WELCOME BACK

UK Offshore Wind Supply Chain Spotlight Breakout Stream 1 Session 3

Ørsted

UP NEXT – BREAKOUT STREAM 1

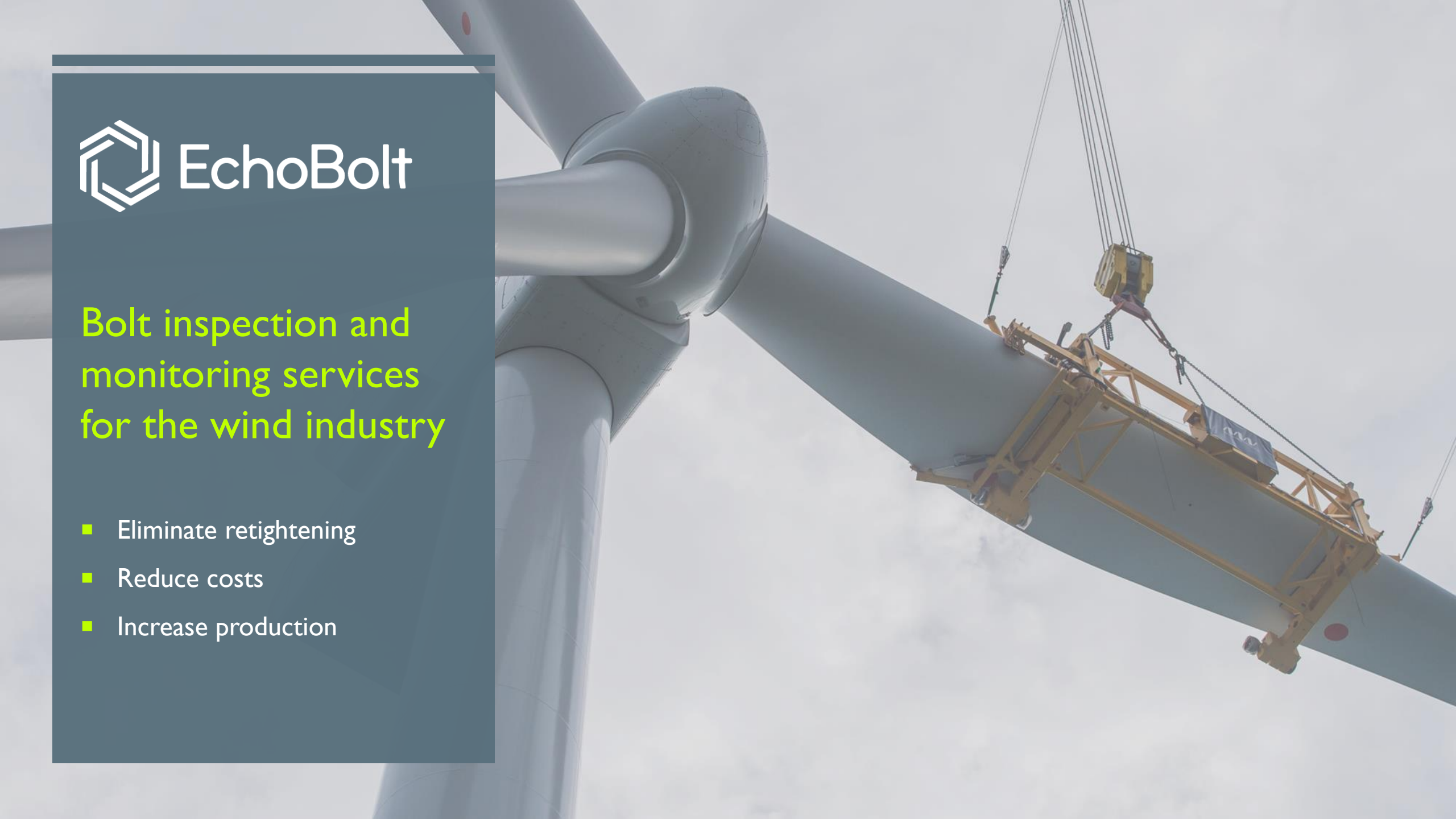
14.45 – 16.00:

Pitch sessions: O&M Services followed by a supply chain discussions

O&M Services

Pitch Session

Pete Andrews– Echobolt

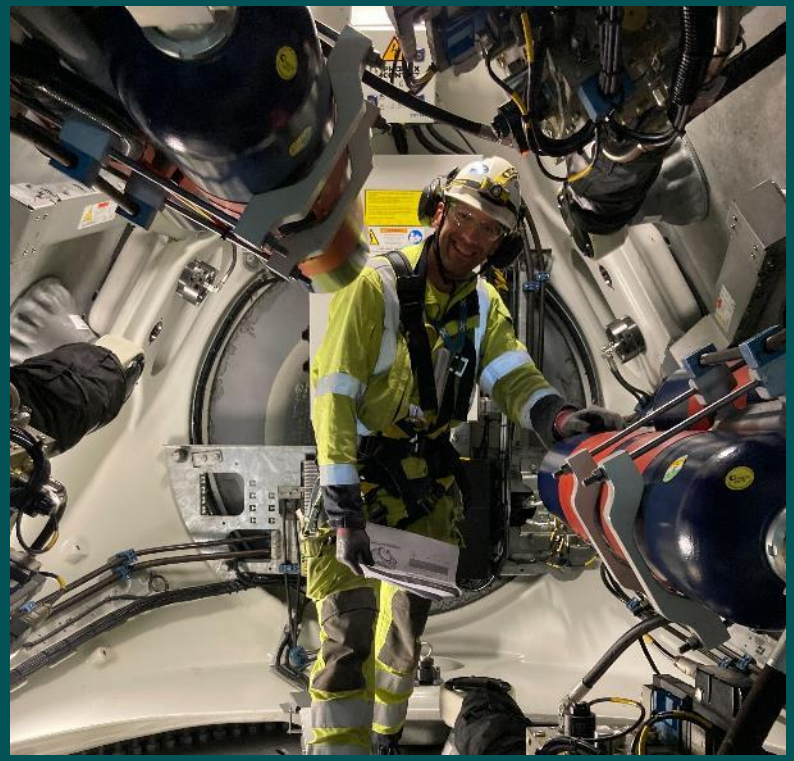


EchoBolt

Bolt inspection and monitoring services for the wind industry

- Eliminate retightening
- Reduce costs
- Increase production

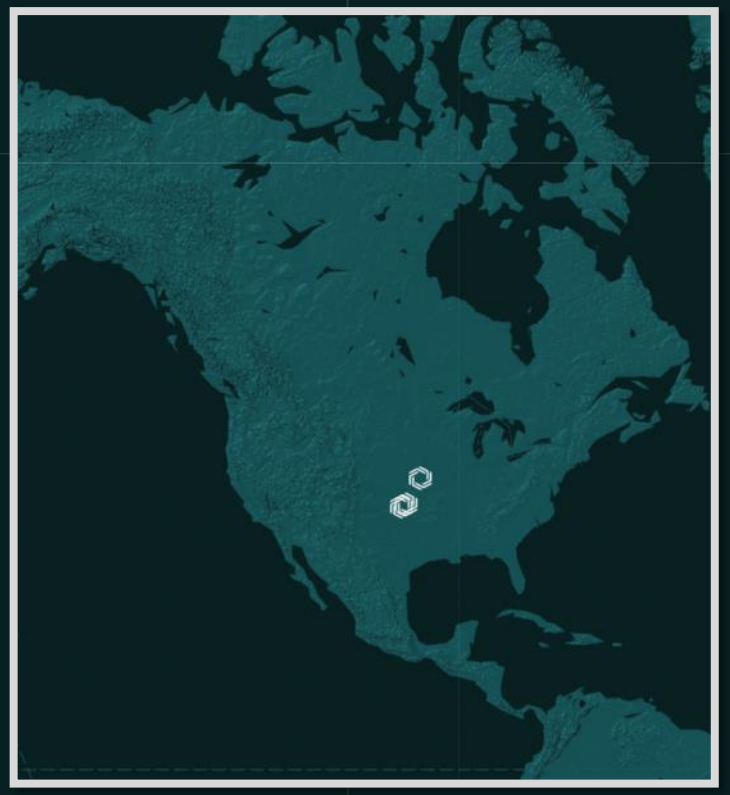
Team



EchoBolt

Customers

- Orsted
- GE Renewables
- RWE
- Vattenfall
- SSE
- Scottish Power
- Equinor
- EDP Renewables
- DNVGL
- Deutsch Windtechnik



EchoBolt

O&M Saving

- £1M/GW/year

Integrity and Risk

- £10M's

info@echobolt.co.uk

O&M Services

Pitch Session

Chris Conway – Synaptec

HV cable monitoring challenges

- 69%* of total power cable failures occur in the joints and terminations
- These locations are not monitored conventionally
- They suffer from a combination of electrical and mechanical stresses leading to ‘sudden’ failure
- Challenging environment, cable accessories and work quality increase risk of failure
- Failure rates poor with 33 kV systems moving to 66 kV, and dynamic cables increasing risk
- Significant spending on monitoring, but focus is on structural integrity and displacement of cables

DTS	**£0.1-0.2M** hotspots/coldspots, RTTR, post-event cable fault location
DAS	**£0.2-0.3M** 3rd party interference, limited cable fault detection
ROV	**£0.4-0.8M** 7day survey to locate deviations, free spanning
PD	**£0.2-0.3M** limited space, networking cost, false positives, late identification of failure
Manual	**H&S risk**, unlikely to see early signs of failure during infrequent visits

These techniques do not see the joints, terminations, link boxes where the majority of failures occur

When DES is combined with DTS and DAS monitoring on all cables, we:

- Reduce project risk for a de-minimis cost (<1% of cable package mitigates > £50M in outage costs**)
- Optimise scheduled maintenance by simple comparison of parameters over time
- Allow better lifetime asset management decisions
- Insurance risks need to be addressed

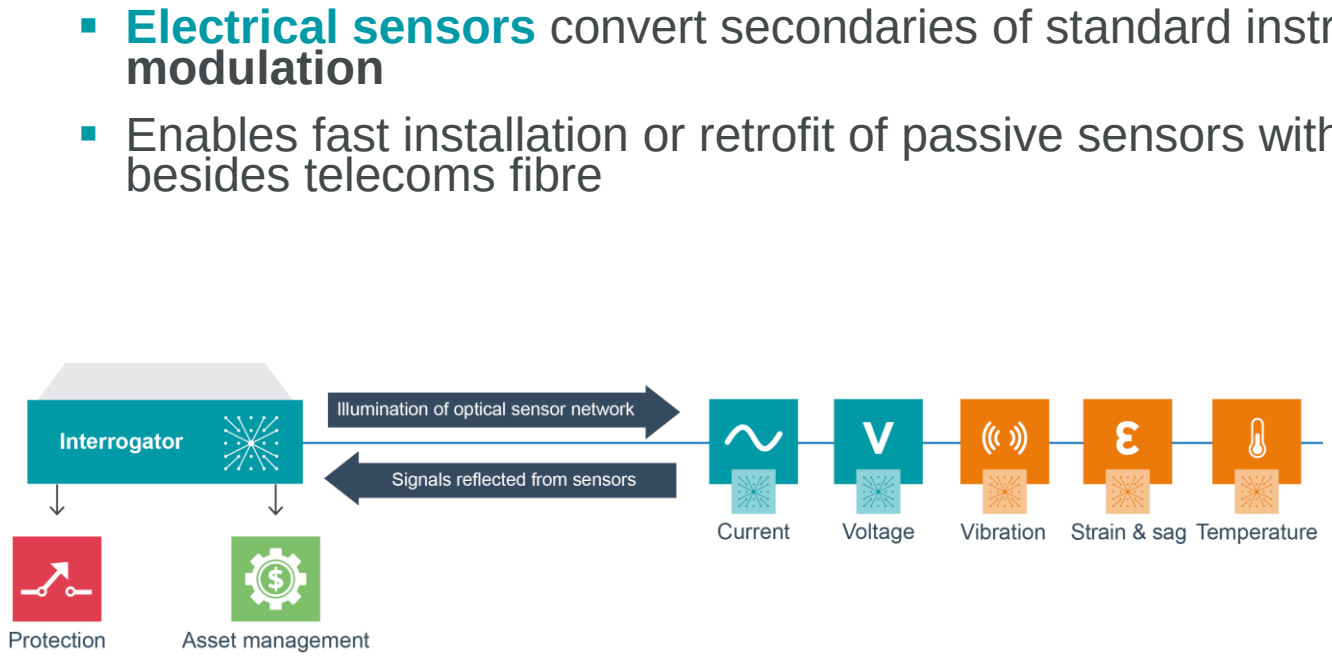
synaptec

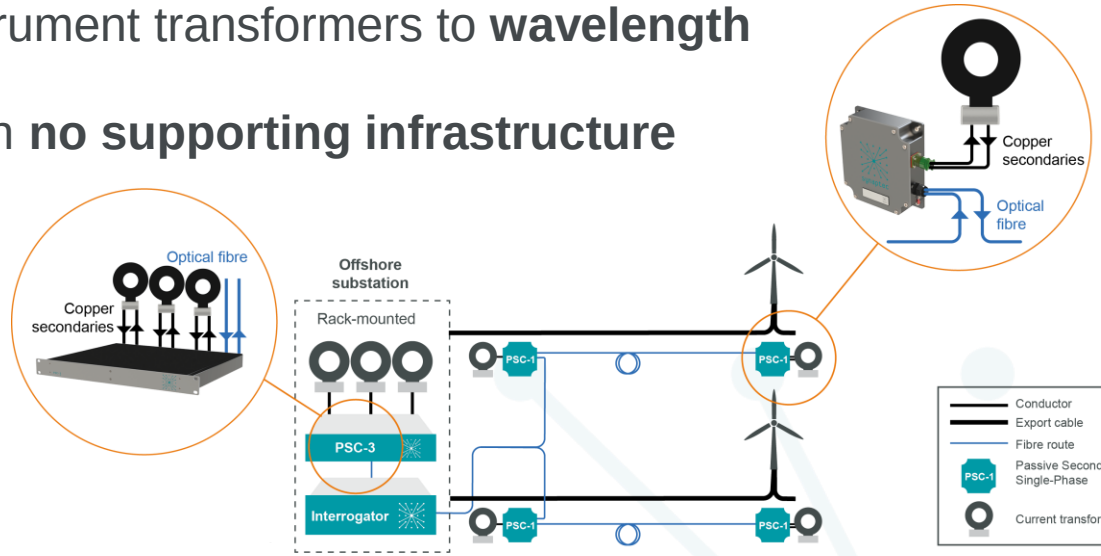
*230_D9.2_JICABLE15_0160

**Based on typical UK project >1GW and 140 km IAC over 35 yr lease.

Distributed Electrical Sensing (DES)

- **Passive** point sensors for electrical measurements, distributed over standard single-mode fibre
- Sensors multiplexed by **wavelength** – immune to environmental interference
- Any combination of **electrical** and **mechanical** quantities
- **Electrical sensors** convert secondaries of standard instrument transformers to **wavelength modulation**
- Enables fast installation or retrofit of passive sensors with **no supporting infrastructure** besides telecoms fibre



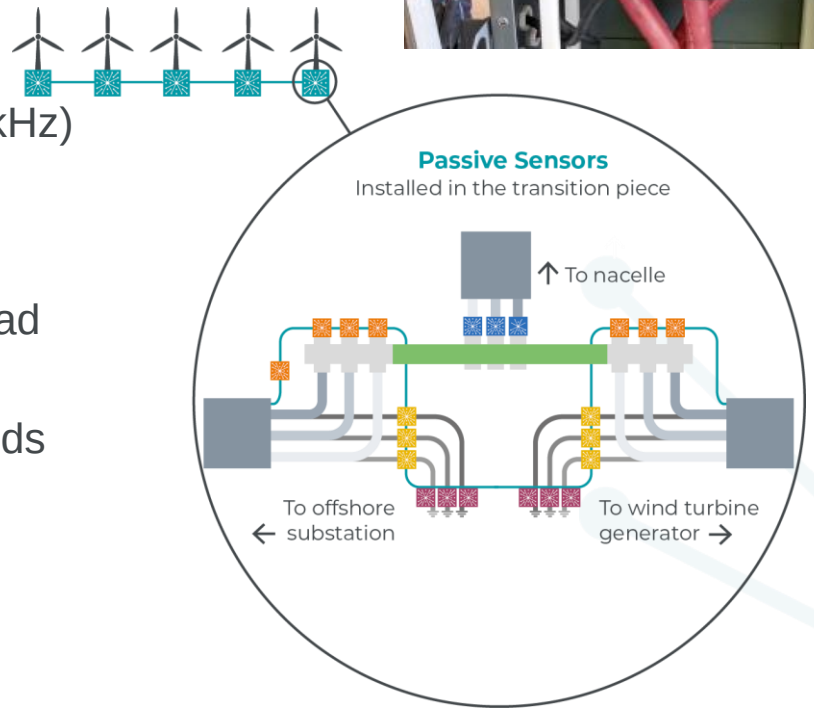


- System combines established fibre sensing technologies, conventional instrument transformers and reliable, fast photonics to deliver passive measurements from any location in the power network

synaptec

Correlating termination temperature and load current

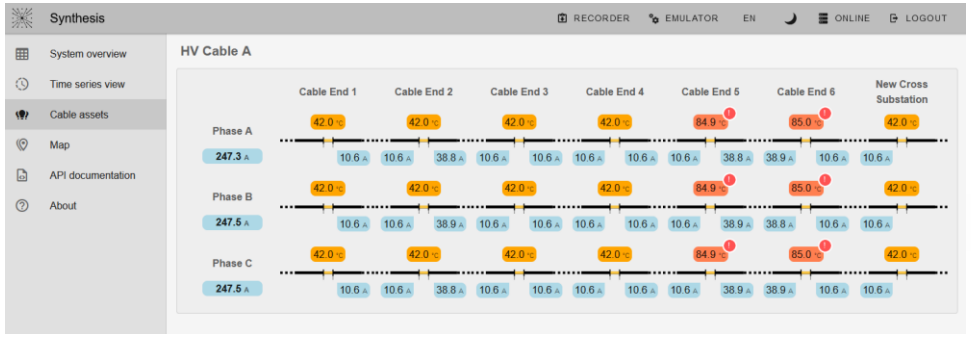
- DTS or DAS resolution not enough for Termination monitoring
- Monitoring temperature alone cannot provide sufficiently early warning of failure – at least 2 weeks advance warning
- We synchronously and permanently monitor:
  - Ambient & termination temperature
  - Phase current waveforms, transients, harmonics (@4kHz)
  - Cyclic load changes and stresses over asset lifetime
- Benefits
  - Instant alarms for excessive temperature relative to load
  - Enhanced Real Time Thermal Ratings
  - Optimised scheduled maintenance based on data trends
  - Faulted Section identification (4kHz current sampling)
- Adding sheath current sensing provides even earlier warning of more cable failure modes



synaptec

Application modules | Cable asset monitor

- Cable-specific visualisations:
  - Ratio of phase current vs. sheath currents
  - Scatter plot of phase current vs. sheath currents
  - Differential of sheath current across sections
- Highlights common failure modes for cable terminations and joints
- Depth of burial monitoring for offshore cables
- Real Time Thermal Rating for onshore and offshore cables
- Delivers online monitoring recommendations in CIGRE Brochure B1 825 “Maintenance of HV Cable Systems”
- System currently being installed on Dogger Bank A&B
- **Tender and product specifications available – come talk to us**

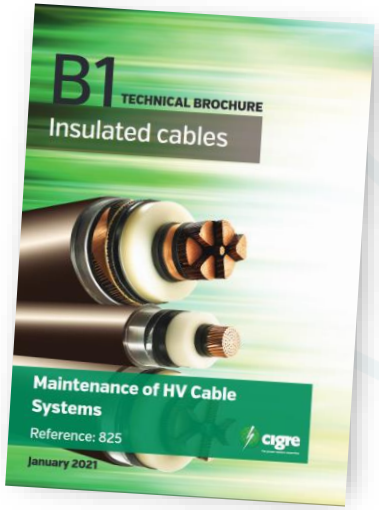


Trends

Phase vs. sheath

App Figure C-23: Sheath currents in a crossbonding with an error in crossing

Visualisations indicate cable flooding, cable/joint breakdown, etc.



Chris Conway
Condition Monitoring Consultant

Phone: +44 (0)7826 851 689
Email: chris.conway@synapt.ec

synaptec

O&M Services

Pitch Session

Philip Taylor – Pict

Pict

Who are Pict?

- Established in 2019 with funding from Ørsted
- Team of 30, based in Fife, Scotland & HOW02
- Make offshore wind safer and more cost effective through innovation in access and lifting technology
- SIG Sprint programme underway (OWGP)

Pict

Get Up Safe

Why GUS?

- Improve safety
- Increase access
- Reduce foundation costs

Pict

Fully commercial & deployed at scale

Ørsted's Hornsea 2 (UK)
165 - Operational from Jan 2022

Ørsted's Southfork (USA)
12 - Operational in summer 2023

Ørsted's Revolution (USA)
65 - Operational during 2024

Ørsted's Sunrise (USA)
84 - Operational during 2025

TBA

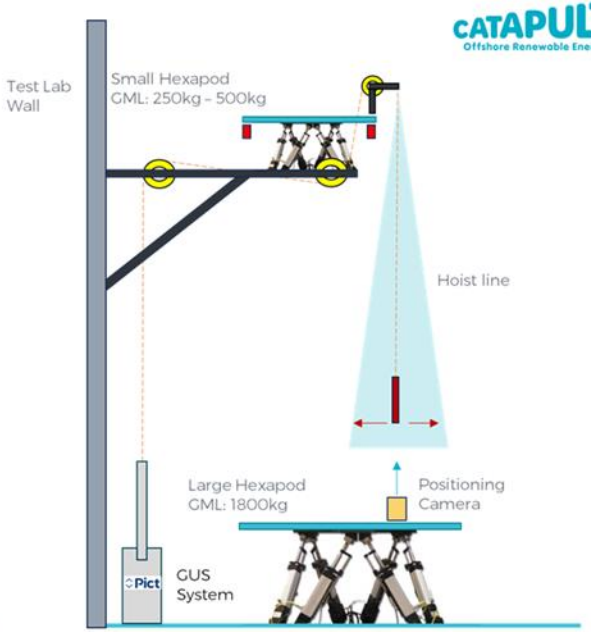
1st non-Ørsted project (Europe)
Operational during 2025

- Safe ✓
- Reliable ✓
- + Business case ✓

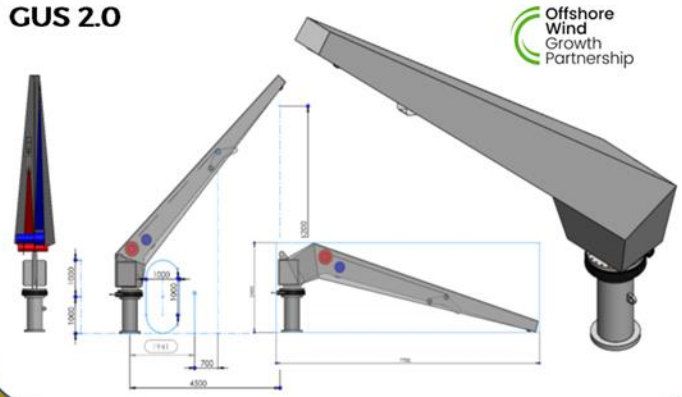
Pict

What's next in 2024?

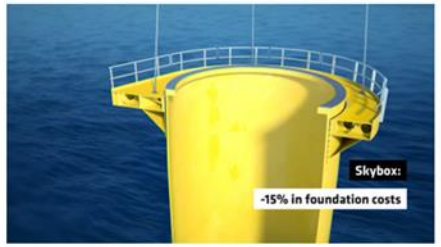
Floating Wind qualification



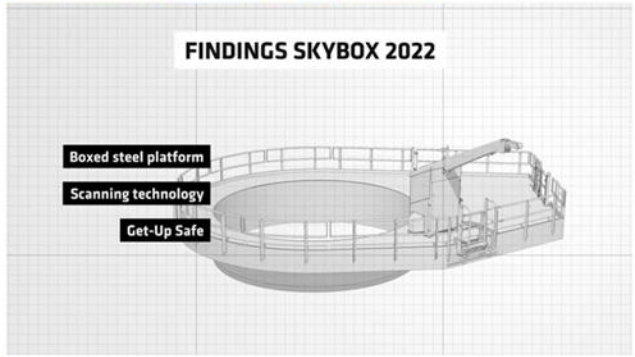
GUS 2.0



Skybox TP-less collaboration



Sif



O&M Services

Pitch Session

James Barry – Renewable Parts

The uncomfortable truth

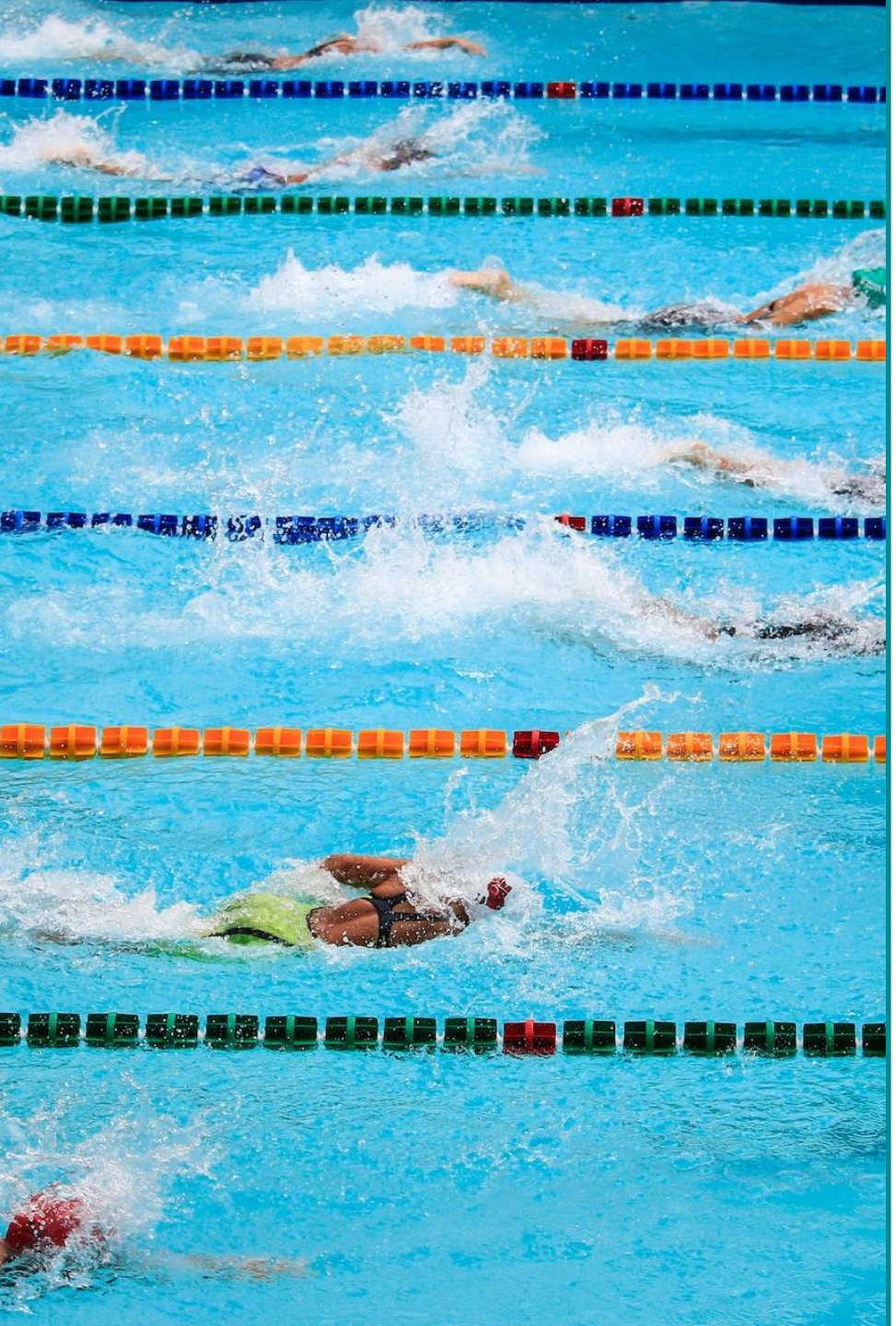
The wind industry is a green energy source, but the aftermarket remains largely non-green

Linear procurement practices remain deeply ingrained for minor parts

The opportunity to embed greater sustainability within the aftermarket has substantial benefits

But this requires a complete change of culture and a willingness to invest in circular economy technology

Renewable Parts Ltd



Translating theory to practice

- To date our refurbishment work has generated a 540 tonne reduction in CO_2 emissions, the equivalent of 120 Olympic sized swimming pools
- That has been achieved using a modest 5,000 ft^2 sized facility over the past 2 years which is now approaching capacity, so what next….

Renewable Parts Ltd

Experience

sse Renewables

Yaw Gear Remanufacture and Redesign

Decreasing failures in turbine components through technical redesign

Ørsted

Yaw Caliper Refurbishment

Reducing waste, carbon emissions, and lead time through refurbishment.

Renewable Parts Ltd

Refurbishment Capability

Pitch System
Main Shaft
Gearbox
Yaw System
Brake System
Wind Instruments
Electrical System

Blade Grease System
Hydraulic System
Generator
High Speed Shaft
Cooling Systems

Renewable Parts Ltd

The transition to parts reuse

Coalition for Wind Industry Circularity

CWIC has been founded by SSE Renewables, Renewable Parts, and the University of Strathclyde to accelerate the development and deployment of circular economy solutions, industrywide.

It has 3 founding principles:

1. **Commitment to quarantine and grant access to used material.**
2. **Sharing of operational / parts usage data.**
3. **Willingness to pilot refurbishment solutions within their operations.**

The coalition now has over 50 members and has formed a steering group and five strategic workstreams

Statkraft
EDF renewables
TotalEnergies
REBLADE
ZERO WASTE SCOTLAND
THE CROWN ESTATE
ScottishPower Renewables
Ørsted
BANKS Group
natural power
Vestas
res power for good
Renewable Parts Ltd

O&M Services

Pitch Session

Rob Sunderland – RedLines

How much will climate change cost?

RedLines
Part of the D.E Group

No progress made on GHG targets

Good progress made on GHG targets

Physical Risks for Wind Farms

1. **Yield changes**
2. **High wind speed changes**
3. **Temperature variability**

Transitional Risks for Wind Farms

1. **Market changes**
2. **Technology innovation**
3. **Policy changes**

Our Solution

SSP	1			
Decade	2030			
		Physical Risks		
Name	Yield	Extreme Wind	Acute Heat	VAR
Wind Farm 1	-7,666	-3,779	-452	-11,897
Wind Farm 2	-8,066	-5,836	-1,194	-15,096
Wind Farm 3	-8,051	-3,588	-529	-12,168
Wind Farm 4	-10,267	-3,413	-1,273	-14,953
Wind Farm 5	-8,377	-5,892	-165	-14,434
Wind Farm 6	-9,644	-4,068	-1,442	-15,154
Wind Farm 7	-8,391	-6,201	-1,020	-15,612
	-60,462	-32,777	-6,075	-99,314

*Example data

Different risks are assessed

- Across different timescales
- Across different SSPs

Always quantified in financial value

Benefits

1. **Enhanced Resilience:**
   Minimise downtime, improve maintenance schedules

2. **Improved Financial Planning:**
   Better budget allocation, insurance planning and investment strategies

3. **Strategic Advantage:**
   Better understanding of complex changing market allows you to seize opportunities

4. **Stakeholder Engagement:**
   Investors, shareholders, customers and employees like proactive action on climate change

Case Studies

ScotWind

Assessed 17 ScotWind Sites

least affected - £1,000,000 increase in yield

most affected - £9,000,000 reduction in yield

European Wind Farm

Assessed onshore 30MW wind farm

£21,000 reduction in yield

Rob Sunderland

Rob@RedLinesAnalysis.com

O&M Services

Pitch Session

Bill Slatter – Eleven-I

ELEVEN-I

info@eleven-i.com

For wind blade designers, manufacturers, owners and operators, ELEVEN-I provide insight into the condition and behavior of their wind turbine blades using bespoke 24/7 monitoring systems coupled with automated analytics

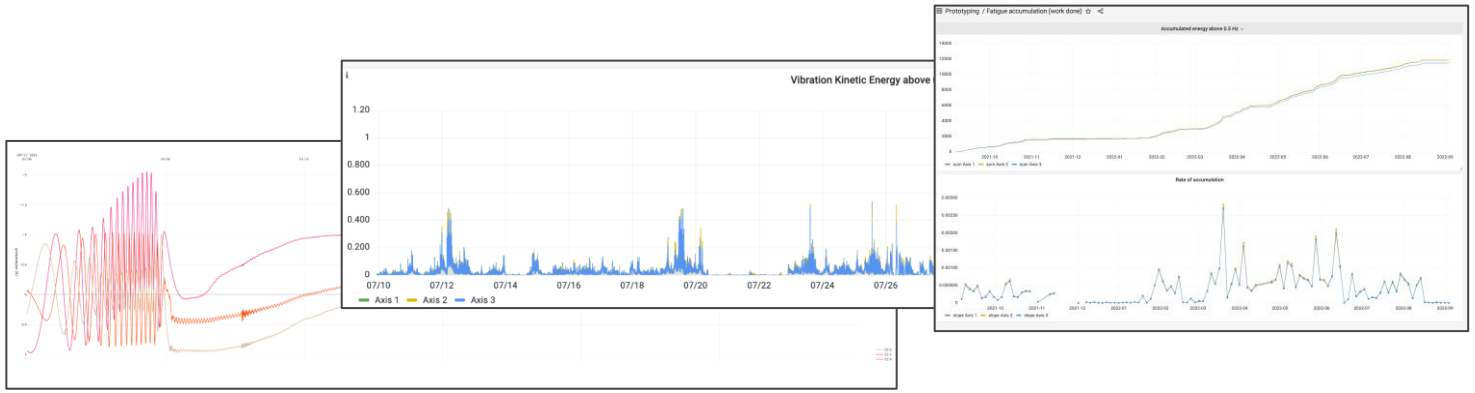
REDUCING RISK + OPEX COST + LCOE

HOW:

- Reducing inspection
- Increased uptime
- Fatigue life metrics
- Root Cause Analysis
- Blade behaviour
- Anomalous event detection
- Targeted inspections
- Blade performance
- Damage detection
- Load estimation

LEADING TO:

- Blade and controller design feedback loop
- **WTG operational characterisation driven O&M**



Solution

ELEVEN-I

SENSE

Lab Quality sensors

- Low cost
- Reliable
- Easy and fast to install
- Core sensor: 3 axis accelerometer
- Additional sensors under development (lightning, acoustic, etc.)

ANALYTICS

Physics based and machine learning tools

Identifying:
- Changes in blade dynamics/structure
- Damage inducing conditions
- Fatigue accumulation

Modelling:
- Blade movement (Azimuth, flex, twist and resonance)

Comparing:
- Behaviour over time
- Against other blades / turbine / fleet

REPORT / PREDICT

Actionable insights

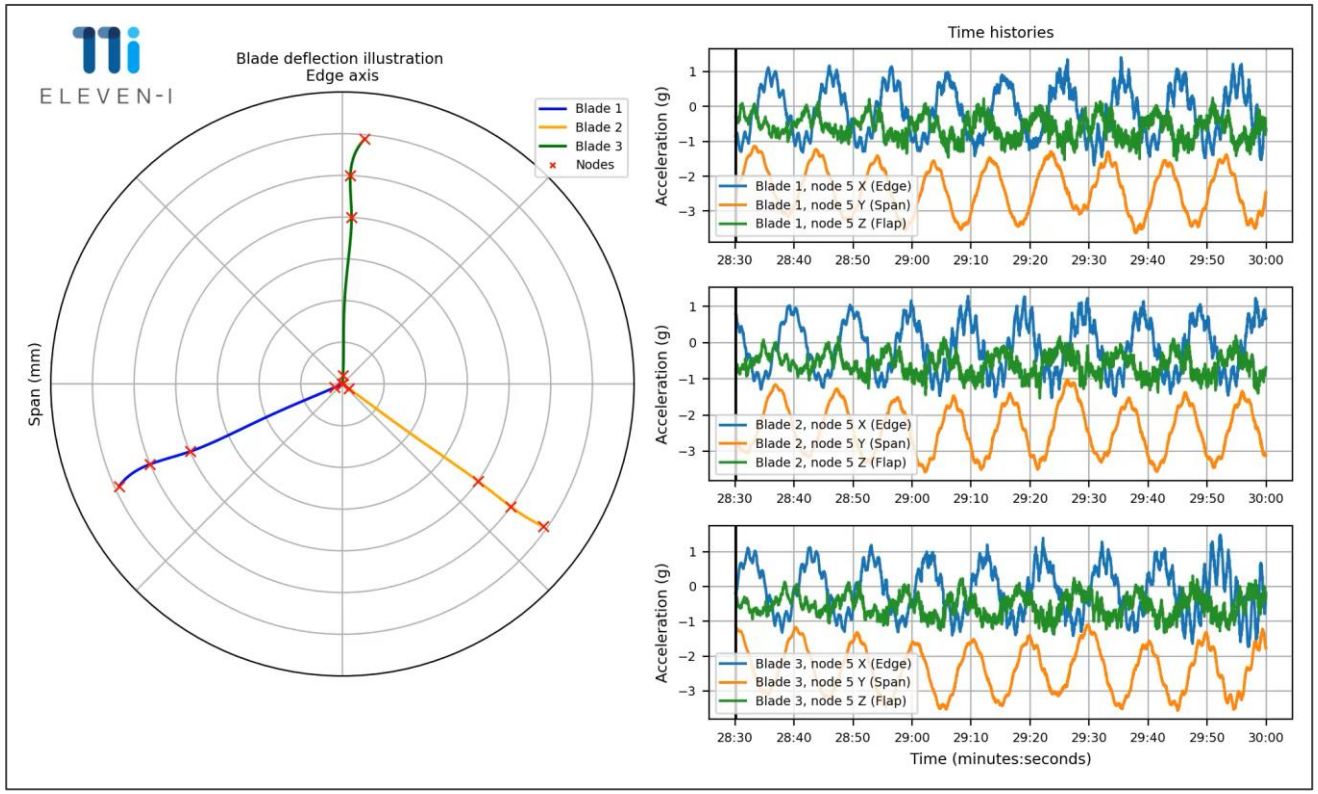
- Providing visibility in the field only usually available on test blades
- Informing and guiding interventions at site
- Informing blade / turbine life extension

Insights

- Identification of abnormal rotor behaviour/ high energy events
- Damage detection
- Information for lifetime extension/fatigue life
- Information on blade dynamics and rotor behaviour
- Automated tools to identify specific behaviour/phenomena
- Comparative tools to detect outliers
- Tip deflection
- Twist calculation
- SIV/VIV detection
- Impulse (knock) detection

Under Development

- Lightning detection
- Lightning characterisation
- Strike location
- Digital twin
- Ice detection



Approach

Current Activities

Blade Test + **Prototype Turbine** + **Problem Solving on Fleet**

Validate and characterise blade behaviour in test facility

Validate and characterise blade behaviour during operation

Visibility and understanding of problems and long term behaviour over multiple machines

Ambition

Full Fleet CMS

Ability to provide validated insight into the condition and behavior or full fleets of turbines. Leading to enhanced O&M scheduling, damage detection and prediction, loads information and lifetime extension information.

info@eleven-i.com

O&M Services

Pitch Session

Scott McMillan – RMI Engineering

WHO ARE RMI ENGINEERING?

Established in 2005 – Providing Engineering services to Port of Felixstowe, Network Rail and Ministry of Defence

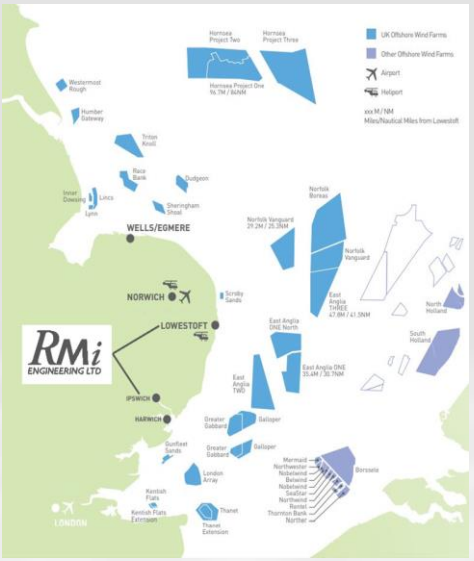
- Mechanical Repairs
- Welding & Fabrication
- Equipment/Mechanical Modifications
- Inspection and Reporting

First Offshore Renewable Wind Project 2009 – Supported construction activities on Gunfleet Sand OWF (& latterly GFS 3)

- Commissioning and rectification of OFSS and WTG Cranes
- Confined Space inspections
- Temporary power supply and Electrical equipment
- Lifting Equipment inspection, testing and certification

Based across two locations, Engineering in Wattisham and Renewables in Lowestoft

Personnel are mechanically trained with Inspection qualifications supported with LEEA accreditation

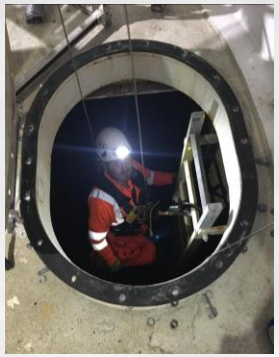
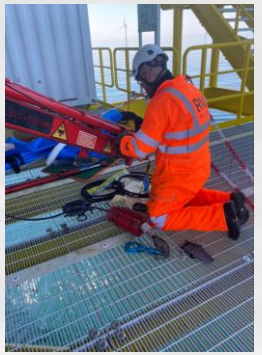


WHAT DO WE DO? – ENGINEERING IN A RENEWABLES ENVIRONMENT

Projects are predominately in the UK, with some projects in Europe, Taiwan and USA.
Supporting the Construction, Operations & maintenance and OFTO phases, providing:

STATUTORY INSPECTIONS - Complete Asset equipment inspection & certification, Full Balance of Plant Topside and splash zone inspection, crane inspection, load testing and re-certification.
ASSET RECTIFICATION -Mechanical & Structural inspections and defect rectification, Crane refurbishments, WTG switchgear exchange, supply, inspection and installation of generator sets for WTG's, Met Mast removal and recycle.
CONFINED SPACE - Confined Space entry and Rescue teams, Ultrasonic WT testing, Drop cell monitoring.
PROJECT SUPPORT - HV Services including SAP's, Control room operators, crane operators, BoP technicians, Client representatives & Project management.
TECHNICAL SUPPORT - Compliance and Regulatory Assessments, Inspection regimes, Written Schemes and Lifting operations design.



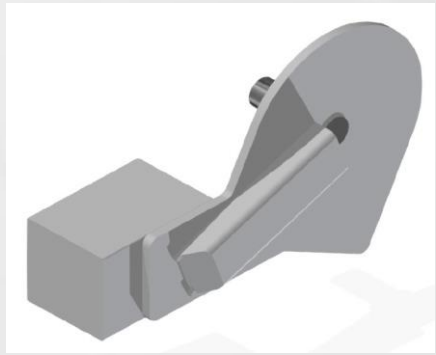



THE DIFFERENCE - RECTIFICATION

RMi

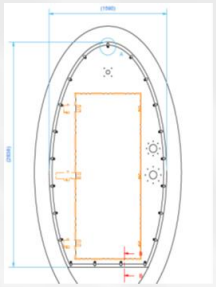
Defect/Downrated TP Davit Cranes

- Designed and implemented a solution to rectify bent boom heads(Offshore) and reinforce
- Rectification of slew ring, replacement of clutches, refurbished motors, load test and recertification



Water Ingress TP Door Surround

- Identified ingress of water, designed replacement TP door surround with an internal clamping solution
- Manufactured replacement TP door surround and door
- Rectified damaged/corroded sealing flange
- Installed replacement surround and tested integrity



THE DIFFERENCE - REFURBISHMENT

RMi

Damaged TP Davit Crane

- Removal of Davit
- Full boom refurbishment.
- Installation offshore and recertification

Defective WTG Crane

- Design of encapsulation clamps
- Refurbishment and recalibration of rams
- Replacement of crane wire and recertification

Defective OFSS Crane

- Coating defect rectification
- Refurbishment of rams
- Replacement of crane wire, load test and recertification

Defective Crane Gearbox

- Removal
- Manufactured replacement components and Refurbished
- Installation, configure and recertify crane

ENGINEERING SOLUTIONS DELIVERED AND CERTIFIED IN FIELD – Reduced risk, reduced environmental impact.

CATAPULT
Offshore Renewable Energy

Offshore Wind Growth Partnership

UK OFFSHORE WIND SUPPLY CHAIN SPOTLIGHT

Showcasing UK Innovation & Excellence

EDINBURGH
12.12.23

F4OR
Fit For Offshore Renewables

LAUNCH ACADEMY

O&M Services

In conversation with…

Ørsted, Echobolt and Renewable Parts

CHAIR: Lynne McIntosh-Grieve

Programme Manager
OWGP

Julian Das

Supply Chain
Development Manager
Orsted

James Barry

Chief Executive Officer
Renewable Parts

Alex Louden

Senior Ventures &
Open Innovation Specialist
Orsted

Pete Andrews

Director
Echobolt

CATAPULT Offshore Renewable Energy

Offshore Wind Growth Partnership

F4OR Fit For Offshore Renewables

LAUNCH ACADEMY

#supplychainspotlight23

O&M Services

That's a wrap!

Be sure to catch our speakers during the drinks reception!

EnBW | bp

Partners in UK offshore wind

DRINKS RECEPTION

Feel free to join us in the Strathblane Exhibition Hall for refreshments