

Final report

1.1 Project details

Project title	Yoke for single blade installation in offshore wind farms
Project identification (program abbrev. and file)	64012-0248
Name of the programme which has funded the project	EUDP
Project managing company/institution (name and address)	Liftra ApS
Project partners	Liftra ApS
CVR (central business register)	10110122
Date for submission	30JUN2015

1.2 Short description of project objective and results

On many new wind turbines without gear box, so-called "direct drive" turbines, it's not possible to turn the hub during blade installation, making single blade installation very difficult, if not impossible. Liftra has aimed at developing a tool/technology that enables single blade installation of blades that exceed 80 meters length. Liftra has successfully achieved this goal.

- The technology has been developed and patented.
- The design has been verified by DNV GL.
- A physical tool has been built and successfully demonstrated in both Hunterston, Scotland and Fukushima, Japan in collaboration with Mitsubishi and MHI Vestas.
- Commercial milestones have been achieved with Mitsubishi as first customer.
- The commercial outlook for the technology is still very promising.

This demonstrated tool, which Liftra calls "Blade dragon 80+", can hold and rotate the blade through 250 degrees angle of the vertical plane, making it possible to mount blades in all positions within this range.

På mange nye vindmøller uden gear, de såkaldte "direct drive" møller, er det ikke muligt at rotere vingenavet under installation af vinger. Dette gør det vanskeligt at installere vingerne enkeltvis. Liftra har i dette projekt sigtet på at udvikle en teknologi / et værktøj der gør det muligt at installere endog meget store vinger med en længde på 80+ meter enkeltvis. Liftra har sucsesfuldt nået dette mål.

- *Teknologien er udviklet og patenteret.*
- *Designet er verificeret af DNV GL.*
- *Et fysisk værktøj er bygget og succesfuldt demonstreret i Hunterston, Scotland såvel som i Fukushima, Japan i samarbejde med Mitsubishi og MHI Vestas.*
- *The commercial outlook for the technology is still very promising.*
- *Projektets kommercielle milepæle er nået med Mitsubishi som første kunde.*
- *Det kommercielle perspektiv for teknologien er særdeles lovende.*

Det demonstrerede udstyr, som Liftra kalder "Blade Dragon 80+", kan fastholde og rotere en 80+ meter vinge i et udsnit på 250 grader af det lodrette plan.

1.3 Executive summary

Liftra has succeeded in developing a robust technology that allows "single blade installation" of very large blades (80+ meters) on offshore wind turbines. Liftra calls it "Blade Dragon 80+". By use of this innovative technology the installation logistics can be significantly optimized and paves the way for large total cost savings in the installation of and offshore wind farm – ultimately reducing the cost of offshore wind energy.

The Blade Dragon technology can be applied by all major offshore wind OEM's for single blade installation of blades, with a particular advantage in installing blades on the so-called "direct drive" turbines. Therefore, the target market for the technology is all OEM's and installation companies operating in offshore wind.

Project results include successful demonstration of a physical tool has installed all blades on Mitsubishi's 7MW Sea Angel prototypes in both Scotland and Japan.

The technology is now fully ready to be utilized throughout the offshore wind installation business in the years to come. Liftra is continuing to develop supporting technologies that will allow still more accurate installation operations and expand the window of environmental conditions for performing offshore single blade installation.

1.4 Project objectives

The technical as well as commercial objectives of the projects have been fully met.

- The Blade Dragon 80+ technology has been developed and patented.
- The design has been verified by DNV GL.
- A physical tool has been built and successfully demonstrated in both Hunterston, Scotland and Fukushima, Japan in collaboration with Mitsubishi and MHI Vestas.
- Commercial milestones have been achieved with Mitsubishi as first customer.
- The commercial outlook for the technology is still very promising.

Over the course of the project there has been a 6-8 month delay in the demonstration phase. The demonstration was planned with Mitsubishi prior to the establishment of their joint venture with Vestas on offshore wind technology. The organisational turbulence caused by this manoeuvre was reason for the delay. MHI Vestas is now a candidate to utilize the Blade Dragon 80+ technology.

1.5 Project results and dissemination of results

The Blade Dragon 80+ has been presented on the EWEA and AWEA exhibitions in 2014 and 2015.

Liftra has presented the Blade Dragon 80+ on an seminar in Hunterston, Scotland in 2014 with a wind industry audience invited by Mitsubishi / MHI Vestas.

1.6 Utilization of project results

The project result is being fully utilized by Liftra ApS that markets and offers the "Blade Dragon 80+" technology to all relevant players in the offshore wind installation market.

The number of OEM's in the offshore wind market for large turbines has decreased significantly over the last 5 years. Liftra sees currently 5 important and consolidated OEM's: MHI Vestas, Siemens, Alstom, Senvion and Adwen. It is extremely important for to promote the Blade Dragon 80+ technology to these organisations.

Based on the project result, Liftra keeps up significant development activity on supporting technologies: tagline control, loading, storage and offloading technology.

1.7 Project conclusion and perspective

Technical as well as commercial objectives of the project have been met.

The "Blade Dragon 80+" technology has proven to be state of the art in offshore single blade installation of large blades.

The project has formed the basis for implementing the technology today as well as further developing the supporting technologies.