



Cairn Duhie Wind Farm wins with pure lidar approach

Supported by advisory services provided by DNV, RES, the world's largest independent renewable energy company has utilised wind lidar as a standalone solution for wind resource assessment and project planning at its 16-turbine scheme, Cairn Duhie. It's a step change in safety, economy and efficiency.

Advances in digital technology have yielded significant benefits to many engineering disciplines and the wind power industry is no different. From flow modelling using computation fluid dynamics to the use of artificial intelligence and machine learning for data analytics, as a modern industry the wind sector has readily embraced many of the most advanced digitally-enabled breakthroughs.

As a route to becoming, safer, more efficient, cost-effective and competitive, these techniques are behind the dramatic

reduction seen in the cost of generation from wind power and a big part of its successful deployment. One key area of development has been in the use of remote sensing technologies and the use of tools such as wind lidars as part of the required resource measurement campaign to accurately record key characteristics of the wind including speed, direction and turbulence.

Leading developers and project operators keen to maintain a competitive advantage have long embraced digitally-enabled

technologies such as lidars. RES, headquartered in the UK, has always had an eye on technologies that can support its development objectives. With more than 24 GW of renewable energy projects delivered worldwide since it was founded over 40 years ago, and an operational asset portfolio exceeding 41 GW, the company was an early adopter of lidar technology.

RES began working with leading lidar company ZX Lidars in 2005 soon after the team released the world's first commercially-available wind

lidar. Today, the two are strategic partners but have a long-term relationship based not only on technical ability but also on an assurance that ZX Lidars will go the extra mile to guarantee performance.

This level of commitment goes back to the earliest days of the relationship, demonstrated by ZX Lidars' Managing Director who camped out in a field with the first ZX Lidars machine to ensure RES got the best possible outcome from Lidar.

'We have always been keen to explore innovative technologies that help us, and our clients meet commercial objectives in a safer and more efficient way. Given the potential operational and safety benefits of lidar it was an obvious route for us to explore over 15 years ago,' explains Karen Anne Hutton, Technical Director at RES.

'Through multiple projects both in the UK & Ireland and overseas, as our depth of knowledge and experience has grown so has the industry's confidence in the flexibility and suitability of lidar to deliver the accurate data that is fundamental to developing wind power projects with well managed project risk as deemed by Independent Engineers,' she adds.

Realising the benefits of lidar

Lidar technology certainly can't be considered new anymore, it's simply the modern approach to wind farm development. With countless project references built up over the last two decades, the evidence of its benefits has become utterly compelling. Deployed in multiple applications from pre-construction wind resource assessments to operational power curve measurements and performance monitoring, lidar has regularly exceeded developer expectations. And, while it has often been installed in conjunction with traditional met masts, lidar typically represents an improvement on the previous, traditional approach.

Based on safe, scanning laser technology, ZX Lidar's ZX 300 model crucially provides detailed data on wind speed and direction

from ground level to 300 metres altitude. This is a significant advantage given trends in wind turbine heights and rotor diameters. Reaching well above and beyond 200 metres, lidars deliver accurate data above the tip height of even the largest turbine in commercial use today and will continue to match or exceed the maximum height of tomorrow's wind turbines both onshore and offshore.

Accurate wind shear data across the full rotor sweep of the turbine eliminates the need for the interpolation of wind data that is seen in met mast approaches and therefore reduces project uncertainty relating to the wind conditions at these higher heights. This capability marks a significant contrast with met mast technology which is limited to around 120 metres.

Met mast costs also increase dramatically once heights exceed 60 metres with greater expenditure on the base concrete platform required and a switch to lattice design, rather than a simple tubular-type structure. Lidar deployment teams are also much smaller than those needed for a large met mast. More on-site staff inevitably increases general mobilisation inefficiencies and interface risk. Working at height also implies an additional challenge in terms of health and safety.

Furthermore, lidars are inherently flexible and can be deployed easily. Lidars require none of the concrete platforms or other infrastructure that met masts need and can therefore also be moved to new locations quickly if required. Another potential benefit associated with lidar wind resource campaigns is their low profile and small physical presence.

Unlike lidar, installing a met mast requires planning approval, and such high-profile structures inevitably attract interest which potentially can have a negative impact on a project's development, if not well communicated. For example, locals may misinterpret the installation of a mast to indicate planning approval for a full development when this is not the case.

Fundamentally, with lidar technology having matured in the previous decade, data produced by lidar measurement are considered just as 'bankable' as data from a conventional metrological wind measurement mast, when appropriately sited. As such, lidars meet all the requirements that both the wind industry and those that finance their projects demand.

'Lidar is a technology which offers real advantages over meteorological mast-based measurements, in particular with respect to the simplicity of installation, flexibility of deployment and the reduction of health and safety risks. As the industry has gained experience with the use of lidar devices, the case for wider use of lidar has become more compelling,' says Paul Leask, Service Line Leader for Project Development & Analytics for Energy Systems at DNV.

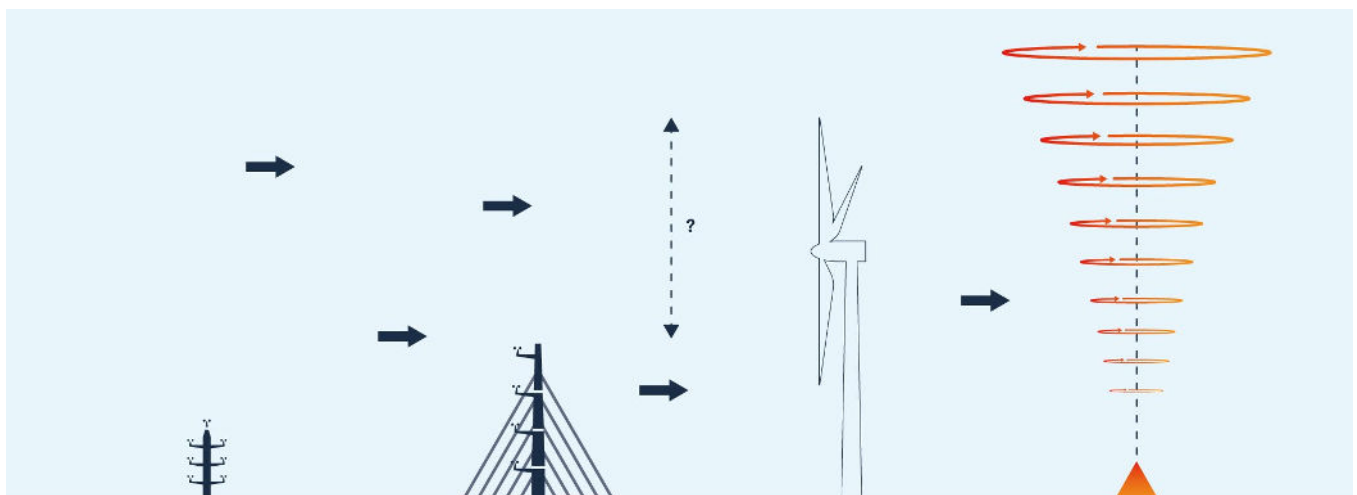
As a tried and tested approach to gathering data on wind characteristics, lidar has a significant role in the clean energy transition but is also making the wind development process easier, less disruptive and quicker too.

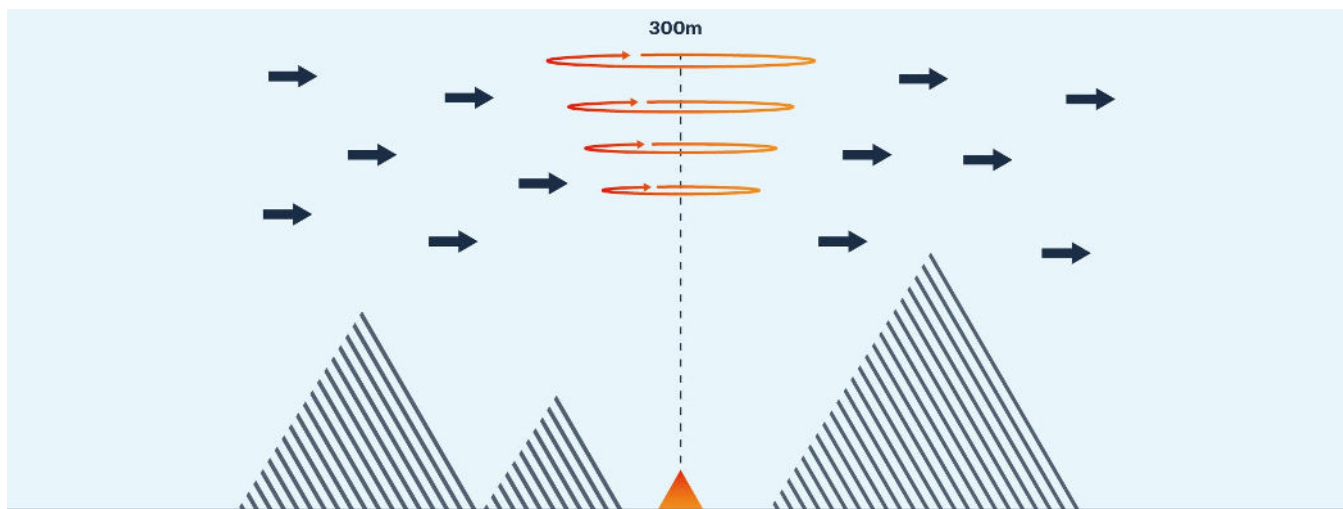
John Boyce, Development Director of Wind in the UK & Ireland at RES, explains: 'We've adopted lidar as a key enabling technology in our efforts towards a future where everyone has access to affordable zero carbon energy. Lidar is easy, quick, safe and sensitive to the land and landowners with whom we partner. The inobtrusive lidar measurement campaigns mean the land can continue to be farmed throughout a significant period of the site exploration, helping to minimise any potential disturbance during the early development process stages.'

Switching to a pure lidar approach

Turning to one of the world's leading wind risk management and classification companies, RES worked with DNV to progress industry best practices such as lidar siting and technology appropriateness to support lidar-only wind resource assessment.

DNV and RES systematically follow a very detailed step-by-step process to ensure





projects using Lidar-only data have the full confidence of investors and turbine manufacturers. This process has established lidar as a technology that is at least as reliable and trustworthy as the conventional met mast approach and would be just as acceptable to investors and financiers.

'At DNV, one of our primary goals is to support our customers to transition faster to a deeply decarbonised energy system, the energy transition. As the world's leading resource of independent energy experts and technical advisors, we have set high benchmarks to ensure business and industry can rely on the data delivered from lidar.

'While it is important to deploy and operate the lidar unit suitably, as with any other kind of measurement technology, DNV has confidence in the quality and accuracy of lidar devices such as the ZX300. We are confident that the ZX300 Lidar has been proven to be a reliable standalone tool for wind resource assessment,' said Leask.

Having established the core parameters, projects using lidar only for resource assessment can ultimately progress to construction and financial close. In the wake of its adoption of the lidar-only approach, DNV offer advisory services to ensure lidars are used optimally on the development site, as well as offering guidance of the pure lidar approach to accurate wind resource mapping.

Cairn Duhie Wind Farm takes the lead with lidar

The recently consented Cairn Duhie Wind Farm is located to the south east of Ferness village, in Nairnshire, approximately 15 km south east of Nairn and 13.5 km north/north west of Grantown-on-Spey. The site was chosen because it lies in an area identified as having 'potential for wind farm development' within Highland Council's Spatial Framework policy, and has good wind speeds for energy generation, no international or national nature designations, and straight-forward access directly from the A939.

Consisting of 16 turbines with tip heights of up to 149.9 m and with a total maximum generating capacity of 67.2 megawatts, Cairn Duhie Wind Farm will be capable of generating sufficient clean, low-cost renewable electricity to meet the needs of around 57,000 homes each year, once operational.

'A lidar-only approach is simply a modern approach to wind farm development, notes Boyce. He adds: Lidar isn't a new technology anymore but it does allow the industry to embrace new methodologies like those RES has developed with DNV. That's real progress and Cairn Duhie reinforces that.

'It means we can develop wind farms without necessarily needing met mast installations while still delivering 'bankable' data that meets or exceeds all industry standards and expectations. Crucially, we can do this quicker, more flexibly, with better safety and lower risk of accident and injury. It really is a win-win.'

Executing lean development with lidar

Companies like RES have built their success on decades of strategised decision-making. RES recognises that modern remote sensing techniques like Lidar are fast and effective. It also brings project stakeholders with them in adopting the best value solution to modern wind farm development.

Collaboration with leading verification bodies like DNV not only reinforces RES' own view but firmly establishes lidar's primary role in the execution of wind power projects. This lidar-only methodology project is a clear demonstration that the journey towards a fully digitally-enabled wind industry just got a lot shorter.

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