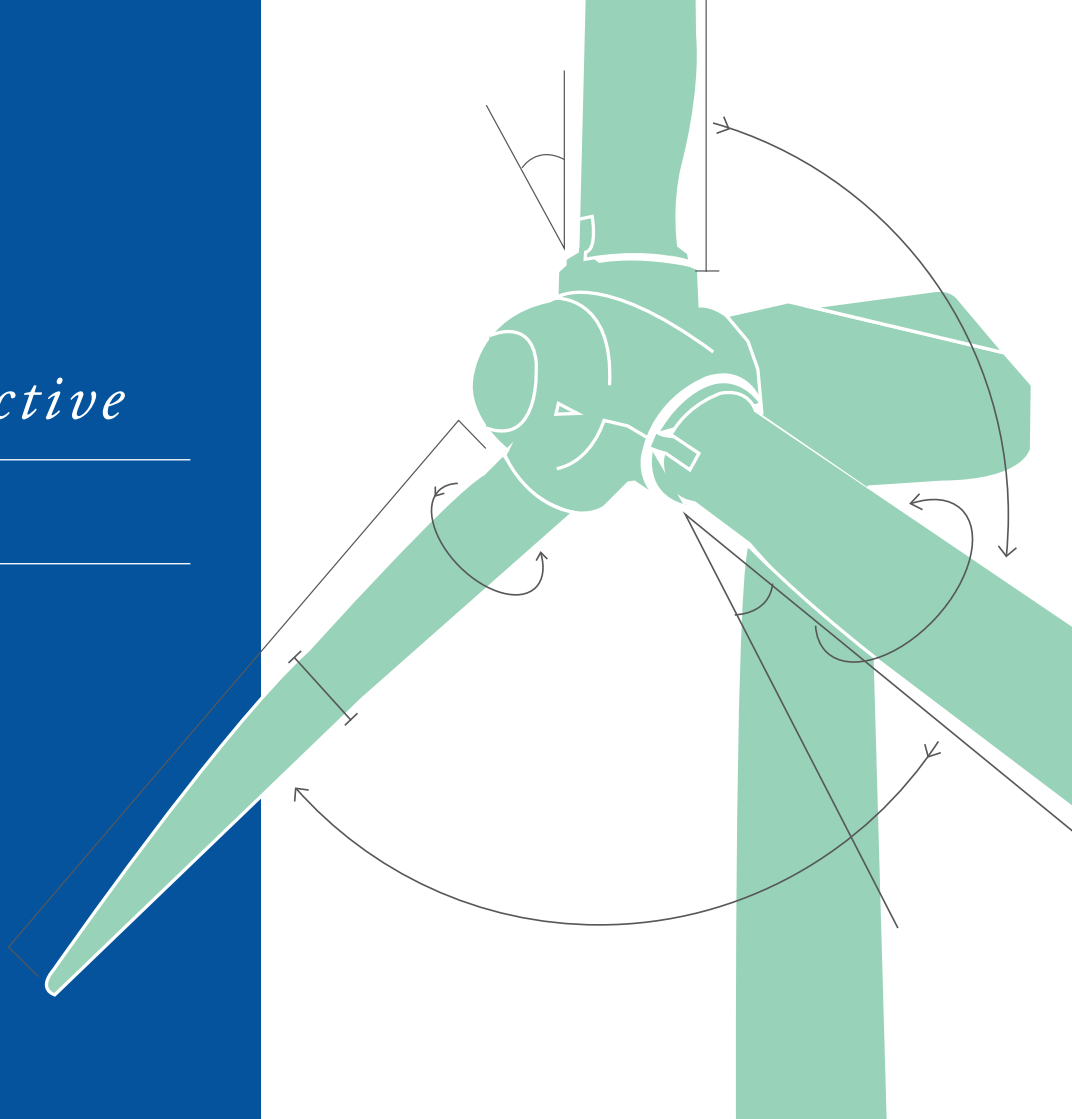
energy technologies institute

An ETI Perspective

Larger Blade Technology
An innovation case study



INTRODUCTION

The UK has the world's highest offshore wind electricity generation capacity. By 2016 it had over 4GW installed but more needs to be done to drive down the cost of offshore wind so it can compete with both current fossil fuel technologies and the lowest priced forms of low carbon energy generation. The UK Government has set a target for 2026 of £85/MWh for electricity from offshore wind. Current prices are in excess of £100/MWh.

WHAT

Recognising these challenges ETI invested in innovative development of very long blade technology with the focus on reducing both blade cost and weight for a given length – helping to increase turbine performance. The longer and lighter the blade, the more energy the turbine can generate in operation.

This was delivered though the development with Blade Dynamics of their technology platform for the manufacture of very large wind turbine blades in a new process that builds the blade not in a single piece but from a set of major sub-assemblies using lightweight carbon fibre materials. This production process reduces costs by allowing the lower cost manufacture of smaller, higher quality parts than previous manufacturing approaches with common structures in each sub-assembly, further reducing costs.

WHY

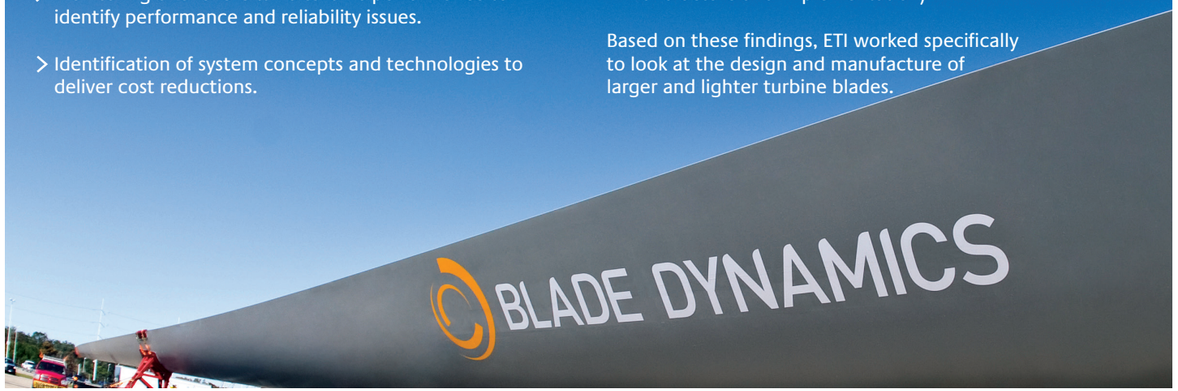
Offshore Wind is the most mature technology programme in the ETI portfolio. Research undertaken by ETI since 2008 has included a review of a number of technology options to determine how best to reduce the cost of offshore wind energy generation. This has looked at:

- Design of turbines and support structures including floating platforms.
- Large-scale indoor test facilities to aid development of next generation turbines.
- Monitoring of offshore wind turbine performance to identify performance and reliability issues.
- Identification of system concepts and technologies to deliver cost reductions.

This research identified that technology innovation to reduce offshore wind energy costs should focus on:

- Accessing higher wind speed areas (designing platforms that would operate in these harsher environments)
- Bigger more reliable turbines with larger swept areas to operate in windier locations (capturing more of the available energy around each individual turbine installation)
- Reduced installation costs (reducing the cost of manufacture and implementation)

Based on these findings, ETI worked specifically to look at the design and manufacture of larger and lighter turbine blades.



HOW

In 2011, ETI approached the market to seek proposals from manufacturers that could develop larger high-performance blades. Developers were asked to design, build and test blades in excess of 90m (the same height as London's Big Ben clock tower) that could be used on the next generation of offshore wind turbines with a capacity of 8-10MW (at the time the industry standard was 5-6MW).

BLADE DYNAMICS

In January 2013, Blade Dynamics, a UK SME, was announced to lead the project. This involved a £15m investment from the ETI with the ETI electing to manage the risk of funding a small start-up business to scale-up and deliver a high risk project by providing equity finance and board level leadership in addition to financing for the project work.

Blade Dynamics had already been working on a long blade design and had developed a technology platform targeted for building blades in excess of 100m. Their design included the use of carbon fibre instead of more conventional glass fibre materials, making the blade lighter but, under a conventional blade manufacturing process, it would be more expensive. To keep costs down Blade Dynamics had created a proprietary manufacturing approach that built the blade not in a single piece but from a jointed set of major sub-assemblies.

By enabling repeatable low cost manufacture of common structures in each sub-assembly the manufacturing processes could be standardised and quality increased. Coupled with the increased performance and power production of the lighter blade on the turbine these manufacturing benefits gave an overall cost reduction on the electricity produced.

The blade is also manufactured through smaller component parts rather than full length mouldings. These advanced manufacturing techniques produced the blades as a series of sub-sections delivering step change improvements in the quality, cost, transportability and performance when compared with other production options.

During the project Siemens were engaged to provide input that influenced the design of Blade Dynamics first new modular blade, a 78m design suitable for use on the Siemens SWT 6.0 turbine, a 6MW turbine. Importantly though, industry collaboration was wider than just Siemens as Blade Dynamics also engaged heavily with other industry leaders including MHI-Vestas and GE to ensure industry acceptance of their planned designs.

With design complete and whilst the blade was being constructed at Blade Dynamics' facilities in the UK Isle of Wight and the USA, ETI helped negotiate testing of the blade in simulated offshore conditions at the newly installed long blade testing facility at the UK's Offshore Renewable Energy Catapult (OREC) in Northumberland.

RESULTS

In October 2015, Blade Dynamics was acquired by GE and they took forward the final testing at OREC of the blades manufactured by Blade Dynamics.

The project has highlighted and demonstrated the cost effective manufacture and transportation of high quality blades at a size that challenges conventional blade manufacturing techniques.

The project has shown that SME's are excellent sources of innovation and that equity support and experienced board level leadership is as important as project funding in securing success for SMEs. The return on investment from the sale to GE has also proved an effective route to recycle funding for the ETI into other low carbon projects within its portfolio. Crucially in this instance, the active engagement of existing and influential market players (Siemens, MHI-Vestas and GE) helped to build investor and industry confidence in innovative designs for larger turbine blades.

WHAT NEXT

The acquisition of Blade Dynamics by GE will see GE take the blade design and manufacturing approaches to market in a range of applications. The resources and market reach that GE bring should enable the technology to progress and reach a much wider global market quicker than would have been possible for Blade Dynamics operating alone.

Effective innovation requires collaboration and shared understanding to facilitate knowledge transfer and learning. Any transition to a low carbon energy system will be achieved more quickly and cost effectively with a shared understanding of the drivers for new technologies and the engagement of diverse stakeholders who can challenge conventions.

energy technologies institute

An ETI Perspective


01509 202020


www.eti.co.uk


info@eti.co.uk


@the_ETI