

**BEFORE THE HEARING COMMISSIONERS
AT PALMERSTON NORTH**

IN THE MATTER of the Resource Management Act 1991
(the Act)

AND

IN THE MATTER of a review by **PALMERSTON NORTH CITY
COUNCIL** of the conditions of consent for
Te Rere Hau Windfarm under section 128
of the Act

**STATEMENT OF EVIDENCE OF ADAM EUGENE RADICH ON BEHALF OF
NZ WINDFARMS LIMITED**

DATED 22 AUGUST 2017



ATKINS | HOLM | MAJUREY

Vicki Morrison-Shaw
PO Box 1585
Shortland Street
AUCKLAND 1140

INTRODUCTION

1. My full name is Adam Eugene Radich.
2. I was originally born in Taranaki and relocated to Palmerston North with my family in 1996. Since then I have schooled, trained and currently reside locally in Palmerston North.
3. I am employed by NZ Windfarms Limited (NZ Windfarms) as Site Manager for the Te Rere Hau Windfarm. I have held this position since June 2013 and previously worked for NZ Windfarms from 2011 as an electrician. Prior to this I worked for Specialised Industrial Group, providing process control, automation and breakdown service to local industry.
4. I am a registered electrician and level four qualified electrical engineer with a Diploma in Frontline Management from the New Zealand Institute of Management. I have qualifications in hydraulics and pneumatics, Programmable Logic Controller (PLC) programming, diagnostics and health and safety.
5. I have eight years' experience in fault finding and diagnostics for manufacturing and process industries. These industries include Fonterra, Yoplait, McCains, Affco and Chemacon.
6. I am authorised to give this evidence on behalf of NZ Windfarms.

Purpose and scope of evidence

7. The purpose of this evidence is to provide information in relation to:
 - (a) site operation;
 - (b) software and mechanical improvements;
 - (c) curtailment constraints and opportunities;
 - (d) monitoring of turbine performance; and
 - (e) engagement with neighbours.

SITE OPERATIONAL APPROACH

8. NZ Windfarms operates ninety six 500 kW turbine assets with a combined output capacity of 48 MW. Sixty five of these turbines are sited on the original TRH site and the other thirty

one were installed later on neighbouring properties. Six full time technicians are employed on-site to repair and maintain the fleet. These six technicians report to me and carry out turbine maintenance and repair work Monday-Friday as scheduled and as weather allows. Outside of work hours the site is monitored remotely and relies on a fault call-out roster to attend breakdowns.

9. Unlike other wind farms, NZ Windfarms employs its' maintenance staff in-house which allows us to have complete understanding and control of our operation. Monitoring and technical staff are highly responsive to breakdowns and in turn NZ Windfarms achieves excellent availability. It also allows us to be very dynamic with work scheduling and develop a work plan 'on the day' based around wind conditions on site and the market spot price.
10. There have been steady operational and turbine performance improvements as retrofits advised by our Original Equipment Manufacturer (OEM), Windflow Technology Limited, were implemented. Following the expiry of our warranty agreement with the OEM in November 2015 we were able to identify further areas causing loss in production and availability, and make marked improvements. Some of these key improvements included:
 - (a) the implementation of an idling code function in November 2016 to reduce the wear on gearbox bearings which had been occurring when turbines were 'parked';
 - (b) design and testing of a 'panic button' function to provide for emergency response independent of cellular network;
 - (c) software changes to improve remote monitoring functionality and ensure correct diagnosis of faults; and
 - (d) publication of a full set of maintenance procedures to capture collective experience and learning, ensuring task consistency to a high standard and health and safety systems compliance.
11. With the skill base of our in-house staff, NZ Windfarms has the ability to not only repair like for like, but to make hardware changes and develop PLC control software for improvement.

12. The overarching control of the farm is done via an industry leading Supervisory Control and Data Acquisition (SCADA) system which we use at the upper end of its capabilities. We have made significant improvements to SCADA to enable enhanced capabilities not only for turbine control, but to ensure compliance with the Health and Safety at Work Act 2015.
13. The site team, although small, is very effective at minimising downtime due to a wide range of skills and turbine specific experience. In previous years the company operating strategy was to keep turbines available and able to generate wherever possible. This clearly was of little economic benefit when power prices were low and turbulence extremes were causing premature failure of components. Under this old strategy we met our availability key performance indicators at the cost of high component failure and greater labour requirements.

2017 STRATEGIC OPERATING APPROACH

14. 2017 has seen us review our operating strategy in order to generate a better financial return, as detailed in the evidence of Mr Worth.
15. New strategies include:
 - (a) software improvements;
 - (b) mechanical improvements;
 - (c) curtailment constraints and opportunities;
 - (d) monitoring of turbine performance; and
 - (e) engagement with neighbours.

SOFTWARE IMPROVEMENTS

TI curtailment

16. TI curtailment curtails turbines in wind conditions that we consider are likely to cause accelerated component failure.

Start-up parameters

17. Neighbour feedback revealed that turbines starting and stopping in low wind conditions was of concern. Changes to turbine start-up timers and wind parameters have created more restrictive criteria which results in significantly less failed

start-up attempts (and associated shut downs) in very low wind conditions.

Noise curtailment

18. Noise curtailment has been developed for the benefit of neighbours and considers wind speed and direction at individual turbines to prevent operation in conditions likely to affect neighbours. As noted by Mr Worth, this is an on-going process, where feedback from neighbours will be used to refine curtailment.

Summary

19. The above three strategies (TI curtailment, start up parameters and noise curtailment) all result in turbines running less as the emphasis has been taken away from availability and placed on generating when it is profitable to do so.

MECHANICAL IMPROVEMENTS

Module 7 gear modification

20. Neighbouring residents have highlighted that the tonal (mechanical) noise generated by turbines is of concern to them. One potential solution we are investigating shifts the 1000 Hz tonal component of the noise emission, where hearing is most sensitive. Whilst this modification is expensive, if it proves to be effective, NZ Windfarms will be considering deploying these modified gearboxes to relevant sites as and when gearbox replacements are required.

Gearbox housing change

21. The change made from 'thin foot' to 'thick foot' gearboxes (for strength) also included making the casting heavier overall which we consider helps reduce noise. Vibration testing at AH Gears showed a noticeable reduction in the 100 Hz component of the gearbox noise.

Blade repairs

22. Damage to the leading edge tape of turbine blades causes damage to blades, loss of efficiency and additional aerodynamic noise. We have a regime in place to inspect leading edges at six monthly intervals, and where required we carry out repairs as weather permits.

CURTAILMENT CONSTRAINTS AND OPPORTUNITIES

Price curtailment

23. NZ Windfarms is currently in consultation with Transpower in an attempt get a 'price curtailment exemption' from the rules imposed in the Electricity Industry Participant's Code. If we are successful with this application for exemption it will allow us to curtail more heavily when prices are low and generation is uneconomic.
24. Often low spot prices are seen during hours of darkness, evenings and weekends; these periods have commonly been conveyed to us by residents as periods of greatest annoyance. To be successful in this application for exemption would result in a win – win outcome as it would improve commercial returns for NZ Windfarms and would assist in further managing noise for neighbours. In other words, NZ Windfarms can run the farm in a smarter way to improve the economics *and* reduce noise effects.

TI Curtailment

25. The development and implementation of the TI algorithm, which actively monitors wind speed and turbulence, has to date seen a 1.5 to 3% average reduction in turbine run hours. We predict that the associated loss in revenue seen from the reduction in run hours will be offset by the reduced maintenance and repair costs.

3 and 5 axis curtailment

26. This builds on TI and price curtailment with additional inputs of inflow angle, wind shear and flow separation. With complex computational fluid dynamics (CFD) modelling currently underway we hope to develop this curtailment further as described by Mr Wallace in his evidence.

MONITORING OF TURBINE PERFORMANCE

27. We closely monitor the outcomes of these new operating strategies and evaluate the reduction in operating hours against the operation and maintenance costs, and perceived benefit to neighbours. Initial figures have seen approximately a 1.5 to 3% reduction in total hours run and also a noted decrease in expenses; however over such a short time period it is difficult to directly associate the

reduction in expenses solely to our TI regime. With more data and time we expect to see favourable economic outcomes.

ENGAGEMENT WITH NEIGHBOURS

28. In May 2017 the decision was made by NZ Windfarms to engage with neighbours face-to-face to gain an understanding of their issues surrounding noise. Considerable effort was put into the consultation process with neighbours and we recorded a range of information that has helped us begin to develop a meaningful solution. Key themes that became apparent through engagement included the following:
- (a) Wind direction and strength. Residents report issues when wind is from the south east direction and there is little or no wind at their residence, but enough wind on site for turbines to start up.
 - (b) Topography. Residents report different levels of noise depending on where they are on their property.
 - (c) Mechanical noise. Strong feedback regarding tonal noise from gearboxes was reported.
 - (d) Seasonal dependence. Residents view noise over summer as of greater annoyance as warmer conditions increase time spent outdoors.
29. In order to implement meaningful noise curtailment, NZ Windfarms took feedback received from residents and analysed complaint data collected by Palmerston North City Council to design a software curtailment program that would potentially offer the residents some relief. NZ Windfarms conveyed that designing this curtailment would require significant trials and would involve a series of consultations with neighbours and software tweaks; we are currently looking to develop the second revision of this process.
30. Neighbours showed support for renewable energy conceptually, and appeared to be keen to understand the vagaries of the electricity wholesale market and the way NZ Windfarms needs to be able to respond to this. Neighbours generally understood that NZ Windfarms cannot curtail all the time, but that relief at times when price is low and winds are from the problem directions would be valued.

31. NZ Windfarms are committed to this process and once sufficient periods of curtailment data from revision two has been captured we will again visit residents to collect feedback and make software adjustments as required.
32. I have attached as **Appendix 1** a table summarising the consultation to date.



Adam Eugene Radich

22 August 2017

APPENDIX 1 – TABLE SUMMARISING CONSULTATION

Name	Address	Date	NZWL Rep
Ash Kells & Lorraine Tremain	406 Pahiatua Track	12 May 2017 02 August 2017	Adam Radich Adam Radich, Peter Chadwick
Callum Wilson & Jena Ivamy	23 Ridgeview Rd	31 July 2017	Phone Call – NZWL to visit
Charles & Barbara Little	186 Harrisons Hill Rd	18 May 2017 31 July 2017	Adam Radich Phone Call
Ciel Wallace & Nicky Banks	48 Ridgeview Rd	15 May 2017 09 August 2017	John Worth John Worth
Geoffrey & Toni Irvin	38 Ridgeview Rd	16 May 2017 31 July 2017	John Worth, Peter Chadwick Phone Call - message
George & Kerry Burgess	18 Harrisons Hill Rd	16 May 2017 02 August 2017	John Worth, Adam Radich Peter Chadwick
James Gordon	102 Harrisons Hill Rd	02 August 2017	Peter Chadwick
Jonathon & Michelle Woods	140 Harrisons Hill Rd	17 May 2017	John Worth
Lee Huffman & Graham Devey	428 Pahiatua Track	26 May 2017 01 August 2017	Adam Radich John Worth, Adam Radich

Name	Address	Date	NZWL Rep
Murray & Rebecca Olssen	19 Ridgeview Rd	16 May 2017 31 July 2017	Peter Chadwick Phone Call (message)
Richard Day	Makomako Rd	16 May 2017	John Worth, Peter Chadwick
Rod & Sandra Tombleson	153 Harrisons Hill Rd	17 May 2017	John Worth
Sam & Sue Ellingham	47 Ridgeview Rd	16 May 2017 31 July 2017	John Worth Phone Call
Scott & Teresa Griffiths	629 Pahiatua Track	17 May 2017 31 July 2017	Peter Chadwick Phone Call
Stephen & Sonia Parlane	96 Harrisons Hill Rd	16 May 2017	John Worth, Adam Radich
Steve Murphy	148 Harrisons Hill Rd	16 May 2017	Phone Call
On site consultation, approx. 10 residences represented	Te Rere Hau	30 May 2017	All Office staff + Board