Wind Blade Repurposing Solutions: The “BladeBridge”

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Presented at SusWind Quarterly Review Meeting 17 June 2021

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Outline

• Overview of Re-Wind project
  (Re-Wind – www.re-wind.info)

• Blade Repurposing Solutions
  • Background
  • The BladeBridge
Re-Wind Partners, Projects, Funding

Network University Members:
• Georgia Tech
• City University of New York
• University College Cork
• Queens University Belfast
• Munster Technological University

Funding (~$2m 2014-current)
• NSF (CBET, PFI, I-CORPS)
• NYSERDA
• SFI
• DfE
• ENEL Green Power

Current Project Partners:
• Logisticus Group
• ENEL Green Power
• Siemens-Gamesa RE
• Cork County Council
• NYC Dept of Design and Construction (DDC)
• IEA Task 45
Blade Repurposing Concepts

• **BladeBridge**
• **BladeHousing**
• **BladePole**
• **BladeBarrier**
• **BladeTower**
• **BladeMachine**
BladeHousing

BladeBarrier

BladePole

BladeTower
The BladeBridge (2016 – to-date)

- 2016- 2017 – Initial Concepts and Alternative Designs; Specific blade identification for demonstration project (A29 aka V29), Blade LiDAR scanning; 8.5m long BladeBridge in Northern Ireland (on hold)
- 2018 – Blade mechanical and structural properties determined; Preliminary bridge structural analysis and design completed
- 2019 - First (ever) paper published on the BladeBridge analysis and design
- 2020 - N29 (LM 13.4) Blade sourced from Everun in Northern Ireland and delivered to Munster Technological University in Cork; Bridge design engineer Kieran Ruane joins team; 5m long BladeBridge in County Cork, Ireland
- 2021 – Blade characterization and testing.
- 2021 Autumn – BladeBridge constructed and installed.
2017-2018 – Preliminary Concept and CAD model

Why this “simple” design?
- Mass market not bespoke
- It is “simple” for structural analysis, design and construction
- Fits all size blades
2018-2019 – Preliminary Structural Analysis
2018-2019 – Preliminary BladeBridge design

Skin
TE Foam

NACA-63-235 Airfoil

Handrail

Blade rotation axis

Spar box

NACA-63-235 Airfoil

Shell

Spar cap

Timber deck 3"x 8" planks

Spar cap

LE Panel

Web foam

Web plates

Thickness of skin = 2.788mm; thickness of spar caps = 14.5mm
Thickness of web plates = 5.92mm; Gelcoat = 0.5mm; Foam thickness = variable
BladeBridges – various length designs

Nordex N29 (~13 m)  
Vestas V29/A29  
5-8 m BladeBridge

Vestas V44 (~21 m)  
12-15 m BladeBridge
BladeBridges – various length designs

GE 37 (~37m) 15-25m BladeBridge

Clipper C96 (~46m) 25-35m BladeBridge
BladeBridges – other simple options

Extensions

Asymmetrical
Windblade Alignment

Complexity of Geometry must be accounted for in actual designs: Pitch of blades, straightness of blades, spacing between blades
County Cork BladeBridge – Midleton to Youghal Greenway
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BladeBridge - Environmental Analysis (LCA)

Functional Unit: Delayed disposal of 4500 kg 22m long blade (Vestas V44) over 60 years (Cradle to Grave)

- Blades transportation 500 km Belfast to Cork
- Lower 2/3 blade replaces steel girders made with partially recycled material
- Top 1/3 blade sent to landfill
- Blades coated in epoxy protective layer
- End of Life Plan: Co-processing of GFRP girders, recycling of hardware

Wooden decking material, abutments, and maintenance schedule assumed equal to bridge made with steel girders
Thanks for listening

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www.re-wind.info
Re-Wind is a Holistic R&D Program

- EOL Repurposing of wind turbine blades
- Architecture and Industrial Design
- Structural Engineering and Construction
- Composite Material Mechanics
- Geographic Information Science and logistics
- Life–Cycle Assessments
- Business Models