First things first with wind measurement

It's not exactly rocket science, but now that wind is measured with lidar, it's worth taking a breath to actually think about what can be done first on a site. Not surprisingly as a lidar manufacturer writing this article, at ZX we say measure the wind first. But, when the goalposts have changed it really is worth seeing if you should adopt a different approach.

The role of lidar within wind measurement campaigns is routinely documented in wind energy publications, conferences, and in important, fundamental academic research. Often, the focus is on the types of and use of measurements/data that wind lidars offer. Sometimes overlooked is the ability to deploy lidar at speed; not only once on site, practically, due to the sensor itself being remote, i.e. at ground level, from the target, i.e. the wind, but actually often without the need for any planning permission whatsoever.

And that's where the goalposts have changed, by at least six months, which is quite significant within the early feasibility stages of an onshore wind farm development. Whether that time means you are 'first' to a site ahead of the competition, key in certain regions, or because you can accelerate a wind resource assessment while you wait for a planning application for a meteorological mast, it can certainly be time well spent.

Helen Thrasher, Head of Technical at renewable energy developer Fred. Olsen Renewables notes, 'We believe in a 'wind first' approach to development, ensuring our wind farms are designed to make the most of the onsite wind resource and be as efficient as possible. To achieve this, it is imperative that we have high-quality data measurements from the site, informing our design decisions every step of the way.'

Fred. Olsen Renewables utilises wind resource campaign management specialist ZX Measurement Services to support its expanding onshore wind development activities in Scotland and to deliver this wind-first approach with lidar at the heart. One of the longest-standing developers in Scotland, the company has a UK portfolio of 258 operational turbines, alongside a further 76 consented. This, combined with projects in Norway and Sweden, brings its total operational capacity to 787.7 MW, providing enough power for 586,190 homes.

One recent example of this wind-first approach is at Scawd Law Wind Farm, where a 12-month comprehensive wind measurement campaign could begin at pace using wind Lidars. The site is located on the Holylee Estate, approximately 4 km north of Walkerburn, in the Scottish Borders and the proposed site design consists of eight turbines and battery storage, delivering 60 MW of clean energy.

'Deploying lidar technology at Scawd Law allowed us to collect this vital data from several locations across the complex site, surveying up to our estimated tip height of 180 m,' Thrasher explains. 'The easily deployable nature of the Lidar meant that we were able to adapt our campaign to improve our modeling accuracy as the project evolved.'

By measuring the wind first, many other wind technical and commercial tasks can also be optimised and altered once an initial estimate of the available wind resource at the site has been made. Prospective site class information can aid early wind turbine OEM discussions, grid connection sizing can be established and the site design can be evaluated. Ongoing measurement campaigns can also be designed and executed, including the redeployment of the lidar itself, or indeed the erection of a fixed reference be that an additional static lidar or a met mast

The result for Fred. Olsen Renewables? 'Efficient and economically viable projects, with an accurate understanding of expected performance,' confirms Thrasher.

Lidar measurements themselves are of course dependent on a robust campaign to make the most of this 'head start'. Simply put, there's no point trying to leapfrog the process if only to be let down by a poorly executed measurement plan from day one.

Wind resource campaigns are multi-faceted and consideration should be given to:

- data measurements required
- instrumentation power supply
- site constraints and access
- installation and commissioning approach
- available communications for data transfer
- data management and quality control
- useful data reporting.

Kasia Szczepanik, development engineer at UK-based renewable energy developer Banks Renewables discusses one such campaign. 'On proposed sites such as Bodinglee Wind Farm, where we are considering the latest wind turbine technology at increasing tip heights, lidars are proving a cost-effective and practical method for providing vital wind measurements across the full height of the eventual wind turbine.'

Banks Renewables conducted complete wind measurement services at the proposed Bodinglee Wind Farm, Mill Rig Wind Farm and Lethans Wind Farm Extension. ZX Measurement Services has recently completed the first of these two-year wind measurement campaigns, using the ZX 300 wind lidar, at the proposed Bodinglee Wind Farm in South Lanarkshire, Scotland. If approved, the 37-turbine site is expected to deliver 266 MW of clean energy, enough to provide around 212,928 homes with green electricity annually.

The family-owned Banks Renewables owned and operated 282 MW of renewable energy generation, with a further 547 MW in various stages of development. With eleven operational onshore wind farms across Scotland and the North of England, a further 14 sites are in development, and wind measurements at key wind sites are underway. In October 2023, Banks Group announced that its renewable energy division Banks Renewables was being acquired by Brookfield, a leading global asset manager with $850 bn of assets under management.

Szczepanik continues, 'The team at ZX Measurement Services has provided us with a professional and holistic approach to our wind measurement requirements, making this part of the project simpler and easier for us.'

Whilst the praise is certainly very welcome, the key point is the concept of the holistic approach to wind measurements.

Lidar can represent improvements for wind energy projects. They can help the industry meet the ambitious targets that the world needs by leapfrogging normal met mast planning permissions. Wind lidars present an opportunity to define wind characteristics across the full wind turbine rotor diameter of today's and indeed tomorrow's wind turbines, easily and quickly relocated throughout the proposed wind development site and with an unprecedented degree of flexibility. They move the goalposts of any wind measurement campaign and by following some simple steps they really can and should measure the wind, first.

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The 7 Ps for wind measurement perfection

Plan

Establish and communicate your wind measurement goals, define the objectives. Know the right data to get ahead.

Prepare

Know the measurement heights for your lidar and pre-test any equipment being mobilised to site, to minimise the unknowns when you get there.

Placement

A good consultancy helps in planning your measurement equipment placement!

Peripherals

Deploy the right power solution for the site conditions and think about what that site will look like in 6 months' time, including climate, flora, and fauna. How will you retrieve the precious data? Is there sufficient cellular network coverage on-site or are satellite communications required?

Performance

Routinely monitor all aspects of the wind campaign against your plan. Set alarms for critical elements but don't wait the full six months to refresh your yield analysis.

Procurement

Think ahead and make the data being collected part of the turbine procurement process from site suitability and loads to the contractual power curve.

Partners

Don't do this alone. Combine project experience with local knowledge and your projects will benefit.