



**Sustainable
Composites**

A PARTNERSHIP BETWEEN THE NCC AND CPI



SusWIND

Accelerating Sustainable Composite Materials
and Technology for Wind Turbine Blades

Delivered in partnership with the Offshore Renewable Energy Catapult
and supported by The Crown Estate, RenewableUK and OGTC

A stylized graphic of a wind turbine with three blades. The blades are light blue and white, set against a dark grey background. Two light blue clouds are positioned in the upper right. A large green triangle is in the bottom right corner, partially overlapping the turbine's hub.

The National Composites Centre (NCC) has launched **SusWIND** – an initiative to accelerate the development of technology, processes and materials that address the recyclability and future development of composite wind turbine blades.

The programme is helping to drive the future sustainability of wind turbine technology for the benefit of the sector and the global community. We are bringing together leading stakeholders in the composites industry and energy sector to solve the following sustainability challenges:

- **RECYCLE: Demonstrating viable technologies for recycling the existing stock of wind turbine blades**, many of which are reaching the end of their life, and then using the waste materials to develop secondary applications such as composite parts in electric vehicles, bridges and even in thermal insulation.
- **SUSTAIN: Driving the use of more sustainable materials**, such as bio-derived feedstock or thermoplastics in developing composites for turbine blades, rather than from unsustainable sources or with limited potential for economic recyclability.
- **DESIGN: Developing innovative new approaches** based on design for disassembly, utilising sustainable materials and with end of life strategies in mind, therefore future-proofing the next generation of wind turbine blades.

This project is part of **Sustainable Composites** – a national initiative led by the NCC and CPI to develop the next generation of sustainable composite materials, bringing together the UK's composites expertise to quickly turn research breakthroughs into industrial applications. As pioneers in the development of new end-of-life strategies for composites, the UK is well-placed to capitalise on this growing circa. £2 billion global market for recycling.

Where we are now

Wind energy is one of the fastest growing sources of renewable energy with predicted global capacity expected to reach approximately 5,000GW¹ for onshore and 1,400GW² of offshore capacity by 2050.

The UK has the largest offshore wind capacity in the world^{3,4}, with over 14GW of total capacity (9.7GW is fully operational and 4.4GW is under construction). We're on track to exceed 40GW in the pipeline by 2030 – that's enough to power all homes across the country. The UK's current onshore capacity is almost 11GW. This world-leading position for the UK will continue well into the future and drive our commitment to net zero by 2050. Ambitious leasing rounds are planned for the UK by The Crown Estate. Together with the UK Government and the wind energy sector, The Crown Estate has driven the UK's offshore wind capacity from a standing start in 2000 to meeting 10% of the UK's electricity demand by the end of 2020. However, sustainability and technology transcend borders and sectors. The outcomes of this initiative are designed to support the global challenge for both onshore and offshore wind, reflecting the global footprint of many of the leading organisations in the industry.

Technology in turbine blade design and manufacture has advanced rapidly over the last 40 years and the industry is already at the forefront of driving to a net zero carbon future. Utilising composites has made wind turbine blades lighter and stronger, enabling the current generation of blades to now exceed 100m in length which drives the turbine efficiency up and the costs of energy production down. A typical wind turbine takes between 6-9 months of operation to generate as much energy as it consumes in its entire lifecycle AND is able to pay-back the carbon released in its lifecycle within a similar timeframe⁵.

Composites therefore inherently contribute to sustainability for wind energy during the manufacture and operational phases of a turbine, but more needs to be done with regards to their recyclability at the end of their life. Today, approximately 2.5 million tonnes of composite materials are in use in the wind sector globally⁶ and it is expected that around 14,000 wind turbines, or almost 50,000 tonnes of composite blades, will require decommissioning and disposing of by 2023. Whilst the benefits of the carbon offset by turbine blades currently outweigh the end-of-life dilemma, it is apparent to engineers, economists and environmentalists alike that we need to find a more sustainable way forward. We must commit to transforming the current linear blade product lifecycle into an increasing circular process. Investing now in the future of blade sustainability will unlock the use of recycled composites for the next generation of sustainable transportation and infrastructure.



¹ https://www.irena.org/-/media/Files/IRENA/Agency/Publication/2019/Oct/IRENA_Future_of_wind_2019.pdf

² <https://gwec.net/oreac-1400-gw-of-offshore-wind-is-possible-by-2050-and-will-be-key-for-green-recovery>

³ <https://gwec.net/global-figures/global-offshore/>

⁴ <https://www.renewableuk.com/news/405601/RenewableUK-releases-new-global-offshore-wind-market-rankings.htm>

⁵ <https://www.newscientist.com/lastword/mg24332461-400-what-is-the-carbon-payback-period-for-a-wind-turbine/>

⁶ <https://windeurope.org/policy/topics/sustainability/>

Where **SusWIND** can take us



It is essential that as an industry, we look at every aspect of the wind turbine product lifecycle to achieve a sustainable future.

The vast majority of the existing components and materials that are used in wind farms are recoverable and recyclable. However, the turbine blades are one of the missing pieces that would enable the industry to achieve a truly zero waste outcome. This will further drive down the carbon and energy payback for the life of a composite wind turbine. We need to investigate the materials we use, how turbine blades are designed for disassembly, how the materials are recycled and how future wind farms are installed and maintained.

The possibilities are endless when we collaborate and bring together the best minds to drive innovation. 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.

We need industry support and collaboration to deliver a more sustainable future by creating a circular product lifecycle for composite materials.



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.

 suswind@nccuk.com

“Composites are a key enabler for the success of wind energy and the role that it plays in delivering a low carbon global economy. But it is apparent to engineers, economists and environmentalists alike that we need to find a more sustainable way forward. We must commit to transforming the current linear blade product lifecycle into an increasing circular process that forms part of a larger future market for low carbon, recycled composites materials. Investing now in the future of blade sustainability will help unlock the use of recycled composites for the next generation of sustainable transportation and infrastructure. We’re excited to work with key partners and the wind industry through this ambitious programme to deliver a more sustainable future.”

Richard Oldfield
Chief Executive
NCC



**THE CROWN
ESTATE**

“As managers of the seabed around England, Wales and Northern Ireland, we’re working closely with government, industry and stakeholders to help enable the sustainable, coordinated growth of UK offshore wind. We’re delighted to support this programme, which offers an opportunity to help translate the important principles of circular economy, already being considered across our real estate portfolio, to further boost the environmental sustainability of wind turbines offshore.”

Adrian Fox
Head of Offshore Assets
The Crown Estate



“We want to leave the Earth a better place than we found it. That is why our vision is to become a global leader in sustainable energy solutions and why we are to become sustainable in everything we do. We have committed ourselves to four sustainability objectives. One of these four is to produce zero-waste wind turbines by 2040 and addressing the specific challenge on recyclability of composite turbine blades is key to achieving this. We are excited to be a part of the SusWIND programme, and as founding members of the NCC we are confident that this initiative will drive technology forward to help solve this challenge that we all face.”

Lisa Ekstrand
Senior Director and Head of Sustainability
Vestas



“As we strive to achieve net zero, offshore wind capacity globally is set to grow rapidly to meet our low carbon energy needs. It’s therefore vital that we work to minimise the direct impact on our environment and look for new and innovative ways to recycle the existing fleet of wind turbines and their blades. We must also work at the same time to future-proof technology for the next generation through the use of composites or more environmentally friendly and sustainable materials. We are pleased to be working on SusWIND to solve this major industry technology challenge.”

Dr Stephen Wyatt
Research and Innovation Director
Offshore Renewable Energy Catapult



“Harnessing the abundant supplies of wind energy in and around the UK and Ireland is one of the most important contributions SSE Renewables can make in the race to net zero. The sustainable use of the world’s resources and reducing the impact of our activities on the natural environment is just as critical. That’s why SUSWind is so important to us – as well as improving the sustainability of wind turbine blades already in use, this national initiative will help deliver a next generation of blades that can be recycled at the end of their life. In doing so we can build a truly sustainable supply chain for the wind industry in every sense.”

Jim Smith
Managing Director
SSE Renewables



“Sustainability is at the heart of what drives the renewables industry. We regularly see old turbines from the UK being given a second life through re-use in other countries and we’re starting to see reprocessing of turbine blades, for example in the manufacture of concrete. SusWIND is a welcome initiative to boost sustainability, recycling and reprocessing of turbines as the industry gears up to help deliver the UK’s net zero emissions target.”

Luke Clark
Director of Strategic Communications
RenewableUK



“We are committed to delivering more and cleaner energy solutions responsibly. As part of this commitment, we are developing sustainable and low carbon design innovations such as using reused and recycled materials in our products, buildings and infrastructure that reduce the carbon intensity of our Retail operations and help drive the transition to a circular economy. Shell is a key partner with the NCC and we are excited to see the benefits that the SusWIND initiative will bring and how recycled materials from decommissioned blades might be reused, for instance to create new customer offers at retail forecourts. This is particularly important as we continue our ambition to supply clean energy for electric vehicle charging.”

Daniel Kunkel

General Manager, Global Retail Network Engineering
Shell



“The wind industry has achieved huge successes over the years in-part due to its great “can do” attitude. The sector is a huge force towards a clean energy future and wind turbines have a really low impact on the climate, compared to other forms of electricity generation. However, finding better ways to use blades at the end of their operational life is now a “must do” for the industry – through collaboration, we can make it happen.”

Bruce Valpy

Managing Director
BVG Associates

Technology
Driving
Transition



“At OGTC, our purpose is to develop and deploy technology to deliver a net zero North Sea. We work across sectors to maximise the potential of an integrated offshore energy system with a vision to reimagine the North Sea. As we transition to this new energy future, it is critical we address the full cycle sustainability of the system. The SusWIND programme looks not only at creating new sustainable materials but also at the recycling and reuse of existing materials. This will enable the emerging new integrated energy system to apply the key principles of a circular economy and ensure its long term sustainability.”

Colette Cohen OBE
Chief Executive Officer
OGTC

Sustainable Composites is a national initiative that is building a supply chain – from raw material suppliers to end-of-life recycling – with the ability to deliver the next generation of sustainable composites by 2040. Led by the National Composites Centre (NCC) and the Centre for Process Innovation (CPI) – two of the seven High Value Manufacturing Catapult centres – it brings together industry, academia and government to accelerate the UK’s progress to achieve net zero through the use of sustainable composite materials.

 www.nccuk.com/suswind

 suswind@nccuk.com

