BEFORE THE TARARUA DISTRICT COUNCIL'S HEARING PANEL

IN THE MATTER	of the Resource Management Act 1991
AND	
IN THE MATTER	of the applications by Energy Bay Limited to the Tararua District Council (202.2022.136.1) for resource consents to establish and operate a solar farm at 410 Managamaire Road, Pahiatua.

STATEMENT OF EVIDENCE OF PETER HAYMAN FOR ENERGY BAY LIMITED

DATED 16 AUGUST 2023

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Introduction and Qualifications

[1] My full name is Peter Russell Trevethan Hayman. I am employed as an Associate Consultant with SLR Consulting Australia Pty Ltd.

[2] I have a Bachelor's Degree in Aerospace Engineering with Honours from RMIT University, Melbourne.

[3] I have 13 years of experience as a consultant with SLR Consulting. In total I have undertaken 41 solar photovoltaic (PV) glare assessments across Australia, New Zealand, Canada and Chile as well as reviews of others' glare assessments. These assessments include investigations of the glare impacts on road users, residential amenity, railway operations and aviation operations.

[4] I have been engaged by Energy Bay Limited to review the Vector Powersmart glint and glare assessment reports of the proposed Mangamaire Road, Tararua solar facility and its associated modelling and to provide additional comments as appropriate regarding potential glint and glare impacts from the proposed facility. In preparing this evidence I have reviewed the following documents

(a) The Tararua Glint and Glare Assessment by Vector Powersmart dated 11 August 2023.

(b) The appendices associated with report mentioned above.

(c) Additional modelling output provided by Vector Powersmart.

Acknowledgment of Practice Notice

[5] I have read and agree to comply with the Code of Conduct for Expert Witnesses as contained in the Environment Court's Consolidated Practice Note (2023). My qualifications are set out above. I confirm that the issues addressed in this brief 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 expressed.

Review of Glare Assessment

[6] The proposed site for the solar farm is located approximately 10 kilometres south-southwest of the town of Pahiatua.

[7] The initial report (SOLAR BAY – TARARUA – Glint/Glare Assessment, Version V20230811) found that there would be up to 398 minutes of glare annually that could leave an after image for an observer at five of the modelled existing observer locations and no glare for the modelled roads. Modelling for the potential receiver locations showed up to 3660 minutes of glare potential for an after image at one location and at least some minutes of glare at 12 of the 26 locations chosen.

[8] It is noted that these assessments included natural obstructions and planned shelterbelts between four and 10 metres in height.

[9] A secondary round of modelling was conducted by Vector Powersmart with the following changes to the modelled parameters.

(a) Array height increased to 2.4 metres.

(b) Road user height increased to simulate small to medium trucks.

(c) Railway line to the west of the project included.

[10] A third round of modelling was conducted by Vector Powersmart with the planned shelterbelt heights reduced from four to three metres.

[11] The results of the additional modelling found no glare for the railway line, no glare for the road users when planned mitigation was included, no glare with the potential for an after image for the existing observer locations and a reduction in the minutes of glare with potential for an after image at some potential (ie possible future) observer locations. The third round showed the same results as the conclusions of the second round except for potential (ie possible future) observer locations where there was a small increase in the minutes of glare with the potential for an after image though this was still less than the amount found in the original models mentioned in Point [7].

Comments

[12] Firstly, it is worth noting that that solar PV panels are designed to capture (absorb) the maximum possible amount of light within the layers below the front (external) surface (and both surfaces for bi-facial PV panels). Consequently, solar PV panels are designed to minimise reflections off the surface of each panel in order to maximise the energy available for conversion.

[13] There is no known existing planning guidance within New Zealand for the quantification of impacts associated with solar reflections from solar panels towards roads, dwellings, or aviation activity.

[14] The Solar Glare Hazard Analysis Tool (SGHAT), developed by Sandia Labs, used for the modelling and assessment is widely used in the industry and was originally designed to quantify the glare impacts on landing aircraft. It classifies glare into three bands - GREEN: low potential to cause "after image", YELLOW: potential to cause temporary "after image" and RED: potential to cause retinal burn (permanent eye damage). Since its inception it has been expanded to incorporate "line" receptors (eg roadways and rail lines) and stationary observer locations.

[15] "After Image" is the term applied to a common retinal phenomenon that most people have experienced at some point, such as the effect that occurs when a photo with flash is taken in front of a person who then sees spots in front of their eyes for a few seconds. A more extreme example of "after image" occurs when staring at the sun. "After image" (also known as "photo bleaching") occurs because of the de-activation of the cells at the back of the eye's retina when subjected to a very bright light.

[16] SGHAT RED zone glare is not possible for standard solar arrays and will generally only occur at concentrated solar facilities.

[17] At SLR we interpret the results of the SGHAT modelling when considering residential amenity using the New South Wales (NSW) Large Scale Solar Energy Guideline (LSSEG, 2022) which provides assessment criteria for

residential dwellings and classifies glare by minutes per day and hours per year.

[18] Under the United States Federal Aviation Administration guidelines used in the SGHAT modelling, GREEN zone glare is allowable for pilots while on final approach. With this in mind, SLR discounts SGHAT GREEN zone glare for road users and residential observers.

[19] This leaves the SGHAT YELLOW zone glare which the NSW LSSEG can be applied to. The existing receivers in the report mentioned in Point [7] showed maxima between 10 and 30 minutes per day which falls into the moderate impact category and requires consideration of mitigation. Potential receivers had maxima above 30 minutes per day at some locations and one location had greater than 30 hours per year (high impact category) though most were between 10 and 30 hours per year requiring consideration of mitigation or avoidance.

[20] All the glare conditions found occur very close to sunrise or sunset meaning that an observer experiencing these reflections would also be looking almost directly at the sun. SLR does not consider this situation to be glare, when the difference in angle between an incoming direct solar ray and its associated reflected ray is less than 10 degrees, as the sun will dominate the field of vision.

[21] Elimination of these reflection conditions can be achieved by either (a) the addition of screening along relevant perimeters of the proposed facility (typically this is evergreen vegetation), or (b) controlling the rest angle of the tracking system, which can effectively prevent the glare from occurring in the first place, or (c) a combination of both of these strategies, where for example back-tracking rest angle control could be used while screening is established and develops to the target shielding height. The operational software controlling modern single-axis back-tracking systems can implement rest angle mitigation to any desired parts of the solar facility array at the times of the year when the glare conditions occur, thus optimising both glare control and facility energy yield.

Conclusion

[22] Some glare with the potential to leave an after image was found to occur at existing and potential residential observer locations around the proposed solar farm as shown by the reviewed modelling. It is my opinion that these refection conditions can be mitigated or eliminated using the methods mentioned in Point [21].

Peter Hayman

August 2023