

**IN THE ENVIRONMENT COURT
WELLINGTON REGISTRY**

**I TE KŌTI TAIAO O AOTEAROA
TE WHANGANUI-A-TARA ROHE**

ENV-2024-WLG-001

UNDER the Resource Management Act 1991

IN THE MATTER the direct referral of applications for resource consents by
under section 87G of the Act for the Mt Munro Wind Farm


BY **MERIDIAN ENERGY LIMITED**
Applicant

STATEMENT OF EVIDENCE OF CLAIRE WEST

ON BEHALF OF TARARUA DISTRICT COUNCIL AND MASTERTON DISTRICT COUNCIL

SHADOW FLICKER

Dated: 23 August 2024


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STATEMENT OF EVIDENCE OF CLAIRE WEST

A. INTRODUCTION

- [1] My name is Claire West. I am a Senior Renewables Engineer at Aurecon New Zealand Limited, a multi-disciplinary consultancy firm which provides engineering, management and specialist technical services for public and private sector clients. I have held this position since October 2020.
- [2] I prepared a report on the application required by s 87F of the Resource Management Act 1991 (**RMA**) on behalf of Manawatū-Whanganui Regional Council (**Horizons**) and Wellington Regional Council (**WRC**) Tararua District Council (**TDC**), and Masterton District Council (**MDC**) (the **Consent Authorities**) dated 15 March 2024 (**s 87F Report**).
- [3] In my s 87F Report, I reviewed the application from Meridian Energy Limited (the **Applicant** or **Meridian**) for resource consent applications lodged with the District Councils for the Mt Munro Wind Farm (**Mt Munro Project** or **Project**) in relation to shadow flicker. The s 87F Report provided recommendations to improve or further clarify aspects of the resource consent applications, including with regard to conditions, should the Court be minded to grant resource consents.
- [4] I confirm I have the qualifications and experience set out at paragraphs 5-9 of my s 87F Report.
- [5] On 31 July 2024, I participated in expert conferencing on shadow flicker, resulting in a joint witness statement dated 31 July 2024 (the **Shadow Flicker JWS**). I confirm the contents of the Shadow Flicker JWS.

B. CODE OF CONDUCT

- [6] I repeat the confirmation provided in my s 87F Report that I have read and agree to comply with the Code of Conduct for Expert Witnesses contained in the Environment Court Practice Note 2023. This evidence has been prepared in accordance with that Code. Statements expressed in this evidence are

within my areas of expertise, except where I state I am relying on the opinion or evidence of other witnesses.

C. SCOPE OF EVIDENCE

[7] My statement will cover the following:

- (a) The extent to which issues identified in my s 87F Report have been resolved through mediation, Meridian evidence, and expert conferencing;
- (b) A response to section 274 party evidence; and
- (c) Conditions.

[8] In addition to the material that was reviewed for my s 87F Report, I have reviewed the following:

- (a) Statement of Evidence of Simon Faulkner (Wind Technical) dated 24 May 2024, on behalf of Meridian;
- (b) The proposed changes to conditions filed with Mr Anderson's evidence (the **Meridian Conditions**);
- (c) Letter from Meridian dated 26 July 2024;
- (d) Evidence of Janet McIlraith (s 274 party) dated 10 July 2024;
- (e) Evidence of Robin Olliver (s 274 party) dated 10 July 2024;
- (f) Evidence of Hastwell/Mt Munro Protection Society Inc. (s 274 party) dated 10 July 2024;
- (g) Evidence (Social Impact Report) of John Maxwell (s 274 party) dated 10 July 2024; and
- (h) Proposed draft conditions attached to the evidence of Mr McGahan on behalf of the Consent Authorities (the **August Proposed Conditions**).

D. OUTSTANDING ISSUES

- [9] My s 87F Report sets out my opinion that shadow flicker effects can be effectively managed through conditions of consent. In reaching this conclusion I reviewed (among other things) the Shadow Flicker Assessment undertaken for Meridian, which appears reasonable.¹ However, I made a number of recommendations regarding the measurement of shadow flicker (including what is an acceptable level of shadow flicker), the need for a pre-instalment report, and the proposed curtailment strategy in conditions.
- [10] Following mediation, expert conferencing and review of the Meridian evidence, and Shadow Flicker JWS, a number of the issues I identified in my s 87F Report have been resolved. In particular I note that:
- (a) My recommendation for the allowable shadow flicker duration to be explicitly limited to 30 minutes per day has been included in both the Meridian conditions and the August Proposed Conditions.
 - (b) Both the Meridian conditions and the August Proposed Conditions require a pre-instalment shadow flicker report to be carried out by a suitably qualified professional and include detail on the curtailment strategy that will be used, in line with my recommendations.
- [11] However, the following matters require further clarification/resolution:
- (a) There remains a need for clarity over how the “*blocking of the sun by cloud*” will be determined when calculating the measured shadow flicker duration (specifically when considering SF2); and
 - (b) Allowance for changes in the surroundings of potentially impacted dwellings for the purposes of the curtailment strategy.
- [12] I address these issues in turn below, including recommendations to inform conditions. I return to conditions again in section F of this evidence.

¹ Section 87F Report – Claire West (Shadow Flicker), 15 March 2024, at [29].

Blocking of sun

- [13] The measured shadow flicker duration must be limited to 10 hours per year in accordance with the Meridian conditions (based on the industry-standard EPHC Guidelines).² Condition SF2 sets out the matters that can be accounted for when measuring the duration. Among other things, this includes times where the sun is blocked by cloud and shadow flicker cannot occur.
- [14] In the Shadow Flicker JWS it was agreed that blocking of the sun by cloud will be determined by measuring sunlight at the turbines that are causing shadow flicker.³ However, it remains unclear what the threshold value for categorising the turbine as being in sun or in cloud will be.
- [15] I am of the opinion that the threshold should be approximately 0.5x clear sky irradiance as the threshold. This is based on my experience analysing solar irradiance data as part of my work on solar farms. To avoid doubt in measuring the duration, I recommend that this threshold be included in Condition SF2.
- [16] I recommend that the curtailment strategy implementation proposed by the Applicant should be explained in detail in the Pre-Instalment Shadow Flicker Assessment. In my opinion, this would involve (as a minimum) provision of the following information:
- (a) How the irradiance threshold for determining whether a turbine is in sunny or cloudy conditions has been applied.
 - (b) How the shadow flicker duration will be monitored and enforced. For example, if the turbine(s) will be operated without any curtailment until the hours per year limit is reached, and then be fully curtailed during the relevant times until the end of the year. Or alternatively, the curtailment times may be chosen more selectively in order to maximise energy generation and/or revenue.

² Australian Environment Protection and Heritage Council, "National Wind Farm Development Guidelines – Draft," July 2010 (the **EPHC Guidelines**).

³ Shadow Flicker JWS at page 4, item 5a.

- [17] I recommend for the conditions be updated so that this information is explicitly required as part of the Pre-Instalment Shadow Flicker Assessment.

Changes in surroundings

- [18] The Pre-Instalment Shadow Flicker Assessment may also take account of vegetation and structures at times when they block the sun at the windows of any habitable dwelling, in accordance with the EPHC Guidelines.
- [19] However, the Meridian conditions were not clear what happens when there is a change to the relevant vegetation and/or structure(s) that are depended upon to limit shadow flicker to a measured duration of 10 hours per year.
- [20] In my view, it should be explicitly stated in the proposed conditions that if changes to the surroundings of a dwelling occur that change the experienced shadow flicker, then:
- (a) The landowner will need to advise the Consent Holder and the Councils; and
 - (b) An updated shadow flicker assessment should be undertaken and curtailment strategy reviewed.
- [21] The Planning JWS recommends a condition to address this issue (proposed SF4) and I agree with the intent of the proposed condition. I note that this condition has been carried over into the August Proposed Conditions.

E. RESPONSE TO SECTION 274 PARTY EVIDENCE

- [22] I have reviewed the section 274 party evidence of Janet McIlraith, Robin Olliver, and John Maxwell. These three parties have raised concerns regarding shadow flicker in their evidence.
- [23] The common underlying theme within the evidence is general opposition to occurrence of shadow flicker. As covered in my s 87F Report, I recognise that shadow flicker can be an annoyance for residences in the vicinity of wind farms.⁴ However, the EPHC Guidelines that have formed the basis of the

⁴ Section 87F Report – Claire West (Shadow Flicker), 15 March 2024, at [41].

proposed conditions, are the industry-standard for limiting annoyance effects to an “acceptable level” for nearby and adjacent landowners.⁵

John Maxwell

[24] Mr Maxwell has raised shadow flicker concerns and I summarise these as follows:

- (a) Shadow flicker may occur as a result of either the sun or aviation lights.⁶
- (b) Thirteen properties in the Hastwell area situated to the south and east will experience shadow flicker in the evening.⁷
- (c) Properties near the Falkner Rd – Opaki-Kaiparoro Rd intersection have been identified as “*exceeding World Health Organization limits for annual shadow flicker exposure*”.⁸
- (d) Properties in the Falkner Rd area are situated to the north of the six turbines on the northern ridge, and will not experience shadow flicker.⁹
- (e) Five properties along Old Coach Rd will experience shadow flicker in the morning.¹⁰

[25] I respond to these points below:

- (a) Shadow flicker cannot occur due to aviation lights as they are not strong enough to cast a shadow or illuminate a room. Shadow flicker can only be caused by very strong lights like the sun.
- (b) While it is not clear which thirteen properties Mr Maxwell is referring to, there are thirteen properties within 1km and further northeast of Hastwell town that have been considered in the

⁵ At [42].

⁶ Statement of Evidence – John Maxwell, 10 July 2024, at page 12.

⁷ At [18].

⁸ At [19].

⁹ At [20].

¹⁰ At [21].

Shadow Flicker Assessment.¹¹ These properties will also be included in the Pre-Instalment Shadow Flicker Assessment and shadow flicker at these properties will be limited to an acceptable level of no more than 30 hours per year (theoretical) or 10 hours per year (actual) and 30 minutes per day in accordance with the proposed conditions.

- (c) I am not aware of any World Health Organization limits on shadow flicker. There are five properties within 1km of the specified intersection that have been considered in the Shadow Flicker Assessment. Four of these properties are predicted to experience shadow flicker over the EPHC Guideline limit of 30 hours per year (theoretical), and therefore curtailment will be used to reduce experienced shadow flicker to 10 hours per year (actual) in accordance with the proposed conditions.
- (d) It is not clear which properties Mr Maxwell are referring to; there are four properties on Falkner Road northeast of the proposed turbines, of which two are predicted to experience some shadow flicker (within the allowable limits). There are a further six properties along Old Coach Road (near Falkner Road) which are north of the proposed turbines and are not predicted to experience any shadow flicker.
- (e) I note that there are six properties along Old Coach Rd that have been considered in the Shadow Flicker Assessment. None of these properties are predicted to experience shadow flicker due to their orientation relative to the proposed turbines.

Janet McIlraith

- [26] Ms McIlraith has raised a concern about shadow flicker across her farm affecting amenity values.¹²

¹¹ Boffa Miskell, "Mount Munro Wind Farm - Landscape Effects Assessment," dated 12 May 2023 - Section 6.6, Appendix 3 and the Graphic Supplement (the **Shadow Flicker Assessment**).

¹² Statement of Evidence – Janet McIlraith, 10 July 2024, at [20].

- [27] Ms McIlraith's residence (12 Smiths Line) was considered in the Shadow Flicker Assessment, but was too far from the turbines to have any shadow flicker effects predicted. Therefore, I consider that any effects to amenity values due to shadow flicker will be less than minor.

Robin Olliver

- [28] Mr Olliver has raised two concerns regarding shadow flicker at his property:

- (a) They will experience shadow flicker in the afternoon "*every day of the year.*"¹³
- (b) They will reach the 30 hour per year limit in "*less than two months.*"¹⁴

- [29] Mr Olliver's residence (48 Smiths Line) was considered in the Shadow Flicker Assessment, and I respond to his points as follows:

- (a) Shadow flicker is predicted to occur on 132 days per year, not every day. Slight movement of the turbines during detailed design is not expected to change this significantly.
- (b) This residence is predicted to exceed the EPHC Guideline limit of 30 hours per year, but curtailment will be used to reduce experienced shadow flicker to 10 hours per year (actual) in accordance with the proposed conditions.

- [30] In summary, I am of the view that the matters raised in s 274 evidence have been considered and assessed as part of the Shadow Flicker Assessment or in evidence. There is nothing raised in the evidence that has caused me to change the opinions I have expressed, and/or my recommendations.

¹³ Statement of Evidence – Robin Olliver, 10 July 2024, at page 3.

¹⁴ At page 3.

F. CONDITIONS

[31] I have reviewed the August Proposed Conditions. Subject to the recommendations I make below, I am in general agreement with the conditions and I consider that they are in line industry best practice.

[32] As I have explained earlier, I am of the view that more detail on the curtailment strategy implementation should be required, including:

- (a) More detail on the irradiance threshold for determining whether a turbine is in sunny or cloudy conditions.
- (b) How the shadow flicker duration will be monitored and enforced.

G. CONCLUSION

[33] Several residences in the vicinity of the Project will be affected by shadow flicker. This will be limited to acceptable levels through the August Proposed Conditions, which, in my opinion, will ensure that shadow flicker effects are no more than minor for the neighbouring residences.

23 August 2024

Claire West