BEFORE A COMMISSIONER APPOINTED BY THE SELWYN DISTRICT COUNCIL

IN THE MATTER OF	the Resource Management Act 1991
AND	
IN THE MATTER OF	applications by KeaX Limited for resource consent to establish a solar array at 150 Buckleys Road, Brookside.

STATEMENT OF EVIDENCE OF MARTIN GLEDHILL

ON BEHALF OF THE APPLICANT

(Electromagnetic Fields)

Dated: 9 February 2023

KeaX Limited
Applicant
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1 INTRODUCTION

1.1 I have an MA degree in Natural Sciences (Physics) and an MSc in Medical Physics. I am a member of the Australasian Radiation Protection Society and of the Bioelectromagnetics Society.

1.2 I am a Director of Monitoring and Advisory Services NZ Ltd (MAASNZ), which through its EMF Services division provides professional measurement and advisory services related to possible health effects of electromagnetic fields. These services are provided to central and local government (including the Ministries of Health and the Environment), the public and industry.

1.3 Before forming MAASNZ I was head of the non-ionising radiation section at the National Radiation Laboratory of the New Zealand Ministry of Health, where my role was similar to what it is now. It included presenting expert evidence at local authority and Environment Court hearings.

1.4 I was engaged by KeaX Limited in December 2022 to provide advice on electromagnetic fields that could result from a proposed solar array on Buckleys Road, Brookside. In particular my work has involved the preparation of this evidence based on the results of measurements of low frequency electric and magnetic fields (EMFs) around the Kea Energy Wairau Valley solar farm.

1.5 In preparing this evidence, I have reviewed the following:

(a) The resource consent applications for the Proposal (including the AEE);

(b) The evidence of Campbell McMath (applicant);

(c) The joint submission of Clark Casey, Liz Casey, Robyn Casey, Donna Kewish, Dave Kewish and Ann Williams.

(d) The Section 42A report for Selwyn District Council; and

(e) Consent conditions.

1.6 Whilst this is a Council hearing, I acknowledge that I have read and agree to comply with the Environment Court's Code of Conduct for

Expert Witnesses, contained in the Environment Court Practice Note 2014. My qualifications as an expert are set out above. Other than where I state that I am relying on the advice of another person, I confirm that the issues addressed in this statement of evidence are within my area of expertise. I have not omitted to consider material facts known to me that might alter or detract from the opinions that I express.

2 EXECUTIVE SUMMARY

2.1 My evidence covers the electric and magnetic fields (EMFs) that will be created by the proposed Buckleys Road solar farm. Estimates of the strengths of those fields are based on measurements of a Kea Energy solar farm in the Wairau Valley.

2.2 The measurements show that at distances more than a metre from the inverter skid, electric and magnetic field levels around the site were very low in comparison to the limits recommended by ICNIRP in 1998 and 2010, and would satisfy the relevant rules in the current and proposed Selwyn District Council Plan. The solar panels themselves, and the combiner boxes mounted beneath each string of panels, only produce very weak fields. Beyond the security fence the solar farm would make an indiscernible difference to electric and magnetic field exposures.

2.3 On this basis, electric and magnetic fields from the solar farm would have no effect on the health of people around it.

2.4 It is also highly unlikely that the EMFs would affect bees or birds in the neighbourhood.

3 SCOPE OF EVIDENCE

3.1 My evidence addresses:

(a) The proposed activities;

(b) The receiving environment;

(c) Measurements made at another KeaX site, and how they can be used to estimate electric and magnetic fields at the proposed Buckleys Road installation;

(d) Potential health effects of the proposal;

(e) The joint submission of Clark Casey and others that raises issues about potential effects on health, pollination by bees, and birdlife;

(f) The s42A Report in relation to the application and matters raised by submitters; and

(g) The proposed conditions of consent.

4 RELEVANT ACTIVITIES

4.1 I understand that KeaX proposes to construct and operate a 258ha solar array on the Site which will have a generating capacity of 160 MW on completion. The solar array will comprise:

a. a total of 5,844 tables of panels (frames) with twenty-six inverters.

b. 1 Single Skid Inverter – 10.2m long, 2.1m wide, and 2.25m high, covering an area of approximately 21.42m².

c. 13 Twin Skid Inverters – 9.2m long, 5.4m wide, and 2.35m high, covering an area of approximately 25m².

d. 13 future battery sites.

5 THE RECEIVING ENVIRONMENT

5.1 The area surrounding the Site is also for dairy farming and other agricultural activities, with some semi-rural lifestyle blocks. A substation (designated: Brookside Substation) owned by Orion New Zealand Limited (Orion) is located at the junction of Buckleys Road and Branch Drain Road, adjacent to the north-western corner of the Site.

5.2 There are a few houses near the site, the closest of which appears to be about 20 metres from the site boundary.

6 BACKGROUND EMF MONITORING UNDERTAKEN

6.1 The Site is made up of 13 modules, each consisting of an array of solar panels surrounding a central inverter. While the total size of the Buckley's Road site is much greater than the KeaX Wairau Valley site, the individual Buckley's Road modules are similar to the KeaX

installation at the Wairau Valley site. For that reason, measurements of EMFs at the Wairau Valley site can be used to estimate EMFs that can be expected from the modules at the Buckley's Road site, and from the entire installation.

6.2 The report on my EMF measurements at the Wairau Valley site ("the Report") is attached as Appendix 1 to this evidence. Key conclusions from my measurements (see section 3.1 of the Report) are as follows:

(a) The highest fields are found close to the inverter skid[1].

(b) Electric and magnetic fields at distances greater than 1 metre from the inverter skid were very low in comparison to limits recommended by the International Commission on Non-Ionising Radiation Protection (ICNIRP) in 1998 and 2010.

(c) The solar panels and the combiner boxes mounted beneath each string of panels only produce very weak fields.

(d) All field levels decrease rapidly with increasing distance from their source (the inverter skid or combiner box) and they would be indiscernible outside the security fence surrounding the site.

6.3 Section 3.3 of the Report considers the effect of modules with larger capacity, such as those proposed for Buckleys Road. It concludes that such modules would still make an indiscernible difference to EMFs outside the security fence.

6.4 Rules 5.1.2.1(a) and 5.1.2.2 of the operative District Plan set limits for EMFs in rural zones (noting that this Site is in a rural zone) at frequencies from 3 kHz to 300 GHz, and at 50 Hz respectively. These rules essentially adopt the ICNIRP 1998 limits. Similar rules are proposed in the proposed District Plan. EMFs from the KeaX installation at Buckley's Road will therefore comply with the rules in the operative and proposed plans.

6.5 On this basis, EMFs from the Buckleys Road solar farm will not adversely affect the health of nearby residents.

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[1] Note that this is erroneously referred to as the "combiner skid" in section 3.1 of the Report.

7 PROPOSED EMF MITIGATION AND MONITORING

7.1 As the Buckleys Road solar farm is expected to make an indiscernible difference to EMF levels outside the site, in my opinion there is no need to mitigate any effects and monitoring is not necessary.

8 SUBMISSIONS

8.1 Five submissions have been received in relation to the application. All oppose the application and all wish to be heard.

8.2 The joint submission from Clark Casey, Liz Casey, Robyn Casey, Donna Kewish, Dave Kewish and Ann Williams raises concerns about electromagnetic radiation from solar panels. These relate to:

a. The absence of long term studies on human health.

b. Possible effects on bees that might affect their ability to pollinate.

c. Possible (but unspecified) effects on bird life, particularly with respect to a "green dot" of native vegetation 500 m from the solar farm.

8.3 The nature of the EMFs created by the solar farm is discussed in Appendix 1 of the Report. Strictly, these EMFs are not electromagnetic radiation. "Radiation" is a very broad term, but generally refers to the propagation of energy away from some source, such as light from a light bulb. True electromagnetic radiation is composed of linked electric and magnetic fields that bear a fixed relationship to each other. The EMFs created by the solar farm do not travel away from whatever is producing them, but are fixed in place, and do not transport energy away from the solar farm. The electric and magnetic fields are independent of each other.

8.4 There have been numerous epidemiological studies investigating the long term health of people who, because of where they live or the work they do, are exposed to higher levels of EMFs than the general population. These studies are discussed in the World Health Organisation (WHO) review referenced in Appendix 2 of the Report and were considered by ICNIRP when formulating their exposure limits.

8.5 As noted in Appendix 2 of the Report, the key open question that remains is whether long term average exposures to relatively high magnetic fields increases the risk of leukemia in children. The WHO, and other reviews since then, have concluded that the evidence is too weak to suggest a cause-and-effect relationship.

8.6 As discussed in section 7 of my evidence, however, based on the measurements of EMFs made at Wairau Valley I conclude that the Buckleys Road solar farm will make an indiscernible difference to EMFs outside the Site, so the question of potential chronic effects does not arise.

8.7 The submitters cite papers by Cururachi et al (2013) and Levitt (2021) to support their conclusions. The paper by Cururachi et al is a systematic review with defined criteria underlying an objective selection of relevant research. However, it is not relevant to the solar farm because it only considers the effects of true electromagnetic radiation at frequencies greater than 10 MHz, and mostly at frequencies around 1,000 MHz. The physical nature of electromagnetic radiation at these frequencies, and the way it interacts with living tissue, are quite different to EMFs at frequencies of 50 Hz and a few kHz that are found around the solar farm equipment.

8.8 The paper by Levitt et al considers both EMFs and higher frequency electromagnetic radiation. Unlike Curachi, however, it does not define any selection criteria for the research considered, and there is no attempt to assess the quality, and hence reliability, of the research. Research quality is an important consideration. The European Union EKLIPSE project on "The impacts of artificial Electromagnetic Radiation[2] on wildlife" did assess research quality and, particularly with respect to studies on invertebrates, considered that was very mixed and it was difficult, if not impossible, to draw any firm conclusions.

8.9 Having said that, the research into effects of low frequency EMFs on bees cited by Levitt et al largely concerns exposures of the magnitude found close to high voltage transmission lines. The measurements at

[2] The EKLIPSE project also included low frequency EMFs within the scope of their work.

the Wairau Valley solar farm showed that electric fields are everywhere thousands of times below those levels. Apart from close to the inverter skid transformer, magnetic fields were hundreds of times lower. Therefore I conclude that it is highly unlikely that EMFs from the solar farm would have any effect on bees and their ability to pollinate in the neighbourhood, and there would be no effect outside the solar farm boundary.

8.10 Research on birds has looked at two possible effects of electromagnetic fields on bird navigation. One concerns a possible interaction at frequencies around 1 MHz, which is far greater than would be produced by the solar farm and is not discussed further. The other concerns lower frequency fields. Because the region within which elevated magnetic fields exist is largely restricted to a small volume around the inverter skid this does not appear likely to have any significant effect. It is perhaps worth noting that magnetic fields of a similar magnitude probably exist already near the transformers at the substation at the junction of Buckleys and Branch Drain Roads (and similar-sized or larger substations).

9 SECTION 42A OFFICER'S REPORT

9.1 I have read the section 42a report for Selwyn District Council (SDC) in relation to KeaX Limited's land use consent application and agree with the summary of electromagnetic radiation matters.

9.2 With regard to the report's comments in para 126 about submitters' concerns about bees and pollination, I have addressed this question in section 9 of this evidence.

10 CONSENT CONDITIONS

10.1 I have reviewed the proposed consent conditions and agree that an EMF condition is not necessary. The only value of such a condition would be to provide confirmation to the submitters that the solar farm equipment does, in fact, make an indiscernible difference to EMF levels in the area.

10.2 If monitoring were undertaken there would need to be measurements both before and after installation in order to distinguish EMFs already present around the site (for example, from the power lines running

along the south side of Buckleys Road and east side of Branch Drain Road) and those from the site itself. This would not be a trivial exercise as the magnetic fields beneath the lines would vary over the day as more or less current flows through them. Given my conclusions in sections 7 and 9 I do not consider monitoring to be necessary.

11 CONCLUSION

11.1 My key conclusions are as follows:

11.1.1 The Buckleys Road solar farm will make an indiscernible difference to EMF levels in the surrounding area.

11.1.2 EMFs from the solar farm will have no effects on the health of nearby residents.

11.1.3 The solar farm is highly unlikely to make any difference to the ability of bees to pollinate nearby crops or birds to navigate in the area.

Martin Gledhill

February 2023