

# Re-Wind

Blades at their End-of-Life: What are the options for owner-operators looking to repurpose their blades?

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Emma Delaney, Conor Graham & Jennifer McKinley  
Queen's University Belfast

BladesEurope  
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# Outline

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- Overview of the US-Ireland Tripartite research project (Re-Wind)
- What are the possible repurposing options for decommissioned blades?
- What are the benefits of integrating wind farm data into a GIS based framework?
- How will 3D laser scans (digital twin) inform blade reusability and what questions does this raise over data ownership?

# Overview of the US-Ireland Tripartite research project (Re-Wind)

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# Re-Wind Project

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- Explore sustainable repurposing strategies for wind turbine blades
- Collaborative US-Ireland research team from QUB, UCC, CUNY and Georgia Tech
- The project engages with a multidisciplinary team with researchers from engineering, architecture, geography, political and social science and Local Development Experts
- Move towards a circular economy

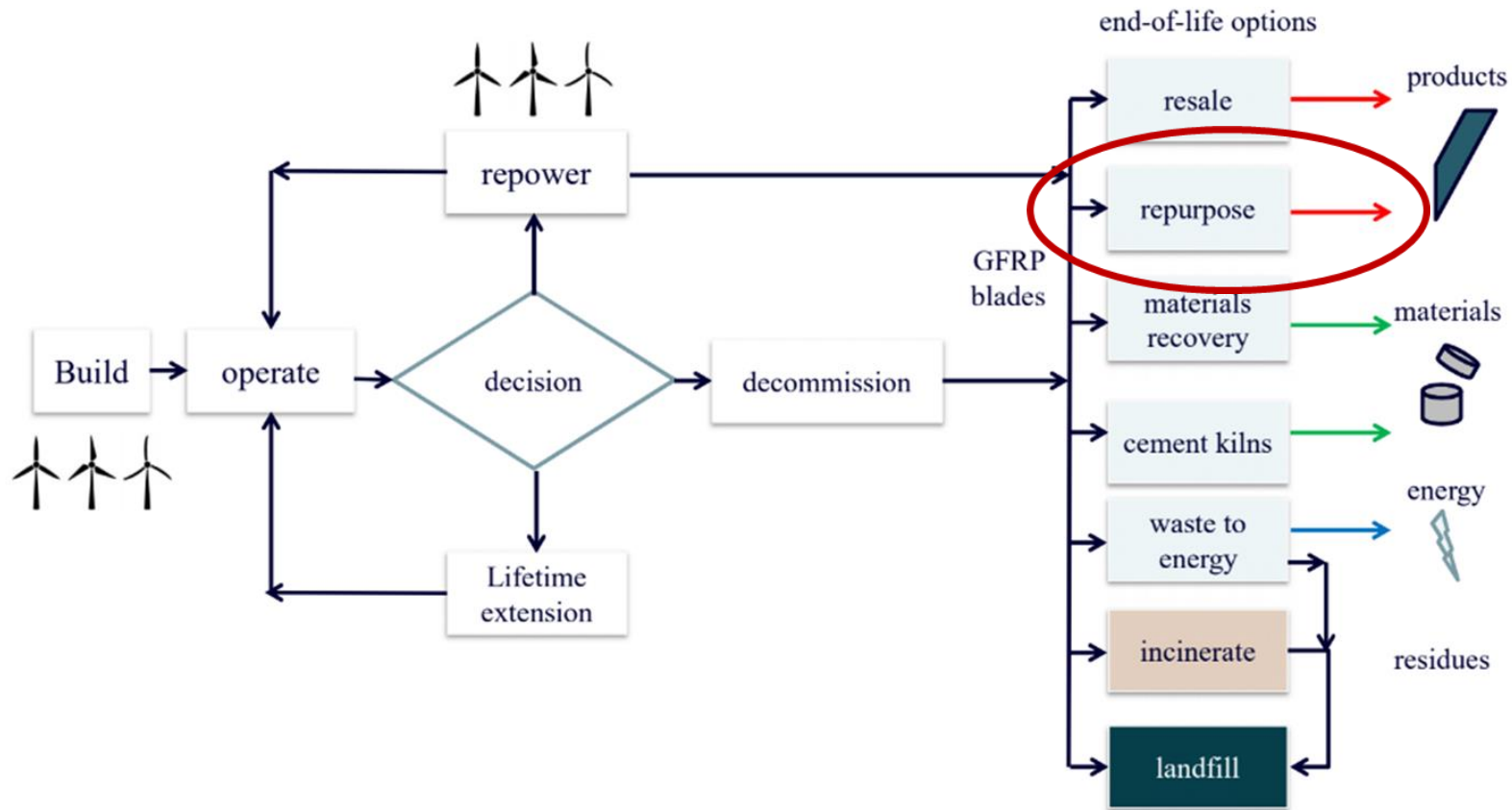


# Re-Wind Research Objective

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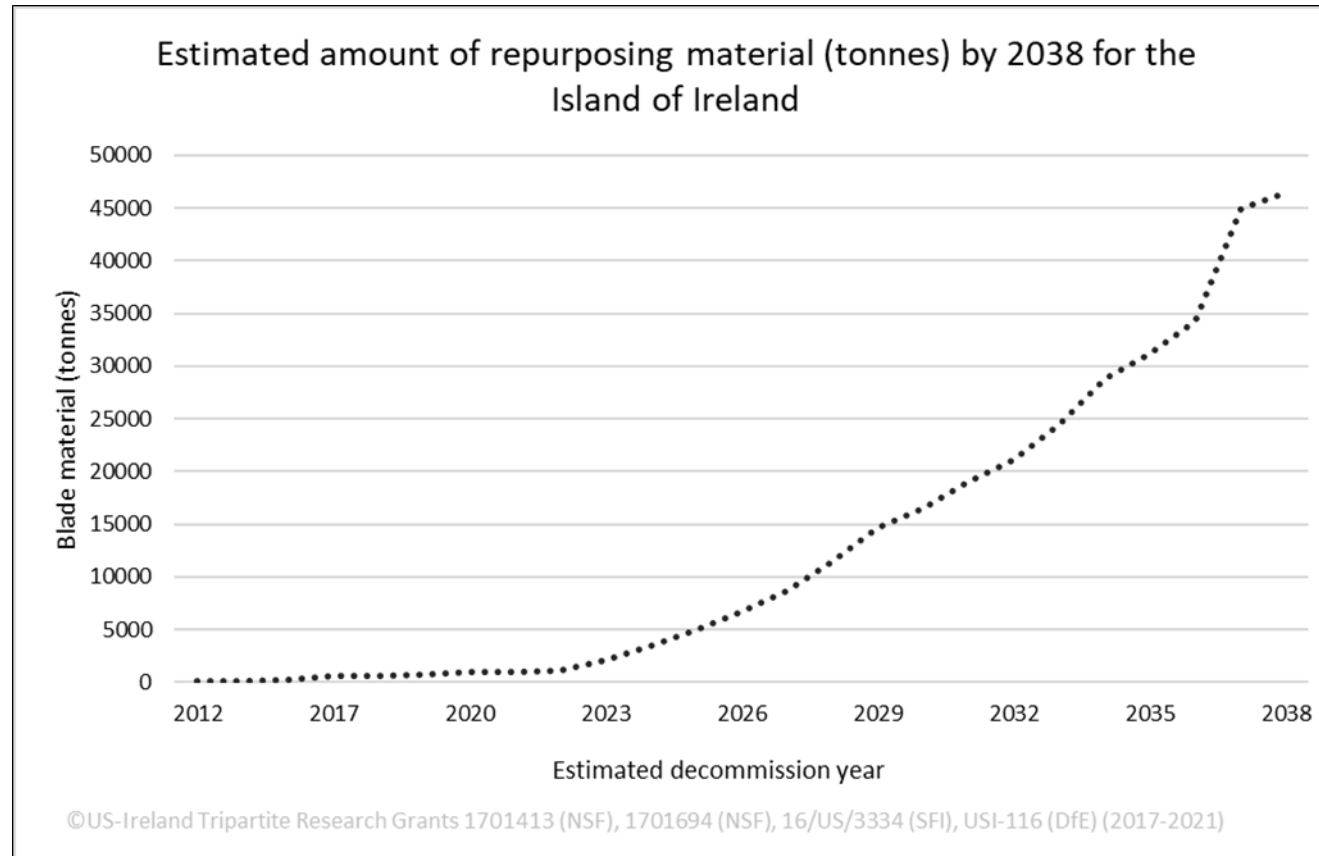
To compare sustainable end-of-life (EOL) repurposing and recycling strategies for composite material wind turbine blades using a **Geographic Information Science (GIS)** platform coupled with environmental, economic and social **Life-Cycle Assessments (LCA)**.

# Wind Farm Lifecycle



**Re-Wind  
Project**

# Waste or Material Resource?



Approx. **45,000+**  
tonnes of blade  
material in Ireland



## What happens to all the old wind turbines?

By Padraig Belton  
Technology of Business reporter

7 February 2020

f [social icons] Share



Welcome to the wind turbine graveyard. It stretches a hundred metres from a bend in the North Platte River in Casper, Wyoming.

# Recent News

Recent BBC article publicly highlighting the issue associated with the decommission stage of wind turbines [2].



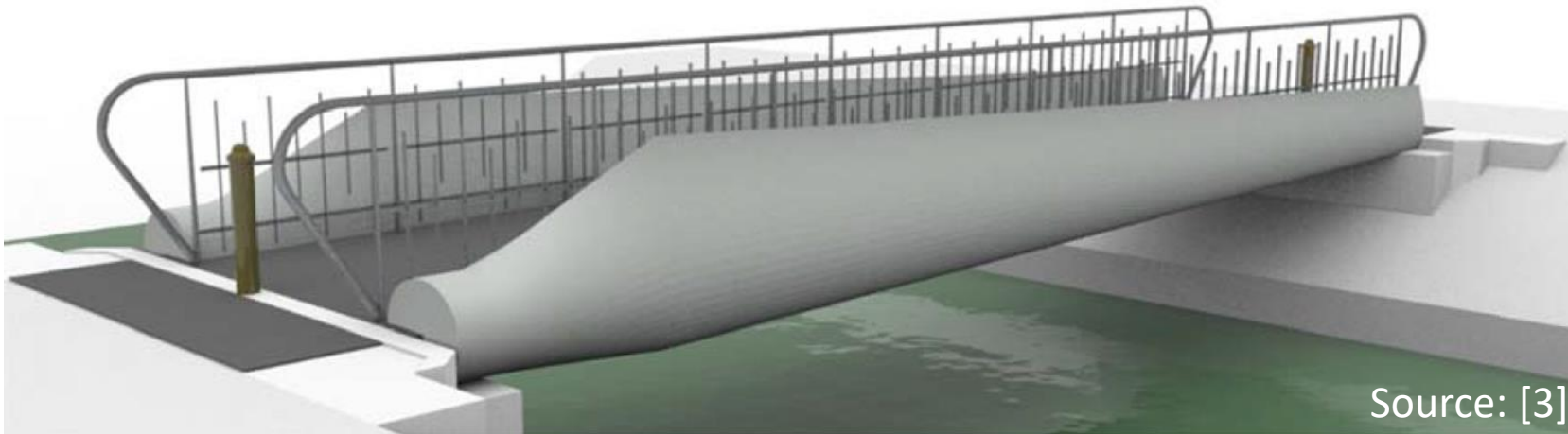
What are the possible repurposing scenarios for decommissioned blades?

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# Pedestrian Bridge

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- A29 Blades (14.3m)
- 8.5 m footbridge

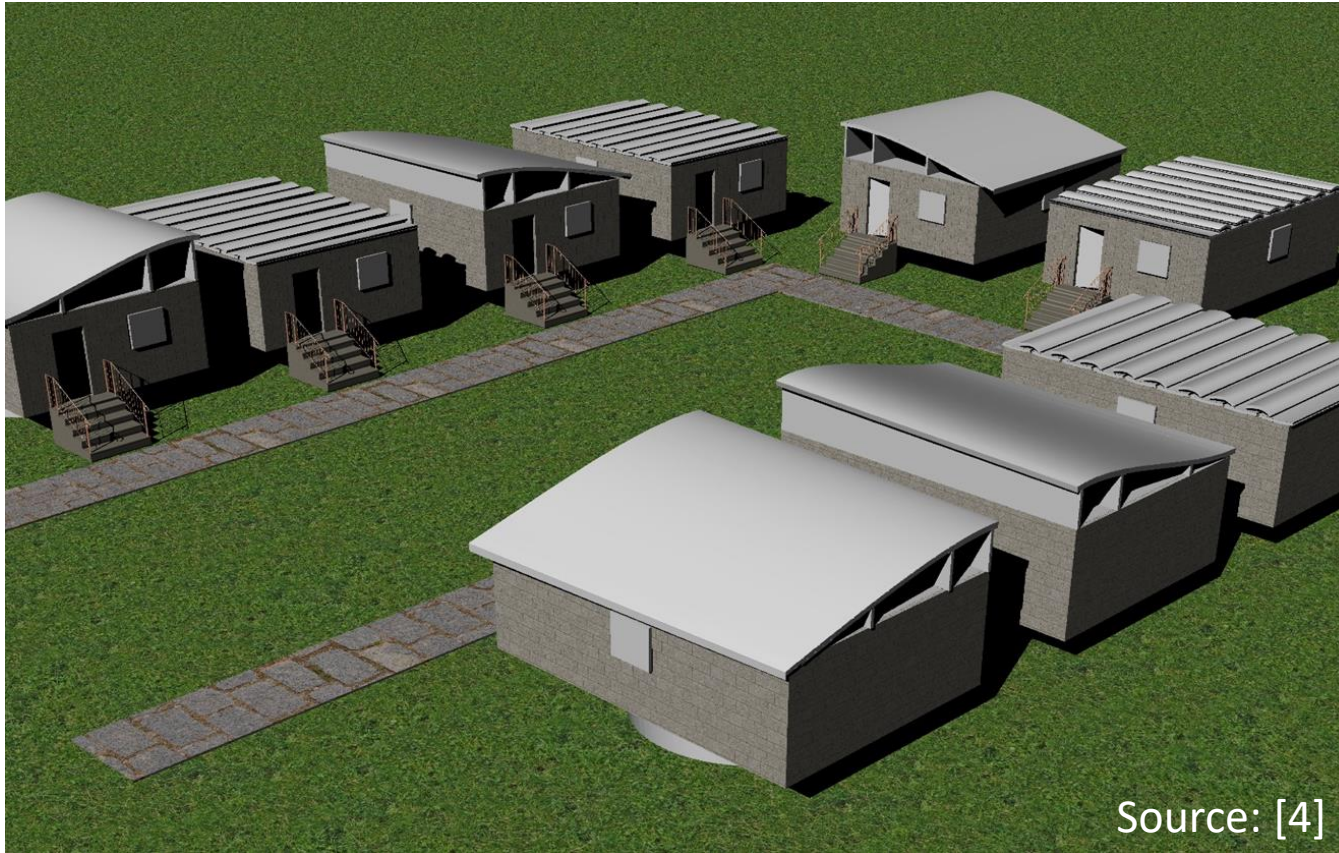


Suha'il et al. (2019)

Source: [3]

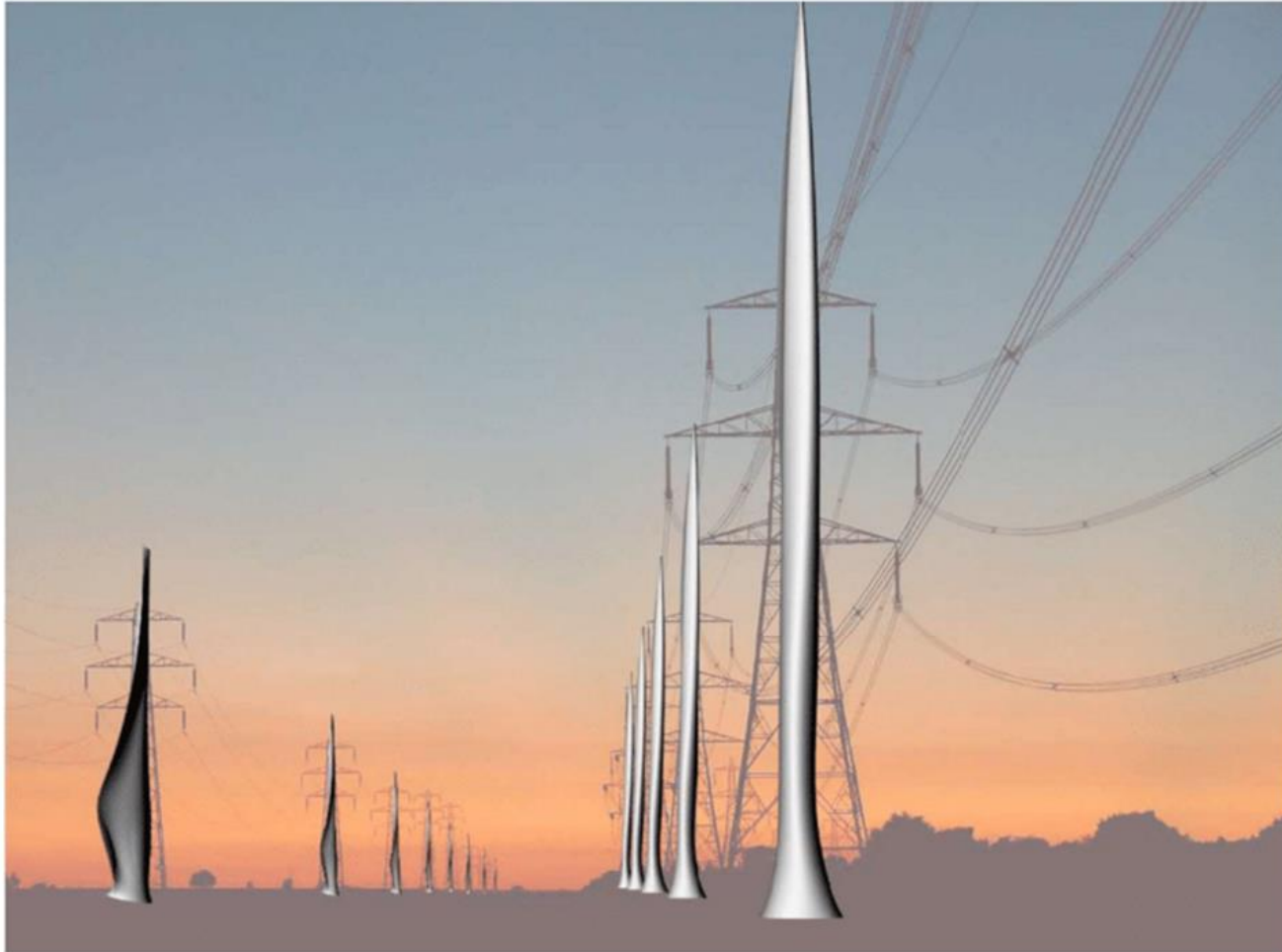
# Affordable / emergency housing

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- 100m Blade
- SNL-100-01

Source: [4]



# Powerline structures

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©US-Ireland Tripartite Research Grants 1701413 (NSF), 1701694 (NSF), 16/US/3334 (SFI), USI-116 (DfE) (2017-2021)

What are the benefits of integrating wind farm data into a Geographical Information Systems based framework?

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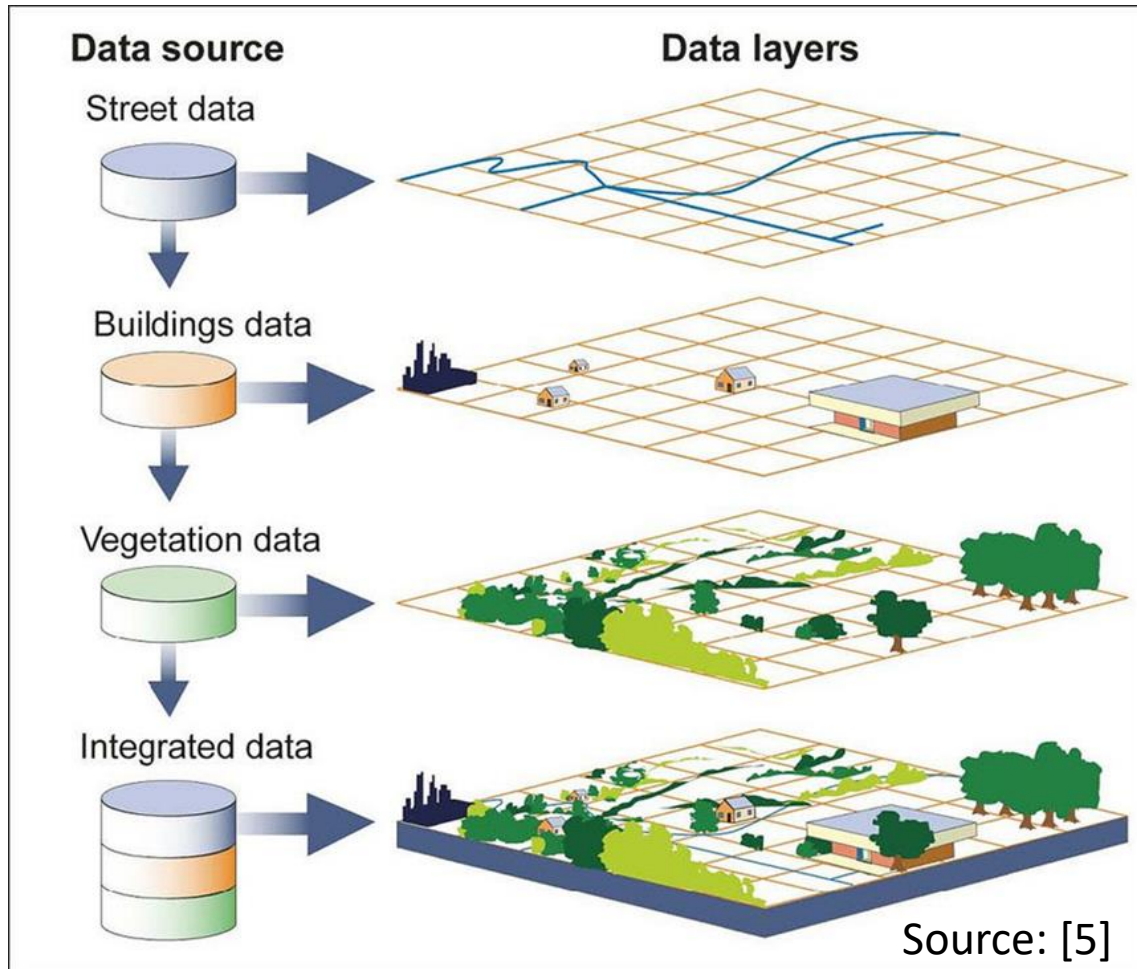


# What is GIS?

- GIS is a framework used to collect, manage, store, map and analyse geographic data
- GIS links the geographic data (spatial data) with descriptive information (attribute data)

Spatial data: **Where** things are

Attribute data: **What** things are



# Wind farm database

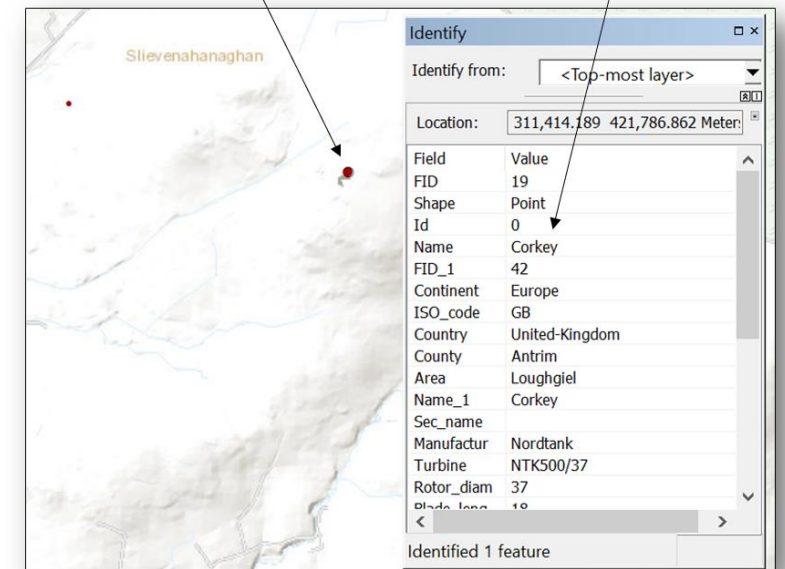
- Official mapping agencies have labelled farms however, do not contain any information about turbine details
- Cross border case study makes it more difficult to get data for both NI and ROI
- Wind farm database was purchased and data were cross compared, gathered and modified to create an up-to-date database

## Spatial data

Point data representing a wind farm location

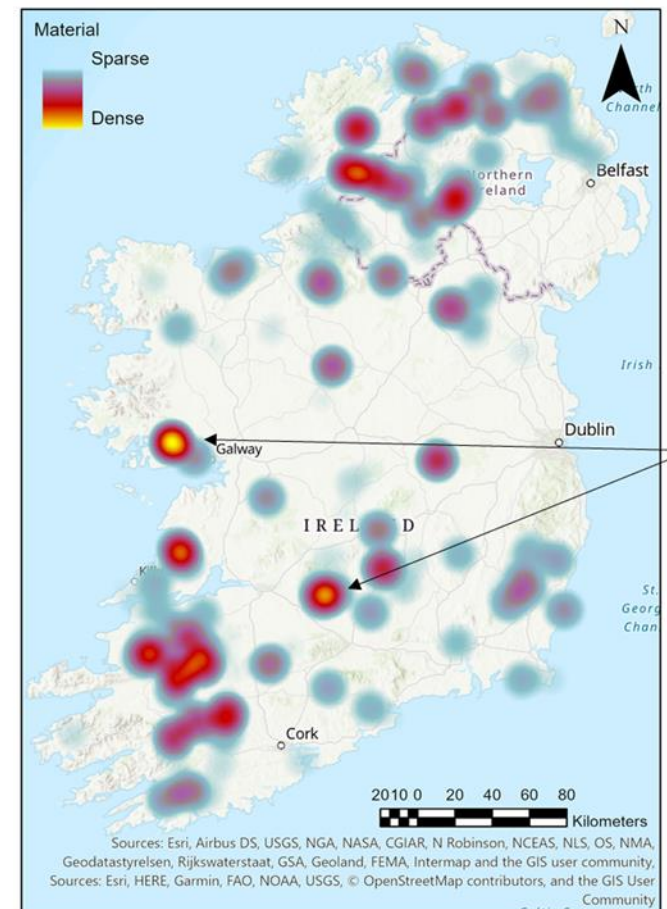
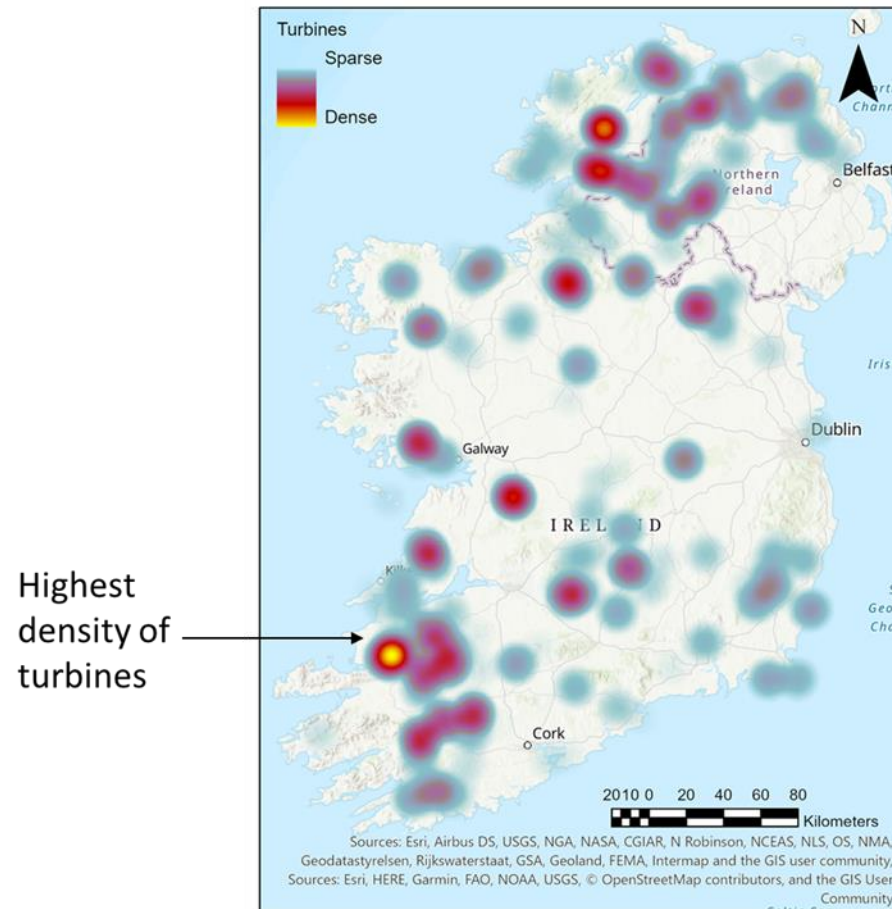
## Attribute data

Gives the information about the wind farm





# Material Locations



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## Number of turbines

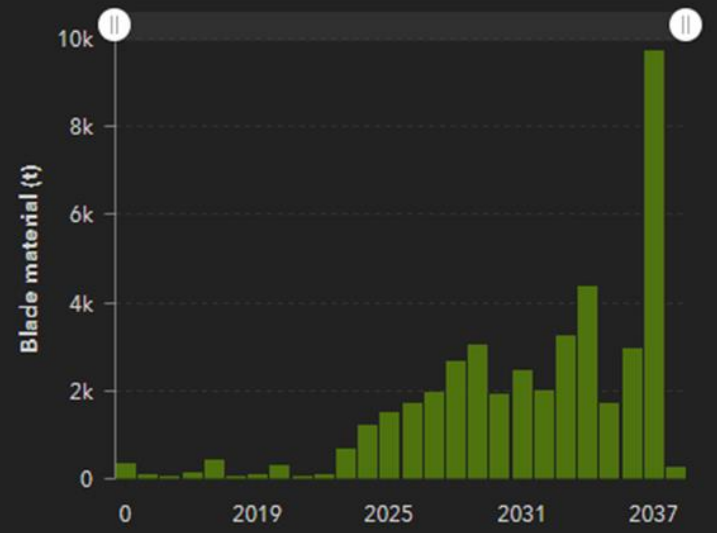


Last update: 2 minutes ago

Reuse material  
**42,812.91**  
 Tonnes

Last update: 2 minutes ago

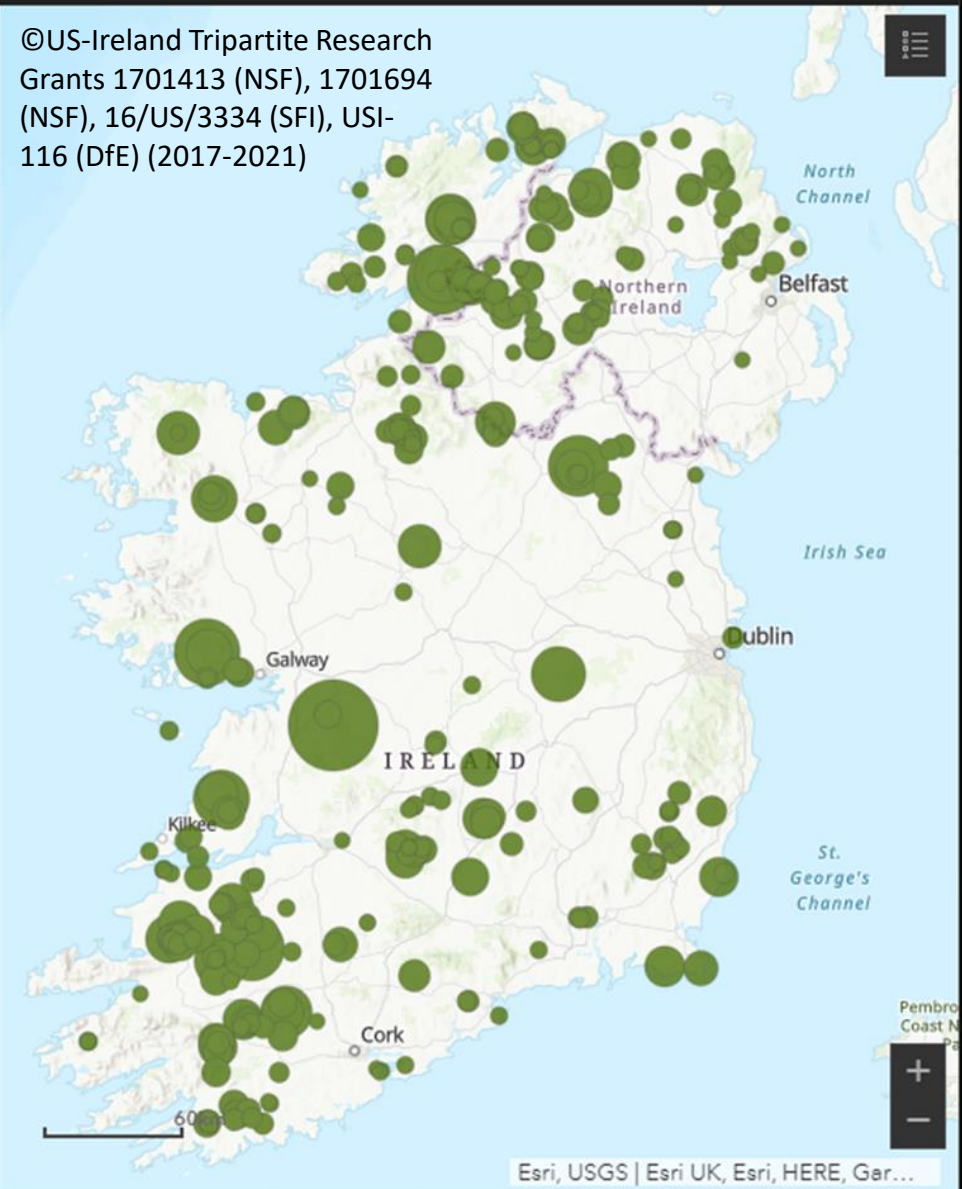
## Predicted material from wind turbines from 2012-2038



Last update: 2 minutes ago

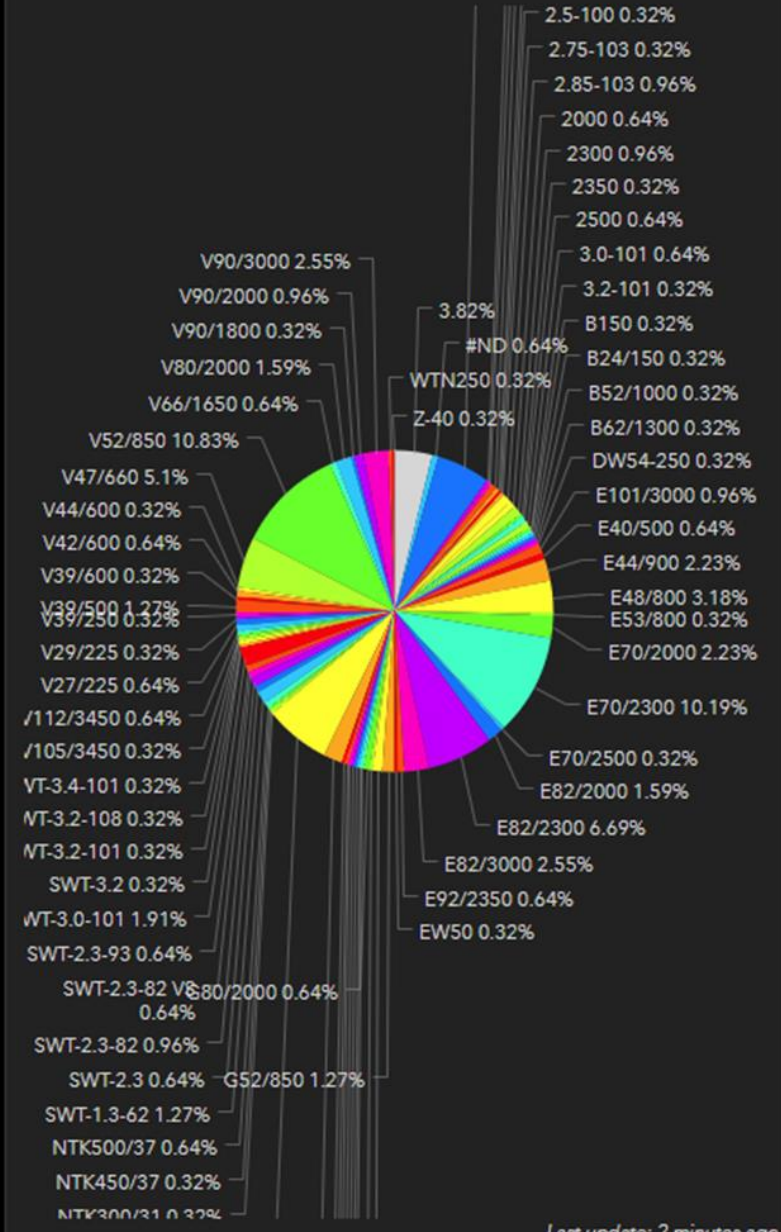
## Location of wind farms

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 (NSF), 16/US/3334 (SFI), USI-  
 116 (DfE) (2017-2021)



Esri, USGS | Esri UK, Esri, HERE, Gar...

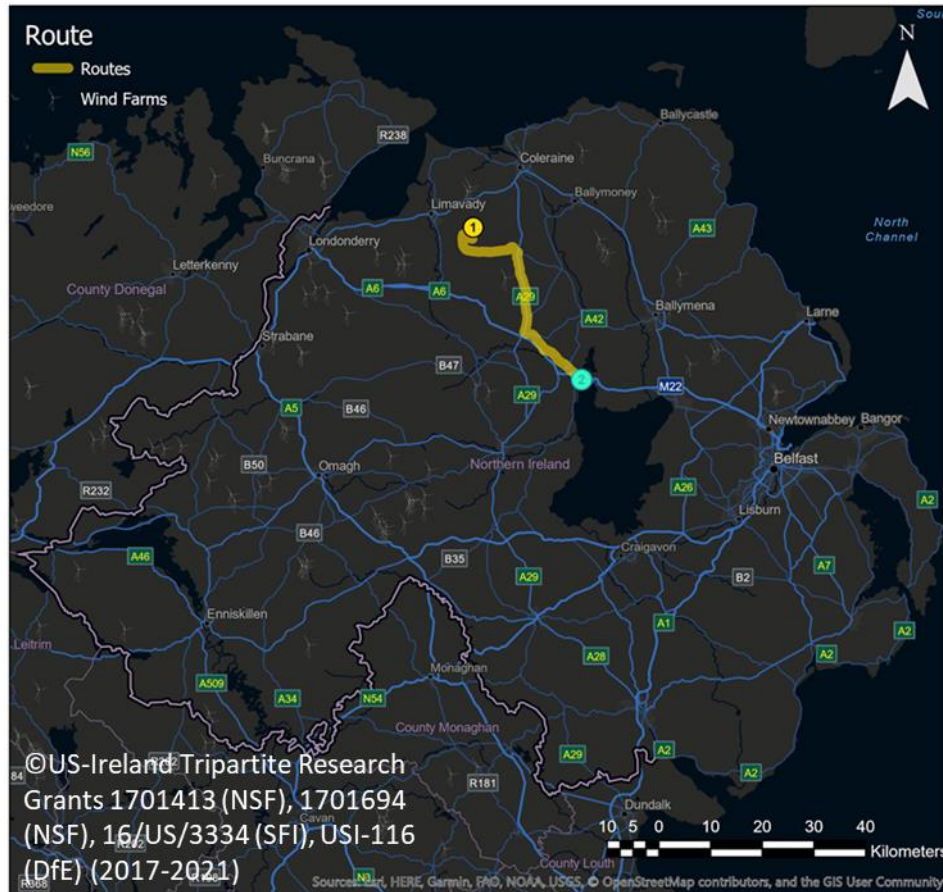
## Turbine details



Last update: 2 minutes ago



# Network Analysis



- Network Analysis is used to solve complex routing problems
- The aim is to find an optimised route associated with the least 'cost'
- Decommission stage involves the removal and transport of blades from the wind farm site to the repurposing site



# Current scenario: pedestrian bridges for greenways

- Many greenways in Ireland are **disused railway** lines- fitting in with the ethos of a reuse scenario
- A lot of spanned roads where removed and need to be replaced providing an ideal ecosystem for the reuse of blades
- Development of greenways means demand for more bridges – “Blade Bridges”





Source: [7]

# What is a greenway?

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- A greenway is a traffic-free active travel pathway used for commuting, recreation or leisure [6]

# Demand for pedestrian bridges: Greenway scenario

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# Case study: Connswater Community Greenway, Belfast City

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- Connswater Greenway had a total of 12 new pedestrian bridges constructed [8]
- Provides example for demand for small pedestrian bridges



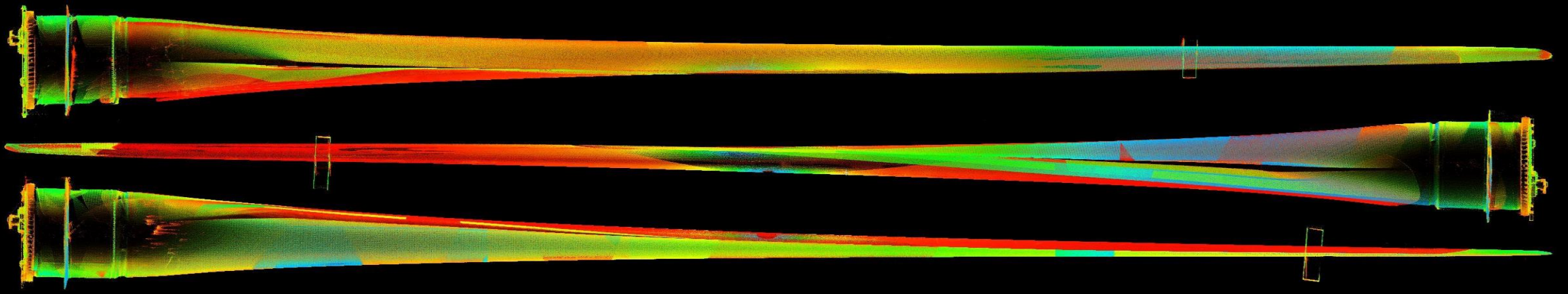


How will 3D laser scans (Digital Twin) inform blade reusability and what questions does this raise over data ownership?

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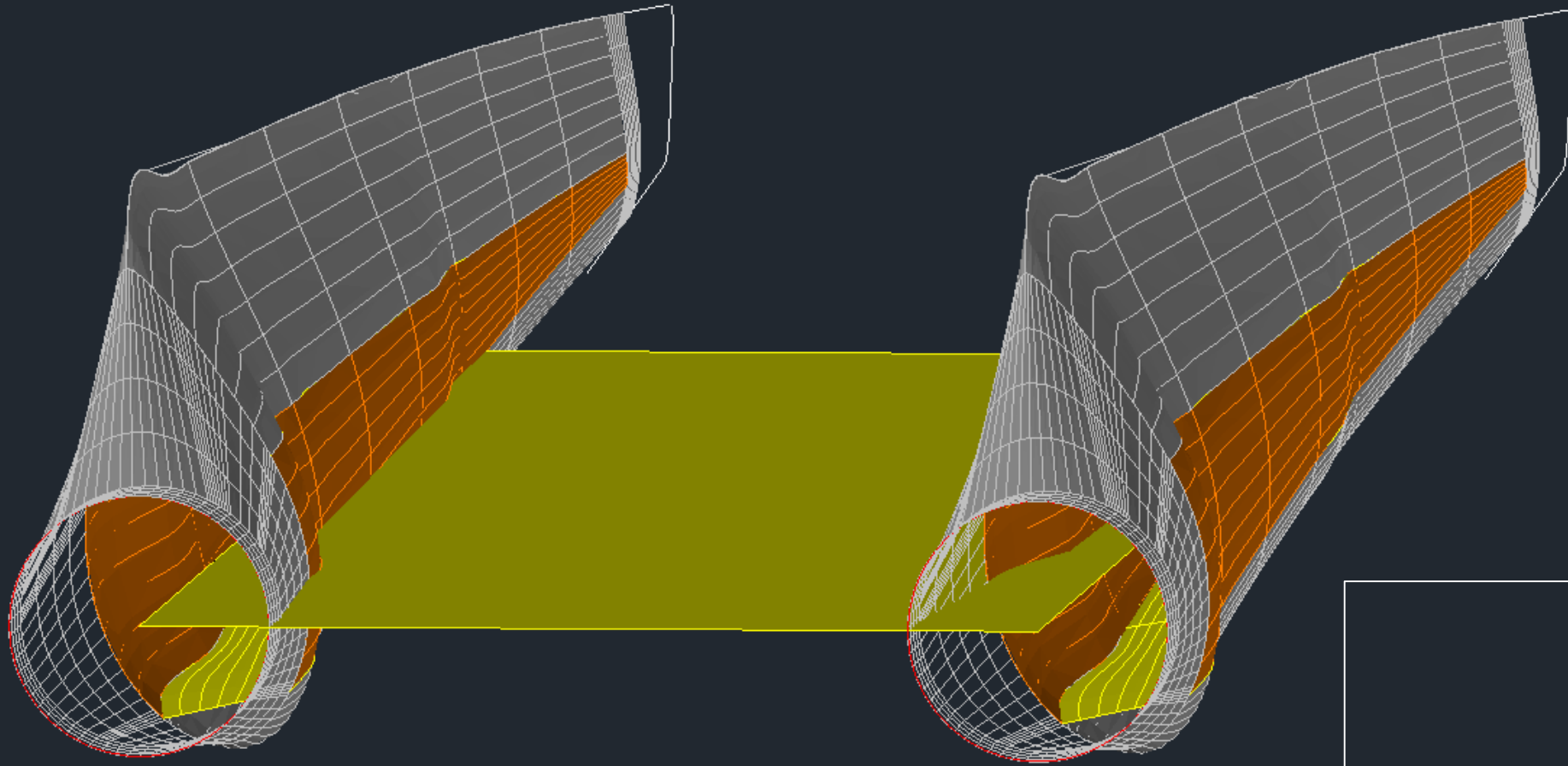
## 3D laser scanning of sample blades – Constructing a ‘Digital Twin’



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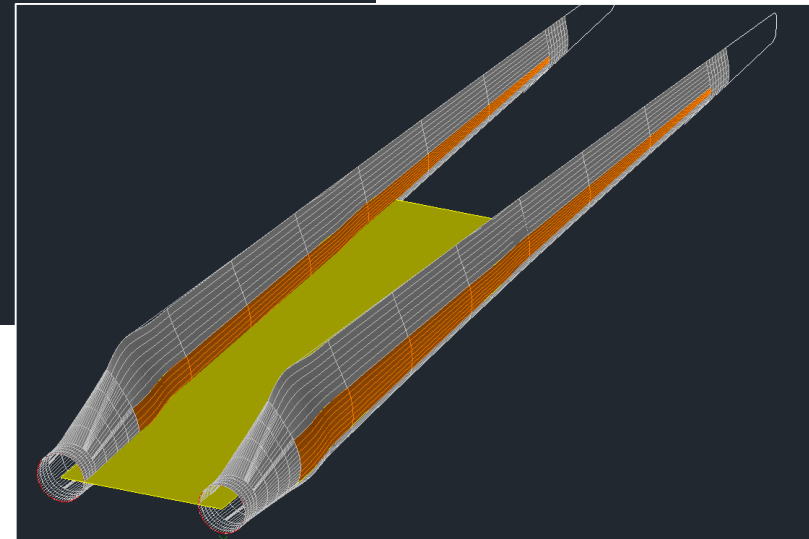
**Constructing a 'Digital Twin' Metric Scan data (visible surface geometry only)**

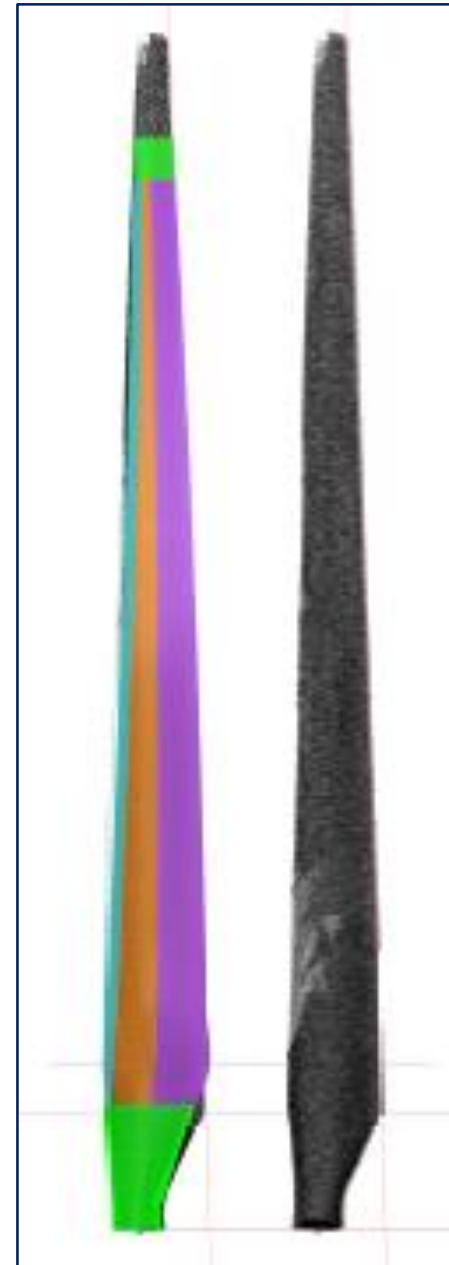
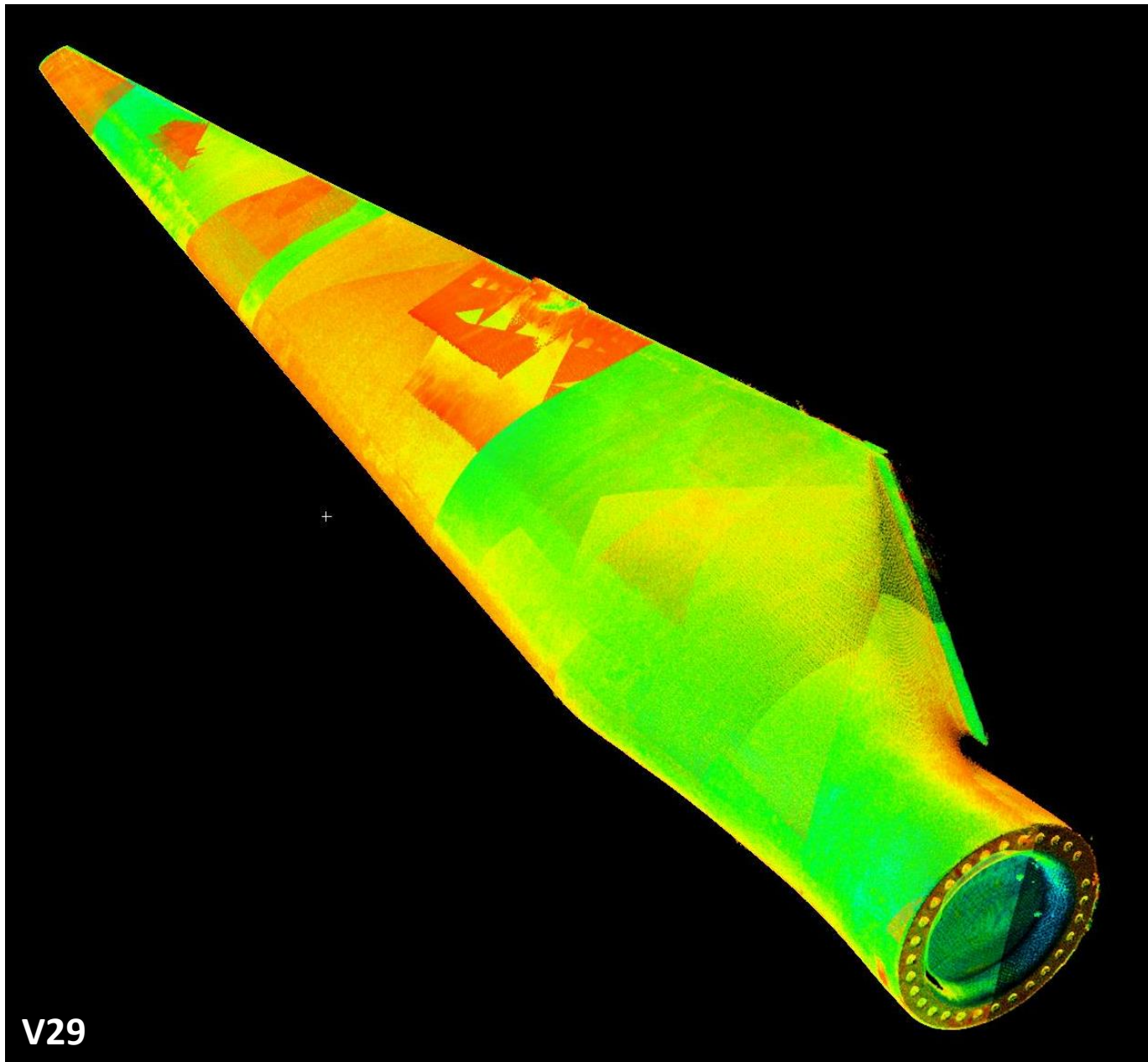




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## Generating high fidelity CAD and FEM models Models built from Vestas reports





3D Laser scans of blades and comparison with available parametric models.

Model v Reality?

Some deviation!

Accurate models may be needed to streamline repurposing. (FME, Design, Planning Visualisations..)

Digital Twin Ecosystem needed?

Free? Licensed? IP?



Appearance

Point budget: 4,000,000  
Field of view: 60

Eye-Dome-Lighting  
 Enable  
Radius: 1.4  
Strength: 0.4

Background  
Skybox Gradient Black White None

Other  
Splat Quality  
Standard High Quality  
Min node size: 30  
 Box  
 Lock view

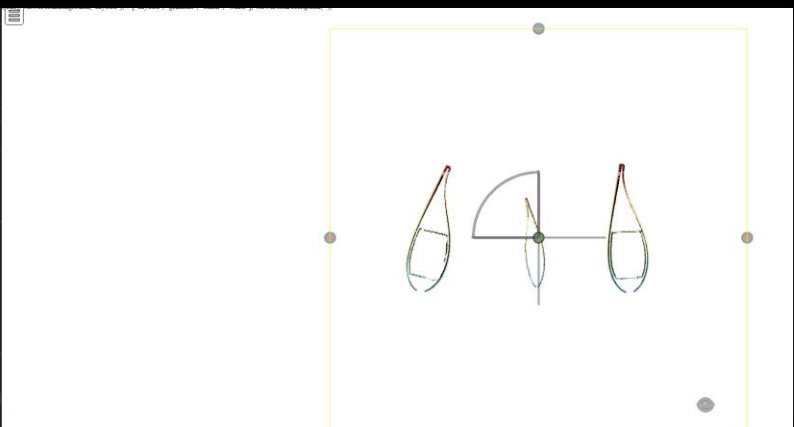
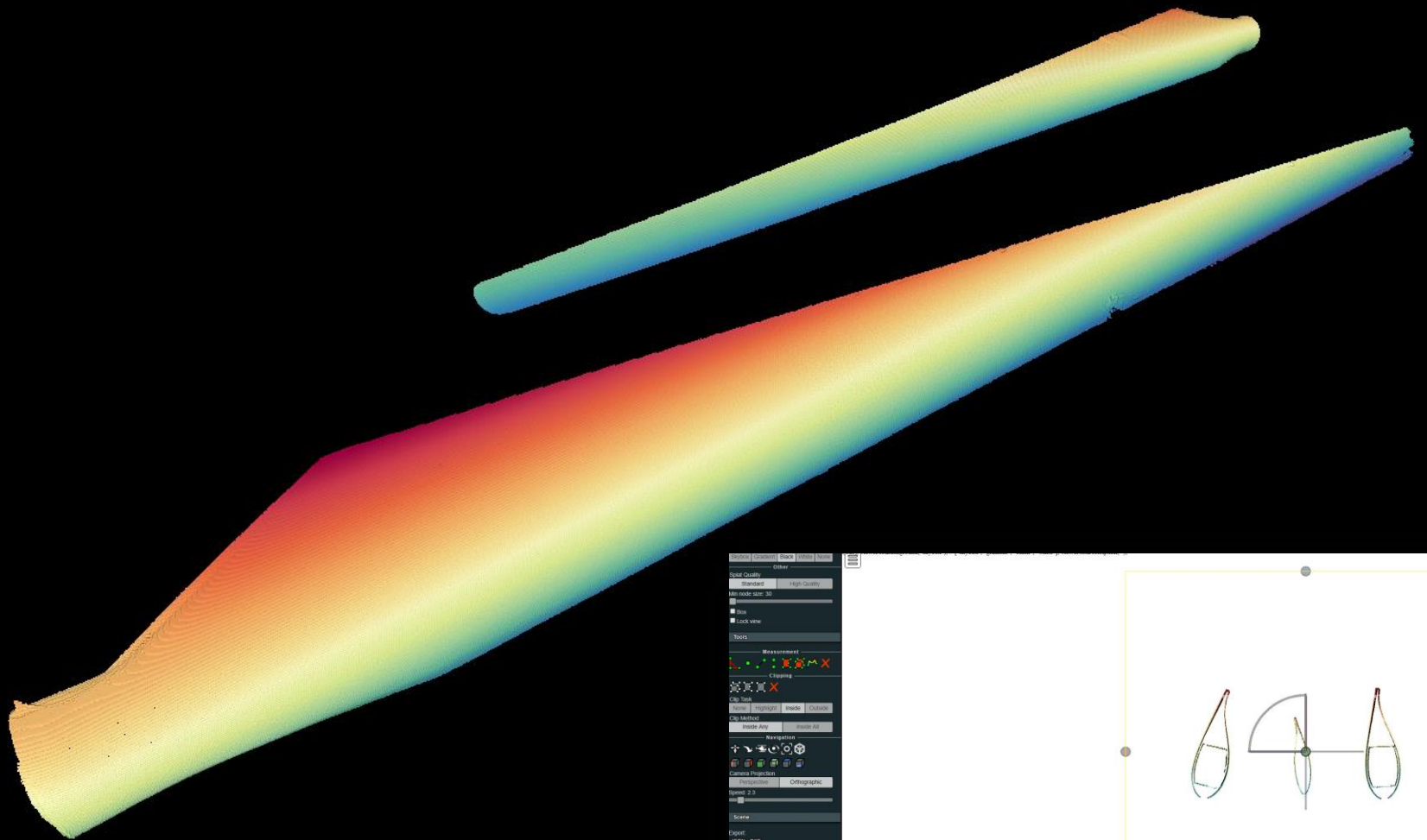
Tools

Measurement

Clipping

Clip Task  
None Highlight Inside Outside  
Clip Method  
Inside Any Inside All

Navigation  
  
Camera Projection  
Perspective Orthographic  
Speed: 4.4



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# Digital Twin OpenSource 3d Viewer – Connected to GIS database?

Thank you!  
Any Questions?

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[re-wind.info](http://re-wind.info)



# Contact Details

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Emma Delaney: edelaney05@qub.ac.uk

Conor Graham: conor.graham@qub.ac.uk

Re-Wind Website: [www.re-wind.info/](http://www.re-wind.info/)



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University College Cork, Ireland  
Coláiste na hOllscoile Corcaigh

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