

A WORD ABOUT WIND

SEPTEMBER 2016

OPTIMISATION

How to boost returns at your wind farms

In association with





Proven wind farm performance optimisation

Whether your wind farm is underperforming or you just want to enhance performance, talk to the optimisation experts.

Our clients are achieving >5% production enhancement through:

- Accurate yaw alignment
- Control improvements
- Blade aerodynamic enhancement
- Forestry restructuring
- Comprehensive measurement and rigorous analysis.

Enhance performance | Boost returns | Reduce operational costs

CONTENTS

Editorial: Companies start taking optimisation seriously	4
Marginal Gains: How to boost wind farm returns	5
Q&A: John Matthew, VP of Asset Management, Allianz	9
Q&A: John Sturman, Director, Kennedy Renewables	10
The Authors: A Word About Wind and SgurrEnergy	11



Vital market insight at A Word About Wind's Financing Wind conference

EDITORIAL



by Richard Heap,
editor at A Word About Wind

“Improving existing assets can help investors boost returns while their margins are being squeezed elsewhere.”

A Word About Wind

www.awordaboutwind.com
editorial@awordaboutwind.com
T: +44 (0)20 7193 6013
+1 (917) 310 3307

2nd Floor,
167-169 Great Portland Street,
London, W1W 5PF

Editor: Richard Heap
Designer: Lee Washington
Sales & Membership:
Joe Gulliver
Publisher: Adam Barber

Cover image: SgurrEnergy

Over the next few years we expect wind farm owners and investors to take optimisation of assets more seriously. Here are the reasons why.

In large part, this is due to increasing numbers of pressures on developers and investors in established markets.

Governments in leading wind nations, including Germany, have been looking to restrict the amount of new schemes coming to the market, in order to keep subsidies in check. If it becomes tougher for firms to build new projects then it puts greater pressure on them to boost returns in other ways. Improving existing assets can do this.

Many of these nations have also been introducing systems where feed-in tariffs are set by reverse auctions, rather than centrally-set rates. This is putting more pressure on investors to reduce the levelized cost of energy of their new schemes. Again, improving their existing assets can help investors boost returns while their margins are being squeezed elsewhere.

We also see big changes coming from within the industry.

The focus on cost-cutting for new projects will no doubt encourage owners and investors to think more creatively about their existing assets. Drones, lidar and turbine improvements can all help to make new schemes better, and owners will not want existing schemes to miss out. Consolidation among major manufacturers will help drive wind's technological arms race.

Investors and owners will also be looking at what they can learn from schemes at the other end of the project lifecycle. In countries like Germany, the first generation of wind farms are hitting the end of their useable lives, and this is getting more investors

focused on how to improve and re-power them. Improving their newer schemes is the next logical step.

So, in short, this is all part of the wind industry's continued evolution. The industry has come a long way in the last five years when it comes to thinking proactively about how best to manage operational assets, but all too often this has focused mainly on how to get turbines to carry on for longer rather than making them more effective while they are operational.

However, as you will see in this report, optimising existing wind farms can do both things: making schemes more efficient and helping them to last longer. Sounds counterintuitive, right? If a turbine is working harder then surely that should be detrimental to its lifespan?

Not so, says SgurrEnergy's director of innovation Alan Mortimer. He explains that running your turbines more efficiently can both improve energy yield, which boosts returns, and put them under less stress, which means they last longer. He calls it a "win-win situation".

In this report, we cover the key cost-effective ways that investors should look to optimise projects; we run through a series of case studies of those who have done it; and we have included two short Q&A interviews with firms that have used some of these techniques.

And this is the key reason why firms should look seriously at optimising their wind farms: it makes good business sense, in a booming market or a more challenging one.

All the best,

Rich

HOW TO BOOST WIND FARM RETURNS

Making small improvements to working wind farms can add up to a large financial boost for project owners and investors

“Most wind farms have potential for between 5% and 11% performance improvements, and sometimes more.”

The British cycling team dominated the Olympics in Rio last month in much the same way it did in London in 2012. This is testament to the continued influence of Dave Brailsford.

Brailsford was, until 2014, the performance director at British Cycling who masterminded the theory of ‘marginal gains’, which says that a cyclist can significantly boost performance by making many small improvements. The idea has gained popularity in the business world and Alan Mortimer, director of innovation at SgurrEnergy, a Wood Group business, says it applies to wind farms too.

He says: “The British Olympics cycling team

is so successful because of their attention to detail and the marginal gains, and it is the same here. When you add together these potential gains then most wind farms could improve performance by between 5% and 11%, and sometimes more if the project is adversely impacted by forestry. Those gains are very attractive for project owners.”

Mortimer says there are plenty of good reasons for investors to optimise their wind farms. Over the short term, it means they can improve the returns from the project by increasing the electricity output; and, over the long term, the improvements made to the turbines can help put less strain on them, which reduces maintenance bills and extends the lifespans of projects. He says there are a number of areas investors should look at to boost returns.

These include improving the aerodynamics of turbine blades; using up-to-date control and monitoring software systems; managing forests that affect air flows around projects; and fixing yaw errors.

He says: “All of these affect the output of wind farms to various degrees and have the potential to be redressed with retrospective measures, which is what this is all about: to be able to go back to operating wind farms and improve their performance.

He also talks about pioneering technology that could help owners to manage their schemes more effectively over the next five to ten years.

Project lifecycle: Marginal gains theory helped Bradley Wiggins at London 2012, and it works in wind too



Source: Dan Davison via Flickr

I. REDUCING IMPACTS OF FORESTRY

One area for owners to look at is whether nearby forests are affecting the airflows for their projects, and this does not just impact schemes that are located within forests. Trees can affect wind farms several kilometres away and, if wind farm owners can work with forestry managers to restructure those areas of the forest that are having greatest impact, this can produce very attractive financial returns.

Typically, owners that address forestry issues could see a 2%-5% improvement in their scheme's energy production, but this can be up to 15%. An improvement of 15% in energy production would raise a project's 20-year absolute internal rate of return (IRR) by 3%.

Mortimer says that SgurrEnergy would typically start by using lidar to monitor the airflows around the forests and wind farms. These laser-based systems can cover large areas and show how trees are affecting the wind before it reaches the wind farm.

"Even when you have turbines with relatively tall towers, the effects of the trees can carry right up to the rotor area. Lidar shows us what is going on at that level, and then we can relate the impacts of the wind to turbine performance," he says.

Lidar data can then be fed into computer models that use computational fluid dynamics to show which changes to the forest would be most beneficial. Such modelling is already widely used for new projects.

Once the most effective changes have been identified, the challenge for a project owner is then to get the permission to make them happen. This is relatively simple if the forestry is on the same site as the wind farm, but harder if someone else owns the land. The wind farm owner can also face environmental and regulatory hurdles around the felling of trees.

However, owners can frequently find solutions. Forestry managers may find the chance to restructure their forest appealing, as it gives them the opportunity to replant felled areas to modern standards and introduce a wider variety of tree species. SgurrEnergy also has people on its team that have forestry experience and so can find mutually-acceptable solutions.

Owners can also find that such changes to forestry can have benefits beyond the initial improvements to energy production. Smoothing the airflow by restructuring the forest can also result in steadier winds that apply lower loadings on turbines, reducing maintenance costs. There will be a limited number of project owners that can take advantage of this, but for those who can, the gains can be substantial.

2. IMPROVING BLADE AERODYNAMICS

By contrast, most owners should be able to achieve financial benefits by making turbine blades more aerodynamically efficient, particularly by using vortex generators. These can help owners to increase energy production by 2%-3% and improve the 20-year project IRR by 0.3%-0.4%.

Forest jump: Lidar can measure the impacts of nearby forests to improve performance



Case study 1

Client: Wilson Renewables
Project: Bankend Rig wind farm
Location: Scotland
Size: 14.3MW
Commissioned: March 2013

The challenge: SgurrEnergy conducted detailed investigation and optimisation services on Bankend Rig wind farm to identify and mitigate against the cause of underperformance on the site. Regular asset performance reporting had identified the underperformance of turbines at the south-eastern end of the site. The underperformance was due to a combination of low wind speeds, high turbulence and wind shear, with additional yield loss due to one of the turbines persistently tripping out.

The solution: As part of the investigation, SgurrEnergy deployed Galion Lidar onsite for a three-month campaign to measure wind inflow and characterise the impact of the surrounding forestry. Located at ground level, the Galion Lidar quantified the degree of underperformance of the turbines, relating this to key inflow parameters including shear, veer and turbulence. The SgurrEnergy team undertook detailed analysis of the data which confirmed that forestry restructuring would be a viable option.

Following the lidar campaign, Computational Fluid Dynamics modelling was used to review forestry restructuring options with the aim of reducing the impact of surrounding trees on turbine performance. The resulting commercial assessment took into account potential revenue enhancement versus forestry restructuring costs and the optimum solution was identified and presented to Wilson Renewables.

The restructuring plan, once fully implemented, is anticipated to deliver in the region of 5% enhancement in annual energy yield for the wind farm, and will provide the additional benefits of reduced loadings and maintenance costs, and extended component lifetimes.

“The issue here is that blades have an acknowledged compromise between aerodynamic efficiency and other factors, such as their manufacturability and the fact they have to carry structural loading,” says Mortimer. “In practice, wind turbine blade designs have to reflect that compromise and this means that aerodynamic losses occur.”

Flow separation is a problem for blades. This is where the wind flowing over the leading edge of the blade does not follow the surface towards the trailing edge. The separation causes reduced lift and increased drag and, as a result, the blade does not operate at maximum efficiency.

This can be solved by vortex generators, which are pieces of plastic that can be attached to blades in precise locations using high-quality adhesives. These generators give a slight twist to the airflow behind them to delay the separation of the flow from the blade.

Mortimer says these are not new technology, but they have not yet been as widely used in the industry as they could: “Most turbines at the moment do not have vortex generators fitted, so there’s a huge ret-

rofit potential. Most schemes could benefit, but it does depend on the blade type as different blades have more or less potential gain,” he says.

The technology is relatively inexpensive, but owners need to ensure they have experts that can install them in the right places if they are to make the promised improvements. As well as improving performance, vortex generators can also reduce the noise of inefficient blades.

3. ACHIEVING ACCURATE YAW ALIGNMENT

Improving blades is not the only way to make turbines more aerodynamic. Owners could also improve project returns by making sure their turbines are facing directly into the wind.

This relies on the effectiveness of the turbine’s yaw system, which is used to keep the turbine facing directly into the wind. Fixing yaw misalignment can raise energy yield by 1.5%-5% and boost the 20-year project IRR by 0.2%-0.8%.

“It has been known for a long time that

“Most turbines at the moment do not have vortex generators fitted, so there’s a huge retrofit potential.”

Case study 2

Client: Confidential
Project: Confidential
Location: Burgundy, France
Size: 12MW
Commissioned: SgurrOptimiser – static yaw error assessment

The challenge: The client appointed SgurrEnergy to conduct end of warranty inspections on the six wind turbine generators making up the wind farm. Yaw alignment measurements were included in the scope of work. Through careful analysis, SgurrEnergy identified a misalignment and presented corrective actions to the client which will result in increased energy yield and revenue.

SgurrEnergy solution: SgurrEnergy examined the ten-minute SCADA information to assess any potential misalignment across the wind farm. Wind turbine nacelle anemometry and wind vane data were used to identify the levels of reported yaw error, and the corrected yaw alignment at which the wind turbine generators were observed to produce optimal power output. The assessment was carried out for all six WTGs, scanning a range of wind speeds and direction of interest at each WTG.

This robust assessment technique provided a quick identification of the individual WTGs that required further investigation in relation to their nacelle yaw error, without the need for met mast or lidar data. Potential for static yaw error correction was found at five WTGs. The assessment suggests that static offsets of five degrees from the incoming wind direction are present, and that once this is corrected the estimated yield gains will be in the region of two to four percent.

The analytical technique adopted by SgurrEnergy is both robust and efficient, and achieves optimum yaw alignment at much lower cost and more quickly than alternative techniques which necessitate the deployment of nacelle-mounted equipment.



Straight on: Owners can increase returns by pointing turbines directly into the wind

turbines could do better in that regard, but we have been saddled with the traditional technology that has been available," says Mortimer. He is referring to the wind vane installed behind the turbine's nacelle that determines the wind direction.

One problem with the wind vane is its location behind the nacelle, where it is subject to a series of turbulent wind flows from the blades and the nacelle itself. The other big problem with the wind vane is that it only covers the direction of the wind at one specific point, but does not cover the whole of the rotor area.

Mortimer says that SgurrEnergy uses its own analytical techniques to realign turbines by several degrees so they are performing as well as they could be.

But he expects lidar to completely take over the role of the wind vane in coming years, as the industry becomes more aware of the wide-ranging capabilities of lidar. The benefit of lidar is that it measures the average direction of the wind throughout the whole of the rotor area and then aligns the turbine to point in the direction that generates most power overall.

He adds that tests by SgurrEnergy have shown that a purpose-built lidar on the nacelle will significantly boost efficiency.

"For us, this is an obvious application for nacelle-mounted lidar, but just one of many," he says. "We are going to see more applications in the future for lidar on turbines and nacelles, to improve turbine control, but yaw improvements are the number one focus for us at the moment."

4. FOCUSING ON WHOLE PROJECTS

Lidar is not the only area where Mortimer sees room for improvement. He says that owners need to monitor and manage wind farms as whole entities rather than a series of individual turbines. This could raise energy yield by 1%-3%, delivering a 20-year project IRR increase of 0.1% to 0.6%.

Mortimer says the benefits of controlling all turbines at once include being able to manage wake effects in real time. He says: "The interaction between wind turbines can be highly complex, and managing a wind farm as a single organic unit brings benefits through optimally managing the trade-offs between adjacent turbines."

Owners need to manage wind farms as whole entities, not a series of individual turbines

Case Study 3

Client: Confidential
Project: Confidential
Location: Sweden
Size: 50MW
Commissioned: Q4 2015

The challenge: SgurrEnergy was engaged by a wind farm operator to investigate the performance of their wind farm using the SgurrOptimiser forestry service. The forestry surrounding the wind farm is creating complex wind flow. This disturbed wind flow can reduce the lifespan and output of the wind turbine generators.

The solution: The investigation began with SgurrEnergy's measurement team deploying a Galion Lidar on site to assess the wind flow in the affected area. The analysis team then analysed the data gathered and subsequent modelling from this campaign and identified the forest areas impacting on the wind farm's performance. The results showed that if forestry restructuring works were undertaken the P50 annual energy yield increase would be in the region of 3%.

Detailed discussions were held with the forest management company and the restructuring options were agreed within the context for forest sustainability criteria. The restructuring works are currently underway and by targeting pockets of the forest for restructuring, a commercial balance can be struck benefiting both the wind farm operator and the forest owner. Ongoing consultation will take place between the forest owner and SgurrEnergy to complete all of the required felling within the annual forest management plans.

This exercise has confirmed that an integrated approach using state of the art lidar measurement technology coupled with computational modelling expertise delivers substantial value for wind farm owners through targeted forestry restructuring. Working within forestry management guidelines, and conducting extensive consultation with forestry authorities are also essential to successful delivery.



Taking control: Owners should think of whole schemes and not individual turbines

Another benefit of monitoring all of the turbines together is that it helps the project owner in their interactions with the grid operator, particularly in being able to better support the grid in times of stress, and to manage grid constraints more effectively.

Owners can also benefit from better management of noise constraints near sensitive areas, such as homes, that could automatically shut down projects when they are close to breaching the limits.

“Very often, that is done in quite a simplistic and conservative way to ensure the limits are met under any condition to ensure there are no problems,” says Mortimer.

However, this also means that projects are shut down when they do not need to be, which affects their profitability.

In contrast, measuring noise in real-time would enable the owner to tailor their

scheme's performance to comply with those noise limits, and restrict the loss in energy yield. Similar systems could help owners comply with constraints over other issues such as ‘shadow flicker’, which is when turbines periodically cast flickering shadows across nearby areas. This is too often controlled by desktop calculations that unnecessarily hit project returns.

Taken together, the main elements of optimisation covered so far in this article can deliver annual energy production uplift of 5%-11%, excluding the impact of forestry. This results in a 20-year project IRR increase of 1%-2.3%. SgurrEnergy's analysis to date has not incorporated the potential cost avoidance benefits of reduced loadings from the operation of turbines.

Typically, SgurrEnergy performs an initial review of a wind farm over four to six weeks to highlight the most promising areas for improvement; and then undertakes a full

John Matthew, VP Asset Management - Renewables, Allianz Capital Partners



What does your business do and how many wind farms do you own / manage?

Since 2005, Allianz Capital Partners has been dedicated to renewable energy and is one of the world's largest financial investors in renewables, with an investment portfolio of 60 wind and seven solar parks in Europe and the US with more in the pipeline.

These have a combined electrical generation capacity of almost 1.7GW, and produce enough energy to supply more than 500,000 households in Europe – which is comparable to a city the size of Munich.

Do you see reasonable prospects to boost the performance of your assets?

Yes. Where previously wind farm owners and investors were working to ensure that projected performance targets were achieved, new techniques and technology are now allowing us to look at enhancing asset performance across individual turbines and whole sites.

Do you have any investigations underway at this stage?

We do have investigations underway to identify areas of improvement on a selection of our sites.

Are there particular optimisation techniques you think are most promising?

The use of lidar technology combined with advanced analytical and modelling techniques opens up opportunities through more accurate yaw alignment, improved pitch control which optimally matches the site wind regime, better management of constraining factors such as grid limits, and in cold climate regions the proper management of icing conditions which is essential as performance can be significantly affected.

Finally, the evaluation of how the wind interacts with forestry is key, and targeted forestry restructuring techniques can provide ways to increase the performance on a forested site.

Do you anticipate increased activity in this area in the future?

I think that wind farm owners and investors are becoming more switched on to the potential for performance enhancement and optimising the financial gains from their sites. As we begin to see results from the early projects we will expect to see optimisation activity increase more generally.

Case Study 4

Client: Capital Dynamics
Project: Dunmore
Location: Northern Ireland
Size: 21MW
Commissioned: Asset Management – grid curtailment optimisation

The challenge: Capital Dynamics appointed SgurrEnergy to manage the Dunmore wind farm asset. The operational monitoring of the project revealed that grid curtailment, which is relatively common in this part of the network, was not being optimally managed therefore production and revenue potential were not being maximised.

The solution: SgurrEnergy analysed the grid curtailment losses and the operational behaviour of the turbines during grid curtailment events. The analysis found that potential production had been lost due to curtailment, and was being further exacerbated by the manner in which the turbines responded to curtailment requests not meeting the requirements of the grid operator.

Improvements relating to the wind turbine generators as well as the wind farm management server software were identified, and enhancements were made to the internal power plant controller architecture, following which the project was deemed to be fully grid code compliant. This means that the incidence of requests for curtailment has been reduced, and furthermore, that when curtailment is applied, the turbines are only likely to incur a generation output set point curtailment instead of a full pause on all generation. This, therefore, ensures maximised energy production and revenues for the owner.

Keith Gains, a Director at Capital Dynamics, says: “SgurrEnergy's work was pivotal to resolving the grid curtailment issues experienced at the Dunmore wind farm, and the company's approach of seeking ongoing improvements regarding asset performance more generally, as an integral part of its service to Capital Dynamics as asset owners.”

investigation, lasting at least three months, to generate a more detailed plan.

However, new technology and different ways of doing business are likely to emerge over the next five to ten years. What should we look out for next?

5. THE FUTURE OF OPTIMISATION

Mortimer says that SgurrEnergy is looking to develop new ways of managing wind farms, and the use of drones is likely to become more widespread over the next decade. For example, drones can help project owners to accurately survey nearby tree cover to better predict wind flows.

He says: "We've used drones for forested areas, and using that technology more widely is one of the things we're investigating right now. Likewise, we will see other improvement opportunities come forward as technology and understanding advances. We're not naive enough to think we know absolutely everything now."

Other trends that are likely to affect wind farm operations over the next ten years include the use of modular construction techniques and advanced materials.

Such innovation is likely to be boosted by the current spate of large manufacturer takeover deals in the wind sector, including the tie-up between Siemens and Gamesa; Nordex's buyout of the wind arm of Ac-

ciona; and General Electric's takeover of Alstom's energy assets.

We expect more innovation in research and development as manufacturers compete for market share. The result should be further innovations that help to drive down the levelized cost of wind energy, and improvements that lengthen the lifespan of projects.

The question about the lifespan of wind farms is a significant one to this discussion. Surely the fact that wind turbines are being optimised to generate more power means that the equipment will likely fail quicker? Mortimer says this is not the case.

"Sometimes people might say, 'Well, if you're sweating the assets to get more out of them then there's a trade-off with the life of components.' Actually, it's quite often the opposite. So, for example, if you are more optimally aligning a rotor with the wind direction then, as well as producing more power, you are also reducing the cyclic loadings," he says.

"You are getting a win-win in that respect. Or, in other words, marginal gains without the pain. We continue to find more opportunities for marginal gains in wind power, just as the British Olympic cycling team has over the past four years. It is hugely exciting to think what gains will be achieved in our industry by using the same winning formula." ■

Case Study 5

Client: Confidential
Project: Confidential
Location: Scandinavia
Size: Confidential
Commissioned: Q2 2015

The challenge: Like many Scandinavian wind farms, this project faced a number of challenges including high levels of turbulence and wind shear from surrounding forestry and the impact of blade icing. The owner approached SgurrEnergy to deliver SgurrOptimiser services to the wind farm.

The solution: To measure the wind inflow at the site, a Galion Lidar was deployed for four months, using different scan modes to measure effects of the forestry and validate the nacelle measurement data. Once the data gathered was analysed, SgurrEnergy carried out modelling simulations identifying how forestry restructuring could enhance the performance of the wind farm. Taking the regulatory constraints of forestry sustainability into consideration, SgurrEnergy presented the findings to the wind farm owner and forest owner to provide the optimal commercial benefit to both parties.

The Galion Lidar also assessed the accuracy of wind speed measuring at nacelle height. The data gathered was compared with the data available from the manufacturer and the findings delivered to the client and original equipment manufacturer.

Analysis was carried out to determine the cause of the irregular behaviour in the power curves that was particularly prevalent on four wind turbine generators. Icing was identified as the cause of the irregularity using SgurrControl expertise. Modifying the controller software on these four WTGs could mitigate the icing losses, generating an increase in annual energy yield of up to 6%.

Further gains of between 1% and 2% could be achieved if additional control improvements were implemented across the whole wind farm.

John Sturman, Director, Kennedy Renewables



What does your business do?

Kennedy Renewables is a private investor and developer in renewable energy solutions to meet the ongoing demands for electricity and heat within today's growing society.

Do you see reasonable prospects to boost the performance of your assets?

Yes, following initial SCADA data analysis and a review of the existing turbine control systems, it looks likely there are measures that can be taken to increase annual energy production at our assets.

Do you have any investigations underway at this stage?

Yes. We have engaged SgurrEnergy in a rear-looking lidar pilot project, and they are also undertaking an analysis of turbine yaw alignment and wind speed/direction against output using lidar technology.

Are there particular optimisation techniques you think are most promising?

Yaw optimisation using analysis derived turbine control offsets. The analysis includes correlating SCADA data with met mast and lidar measurements.

Do you anticipate increased activity in this area in the future?

Yes, there is a lot of activity in the application of lidar technology to turbine control systems to provide more accurate wind readings than existing cup or sonic based anemometers.

ABOUT THE AUTHORS



ALAN MORTIMER,
DIRECTOR OF INNOVATION,
SGURRENERGY

Alan Mortimer joined SgurrEnergy in 2013 as director of innovation. His role involves extending the company's renewable energy activities in onshore wind, offshore wind, solar, wave,

tidal, heat and transport with greater involvement in technology development and innovation.

A graduate of Glasgow University, Alan started his career with James Howden & Co Ltd in Glasgow before joining Scottish Power. He had a variety of roles with the company, including head of wind development where he developed the strategy for, and led the development of a wind portfolio including Whitelee Wind Farm.

In his subsequent role as head of policy for ScottishPower Renewables, Alan was responsible for managing policy and strategic issues whilst maintaining responsibility for identifying new business opportunities in renewables, including SPR's role in technology development programmes such as the Offshore Wind Accelerator, and marine renewables.



SgurrEnergy is a leading renewable energy consultancy, providing engineering and technical advisory services in onshore and offshore wind, solar, wave and tidal and hydro projects.

Founded 14 years ago, the company has been involved in more than 160GW of renewable energy projects in over 90 countries around the world. Its clients include utilities, financiers, developers and many other public and private sector organisations. The firm gets involved in delivering services at every phase of a project.

Headquartered in Glasgow, SgurrEnergy has more than 250 staff in international offices in China (Beijing), Canada (Vancouver, Toronto and Montreal), India (Pune), France (Paris), Ireland (Dublin), the US (Portland, Austin and San Francisco), Brazil (Rio de Janeiro), Chile (Santiago), Mexico (Mexico City), Norway (Stavanger), Germany (Hamburg) and South Africa (Johannesburg).

SgurrEnergy is a subsidiary business of Wood Group, which is an international energy services company with around \$6bn sales and operating in more than 50 countries. To find out more, visit: www.sgurrenergy.com



RICHARD HEAP, EDITOR,
A WORD ABOUT WIND

Richard Heap joined A Word About Wind as editor in 2014. He is responsible for writing the news and analysis in the newsletters three times a week; developing the programme of special reports; and shaping events.

A graduate of the University of Southampton and London's City University, Richard started his career in business journalism in 2005 as a trainee at global publishing firm United Business Media, writing about a wide range of business sectors.

After this he joined industry-leading commercial property magazine PropertyWeek in 2006, where he was nominated for a series of awards. He spent five years at the publication, including three years heading its professional and legal coverage.

In 2011, Richard became research manager at the Sunday Times Fast Track, where he managed the Profit Track 100 and Tech Track 100 reports in The Sunday Times; and then spent one year working for the New York-headquartered Future Cities.



A Word About Wind started life in 2011 as a news and analysis service for time-poor wind industry professionals, and is now read by over 2,500 people each week.

In addition to the newsletters, A Word About Wind subscribers and members benefit from an extensive and growing programme of focused industry reports. These include the flagship Top 100 Power People, which shows where the real influence sits in this global market; and Legal Power List, which launched in June 2016 to rank the 100 most influential lawyers working in wind today.

These reports contain insight from big-hitting interviewees, with recent profiles of Lord Irvine Laidlaw, founder of Highland Group Holdings; Francesco Venturini, CEO of Enel Green Power; David Jones, head of renewables at Allianz Capital Partners; Henrik Stiesdal, former chief technology officer at Siemens; and more.

And that is not all. A Word About Wind also runs networking events throughout the year including the annual Financing Wind conference, which is happening on 27th October. To find out more, visit: www.awordaboutwind.com

A WORD ABOUT WIND

