ARENA

ARENA SHORT TERM FORECASTING TRIAL ON THE NEM: AN INTERVIEW WITH VESTAS, UTOPUS INSIGHTS AND INFIGEN

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Australian Government

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THE VESTAS LAKE BONNEY WIND FARM SHORT-TERM FORECASTING TRIAL

A short-term forecasting trial at Infigen Energy's Lake Bonney 2 and 3 wind farms improved forecasting accuracy by an average of 26% when compared with AEMO's forecasting system. ARENA interviewed the team and asset owner to learn about their results and where they're setting their sights next.

INTERVIEW WITH:

VESTAS:

HUGH MCKENZIE
BUSINESS MANAGER FLEET
OPTIMIZATION VESTAS ASIA PACIFIC

PETER COWLING
HEAD OF VESTAS AUSTRALIA
AND NEW ZEALAND

UTOPUS INSIGHTS:

SHEKHAR KAMATH
GENERAL MANAGER
BUSINESS DEVELOPMENT

JOSÉ SEBASTIAO
DIRECTOR OF PORTFOLIO MANAGEMENT
AND CUSTOMER INTEGRATION

INFIGEN ENERGY:

MATT DICKIE
GENERAL MANAGER OPERATIONS

WHAT WERE THE KEY DRIVERS FOR VESTAS TO DEMONSTRATE THE ABILITY TO SELF-FORECAST?

VESTAS: Self-forecasting in the National Electricity Market (NEM) provides semi-scheduled generators with the opportunity to more accurately predict their electricity production and more closely meet their dispatch target. By doing so, they can reduce their exposure to Frequency Control Ancillary Services (FCAS) 'Causer Pays' costs and contribute to stabilising the grid.

Across Australia and New Zealand, Vestas currently services 3.7 GW worth of projects. Within a focus on the NEM, Vestas is positioned to play a key role in shaping a grid that is less reliant on FCAS and better equipped to absorb more renewables in its energy mix. Equally important is improving the business cases of renewable asset owners in the NEM, which we hope will lead to further investment in renewables, lower power prices for consumers and ultimately a reduction in carbon emissions.

UTOPUS INSIGHTS: Utopus Insights used the self-forecasting trial under ARENA's Advancing Renewables Program, as an opportunity to explore and push the boundaries of Machine Learning by making renewable energy production forecasting as accurate as possible. The team strived to make renewables more dispatchable in the power market, and to improve the accuracy of five-minute forecasting, which is going to be increasingly important in the coming years, not only in this region, but worldwide.

Self-forecasting is a clear fit in our mission to deliver digital solutions to Independent Power Producers (IPPs), farm owners and operators to maximize asset output. The ability to self-forecast helps renewable power producers minimize their exposure to financial penalties associated with 5-minute intermittent resource forecast requirements, which we have now proved to be among our strongest digital solution service offering.

WHY WERE THE LAKE BONNEY WIND FARMS 2 AND 3 CHOSEN AS THE TRIAL SITES?

VESTAS: Vestas is the long-term service partner to Infigen with over 550 MW of wind assets in Australia. Vestas is committed to optimising the performance of these assets to the end of their operating life, supported by digital solutions via Utopus Insights. Infigen is a long-term operating market participant with semi-scheduled generators in the NEM, alongside a familiarity with the AWEFS forecasting system, market dispatch systems, and surrounding IT infrastructure. Therefore, when the opportunity was presented by ARENA to participate in this initiative, we felt it was a natural fit to leverage our respective capabilities and co-develop a self-forecasting solution.

Lake Bonney Wind Farms 2 and 3 were ultimately chosen as the initial sites to trial self-forecasting as they are the only Vestas manufactured, and serviced, semi-scheduled wind farms owned by Infigen, in the NEM (the remaining Vestas serviced wind farms owned by Infigen are non-scheduled and/or not manufactured by Vestas). While the self-forecasting product which we have developed is designed to be wind turbine manufacturer agnostic, there was an inherent advantage and greater flexibility in utilising Vestas' own technology in the development process.

INFIGEN: There were several reasons for selecting Lake Bonney 2 and 3 wind farms. First, we are always interested in improving the performance of renewable energy assets. We believe that the future of Australia's electricity market is firmed renewable energy and as we improve the forecast accuracy of renewable assets, we enable additional renewable capacity to enter the electricity market. Second, we have a strong history and an excellent working relationship with our supplier and partner Vestas, which put us in a strong position to collaborate on this project. Finally, we saw an opportunity at Lake Bonney 2 and 3 wind farms to improve our forecast accuracy and generate cost savings.

CAN YOU EXPLAIN THE SELF-FORECASTING MODEL/S YOU TESTED?

UTOPUS INSIGHTS: In total, Utopus Insights developed four core, diverse models that were submitting self-forecasts used for farm dispatches by AEMO. All four models performed better than AWEFS in terms of Mean Absolute Error (MAE) and Root Mean Square Error (RMSE) at Lake Bonney 2 and 3 for most of the time. This was especially demonstrated at higher power production ranges, with only a few exceptions and for limited periods of time.

Our industry-differentiating, SCADA-only model outperformed AWEFS forecasts, using existing infrastructure and not requiring any additional, cumbersome hardware. Our SaaS solution was effective in delivering the needed power forecasting accuracy requirements.

DATA MODEL	DATA MODEL OVERVIEW
SCADA Model	This unique data model used real-time signals from SCADA as the only source of input. SCADA model beat AWEFS forecasting with better accuracies for LB2 and LB3 farms
SCADA + Met Mast Model	SCADA model augmented using real-time signals from two weather masts as additional input
SCADA + Weather Model	SCADA model augmented using Utopus Insights proprietary weather model
SCADA + Met Mast + Weather Model	Ensemble model using weather signal data from SCADA, weather masts and Utopus Insights proprietary weather model

HOW DID YOU ADDRESS CYBERSECURITY CONCERNS?

UTOPUS INSIGHTS: Data privacy and security is of utmost importance for Utopus Insights as we manage terabytes of global customer asset data. Australian Energy Market Operator (AEMO) reviewed the cybersecurity plan we had provided, including some of the potential vulnerability risks, and how these were mitigated.

Utopus Insights manages and hosts data on a private cloud infrastructure. All data on our platform is secure and encrypted at all stages, from the time it is collected from the customer end and ingested into our Scipher platform. After processing, the forecast information is submitted to the customer through a secure connection. Our resources are also protected by our firewall with stringent data security rules.

WHAT RESULTS ARE YOU MOST PROUD OF ACHIEVING IN THE TRIAL?

UTOPUS INSIGHTS: The fact that we were able to deliver commercial value early on to Infigen has been the most important achievement. Our forecasting models performed well early into the project to show results for the customer, and we were the first wind power self-forecasting service to qualify on behalf of Infigen Energy.

What started as a trial project to test short-term forecasting, has developed into a solution from Utopus Insights that can now serve power producers in the NEM, and can also serve future global customers as market regulations evolve.

VESTAS: In addition, we've demonstrated that renewables have the capacity to contribute to greater power system security via data driven technology.

DID THE BENEFITS OUTWEIGH THE COSTS FOR SELF-FORECASTING FOR INFIGEN?

VESTAS: It was estimated by Infigen that the Causer Pays Factor (CPF) at Lake Bonney 2 and 3 reduced by 26% due to the more accurate self-forecast. The estimated cost saving was $198,000 (or $1,000 per MW) annually based on the median 28-day cost reductions.

Infigen did however note that there has been a large historical variance in both the CPF and Regulation FCAS charges over varying 28-day evaluation periods at both wind farms, which makes it hard to narrow the estimated savings.

Following the trial, Infigen and Utopus Insights have continued their partnership, with the Self Forecast continuing to be supplied as a Software-as-a-Service subscription. The estimated cost savings outweigh the costs of the subscription.

INFIGEN: The results we've seen have made a compelling case to Infigen that an ongoing subscription is worth the cost. It is very pleasing to see the financial benefits that the Vestas and Utopus Insights self-forecasting solution has been able to achieve for Lake Bonney 2 and 3 Wind Farms.

WHAT ARE THE BIGGEST CHALLENGES AND OPPORTUNITIES FOR SELF-FORECASTING GOING FORWARD?

UTOPUS INSIGHTS:
Challenge: Data science is built on the foundation of reliable, high-resolution accurate data from assets. This access, while fundamental, can be complex, especially in the case of real-time, low latency, time-critical applications such as short-term forecasting. It thereby limits the ability of technologies like Artificial Intelligence/ Machine Learning to solve the challenges of intermittent generation.

Opportunity: Self-forecasting of renewable power producers' assets can improve grid efficiency to deliver sufficient and reliable energy to the market while reducing generator dispatch uncertainty and generation forecast error. These improvements can lead to making renewable energy even more affordable and facilitate their integration into the grid.

VESTAS: Another challenge includes the way in which a forecast can adapt over time to the dynamic nature of the grid and the role of FCAS. For example, it was observed in our trial that Raise Regulation FCAS was required in the NEM more often than Lower Regulation FCAS. Therefore, due to an observed slight tendency of the self-forecast to under-forecast production there was less risk of actual production being lower than the forecasted production and less exposure to the more frequent Raise Regulation FCAS.

However, if every semi-scheduled generator was to intentionally under-forecast production, we may see a need for more Lower Regulation FCAS and a bias to over-forecast would be advantageous from a cost perspective.

HOW DOES IMPROVED SHORT TERM POWER FORECASTING BENEFIT THE NEM AND, ULTIMATELY, THE AUSTRALIAN CONSUMER?

VESTAS: Accurate short-term power forecasting improves the value capture of renewable energy asset investments while contributing to a more secure power system. When the supply of electricity more accurately meets the demand, in other words, when the forecasted production meets actual production, there is less reliance on high cost FCAS. With less FCAS required and a greater proportion of low-cost renewables in the energy mix, the wholesale cost of energy is expected to reduce, benefitting the Australian consumer.

With the introduction of the 5-minute settlement rule in the NEM, the importance of accurate short-term forecasting will become more apparent. We look forward to the rule change and expect the Australian consumer to further benefit from lower power prices.

UTOPUS INSIGHTS: Utopus Insights' aim is to offer an advanced forecasting solution that can reduce generator dispatch uncertainty, lower the operational cost of balancing energy supply and demand, and limit energy price volatility and regulatory complexity. Our solution will help deliver sufficient and reliable renewable energy to the market.

Australia is leading the world in many ways. Creating an industry-leading product for that market is essential and differentiating, making renewable energy more competitive against conventional energy sources. Such a product also enables customers to make smarter and more profitable decisions about the energy they generate.

INFIGEN: Self-forecasting allows renewable generators to take advantage of the wealth of operational data they have of their assets. This results not only in financial savings but also in improved dispatch for the broader market. Being able to reduce dispatch uncertainty encourages more efficient electricity dispatch and can reduce the amount that reserves are called on to balance supply and demand within the network. Improved market efficiency results in savings for Australian consumers. Moreover, the improved operational efficiency of renewable energy enables companies like Infigen to invest in additional low-cost renewable generation.

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