CIRCUIT

CATAPULT
Offshore Renewable Energy

ore.catapult.org.uk
@ORECatapult

ISSUE 8 | SUMMER 2016

OPERATIONS & MAINTENANCE: THE KEY TO COST REDUCTION

FEATURES

We work with
Innovate UK

CATAPULT
Offshore Renewable Energy

Independent, open access facilities for offshore wind, wave and tidal energy

ore.catapult.org.uk
@ORECatapult

We work with
Innovate UK

WELCOME

THIS ISSUE WE FOCUS ON THE OPERATIONS AND MAINTENANCE ACTIVITIES ASSOCIATED WITH OFFSHORE RENEWABLE ENERGY.

Andrew Jamieson
CEO

Operations and maintenance accounts for an estimated 25% of the total lifecycle cost of an offshore wind farm, so even a small saving can make a huge impact on the industry's continued cost reduction efforts.

At the end of February, we officially inaugurated our 7MW offshore wind demonstration turbine, located at Levenmouth on the Fife coast. As the world's most advanced, open access, offshore wind turbine dedicated to research, it offers UK industry and academia an unrivalled opportunity to develop a deeper understanding of a wide range of technologies, as well as the operations and maintenance aspects of offshore wind turbines, with the ultimate goal of reducing the cost of energy.

The turbine is a welcome addition to our existing test and demonstration assets in Blyth, Northumberland, which have been at the forefront of developing testing representative of actual offshore conditions since 2002. Robust test regimes carried out in a controlled environment at full-scale on wind and marine turbine components, coupled with focused, applied research, play a major role in reducing risk, contingency and ultimately costs of offshore projects.

The Catapult is very much at the heart of tackling operations and maintenance challenges, from product development and facilitation (including commercialisation support, testing and demonstration) through to facilitating knowledge sharing, best practice and standardisation across the sector.

The old truism that a problem shared is a problem halved could never be more apposite than in operations and maintenance. The collaborative approach that is at the heart of all that ORE Catapult does is essential if we are to continue to deliver on cost reduction, and the operations and maintenance case studies series highlighted in this issue (see page 7) provide tremendous examples of industry working together to collectively drive the sector forward.

CONTENTS

DEMONSTRATOR TURBINE SET TO TRANSFORM OFFSHORE WIND RESEARCH

ACQUIRED BY ORE CATAPULT FROM SAMSUNG IN DECEMBER 2015, WE LOOK BACK ON THE LAST SIX MONTHS OF OPERATIONS AND WHAT THE FUTURE HOLDS.

At 196 metres from blade tip to sea level, it's taller than London's Gherkin building. Each of its blades weighs the equivalent of 15 family cars, and it generates enough electricity to power 4,800 homes. The Levenmouth 7MW offshore wind demonstration turbine stands proudly on the East Fife shoreline as the world's most advanced, open access, offshore wind turbine dedicated to research.

Ultimately, the Levenmouth turbine does exactly what it is meant to do – it generates electricity. But it also offers a host of other benefits, such as unrivalled access for offshore wind research and demonstration, and complementary opportunities for training and development of skills vital for the future of the offshore wind industry.

Generating electricity
As the turbine turns, the electricity it generates is fed into the National Grid, powering local homes. As the Catapult is a not-for-distributed-profit organisation, this means that any revenue generated first covers the costs of operating the turbine and then the surplus is reinvested back into the Catapult's research agenda and wider activities, as well as a skills development agenda for the local area.

Operations and maintenance support is local too, with leading Scottish renewable energy consultancy SgurrEnergy supporting the Catapult in the day-to-day running of the turbine, providing invaluable operations support, knowledge and expertise.

Cost reduction through research
The turbine also offers UK industry and academia an unrivalled opportunity to develop a deeper understanding of a wide range of technologies as well as the operations and maintenance aspects of offshore wind turbines, with the ultimate goal of reducing the cost of energy.

image above
SgurrEnergy personal accessing the Levenmouth turbine

image left
The Levenmouth 7MW offshore wind demonstration turbine

The Catapult is working closely with key academic and industry stakeholders to align the research programme of the Levenmouth turbine with industry priorities to drive cost reduction in offshore wind.

For example, the recent EU funding call for 'Demowind' – projects relevant to the demonstration of new offshore wind technologies – has galvanised interest amongst the industry and research communities to use the Levenmouth turbine for research purposes.

Two new project bids have been submitted as part of this call, with the turbine at the heart of them. The first is a project focused on offshore blade technology, looking to improve blade performance and ultimately turbine performance through aerodynamic improvements or by reducing operations and maintenance costs through fibre optic monitoring, leading edge protection or structural stiffening. The second project involves the University of Strathclyde and using nacelle-mounted Lidar to improve the measurement of the wind at the turbine. This will help to improve the turbine's control algorithims, measure its performance more accurately, and reduce the damaging loads turbines can experience under adverse weather conditions.

Community impact
The Catapult is conscious of how the day-to-day running of the turbine affects those living nearby, and strives to operate the turbine as a good neighbour. Two areas of concern for local residents have been flicker from the turbine, and noise generated by its operation.

To mitigate flicker issues, Catapult engineers have developed predictive calculations based on the trajectory of the sun as to when flicker may occur, and combined with active monitoring and managing, we are able to shut down the turbine when flicker may be an issue.

The Catapult has, and is continuing, to conduct extensive research on any noise created by the turbine's operation. It continues to operate the turbine within permitted noise levels and, in conjunction with previous owner's Samsung, has identified particular wind strengths and directions where noise could be a potential issue. There are now mechanisms built-in

to the turbine's controlling software to shut it down in these circumstances.

Marine Scotland has recently granted a variation to its noise consent for the Levenmouth turbine. The previously granted consent included a permissible noise limit based upon a fixed background noise level. That meant that, in circumstances where other activity in and around the Energy Park was creating higher background noise levels, operation of the turbine would be curtailed regardless of the actual effect on noise levels.

The consent variation which has recently been granted allows for the turbine to continue operating during periods of higher background noise (such as high activity around the Energy Park), whilst still restricting the overall noise level.

Local benefit

ORE Catapult is working with local partners, including Fife Council, Fife College, Levenmouth Academy, Skills Development Scotland and the Energy Skills Partnership, to develop and deliver educational and training programmes that will both support local young adults to move on to further and higher education and develop a unique curriculum to ensure local training programmes deliver employment-focused, in-demand skills to local people.

The Catapult will be sponsoring a STEM Engagement Officer role within the new Levenmouth Academy; it's working with the Energy Skills Partnership and Heriot Watt University on the development of a Virtual Reality training system using CAD models of the Levenmouth Turbine; Catapult engineers have provided mentoring support to one local primary school that has led to them making the finals for the Junior Saltire Prize; and the turbine has already hosted visits from 14 students who are studying as part of the turbine and technician course at Fife College.

The Levenmouth demonstration turbine is set to play a major part in the development of future technologies to lower the cost of offshore wind. It offers opportunities for UK supply chain and technology development and, sitting so prominently at the heart of the Levenmouth communities, it is vital that the turbine also plays a role in locally developing and supporting the next generation of Scottish engineers, who will ensure that Fife enjoys a bright future thanks to renewable energy.

OPERATIONS AND MAINTENANCE CONTRACTORS

The operations and maintenance of the turbine falls under the remit of SgurrEnergy and since taking over in December 2015, its operations and maintenance specialists have undertaken a host of improvements, implementing processes and ensuring compliance.

Since SgurrEnergy's appointment, significant progress has been made on the turbine itself and the surrounding site, including improvements to the site's access road, the resolution of a drainage issue and upgrades to the high voltage apparatus. Low voltage power distribution upgrades have also been undertaken alongside improvements to site communication infrastructure. SgurrEnergy's dedicated health, safety and environmental (HSE) team has implemented a site-specific plan to ensure that all HSE standards are met.

A site manager has been on-site since December, coordinating O&M activities, site safety, health and safety inductions for all site visitors and compliance with statutory legislation, planning conditions and legal requirements. One key aspect of responsibility is ensuring that the turbine is operated under the wind turbine safety rules (WTSR), while striving to optimise performance with minimal downtime and allow for sufficient research and development activity.

In addition, the O&M team undertakes regular inspections of the turbine and its supporting offshore substructure, as well as balance of plant maintenance both onshore and offshore for civil, mechanical and high voltage electrical plant.

Using the data from the turbine SCADA system, SgurrEnergy's 24/7 control centre monitors and controls its activity, managing key operational and performance metrics including wind speed and direction, power output and alarm and fault data. Control centre works using the SgurrPerformance asset management tool which is linked to the turbine SCADA system, allowing logging of operational data, analysis and presentation of key data parameters.

Using this data, operational controllers can remotely identify and assess issues impacting the turbine, resetting faults to ensure smooth operation. The control centre also monitors any inclement weather in the surrounding area, such as lightening and wind speed, from a health and safety perspective, and performs CCTV monitoring for security.

Alongside the technical challenges that the team faces on-site, community engagement is high on the agenda for this project, which aims to work with local partners to develop and deliver education and training to support the development of in-demand skills in local people. As a hands-on operational specialist, SgurrEnergy has been involved in stakeholder engagement events, including hosting O&M students from Fife College on an educational visit, involvement in community events and managing the concerns and questions of local residents.

A Galion Lidar wind measurement device has been deployed on-site to characterise the wind regime around the turbine, and this will provide accurate data to better enhance the turbine's performance.

image below

Sunset over Levenmouth

Image courtesy of Matthew Kelly of SgurrEnergy

LEARNING THE O&M LESSONS FROM INDUSTRY

Operations and maintenance (O&M) costs can account for up to 25% of the overall Levelised Cost of Energy (LCoE) for offshore wind farms. Reducing those costs is a huge driver for today's Owner/Operators and Original Equipment Manufacturers (OEMs) and so ORE Catapult is delivering a programme of offshore wind farm O&M case studies to share best practice, knowledge and experience of O&M topics.

The project, sponsored by the Offshore Wind Programme Board and The Crown Estate, addresses a need first identified by ORE Catapult's O&M Forum, a group of industry representatives who meet on a regular basis to discuss O&M topics and concerns. They wanted a mechanism to share knowledge and experience, and these case studies have provided a platform for operations and maintenance experts from across the UK offshore wind sector to share their knowledge on specific technical, commercial and operations challenges.

Case study reports

The case study topics were proposed by members of the O&M Forum and were used to showcase best practice and highlight common issues and experiences from across the sector. They draw on the operational experience of key resources and highlight the key learning outcomes and recommendations to others arising from each topic.

Eleven case studies have been documented in partnership with Owner/Operators and an experienced O&M professional consultant. On-site interviews were conducted at offshore wind O&M bases around the UK throughout 2015/2016 and all of the resulting case study reports are being made publicly available via the ORE Catapult website.

Industry workshops

The case studies are being presented by the participant organisations at a series of ORE Catapult-hosted industry workshops. The first five case studies were presented in London in April 2016 and the remaining six case studies are scheduled to be presented in June 2016. These workshops have stimulated lively and productive debate amongst operators, further enhancing the knowledge sharing and highlighting further topics for consideration for more case studies.

CASE STUDY EXAMPLE

Here is a short synopsis of an example case study which has been produced by the programme:

Title: An Evidence-Based Appraisal of Crew Transfer Vessel Thresholds (RWE)

This case study describes the development of a method to assess the capability of current crew transfer vessels and explores the additional benefits that use of a helicopter may provide.

The key recommendations of the case study are:

- Using actual site data, it was found that the use of helicopters at this site offered no commercial benefit to the windfarm owner in terms of gaining additional access.
- Crew transfer vessels can safely transfer teams in sea states with significant wave heights (Hs) of up to 1.8m Hs.
- The development and application of an access optimisation methodology has enabled several key areas, including future performance improvements, improved confidence in setting guidance, the evaluation of key health and safety considerations and an improved approach to evaluating engineering risks.

Further Information All case studies are available to download via the ORE Catapult website: https://ore.catapult.org.uk/analysis-insight

CASE STUDY TOPICS

The list of case study topics, and the Owner/Operators involved, is below:

Self-Perform O&M at Robin Rigg - *E.ON*
An Evidence Based Appraisal of Crew Transfer Vessel Thresholds - *RWE*
Early Fault Detection Using SCADA Data - *E.ON*
End of Warranty O&M Contracting Strategy - *Centrica*
Assuring O&M Data Quality - *Centrica*
Management of H2S Gas in Wind Turbine Sub-Structures - *EDF*
Early O&M Experience of Jacket Foundations - *Vattenfall*
Responding to an HSE Emergency - *Centrica*
The Integration of Operational Data Using CORE - *SPR*
A Novel Offshore Wind Transfer Technique - *Repsol*
Helicopter Strategy Appraisal at Westermost Rough - *DONG*

SIX DEGREES OF FREEDOM
THE FUTURE OF RENEWABLES TESTING

THE TESTING OF OFFSHORE RENEWABLE ENERGY TECHNOLOGIES IS A VITAL STEP IN THE PROCESS OF VALIDATING THE DESIGN PRIOR TO FULL-SCALE DEPLOYMENT OFFSHORE. IT HELPS TO GIVE DEVELOPERS AND INVESTORS THE CONFIDENCE THAT THE TECHNOLOGY IS RELIABLE AND THAT IT CAN SURVIVE ITS DESIGN LIFETIME IN SOME OF THE HARSHEST ENVIRONMENTAL CONDITIONS.

Test houses must strive for continuous improvement in test methodologies to accurately simulate the complex, real-world operating environments of a variety of turbine systems and components in order to deliver the most representative testing possible. Robust test regimes carried out in a controlled environment at full-scale on wind and marine turbine components, coupled with focused, applied research can significantly influence the rate of cost reduction.

ORE Catapult's National Renewable Energy Centre in Blyth has been at the forefront of developing representative testing methods since 2002. Its blade, drive train and electrical test facilities are capable of accelerated lifetime testing, allowing the precise, controlled emulation of IEC wind events and other in-field conditions. As such they contribute toward system validation (i.e. complete nacelle test), sub system validation (i.e. powertrain), component validation (i.e. gearbox bearings and blades), and materials validation.

Drive trains

Wind and tidal turbines experience far more complex load profiles than simple torque; being able to replicate these profiles dynamically in six degrees of freedom allows for a much more representative form of testing of renewable energy technologies. The Catapult's Force Actuation System (FAS) in its 3 and 15MW drive train test facilities enables the most advanced testing of this type.

Six degrees of freedom refers to the freedom of movement of a rigid body in a three dimensional space. Specifically, the body is free to change position as forward/backward (thrust), up/down (heave), left/right (sway) in three perpendicular axes, combined with changes in orientation through rotation about three perpendicular axes, often termed pitch, yaw and roll. The FAS achieves this by utilising high pressure hydraulic activators – one set acting on a forged disc and the other set acting on a shaft. This produces five degrees of freedom – the sixth is derived from the rotational torque of the motor.

The FAS can deliver on demand, extreme loads in multiple degrees of freedom and as such it allows us to replicate the real forces and moments turbines, both wind and tidal, would experience in actual in-field conditions but in the controlled environment of a test facility

Atlantis Resources Ltd is currently carrying out validation testing on its AR1500 tidal turbine using the Catapult's 3MW drive train test facility. This turbine series is to be installed at MeyGen, the UK's first tidal array, in the Pentland Firth off the Scottish coast. The tests are the critical final stage of development that will provide Atlantis, MeyGen and their investors the confidence in the performance and reliability of the turbine. The test rig will be used to simulate the dynamic forces the turbine will experience during operation. This type of testing is critical to ensuring that any technical issues are resolved prior to deployment, mitigating the risk of early failure and unplanned maintenance. ORE Catapult and Atlantis have worked together to develop the test plans to be as representative as possible of the real life operating conditions.

image above
ORE Catapult's 15MW drive train test facility

image left
ORE Catapult's 3MW drive train test facility

The 15MW test facility houses the sister nacelle to that which is installed on ORE Catapult's 7MW offshore wind demonstration turbine in Levenmouth, Fife. This gives the added benefit of being able to measure actual loads the turbine experiences and then simulate those on the sister nacelle using the FAS in the test rig. This, in turn, allows the iterative process of design improvements to be accelerated.

Blades

The Catapult is also developing a method to optimise blade fatigue testing, which is used to demonstrate that a blade can survive its design lifetime. The bi-axial blade fatigue testing method delivers loads in a manner which is far more representative of real life conditions. It has the added benefit of reducing test duration. It is hoped this real-life test will show that an optimised bi-axial test - flapwise and edgewise fatigue testing being carried out simultaneously will accurately predict the induced blade damages, leading to a reduced contingency being required at the design stage. It therefore has the potential to make a significant contribution to the reduction in weight and loads consequently transferred to the drive train.

During operation the blade is loaded in both the flapwise direction (out of the rotor plane) by aerodynamic forces and in the edgewise direction (in the plane of the rotor) by gravity as the rotor spins. The current industry standard of single axis fatigue testing treats these sources of loading separately so it is less realistic. Bi-axial fatigue testing means that both blade axes are fatigue tested simultaneously. This is achieved using a hydraulic excitation system to resonate the blade at its natural frequency.

Representative testing offered by the Catapult brings many benefits to OEMs, asset owners and investors. It helps to drive the reliability and durability of prototype designs. This, in turn, reduces the cost of unplanned maintenance and increases availability, and output. Design margins can be reduced, saving material costs and contributing to more efficient designs. It also allows the designers' calculated effect of upscaling to be validated. The iterative design process is accelerated, reducing the time and cost of getting a new technology to the market, and provides increased investor confidence. It also allows the Catapult to build a solid knowledge base and expertise in key areas, sharing that knowledge for the wider industry benefit, and driving technology innovation that will ultimately make renewable energy more competitive.

NEW GLOBAL BENCHMARKING SERVICE WILL DRIVE WIND ENERGY COST REDUCTION

Benchmarking performance across energy sectors, particularly within oil and gas, is well established. The offshore wind sector has embraced operations and maintenance benchmarking with the SPARTA (System Performance, Availability, Reliability and Trend Analysis) system, but the onshore sector has not yet developed a similar system. Most onshore benchmarking is undertaken at individual portfolio levels, with very little benchmarking across competing portfolio asset managers, be they owner/operators or service providers.

BENCHMARKING IS BECOMING A VITAL TOOL TO SUPPORT WIND ENERGY COST REDUCTION. HERE WE LOOK AT WHY, AND INVESTIGATE A NEW TOOL DEVELOPED FOR THE ONSHORE MARKET.

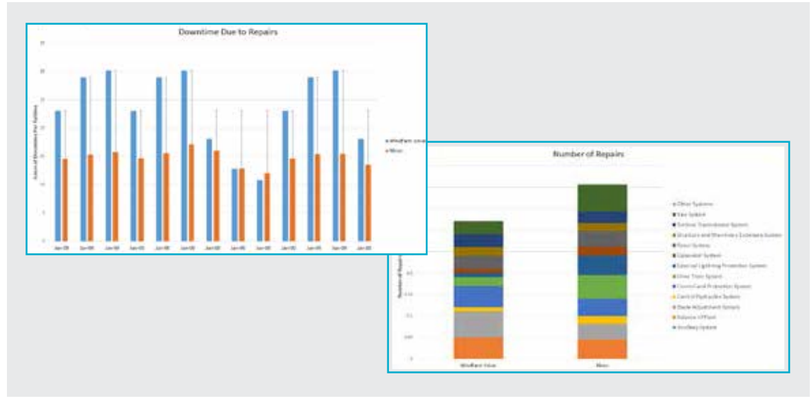
However, with more than 97% (GWEC 2015) of the globally installed wind capacity onshore, and with ageing assets coupled with reducing subsidies and increasing competition, wind farm stakeholders have more motive than ever to benchmark – reliability-related profit vs risk margins. Benchmarking provides a unique and objective understanding of risk from individual wind turbine components up to whole wind farms, leading to increased profitability by identifying loss drivers from a time and cost perspective.

With a track record in offshore benchmarking, ORE Catapult has formed a Joint Venture with Sciemus Ltd, a London-based data analytics firm, to provide a new, independent, standards-based, operations and maintenance benchmarking service to the worldwide onshore wind community.

The Wind Energy Benchmarking Service Ltd (WEBS) has licenced ORE Catapult's benchmarking software, modified it for the onshore wind sector, and added 185,000 turbine years' worth of availability and reliability data from Sciemus' proprietary data set developed over six years.

In wind farm benchmarking, advanced statistical methods are used to understand the relationships between metrics, such as maintenance and performance, and the effect on outputs, such as profit. These analysis tools can help wind farm owners understand the impact of altering, for example, maintenance work effort and spend in pursuit of greater profits. In particular, the value of each incremental spend can be looked at in respect of the resulting reliability improvements, to find the ceiling above which additional spending results in only marginal improvement.
For investors, benchmarking specific investment opportunities against others supports decision-making and negotiation around pricing and terms. Investors are also keen to understand the scope for value creation within assets through performance improvement. Benchmarking can help measure the value creation opportunity and indicate where the main improvement focus should be.

› **image right**
Graphical outputs from WEBS



Analysing asset reliability also enables a more accurate projection of the earning potential of that asset throughout its lifespan, leading to a better understanding of the impact of asset underperformance on profit margins. These outputs in turn feed financial modelling, asset valuations, energy yield predictions and cost of energy calculations to provide powerful information to investors.

As well as the benefits associated with benchmarking, there are also three fundamental data concerns all potential participants will have – data security, quality and sample size. Operational data is commercially sensitive; owner/operators and asset managers need assurances from benchmark service providers that their data will be secure and anonymised. Additionally, the security of any benchmarking system as a whole is likely to be closely scrutinised to ensure that data cannot be leaked or hacked from the system.

Data quality concerns are predominantly based around participants inputting incorrect and/or inconsistent data. To manage this risk, benchmark service providers should use internationally recognised standards, such as IEC 61400 26-1/2 for availability and link reliability / repair metrics to component taxonomies such as RDS-PP. Furthermore, benchmark service providers should undertake some form of assurance or verification process for key input data items such as availability and reliability metrics. Problems can be identified and resolved, improving both the value of, and confidence in, the returned benchmarks.

Sample size is also hugely important – the bigger the sample size, the more "representative" the benchmark becomes for observed real-world performance. As a bigger sample size is collected, this also gives organisations the ability to drill-down into more specific benchmark criteria, e.g. farm size, or turbine technology.

Benchmarking provides a platform for the industry to work more effectively together in the interests of ensuring wind becomes truly cost-competitive in the global energy market. It can help lower the Levelised Cost of Energy (LCoE) through more effective operational expenditure and provide a greater return on investment. Establishing a major benchmark takes time, agreement and a willingness for organisations to participate. However the upside in terms of accelerated equipment understanding, technology maturity, and lowering LCoE makes this investment in benchmarking systems one of the cornerstones of success for the industry going forward.

Providing independent benchmark values and insight for subscribers across the onshore wind energy sector, while ensuring both data confidentiality and confidence in the quality of the results, is the goal of WEBS. It provides a solution for wind farm owner operators, service providers and investors, in line with the above thinking and is actively seeking subscribers.

For further information contact ….
Keith Harrison keith.harrison@orecatapult.org.uk

PROJECT SNAPSHOTS

Remote Turbine Inspection

ORE Catapult is developing services to support testing, training, R&D and technology innovation for offshore wind turbine remote inspection techniques, such as ROAV (Remotely Operated Arial Vehicles) and transition piece mounted cameras. These services are based around the Levenmouth turbine, providing open access to a representative offshore asset facilitating, amongst other applications, test and validation of remote inspection accuracy, as well as research into new inspection methodologies and technology improvements.

SWEPT2

SWEPT2 (Simulated Wake Effects Platform for Turbines) is a cross-industry/academic join industry project (JIP), part-funded by Innovate UK, integrating cutting edge cloud based Computational Fluid Dynamics (CFD) code for wind resource and wake modelling into a commercial software package to enable industry to improve wind farm design and efficiency and in turn reduce the levelised cost of energy (LCOE). ORE Catapult is playing a key role in the validation of the SWEPT code through comparison to field data from offshore wind farms, which includes wind farm SCADA and meteorological mast data, as well as turbine-mounted and scanning Lidar data.

OPTIMUS

ORE Catapult is the project lead in a €5.6million FP7 EU funded project involving 12 project partners participating from six countries across Europe. The 36 month project, which commenced in August 2013, is developing novel strategies to help monitor and predict the remaining operational life of key wind turbine components. The consortium will be reviewing wind turbine data and this will be used to carry out vital modelling used in the development of a new condition monitoring system.
http://optimusfp7.eu/

Knowledge | Collaboration | Innovation

Lifes50+

ORE Catapult is a key partner in the European Horizon2020-funded programme LIFES50+, which is set to drive forward the development of the next generation of floating wind substructures. LIFES 50+ is developing a robust system for evaluating new technologies and supporting the qualification of two new innovative designs in floating wind. Funded through the H2020 programme, this €7.3 million project will result in the qualification of innovative floating substructures for 10MW wind turbines in water depths greater than 50m. We will lead on the uncertainty and risk management work package of the project, evaluating the risks associated with the substructures being developed and designing and developing a risk assessment methodology for floating substructures.

TLPWIND UK

This collaborative project brings together the academic expertise of Strathclyde University with engineering of IEC and the cost modelling of ORE Catapult. It aims to drive forward the technological development and de-risking of the Tension Leg Platform (TLP) WIND concept, designed for sites in UK waters. It will ensure that the technology is ready for full-scale demonstration, prior to development on a commercial scale.

WIN WIN

ORE Catapult is a participant in the DNV GL-led WIN WIN joint industry project that marries floating wind turbines with water injection technology for ageing offshore fields. Initial DNV GL studies showed that a standalone wind-powered water-injection system could become cost competitive for various types of applications, particularly for water injection far from the production platform, and when costly retrofitting is not an option.

NEWS ROUND UP

New report confirms offshore wind costs falling fast with 12 of 13 cost indicators on or ahead of target

The second Cost Reduction Monitoring Framework (CRMF) was delivered by ORE Catapult to the Offshore Wind Programme Board. The report provides strong evidence that the cost of energy from offshore wind continued to fall through 2015 and remains on track to deliver the target of £100/MWh by 2020. It also shows that investment in turbine technology has delivered significant cost benefits, but that further reduction will need to come from the innovations in 'balance of plant', such as foundations, cables and substations.

Of the 13 cost reduction indicators in the report, all but one are ahead or on target with the milestone set in 2015. The only measure that is behind target is growth and scale. Findings show that industry has already adopted innovations that were not previously expected to significantly drive cost reduction until 2017, particularly in the areas of turbine design and project maintenance.

The report also assessed the degree of confidence that the industry has in delivering further cost savings. It found high confidence of delivery in eight of the indicators, with medium confidence in a further three, to achieve the milestone of £100/MWh in 2020. Such confidence has brought a commitment from Government to work with industry on agreeing a new, ambitious cost reduction target for the 2020s.

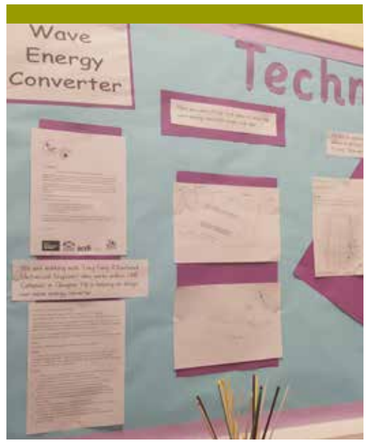
ORE Catapult and Tecnalia to collaborate on offshore renewable energy research and development

The Catapult has signed a collaboration agreement with Tecnalia, one of Europe's leading research centres, to work together to tackle some of the sector's key technology challenges. The parties will collaborate on EU frameworks and share testing and demonstration experience in offshore wind energy technologies, with a view to improving existing testing capabilities and facilitating access to each other's testing infrastructure.

Representatives from both organisations will sit on each other's respective advisory groups, helping to identify and prioritise critical areas where innovative approaches and technological development can accelerate cost reduction in the delivery of offshore renewable energy.

Ignacio Martí Pérez, Innovation & Research Director for ORE Catapult, said: "ORE Catapult was set up to drive forward industry collaboration and technology innovation in offshore renewables, and to promote the sharing of best practice and learning.

"Working collaboratively with Tecnalia will enable us to develop international best practise in technology research and development and to focus on accelerating cross border innovation. We can then share that knowledge, ultimately benefitting the whole offshore renewables industry and helping to drive down the cost of energy from offshore wind."



Wave generator puts Benarty Primary in national spotlight

ORE Catapult engineers Tony Fong and Ross Jackson have been lending a helping hand to pupils from Benarty Primary School in Fife, helping them to design two renewable energy generators and reach a national engineering competition final.

The Primary 7 pupils designed two scale-model wave energy converters for the Junior Saltire Prize, a marine energy competition open to pupils from across Scotland. Now, having wowed the judges, the aspiring young engineers are travelling to FloWave at the University of Edinburgh as we go to press in a bid to win the top prize, £750 for the school and the hotly contested Junior Saltire Trophy.

Latest news and developments

EDF Energy Renewables starts work on the Blyth offshore wind farm

EDF Energy Renewables has announced that it is to build a new offshore wind farm off the coast of Blyth in Northumberland. Construction work for the project has begun onshore and offshore work will start in 2017 to install five turbines of 41.5MW in capacity. The turbines will provide enough low carbon electricity to power 33,000 homes. The project has permission for a maximum total generating capacity of almost 100 MW.

The project will use the latest generation of offshore wind turbines manufactured and installed by MHI Vestas Offshore Wind and this will be the first project to use 66kV cable technology which will be installed by VMBS who specialise in subsea power cable installation. The standard voltage for cables has been 33kV until now but with turbines growing in power a higher specification has been developed.

The concrete gravity base foundations are the first of their kind to be built in the world and the new installation method of 'float and sink' will be used for the project. This is the first time this method has been used for wind turbines. The foundations will be designed and built by Royal BAM Group in the Neptune dry dock on the Tyne and will then be floated and sunk in position using tugs.

ORE Catapult worked on the project from its inception and CEO Andrew Jamieson said: "EDF Energy Renewables' green light on the Blyth Offshore Wind Farm is great news for the industry, and for the North East in particular.

"The Catapult will continue to work closely with EDF ER through this and other projects on the development of innovative new technologies to further drive down the cost of offshore wind."

Internationally renowned scientist joins ORE Catapult Board

Dame Anne Glover DBE has been appointed to the ORE Catapult Board as a Non-Executive Director.

A biologist and academic, Dame Anne is Vice Principal for External Affairs and Dean for Europe at the University of Aberdeen and a former Chief Scientific Adviser to the President of the European Commission and Chief Scientific Adviser for Scotland. She was joint chair of the Scottish Science Advisory Committee and served on the Scottish Council of Economic Advisers until her appointment to the European Commission in 2012.

ORE Catapult Chairman Colin Hood commented, "I am extremely pleased to welcome Dame Anne to ORE Catapult's Board. Her considerable experience of science, technology and innovation, and of shaping both UK and European policy, will prove invaluable at a critical time for the offshore renewables industry as we seek to drive technology innovation to lower the cost of energy from the UK's extensive offshore renewable resources.

Dame Anne Glover said, "One of the most exciting prospects we face is to harness renewable energy. For this reason, I am delighted to join the Offshore Renewable Energy Catapult. Any new technology poses both challenges and opportunities and ORE Catapult is the catalyst to procure and harness knowledge, engage industry (large and small) and to accelerate the delivery of sustainable energy options. I greatly look forward to contributing to that process."

Catapult blades research engineer wins prestigious award

Peter Greaves, Research Structural Engineer – Blades, won the Judges Award at the Scottish Renewables Young Professionals Green Energy Awards in Glasgow. The Judges Award, sponsored by EDF Energy Renewables, is awarded to an entry that the judges felt merited special commendation. Peter was recognised for his work in developing a new form of offshore wind blade testing, where the blade is tested in both axes at once rather than single axis testing.

CATAPULT
Offshore Renewable Energy

ORE Catapult

Inovo

121 George Street,
Glasgow,
G1 1RD, UK
T: +44 (0)333 004 1400

National Renewable Energy Centre

Albert Street, Blyth,
Northumberland,
NE24 1LZ, UK
T: +44 (0)1670 359 555

Fife Renewables Innovation Centre (FRIC)

Ajax Way,
Leven,
KY8 3RS
T: +44 (0)1670 357649

ore.catapult.org.uk
@ORECatapult
info@ore.catapult.org.uk

For further information, or to request paper copies of **Circuit** contact:
Vicki Buchan, Marketing Communications Manager, on **Tel:** 0333 004 1404 or **Email:** vicki.buchan@ore.catapult.org.uk