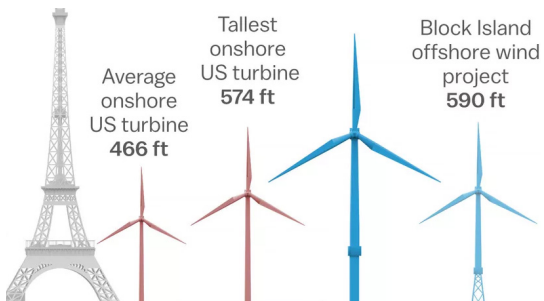


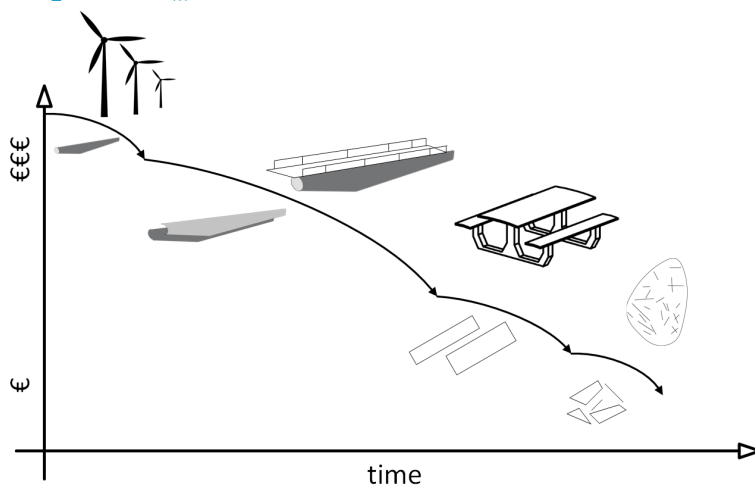
# Composites in a Circular Economy

## *The value of preserving products and materials*



Wind energy is one of the biggest users of composite materials: Wind turbine blades are made of Glass Fibre Reinforced Plastics (GFRP).

Wind turbines are designed to last 20 years, their size is steadily increasing.



Opportunities for recovery of wind turbine blades or their materials can be seen at different levels, ranging from repurposing large elements, using blade segments (through smart partitioning) or blade fragments (obtained by shredding).

This can prolong the life of the composite material, through design studies we find valuable insights into how new wind turbine blades could be designed to facilitate recovery.

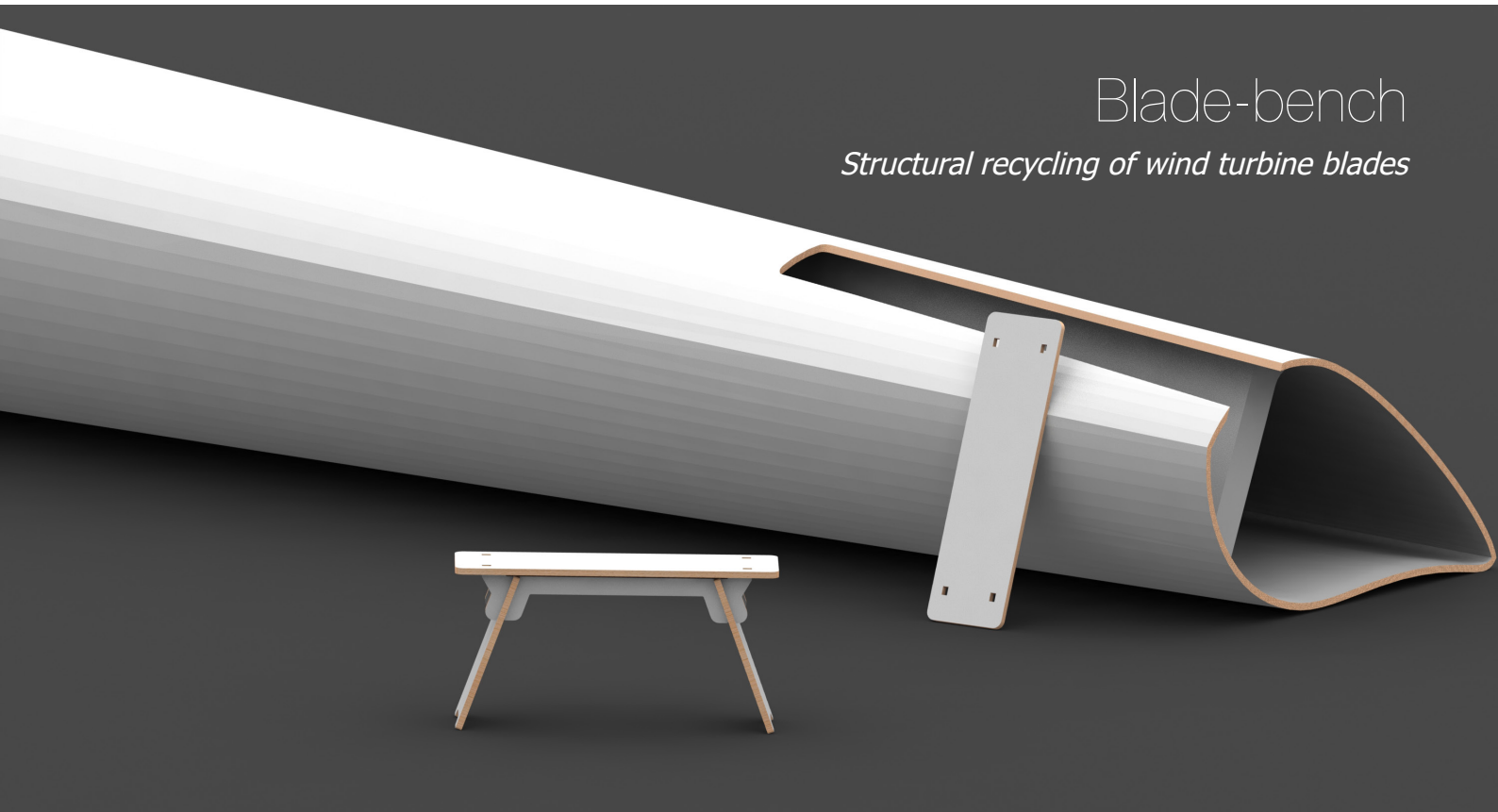


*No value, no recovery: blades in a landfill*

*How to design products containing composites for reuse and recycling in a Circular Economy?*

# Blade-bench

*Structural recycling of wind turbine blades*

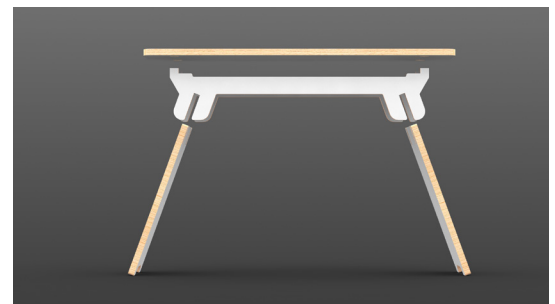


## PRESERVING VALUE

Most of the value of composites is in their combination: separating fibres from resin delivers low grade materials. This bench preserves the material's structural value by cutting panels directly from a used wind turbine blade.

## ASSEMBLY

No additional fasteners or glue needed: all parts slot together. As panel thickness depends on where it was cut from the blade, the joints are designed to allow for some variation.



## LESSONS LEARNED

With the right equipment, blade material can be reused as-is. However, cutting exposed the wooden core and bare laminate, making them susceptible to degradation from rain and UV radiation.



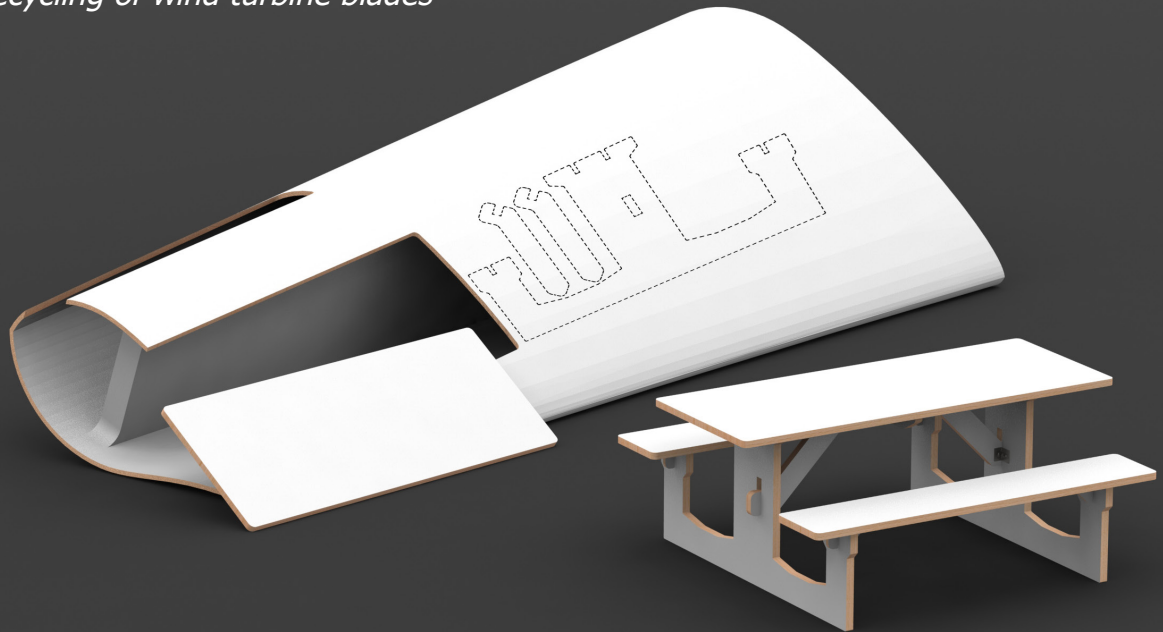
Jelle Joustra  
Structural recycling of wind turbine blades  
October 2019

**Committee** Ruud Balkenende  
Bas Flipsen  
**Project** EU Horizon2020: Ecobulk  
www.ecobulk.eu

 TU Delft

# Picnic table

*Structural recycling of wind turbine blades*



*The blades may be curved, but they're also huge (80 m.); a 2 m. panel is mostly flat.*

## FASTENER & CONNECTION SELECTION



### Slots

For easy (dis-) assembly, and no additional material needed.

### Bolts & through holes

Eliminate play, coming from panel thickness variations.

### Adhesive bond

Prevents moisture ingress on joints.  
Designed to be demounted after use.

## LESSONS LEARNED

Machining fibreglass panels generates a lot of dust and wears tooling quickly. Waterjet cutting works, but is restricted to 2D cutting patterns. With limited processing options, fasteners & connection selection is extra important, especially considering disassembly at end of use.

Jelle Joustra  
Structural recycling of wind turbine blades  
October 2019

**Committee** Ruud Balkenende  
Bas Flipsen  
**Project** EU Horizon2020: Ecobulk  
www.ecobulk.eu

 TU Delft