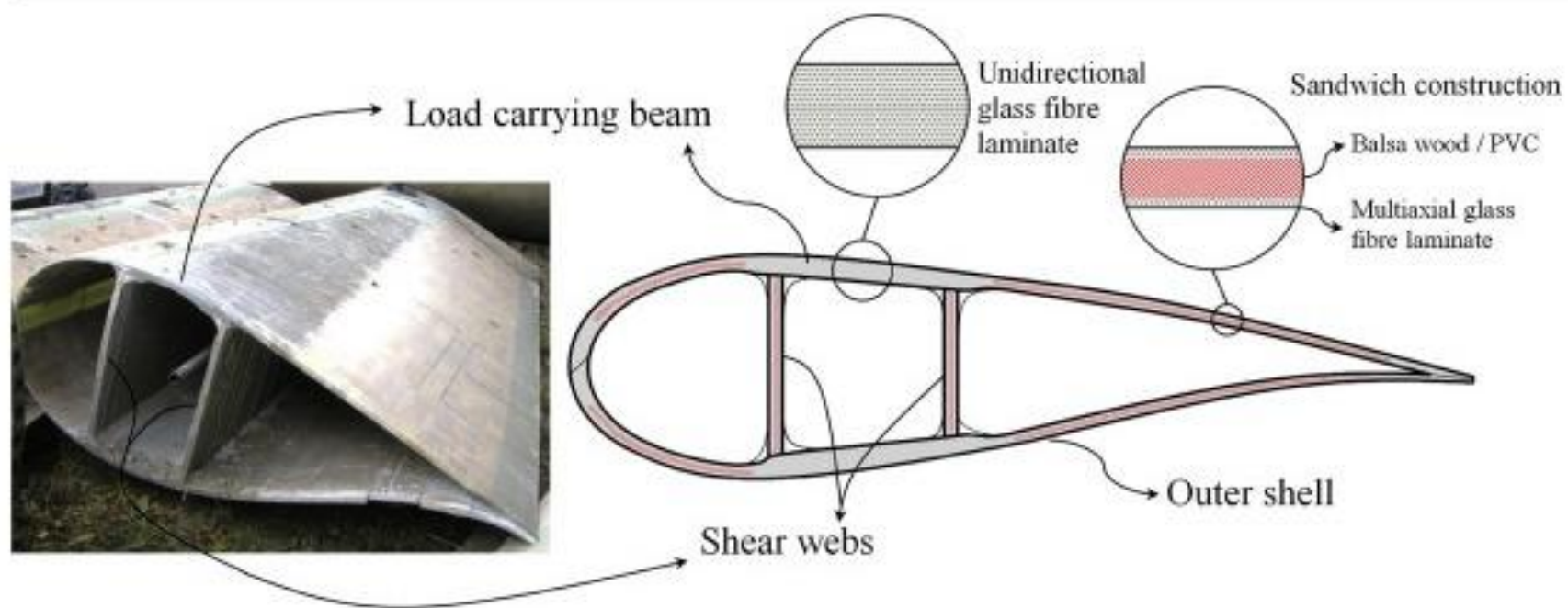
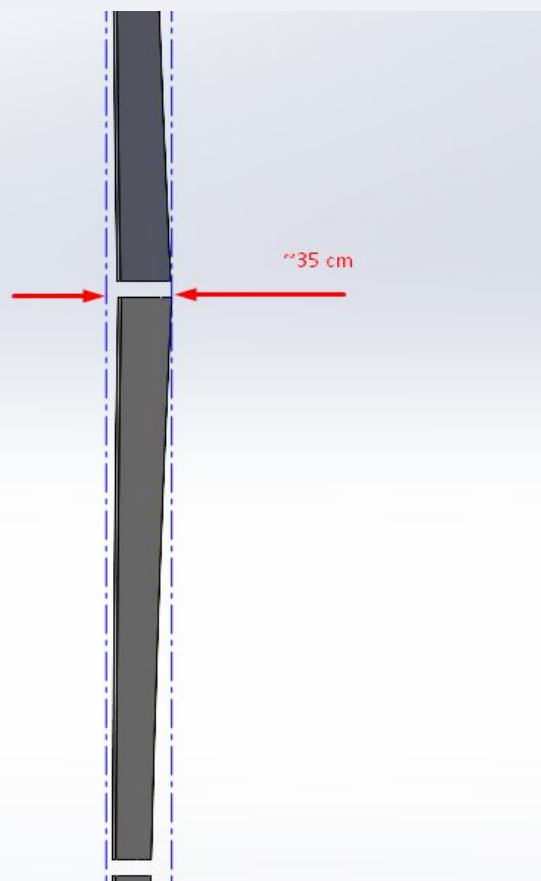
- Some 5700 wind turbines per year could be decommissioned in Europe by 2030
- The owners of wind turbine farms need to pay hefty amounts to decommission turbines (350 000 - 500 000 euros per turbine)
- A potential bargaining for low prices of cut pieces can be argued for.



An aerial photograph of a multi-lane highway bridge spanning a body of water. The bridge has several lanes in each direction, with white lane markings. Several vehicles, including cars and trucks, are visible traveling across the bridge. The water is a deep teal color with visible ripples. The text "Thank you" is overlaid in the center of the image in a white, sans-serif font.

Thank you





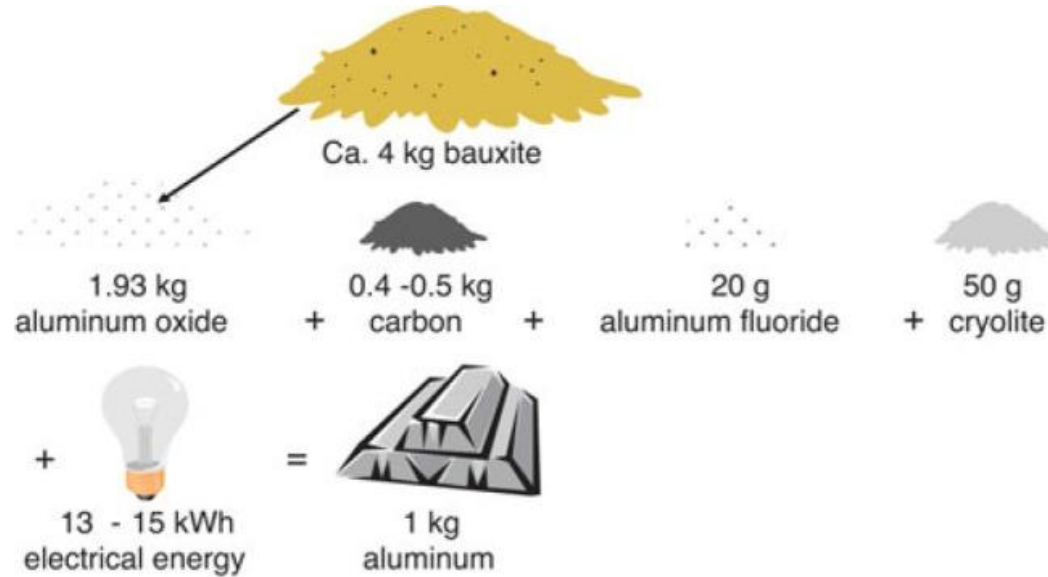
# Leftover Material: Sawdust



- Created regardless of whether the blade is in a landfill or used as a structure.
- Sawdust can be recycled using various methods
  - Conventional incineration
  - Mechanical Recycling
  - Fluidized bed Thermolysis
  - Pyrolysis Recycling
  - Chemical Recycling
- But how energy intensive is this?

<https://iopscience.iop.org/article/10.1088/1757-899X/1034/1/012087/pdf>

# Aluminum Smelting Process

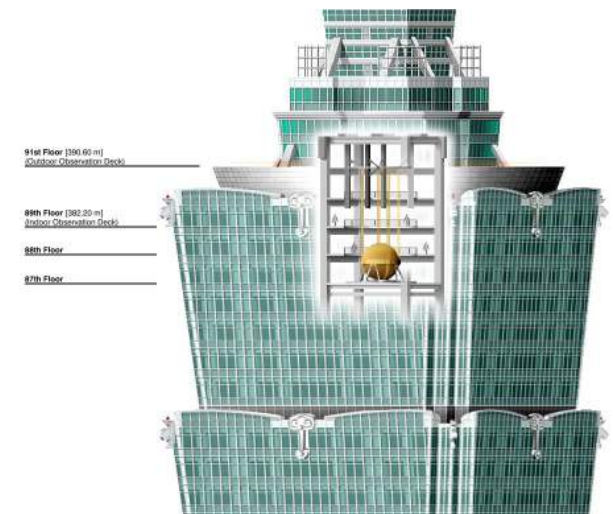
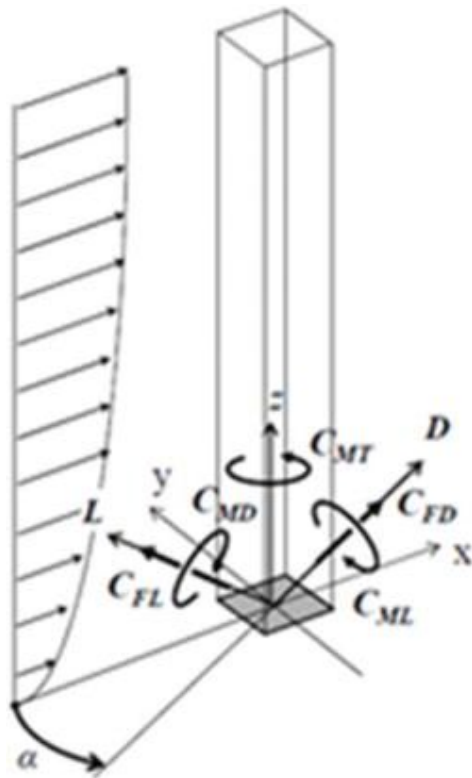
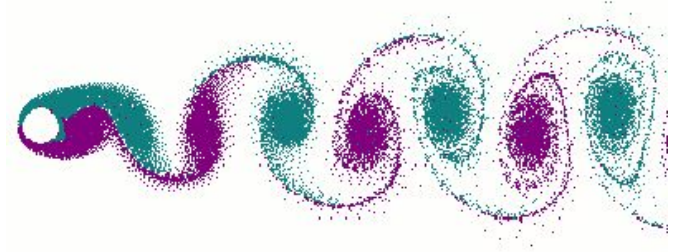


What could you do with GFRP sawdust with 15kWh of energy?

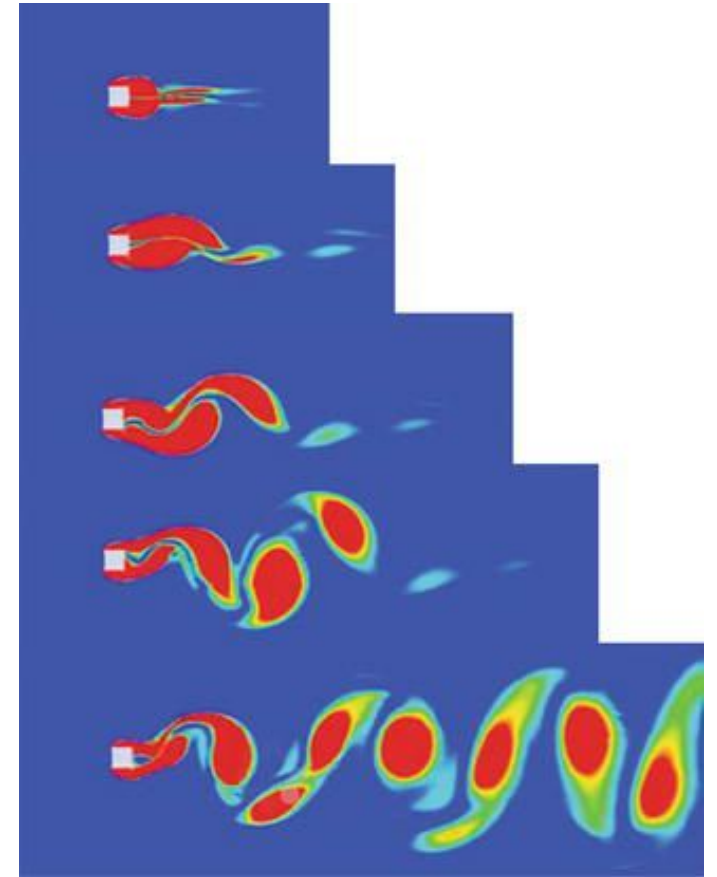
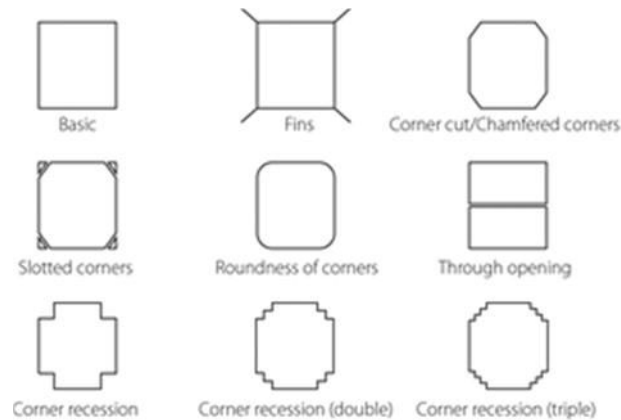


# Wind Induced Vibrations in buildings

- Building first two primary modes of vibration.
- 2<sup>nd</sup> mode requires expensive internal dampers to prevent



# Use leftover wingtips to create a moveable facade



Test alternate cross sections to prevent vortex shedding



# Locker out of glass fibres

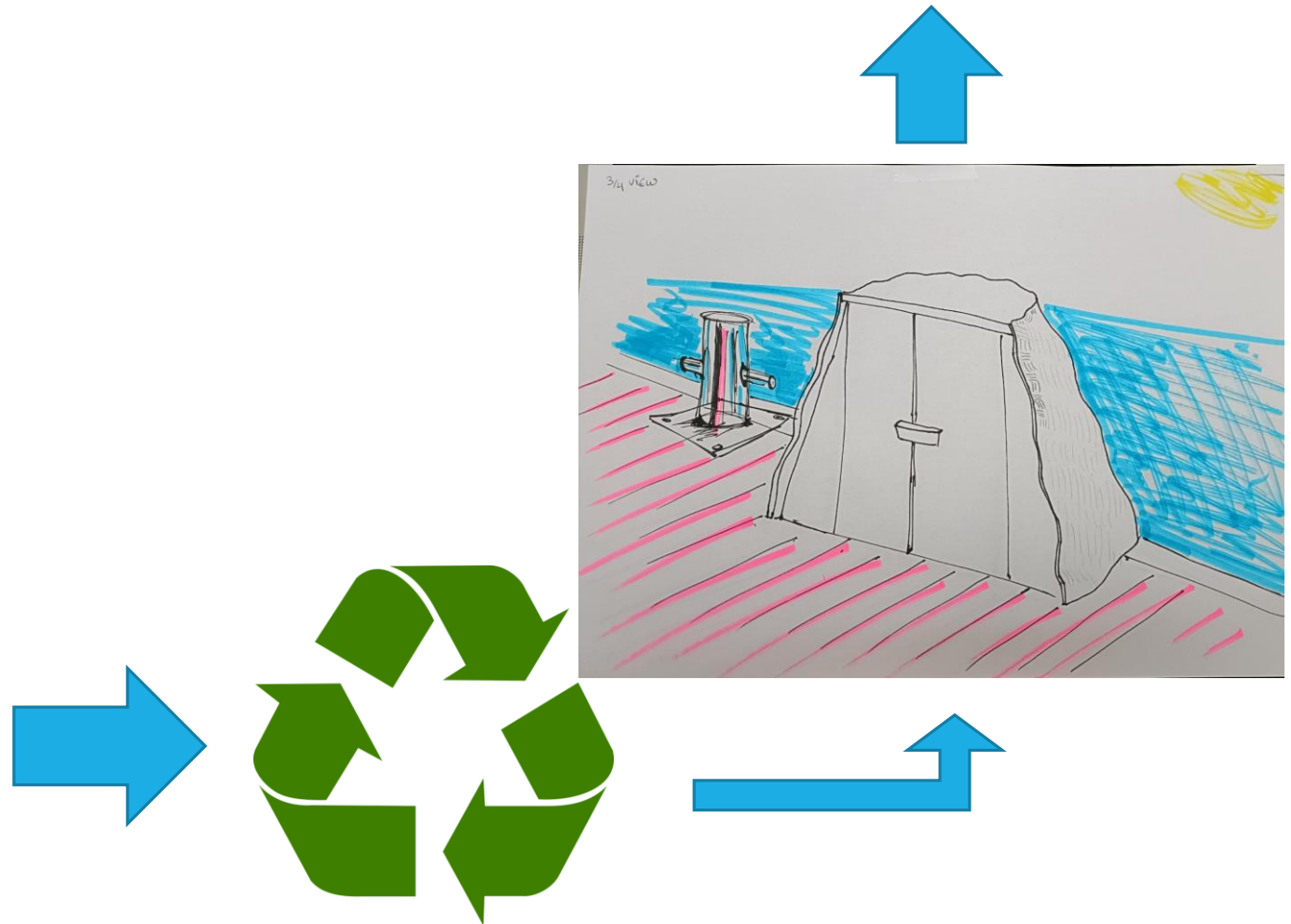
*Team 2 : Interior design or furniture elements with specific requirements*



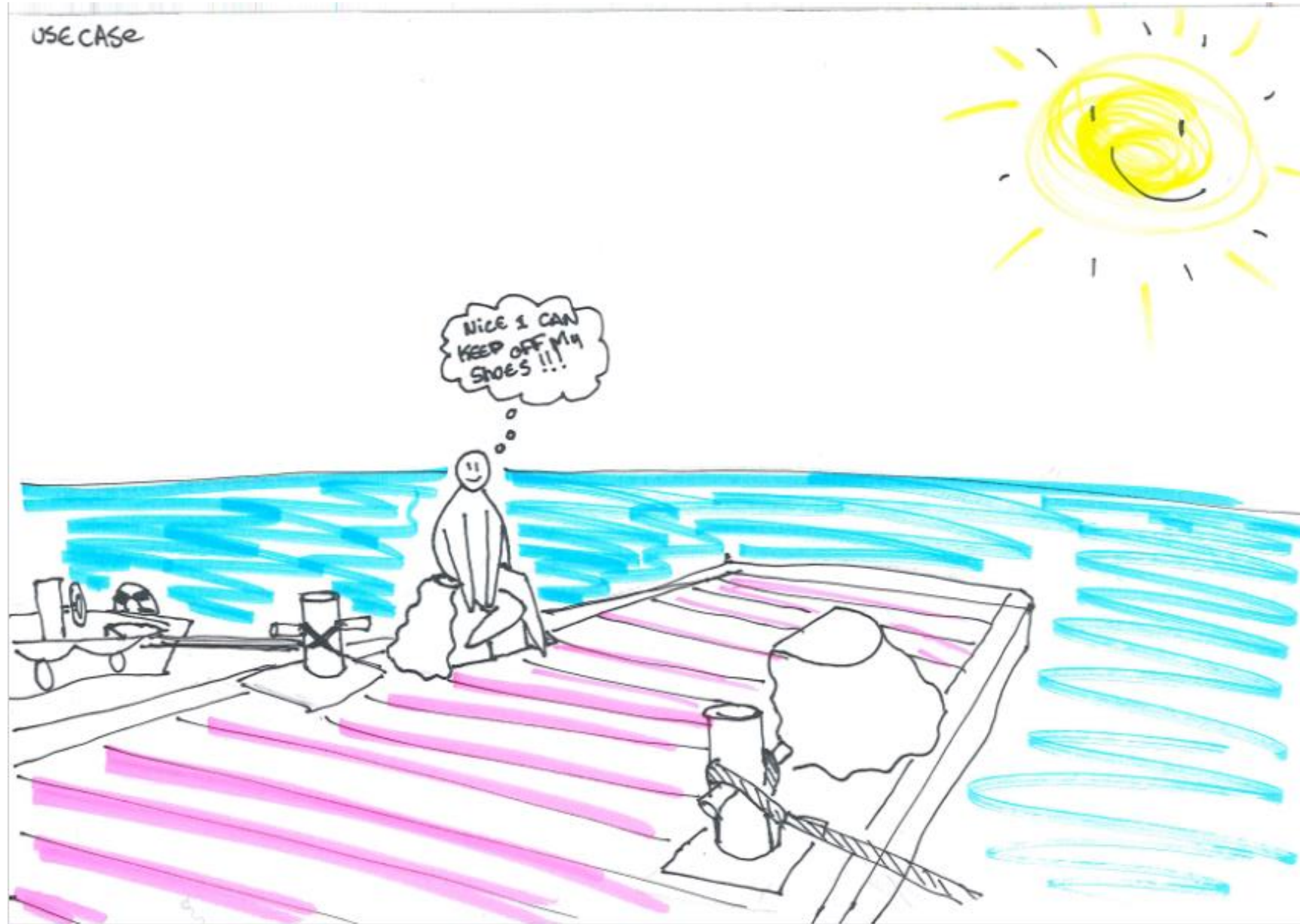
# The aim of the project



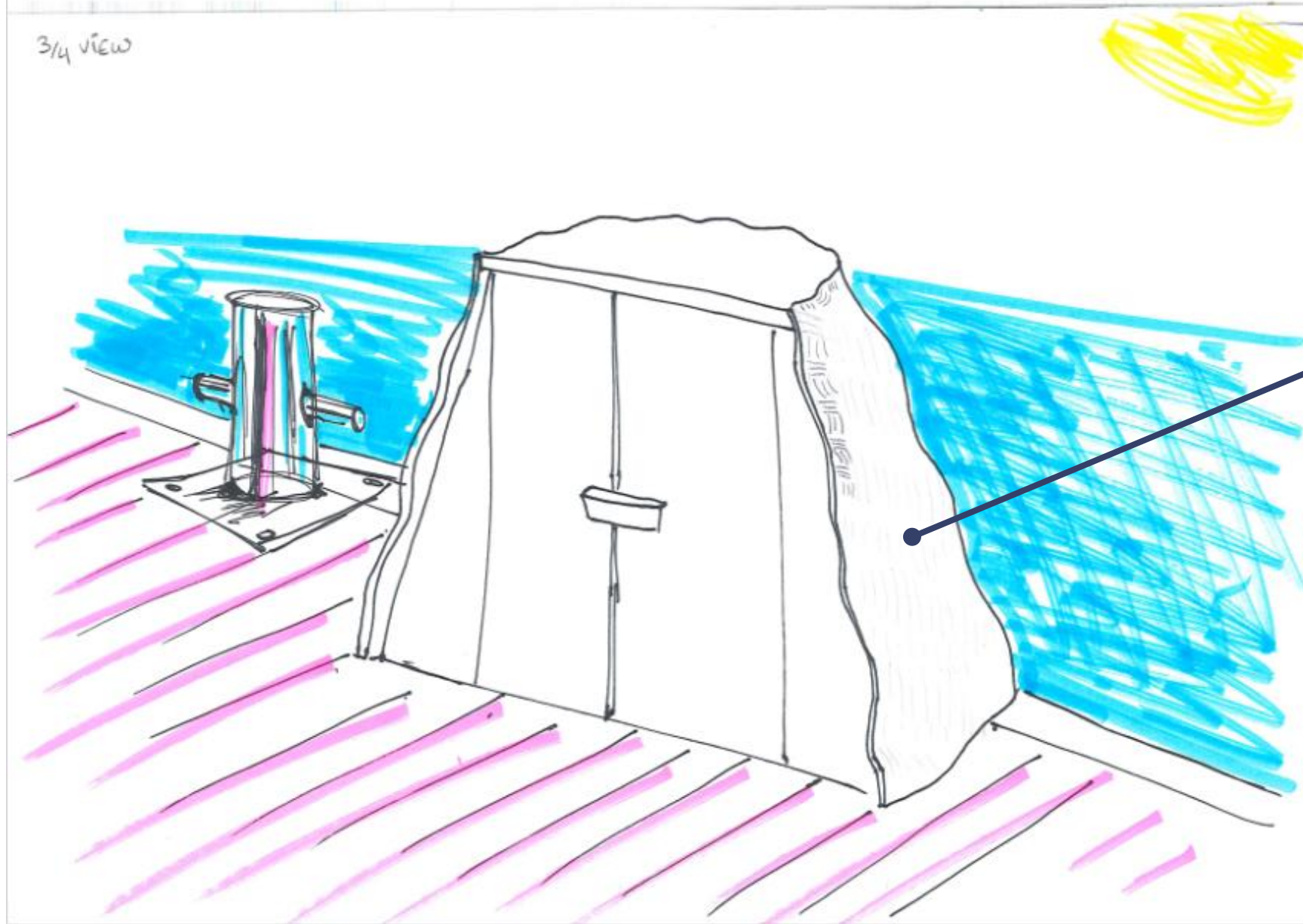
Crushing into powder  
to reuse it as talcum



# Why it is useful !!!!



# The object



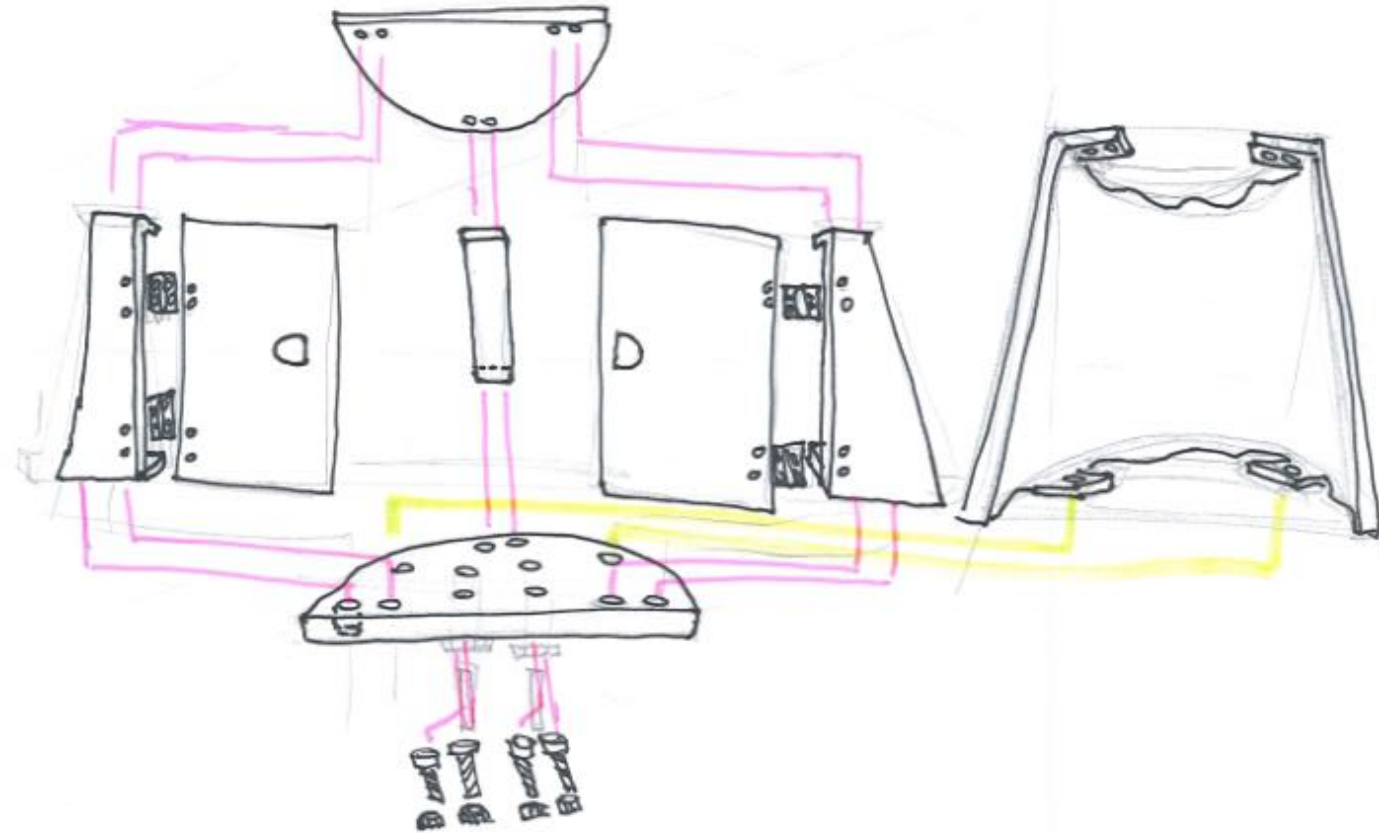
Wave shape  
to avoid rain



# Technical aspect

- 3 support points
- Screws to fix it to the ground
- Top bottom and doors made of sandwich composite
- Shell made of randomly organized glass fibers with epoxy

Exploded VIEW



# The prototype



# Acknowledgement



Co-funded by  
the European Union



**RTU**  
FACULTY OF  
CIVIL ENGINEERING

Thank you  
for the  
Hackathon





# GLASS FIBER ENVIRONMENTAL PROJECT



"GlassCircle" Hachaton





# TABLE OF CONTACT

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Environmental Impact of  
Fiberglass

3

Fiberglass Waste Generation

4

Recycling and Waste  
Management innovation  
(business model)

5

Other alternatives


6

Team

7

Questions & Answers



A black and white photograph of a trash can overflowing with plastic waste in a field. The trash can is a large, dark, cylindrical container with a lid that is completely covered by a massive pile of plastic bags, bottles, and other debris. The trash is piled high, spilling over the edges of the can. The background shows a field of tall grass and some distant hills under a cloudy sky. The foreground is filled with more plastic waste, including bags and bottles, scattered on the ground. The overall scene depicts a significant problem with waste disposal.

10-20% by weight  
of the processed  
glass material is  
sent for disposal

PROBLEM STATEMENT





# The negative effects

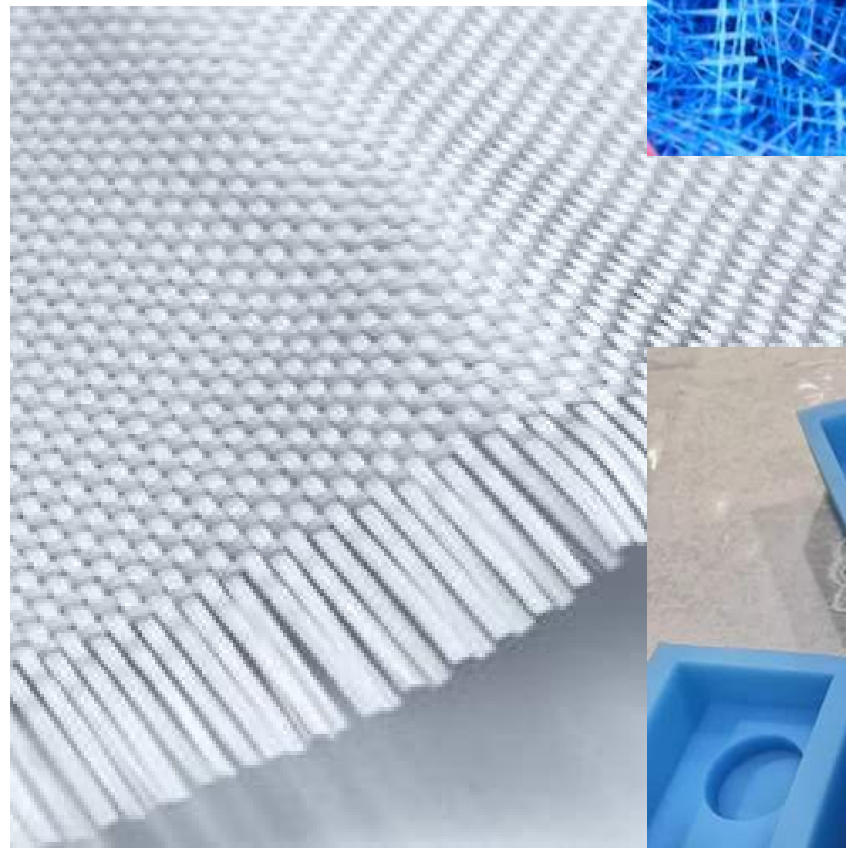
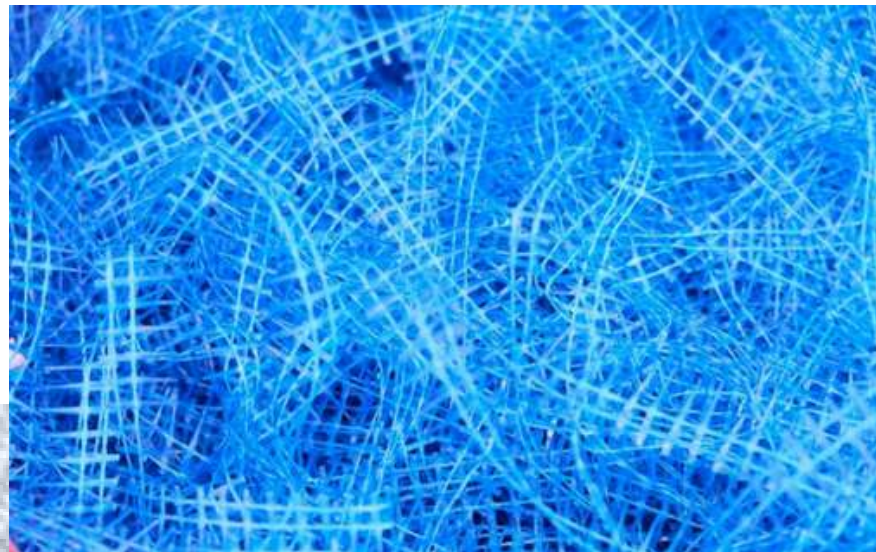


Glass fiber can harm the eyes, skin, and the lungs. Workers may be harmed from exposure to fibrous glass., it contributes to greenhouse gas emissions and takes up space





# Action plan



01

Use glass fiber in sheets for the composite material forms instead of silicone forms

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02

Instead of materials such as duck tape use trimmed edges from constructing mesh to close the form

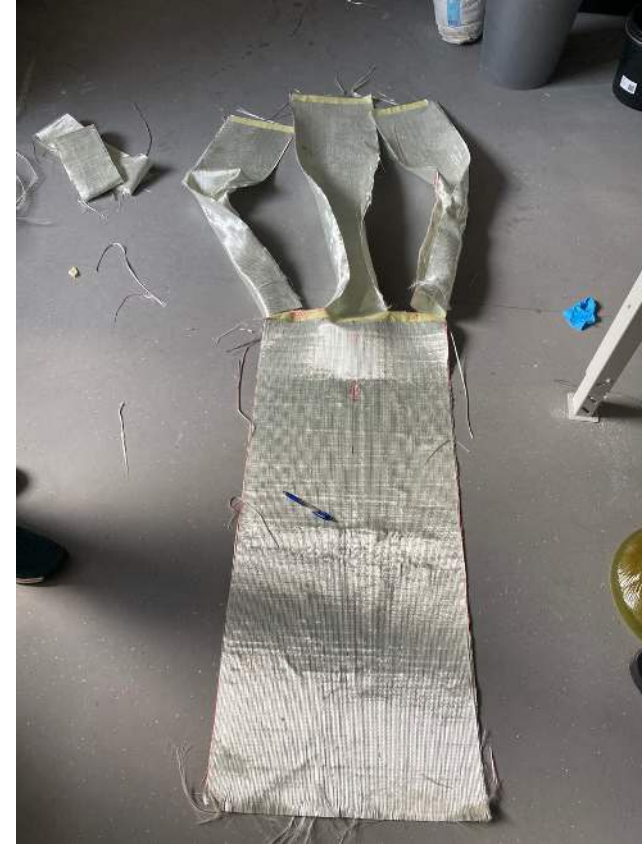
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03

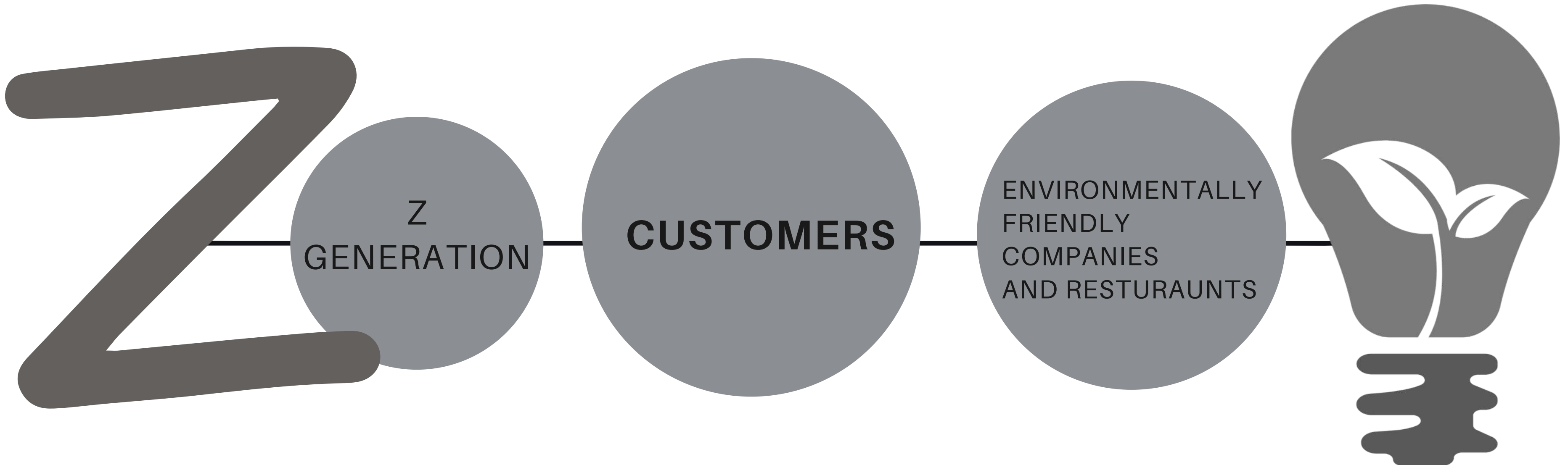
Make any desired form of 100 % recycled fiber glass

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# REFERENCES:

1. <https://www.osti.gov/servlets/purl/889402> ]
2. <https://www.cdc.gov/niosh/topics/fibrousglass/default.html#:~:text=Fibrous%20glass%20is%20a%20synthetic,duration%2C%20and%20work%20being%20done>.





Thank you!





# EcoFlight Component

Housing for different IoT and Remote-control toys

Mads & Anders MSc Technology Based Business Development

AARHUS UNIVERSITY

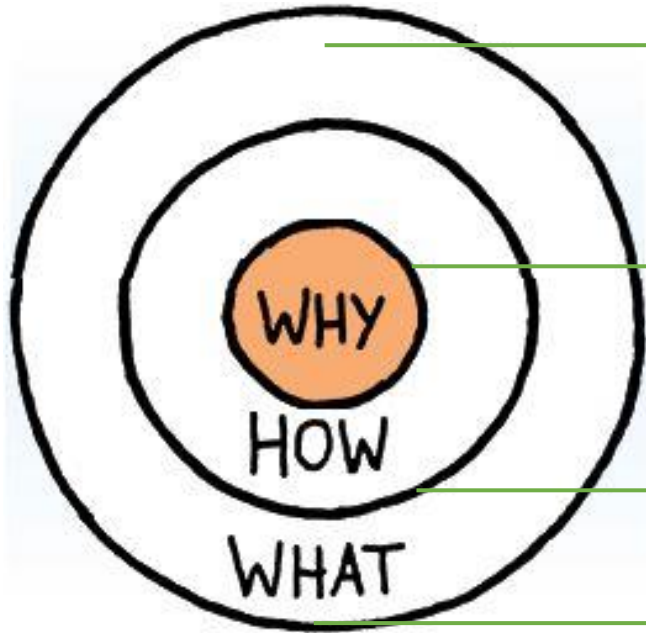
# EcoFlight Component

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- Designed and manufactured using recycled glass fiber materials
- Compression molding with 3D-printed molds – **1<sup>st</sup> draft!**
- Sustainable alternative to traditional RC drone components made from virgin materials
- This component is placed within the structural frame
- Offers comparable performance to conventional components while reducing the reliance on new raw materials



# THE WHY



## **Cost-effectiveness:**

Eliminates the need for expensive tooling and reduces production costs, and purchasing new materials

## **Environmental Sustainability:**

Reducing the need for new raw materials and minimizing waste

## **Efficient Compression Molding:**

This method allows to produce high-quality, uniform components with excellent mechanical properties

## **Customizable Mold Design:**

Provides the flexibility to create customized designs and modify the shape, size, intricacy for specific requirements

## **Enhanced Material Properties:**

Compression molding helps retain the beneficial properties of glass fiber, such as high strength, stiffness, and resistance to corrosion.

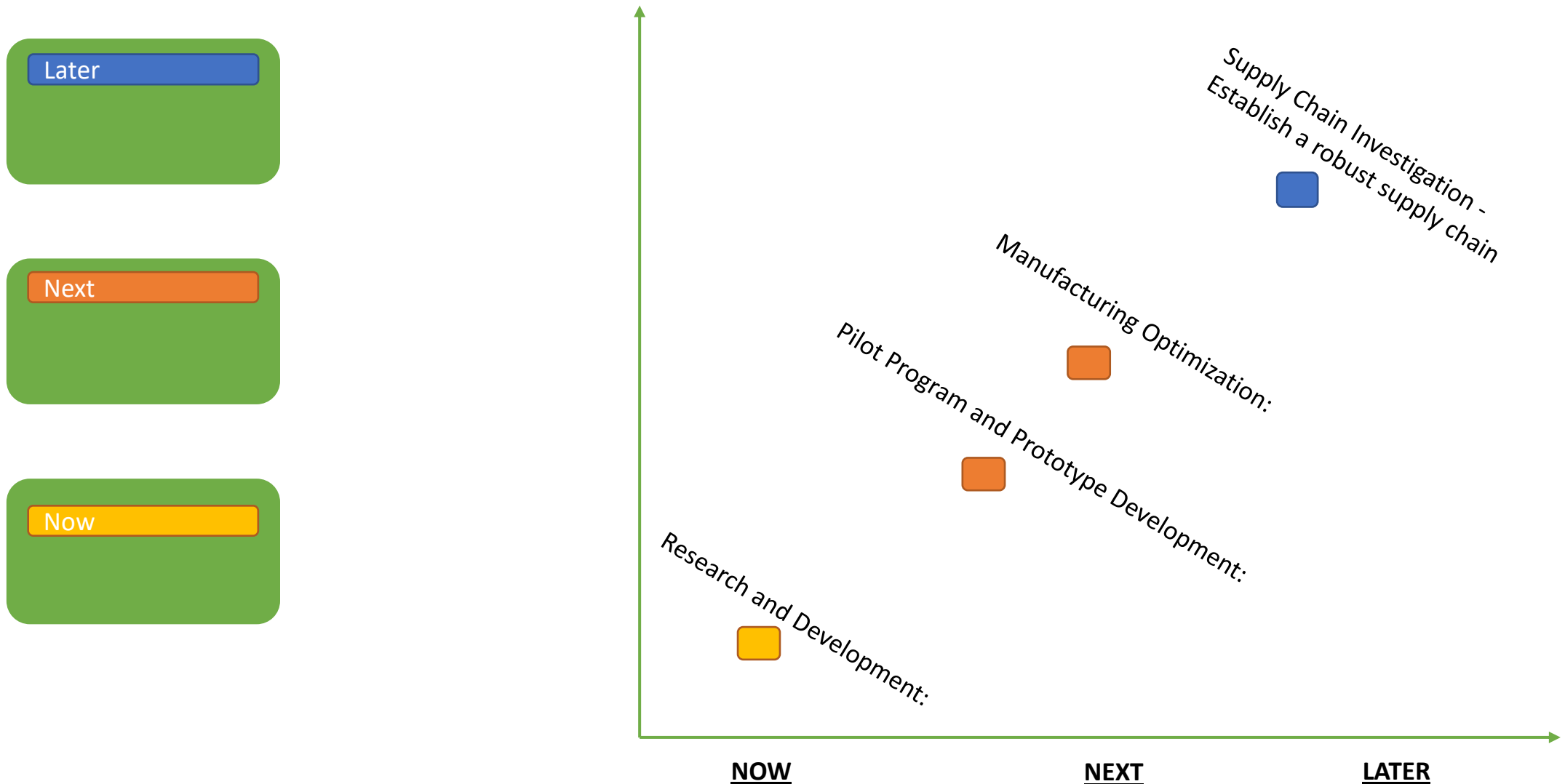


# Business Case (CE): Recycled Glass Fiber Drone Components

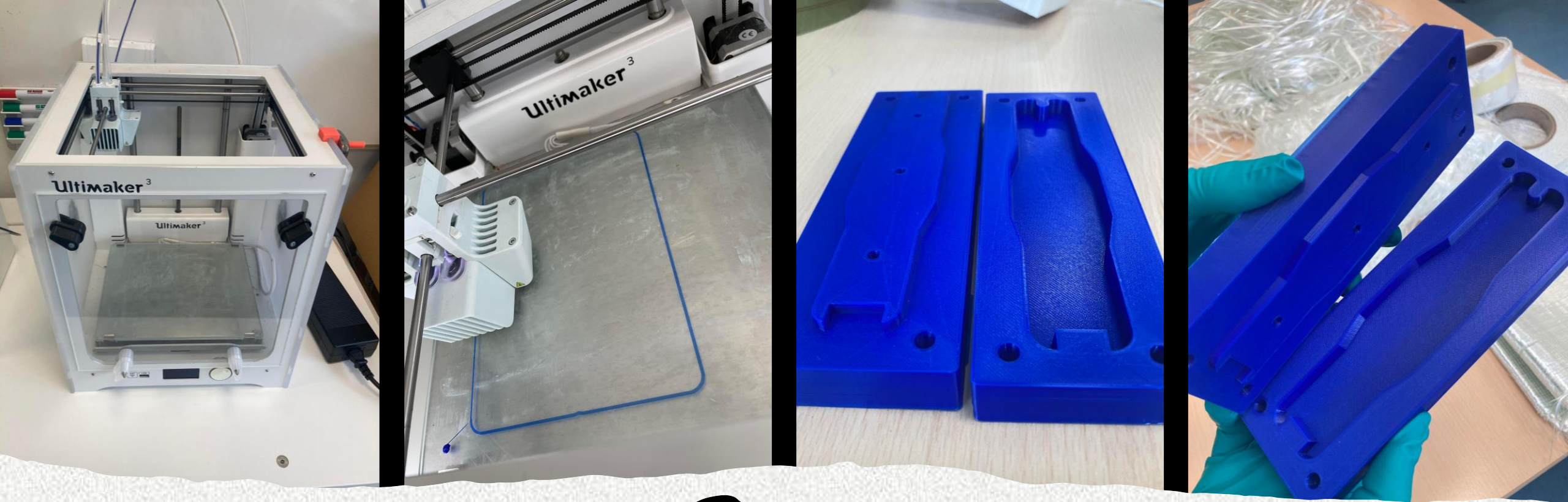
- **Market Demand:** Customers who prioritize eco-conscious practices that values sustainable and environmentally friendly solutions
- **Cost Savings:** Recycling glass fiber drone components can lead to significant cost savings for both manufacturers and end-users - reduce the need for raw materials and lower production costs
- **Sustainability and Corporate Social Responsibility (CSR):** aligns businesses with sustainability goals and demonstrates a commitment to CSR
- **Regulatory Compliance:** Recycling initiatives are gaining momentum globally, and governments are increasingly implementing regulations and incentives to promote recycling practices
- **Long-Term Cost and Supply Chain Stability:** Reducing reliance on virgin materials, less vulnerable to price fluctuations and disruptions



# Roadmap for Introducing Recycled Glass Fiber Drone Components:







Instant compression molding method  
for recycling of glass fiber materials



# Glass fiber waste

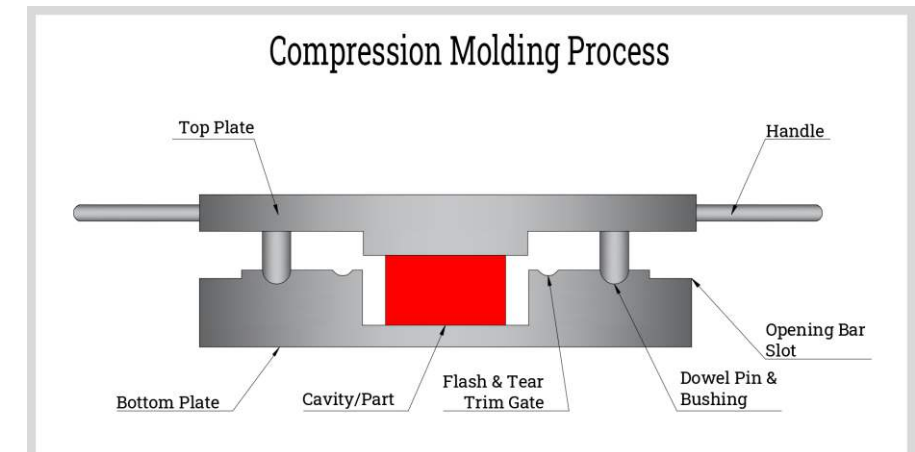
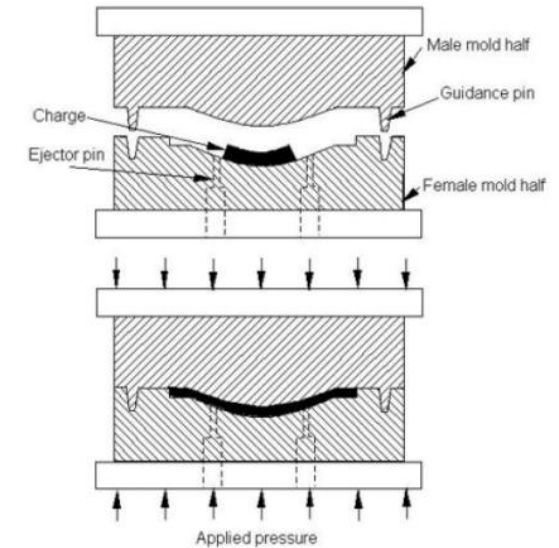
- Collecting and sorting
- Cleaning and preparation
- Shredding or cutting
- Mixing with binder (resins)
- ***Compression molding process***
- Inspection and quality control
- Evaluation and refinement





# Compression molding

- Speed and design flexibility
- Customization
- Enhanced Material Properties: Glass fiber-reinforced materials offer excellent strength, stiffness, and lightweight properties



- (Dhananjayan, V. K. (2013). Design And Analysis Of A Compression Molded Carbon Composite Wheel Center. <https://rc.library.uta.edu/uta-ir/handle/10106/11909>

# Reuse of Glass fibres

->Home furniture

Parwinder Singh

AU BTECH BSS



# Objectives

- To use the glass fiber waste material in its original waste form as much as possible.
- Restrain as much as possible from additional or complicated process which can become another problem for environment.
- Simple re-using process and easy to use the final product.



# Motivation: Traditional Charpai (Flexible Bed)

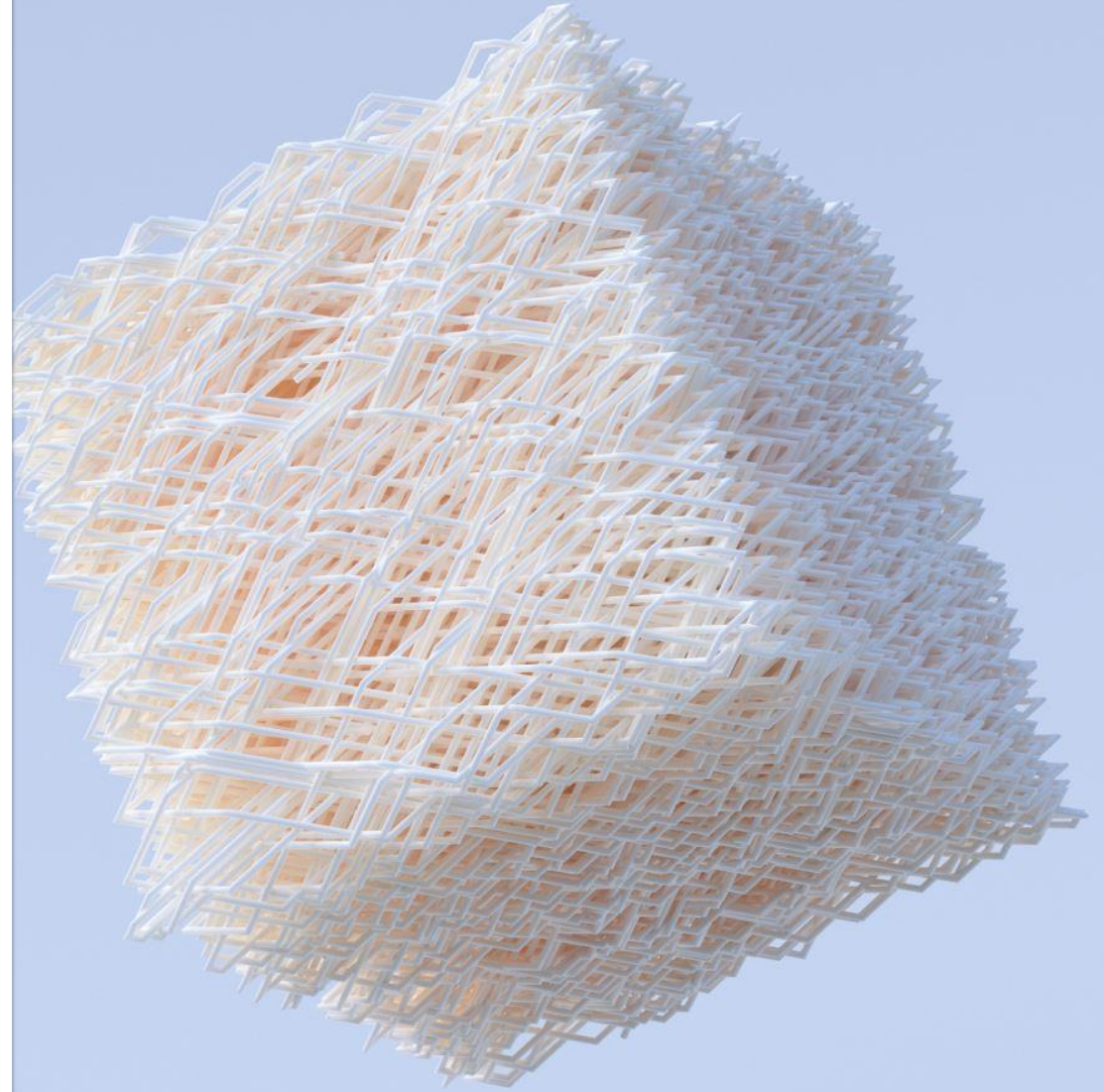
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- A charpai, also known as a "charpoy", is a traditional Indian bed made of a wooden frame woven with ropes or cords.
- The design of a charpai varies by region, but typically consists of a **rectangular frame with four legs, and a criss-crossed rope or cord support** system that provides a comfortable and flexible sleeping surface.
- Charpais are **commonly used in rural areas** and are often **found in homes, guesthouses, and outdoor spaces**.
- They are lightweight, easy to assemble and disassemble, and can be used as both a bed and a seating option.





**Idea-Use glass fiber  
as cords to build  
placeholder for  
holding objects**



# Prototype – Placeholder Object

Develop a shelf/table frame that can be knitted with the glass fibre yarn.

For safety put an insulated cover on top of it.



Traditional jutte knitted placeholder or frame





# Advantages over others

- **Durability:** withstand a lot of wear and tear without breaking or fraying. This makes them ideal for use in charpais that will be exposed to the elements or used in heavy-duty applications.
- **Moisture resistance:** won't rot or decay over time, even if they are exposed to damp conditions.
- **Pest resistance:** resistant to pests such as rodents and insects, which can damage or destroy natural fiber cords.
- **Easy to clean:** easy to clean and maintain, and can be wiped down with a damp cloth to remove dirt and stains.
- **Consistency:** consistent in size and strength, and provide a uniform level of support across the frame
- **Higher Consumption** - Consumption of glass fiber yarn is high in knitting the frame.
- **Flexible and Dampening properties**

# Prototype Process

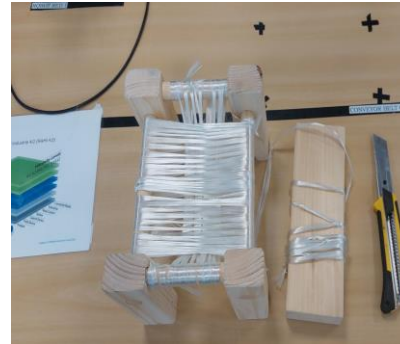
Glass fiber yarn  
waste material



Wooden frame  
Prepared(Could be 3D  
printed or metal frame)



Yarn sorted and rolled.  
Manual Knitting



Final Prototype



Frame Preparation  
time=30 mins

Sorting Time=30 mins  
Knitting(Manual) Time=60 mins

Total effective manufacturing time around=2 hours

Around 25 meters length of fiber yarn used to build this prototype.



# Challenges & Counter Measures

## Safety and spilling of crystals in environment

- While knitting manually, the personnel should **wear gloves and masks**.
- The whole process **could be automated via robotics** automation. This will improve quality as well as will not pose any health risks along with productivity.

## Strain & Strength

- Its found better than the jute strength.
- Knitting design process can makes it better in strain and strength.

## During knitting process lots of fiber material comes out.

- Sorting of fiber material (such as knitting rolls) in advance can be the added value here.
- Treat it beforehand, with **some kind of glue material or insulation method in combination to other material (e.g. reuse of plastic on top of it as cover that can insulate the knitting)**, so that waste elimination should be less during the knitting.

# Business Applications & Values

- **Application areas can be to build placeholder objects for dampening (or shock resistant) objects during transportation**

Some specific real-world examples

1. Shipping fragile electronics.
  2. Moving delicate artwork (a box shaped object).
  3. Transporting musical instruments
  4. Shipping glassware (a box shaped object).
- **This can also be used as vertical shelves in warehouse or tables, furniture e.g. sitting objects in parks but needs safety precautions like covering or insulating of objects.**
    - Huge market around the world(e.g. 60% rural population in India who use charpais as furniture in every household) if objects can be insulated before use.

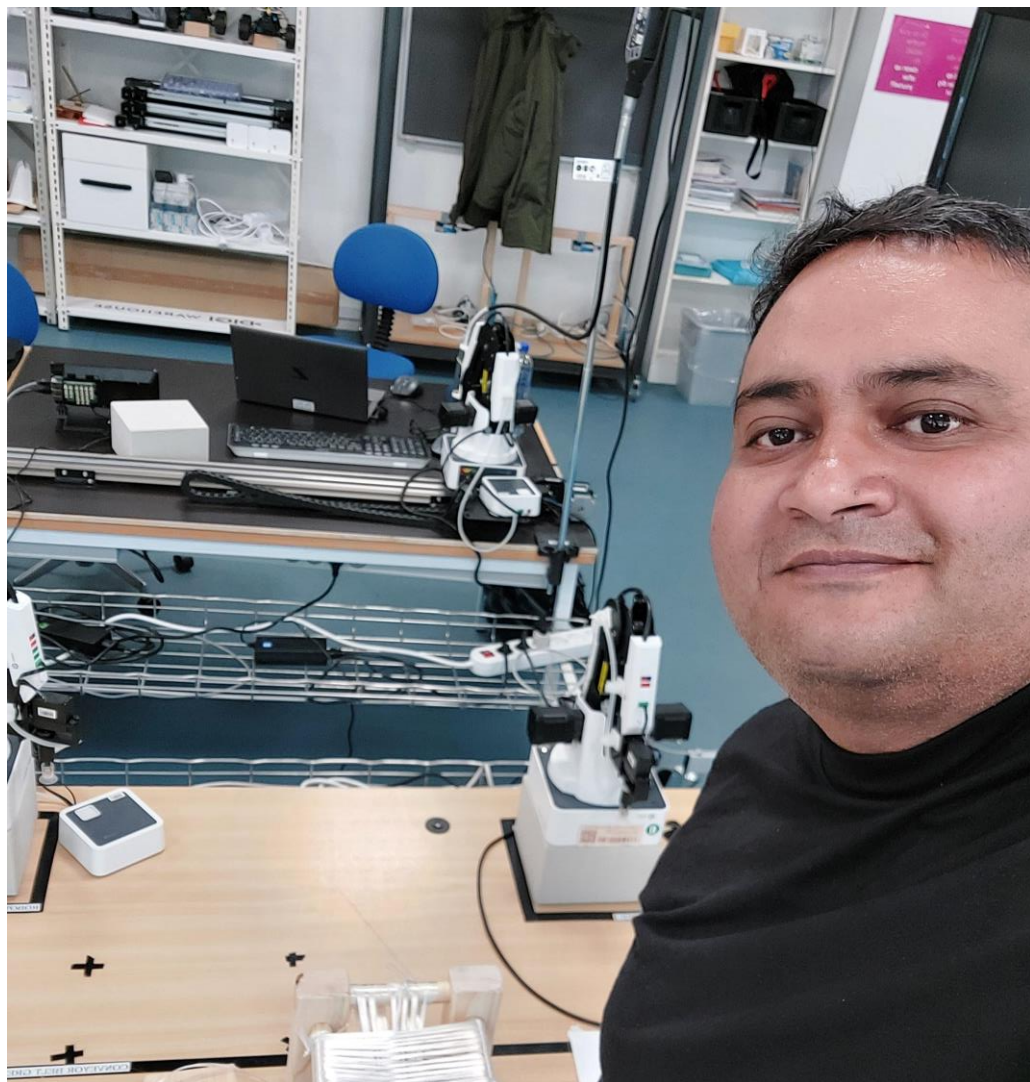
**Values- Circular re-use of glass fiber without any additional complicated or costly process , durable, sustainable and long life span objects**



# Recycling of glass fiber yarns-(Idea?)

- **Glass fibers can be spun together to create a strong, durable, and lightweight rope.** The glass fibers must be prepared for spinning by cleaning and processing them. The fibers are then twisted or spun together to create a continuous strand. The continuous strands of glass fibers can be twisted together to form a rope. The number of strands and the degree of twist will depend on the desired strength and flexibility of the rope.





thanks