



SusWIND Annual Review

November 2023

Executive Summary

SusWIND is a collaborative innovation programme focused on creating a viable circular economy for wind turbine blades. To enable this future state, SusWIND and its partners are developing methods and tools for assessment and scenario planning for three key facets of a future industry: Reclaim, Adopt and Develop.

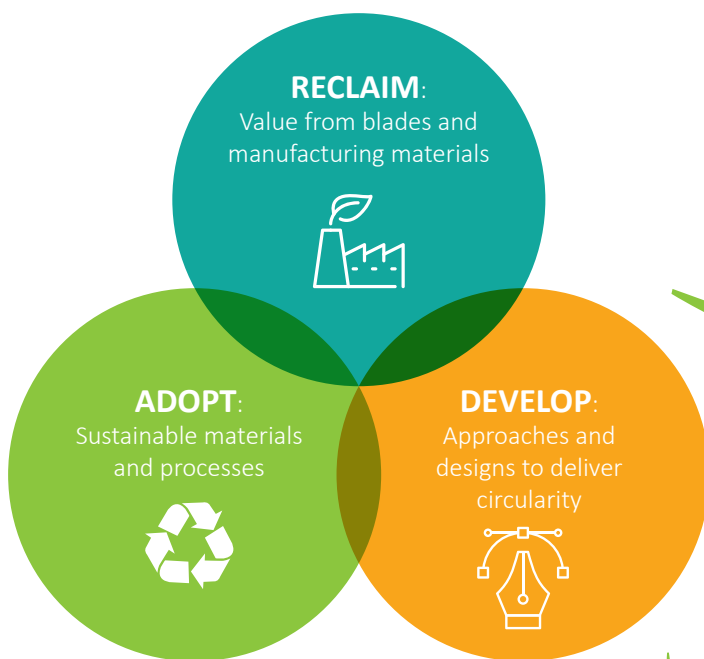


Figure 1 The SusWIND approach; three interdependent areas of focus to solve the challenges of end-of-life wind turbine blades.

- Demonstrating the technologies and required supply chain to reclaim the value from in service blades and manufacturing facilities using the lowest impact routes.
- Driving the adoption of more sustainable materials and processes for the next generation of products.
- Developing innovative new design approaches based on circular economy principles.

To help ensure these insights are given voice and converted into action, the programme has built a consortium of likeminded businesses from across the industry. SusWIND

partners are collaborating in order to inform and evidence the investment cases and requests for policy and regulation needed to enable the creation and scaling of circular supply chains for turbine blades and composite materials.

Launched in 2021, SusWIND members EDF Renewables, Net Zero Technology Centre, SSE Renewables, Shell and Vestas have been joined this year by Total Energies, Owens Corning, bp and Scottish Power Renewables to form a membership core. This group is supported by programme-partners BVG Associates, Crown Estate, Crown Estate Scotland, Renewables UK, Zero Waste Scotland to form a collaborative and industry leading group.

A year of insights

The successful second year of the SusWIND programme created industry leading evidence that enables the bold decision making needed to deliver industrial transformation by:

Signposting a route to industrial circularity

- Identifying mechanical recycling as the most beneficial and viable route forward in the UK for today's fleet of glass fibre turbine blades.
- Evidencing the necessity of separate reclamation routes for carbon and glass fibre composites from wind turbine blades to create the most economic and environmental benefits.
- Identifying that the current low-TRL technologies show very limited promise in delivering a viable route to reclaiming value from Glass Fiber Reinforced Polymer (GFRP) but are promising for Carbon Fiber-Reinforced Plastic (CFRP) from technical, environmental, and economic perspectives.

Focusing the innovation agenda

- Prioritising reduced impact of carbon fibre manufacturing for future blade procurements and exploring strategies to reduce carbon fibre utilisation offer greatest potential gains.
- Maintain focus on developing resin chemistries whose reclamation processes are significantly less energy intensive than any known solution to date. This would target the 2nd largest value resource in modern blades.
- Innovate to increase resource efficiency for virgin glass fibre whilst also preventing excess environmental impact from the current crop of reclamation processes.



Ambition into actions

The next 12 months aims to convert insights into actions for policy makers, industry partners and the R&D community to move the industry forward. Based on the successful collaboration to date, the SusWIND partners recommend that industry and Government should:

Create enabling conditions for success

- The wind industry needs to increase transparency between OEMs and owner-operators to enable educated procurement decisions that will reduce through-life environmental impact.
- Carbon fibre should be sourced from production facilities in locations with a low carbon energy grid mix. This single intervention could reduce Global Warming Potential (GWP) by up to 27% with minimal technical risk.
- Supply chain needs to develop services to separate and process blade materials in accordance with their value to maximise environmental and economic benefits at end-of-life.
 - Low impact recycling for low value materials – mechanical recycling of glass fibre composites.
 - High impact recycling for high value materials – where present, carbon fibre composites should be recycled via processes that allow the reclamation of high-quality fibres and resin fractions.
- Supply chain demonstration is required as a priority to focus development efforts based on documented technological, environmental and economic performance as well as current legislative barriers.
- Development of low-TRL technologies for glass fibre recycling should prioritise efforts to reclaim value from the non-fibre constituents, particularly the resin fractions. Any investments should be assessed using the principles as presented in the SusWIND programme to ensure that the most suitable technologies are developed for composites recycling.
- Manufacturers should aim to implement robust sorting of unavoidable waste while exploring less-impactful consumables. These are critical actions to meet their zero waste goals and enable local supply chains to form around their requirements.
- Provide demand signal to future supply chains for mechanically recycled blade materials to increase investability of potential EoL solutions and incentivise supply chain action.



In the coming year SusWIND will develop the guidance and evidence it provides to guide stakeholders and give confidence to decision makers via:

Demonstration of reclaiming material value today

- **Demonstration of viable solutions** for the repurposing and recycling for end-of-life blades and manufacturing waste that have an end-to-end supply chain in the UK today.
- **Evidence to form the case for investment** to make mechanical recycling of GFRP commercially viable and seed a new UK industrial capability (as per example shown in Figure 2).
- **Facilitated opportunities to work with other industrial sectors** to scale-up demand for GFRP recycling. This will help reach commercially viable volumes and make mechanical recyclate cost competitive with virgin materials far sooner than current projection of 2035.

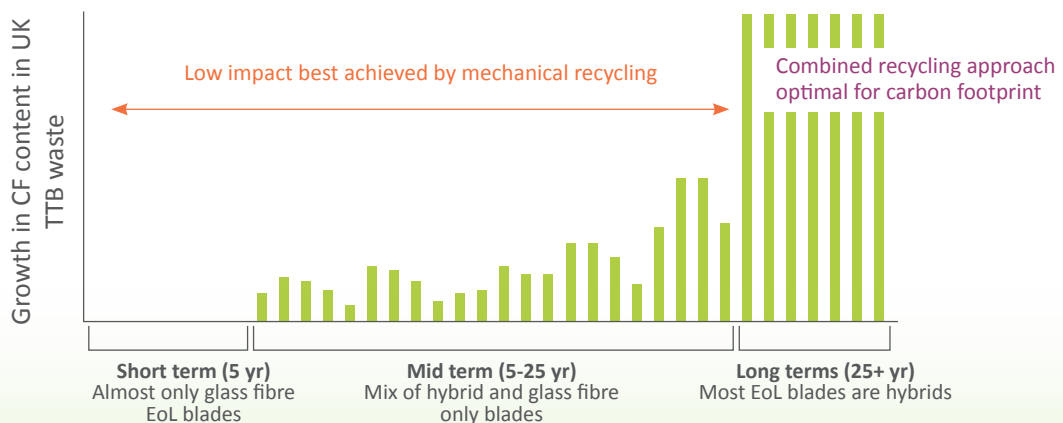


Figure 2 Example industrial scenario for wind turbine reclamation industry based on current understanding.



SusWIND Programme

Composite materials are a key enabler for the success of wind energy and the role that it will play in delivering a low carbon global economy. SusWIND is bringing together stakeholders across the composites industry and wind energy sector to look at every aspect of the wind turbine product lifecycle to achieve a sustainable future.

Our Partners and Supporters

Offshore Renewable Energy Catapult - Delivery partner

Vestas

SSE Renewables

EDF Renewables

Shell

Net Zero Technology Centre

Total Energies

Owens Corning

bp

Scottish Power Renewables

The Crown Estate

Crown Estate Scotland

RenewableUK

BVG Associates

Zero Waste Scotland

Contact us

Contact us to discuss the programme in more detail and how you can get involved in this exciting initiative. We look forward to working with you to drive the successful outcomes we need to deliver the sustainable future we are all committed to achieving.

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