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MEMO

To:	Timothy Allen, Solicitor Beatty Hughes & Associates
From:	Suzie Rawlinson, Director
Date:	25th July, 2022
Re:	**Mid-Western Regional Council ats IT Power (Australia) Pty Ltd** **LEC Proceedings No. 2021/00361625** Revised Glare Risk Assessment

1. Introduction

This memo contains a revised Glare Risk Assessment for the *Burrundulla Mini Sustainability Park*.

2. Methodology

2.1 Identifying receptors

For the purposes of this assessment, an observer point has been selected for each dwelling considered in the visual impact assessment. In addition to this, a further 24 receptors have been assessed, extending the assessment to include dwellings at locations up to four kilometres from the site. Each receptor has been assigned a unique number and the address recorded.

Because the GlareGauge software has a 40 Observer Point (OP) limit per analysis, the assessment of glare risk for private properties has been undertaken in two analysis reports (refer to section 3.1 of this memo).

2.2 Solar Glare Hazard Analysis

To identify the risk of glare effects from the proposal the Solar Glare Hazard Analysis Tool (SGHAT 2021A) 'GlareGauge' has been used. This is a solar glare analysis model specifically designed to identify the risk of glare caused by solar farms.

Notably, the following revised assumptions were adopted:

- a Solar tacker height of 1.55 metres, and
- a two-degree resting angle.

The specific parameters used for this analysis is shown in Table 1.

The tracker height of 1.55 has been selected because it is the mid-point of the range of potential heights of the panel arrays above the existing landform. The trackers will be horizontal whereas the natural landform will vary

gently. The variation between the lowest and maximum possible height of the tracker will not make a material difference to the result of this analysis.

As the greatest risk of glare occurs when the sun is low in the sky and the panel arrays are at or near to zero degrees, a two-degree resting angle has been adopted. At this angle the potential for a glare risk is eliminated from most locations. This maximum resting angle does, however, reduce the energy generating capacity of the solar farm.

TABLE 1 INPUT DATA FOR SGHAT ANALYSIS

Parameter	Value
Time zone	UTC +10
Axis tracking:	Single-axis rotation
Axis height	**1.55 metres**
Backtracking:	Shade / slope
Tracking axis orientation:	180.0 deg
Maximum tracking angle:	60.0 deg
Resting angle:	**2.0 deg**
Ground coverage ratio	0.36
Panel material:	Smooth glass with Anti Reflective coating

The results of this analysis are provided at:

- **Attachment A -** Solar Glare Hazard Analysis Tool (SGHAT) data – Private properties (Observer point 1-40)
- **Attachment B -** Solar Glare Hazard Analysis Tool (SGHAT) data – Private properties (Observer point 41-70)
- **Attachment C -** Solar Glare Hazard Analysis Tool (SGHAT) data – Roads

The following section summarises the results of the GlareGauge analysis.

3. Summary of glare risk assessment

This analysis shows the risk of glare from the proposal during operation.

The analysis considers the glare risk from private dwellings (refer 3.1), from surrounding roads (refer 3.2) and from aviation operations (refer 3.3). The location of the dwellings is shown in **Figure 1**.

3.1 Glare risk from private dwellings

This analysis identified **no minutes of glare risk** for all but one of the private dwellings assessed.

The following table (refer Table 2) summarises the results of the GlareGauge analysis contained in **Attachment A** Solar Glare Hazard Analysis Tool (SGHAT) data – Private properties (Observer point 1-40) and **Attachment B** Solar Glare Hazard Analysis Tool (SGHAT) data – Private properties (Observer point 41-70).

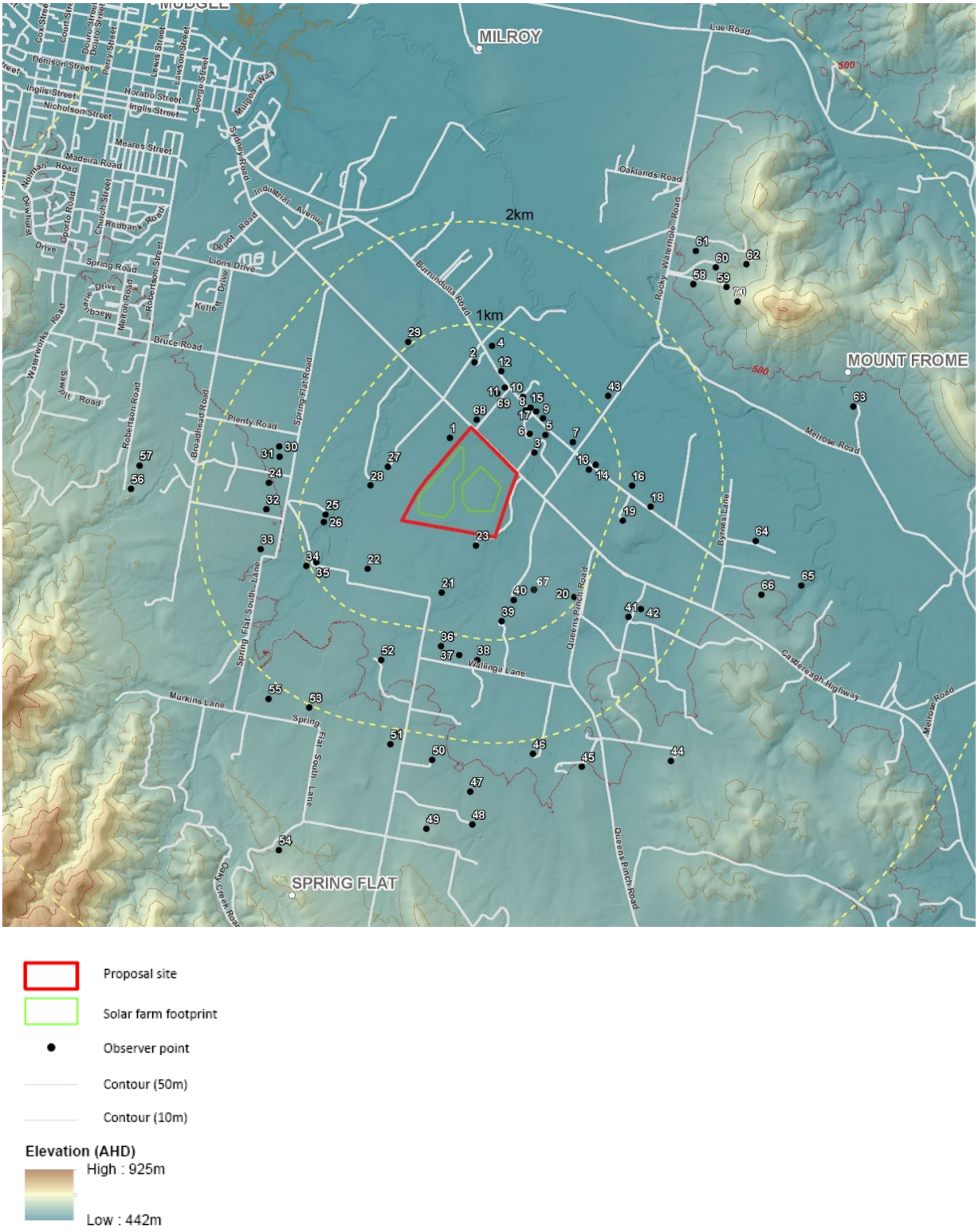


FIGURE 1 OBSERVER POINT (DWELLINGS) LOCATIONS

TABLE 1 GLARE RISK IDENTIFIED FROM PRIVATE DWELLINGS SURROUNDING THE PROPOSAL SITE

			Western panel array (PV System A)		Eastern panel array (PV System B)		
OP *(Unique identifier)*	**OP** *(Refer Attachment)*	**Address**	Green Glare (minutes)	Yellow Glare (minutes)	Green Glare (minutes)	Yellow Glare (minutes)	Notes
Refer Appendix A							
OP 1	OP 1	3b Sydney Road (Associated property)	0	0	0	0	No glare risk identified
OP 2	OP 2	252 Burrundulla Road, Burrundulla	0	0	0	0	No glare risk identified
OP 3	OP 3	446 Rocky Waterhole Road, Burrundulla	0	0	0	0	No glare risk identified
OP 4	OP 4	253 Burrundulla Road, Burrundulla	0	0	0	0	No glare risk identified
OP 5	OP 5	354 Burrundulla Road, Burrundulla	0	0	0	0	No glare risk identified
OP 6	OP 6	328 Burrundulla Road, Burrundulla	0	0	0	0	No glare risk identified
OP 7	OP 7	371 Burrundulla Road, Burrundulla	0	0	0	0	No glare risk identified
OP 8	OP 8	322 Burrundulla Road, Burrundulla	0	0	0	0	No glare risk identified
OP 9	OP 9	331 Burrundulla Road, Burrundulla	0	0	0	0	No glare risk identified
OP 10	OP 10	297 Burrundulla Road, Burrundulla	0	0	0	0	No glare risk identified
OP 11	OP 11	290 Burrundulla Road, Burrundulla	0	0	0	0	No glare risk identified
OP 12	OP 12	275 Burrundulla Road, Burrundulla	0	0	0	0	No glare risk identified
OP 13	OP 13	404 Burrundulla Road, Burrundulla	0	0	0	0	No glare risk identified
OP 14	OP 14	447 Burrundulla Road, Burrundulla	0	0	0	0	No glare risk identified
OP 15	OP 15	321 Burrundulla Road, Burrundulla	0	0	0	0	No glare risk identified
OP 16	OP 16	447 Burrundulla Road, Burrundulla	0	0	0	0	No glare risk identified
OP 17	OP 17	327 Burrundulla Road, Burrundulla	0	0	0	0	No glare risk identified
OP 18	OP 18	473 Burrundulla Road, Burrundulla	0	0	0	0	No glare risk identified
OP 19	OP 19	452 Burrundulla Road, Burrundulla	0	0	0	0	No glare risk identified
OP 20	OP 20	46 Queens Pinch Road, Spring Flat	0	0	0	0	No glare risk identified
OP 21	OP 21	411 Spring Flat Road, Spring Flat	0	0	0	0	No glare risk identified
OP 22	OP 22	345 Spring Flat Road, Spring Flat	0	0	0	0	No glare risk identified
OP 23	OP 23	312 Castlereagh Highway, Spring Flat	0	0	0	0	No glare risk identified
OP 24	OP 24	17 Hill Sixty Drive, Spring Flat	0	0	0	0	No glare risk identified
OP 25	OP 25	217 Spring Flat Road, Spring Flat	0	0	0	0	No glare risk identified
OP 26	OP 26	217 Spring Flat Road, Spring Flat	0	0	0	0	No glare risk identified
OP 27	OP 27	3b Sydney Road, Mudgee (associated)	0	0	0	0	No glare risk identified
OP 28	OP 28	3b Sydney Road, Mudgee (associated)	0	0	0	0	No glare risk identified

			Western panel array (PV System A)		Eastern panel array (PV System B)		
OP *(Unique identifier)*	**OP** *(Refer Attachment)*	**Address**	Green Glare (minutes)	Yellow Glare (minutes)	Green Glare (minutes)	Yellow Glare (minutes)	Notes
OP 29	OP 29	139 Castlereagh Highway, Burrundulla	0	0	0	0	No glare risk identified
OP 30	OP 30	15 Plenty Road, Spring Flat	0	0	0	0	No glare risk identified
OP 31	OP 31	14 Hill Street Sixty Drive, Spring Flat	0	0	0	0	No glare risk identified
OP 32	OP 32	17 Hill Sixty Drive, Spring Flat	0	0	0	0	No glare risk identified
OP 33	OP 33	46 Spring Flat South Lane, Spring Flat	0	0	0	0	No glare risk identified
OP 34	OP 34	282 Spring Flat Road, Spring Flat	0	0	0	0	No glare risk identified
OP 35	OP 35	281 Spring Flat Road, Spring Flat	0	0	0	0	No glare risk identified
OP 36	OP 36	13 Wallinga Lane, Spring Flat	0	0	0	0	No glare risk identified
OP 37	OP 37	39 Wallinga Lane, Spring Flat	0	0	0	0	No glare risk identified
OP 38	OP 38	55 Wallinga Lane, Spring Flat	0	0	0	0	No glare risk identified
OP 39	OP 39	83 Wallinga Lane, Spring Flat	0	0	0	0	No glare risk identified
OP 40	OP 40	344 Castlereagh Highway, Spring Flat	0	0	0	0	No glare risk identified
Refer Appendix B							
OP 41	OP 1	470 Castlereagh Highway, Burrundulla	0	0	0	0	No glare risk identified
OP 42	OP 2	470 Castlereagh Highway, Burrundulla	0	0	0	0	No glare risk identified
OP 43	OP 3	382 Rocky Waterhole Road, Burrundulla	0	0	0	0	No glare risk identified
OP 44	OP 4	195 Queens Pinch Road, Spring Flat	0	0	0	0	No glare risk identified
OP 45	OP 5	200 Queens Pinch Road, Spring Flat	0	0	0	0	No glare risk identified
OP 46	OP 6	132 Wallinga Lane, Spring Flat	0	0	0	0	No glare risk identified
OP 47	OP 7	591 Spring Flat Road, Spring Flat	0	0	0	0	No glare risk identified
OP 48	OP 8	593 Spring Flat Road, Spring Flat	0	0	0	0	No glare risk identified
OP 49	OP 9	673 Spring Flat Road, Spring Flat	0	0	0	0	No glare risk identified
OP 50	OP 10	571 Spring Flat Road, Spring Flat	0	0	0	0	No glare risk identified
OP 51	OP 11	572 Spring Flat Road, Spring Flat	0	0	0	0	No glare risk identified
OP 52	OP 12	512 Spring Flat Road, Spring Flat	0	0	0	0	No glare risk identified
OP 53	OP 13	283 Spring Flat South Lane, Spring Flat	0	0	0	0	No glare risk identified
OP 54	OP 14	398 Spring Flat South Lane, Spring Flat	0	0	0	0	No glare risk identified
OP 55	OP 15	251 Spring Flat South Lane, Spring Flat	0	0	0	0	No glare risk identified
OP 56	OP 16	247 Robertson Road, Spring Flat	0	0	0	0	No glare risk identified
OP 57	OP 17	235 Robertson Road, Spring Flat	0	0	0	0	No glare risk identified
OP 58	OP 18	243 Rocky Waterhole Road, Mount Frome	0	0	0	0	No glare risk identified
OP 59	OP 19	241 Rocky Waterhole Road, Mount Frome	0	0	0	0	No glare risk identified
OP 60	OP 20	239 Rocky Waterhole Road, Mount Frome	0	0	0	0	No glare risk identified
OP 61	OP 21	217 Rocky Waterhole Road, Mount Frome	0	0	0	0	No glare risk identified

			Western panel array (PV System A)		Eastern panel array (PV System B)		
OP *(Unique identifier)*	**OP** *(Refer Attachment)*	**Address**	Green Glare (minutes)	Yellow Glare (minutes)	Green Glare (minutes)	Yellow Glare (minutes)	Notes
OP62	OP 22	203 Rocky Waterhole Road, Mount Frome	0	0	0	0	No glare risk identified
OP 63	OP 23	227 Melrose Road, Mount Frome	0	0	0	0	No glare risk identified
OP 64	OP 24	24 Byrnes Lane, Burrundulla	0	0	0	0	No glare risk identified
OP 65	OP 25	563 Burrundulla Road, Burrundulla	0	0	0	0	No glare risk identified
OP 66	OP 26	577 Burrundulla Road, Burrundulla	0	0	0	0	No glare risk identified
OP67	OP27	344 Castlereagh Highway (short term accommodation)	0	0	0	0	No glare risk identified
OP68	OP28	243 Castlereagh Highway (former nursery)	0	0	0	0	No glare risk identified
OP69	OP29	243 Castlereagh Highway	0	0	0	0	No glare risk identified
OP70	OP30	241 Rocky Waterhole Road, Mount Frome	170	0	0	0	A low glare impact

The dwelling at 241 Rocky Waterhole Road, Mount Frome (OP70), is located about three kilometres from the solar panel arrays and located on the slopes of Mt Frome. This dwelling is situated over 100 metres above the level of the solar farm site. This property has panoramic views across the valley, which includes a view across a diverse range of development types, including the Mudgee township. From this dwelling the SGHAT analysis has identified a risk of green glare for 170 minutes per year. This glare risk is for less than 10 minutes on any one day and would occur on sunset, in mid-summer. The area potentially causing the glare risk is the northern most panels on the western panel array (PV System A) Refer to **Appendix B**.

This glare risk would result in a **low glare impact** using the NSW Department of Planning, Industry and Environment *Draft Large Scale Solar Guideline* (December 2021, Table 3, page 34). This guideline states that no mitigation is required when a low glare impact is identified.

Given the small number of minutes per year when there is a risk of a glare, and the lower intensity of the potential glare reflections (green glare, low potential to cause an after-image), the potential glare impact is minimal. If seen, the visible area of glare would be small due to the viewing distance. Furthermore, due to the panoramic and complex nature of the existing view, there would be other sources of reflection and artificial light seen in this view on sunset, during the time when there is a risk of a glare reflection. Over time, the proposed scattered trees on the mounding on the project site would filter the view to the area of the panel array where there is a risk of a glare reflection seen from this dwelling, reducing the potential for a direct line of sight to the panel arrays. Overall, in my opinion this glare risk is acceptable and further mitigation measure would not be warranted.

3.2 Glare from surrounding roads

An assessment of glare risk has been undertaken for the roads surrounding the proposal. The results of the SGHAT analysis is contained in **Attachment C**. Table 2 summarises these results.

This analysis identified **no minutes of glare risk** and no glare hazard risk from surrounding roads during project operation.

TABLE 2 GLARE RISK IDENTIFIED FROM ROADS SURROUNDING THE PROPOSAL SITE

	Western panel array (PV System A)		Eastern panel array (PV System B)		
Route	Green Glare (minutes)	Yellow Glare (minutes)	Green Glare (minutes)	Yellow Glare (minutes)	Notes
Burrundulla Road	0	0	0	0	No glare risk identified
Castlereagh Highway	0	0	0	0	No glare risk identified
Queens Pinch Road	0	0	0	0	No glare risk identified
Rocky Waterhole Road	0	0	0	0	No glare risk identified
Spring Flat Road	0	0	0	0	No glare risk identified
Wallinga Lane	0	0	0	0	No glare risk identified

3.3 Glare risk to aviation operations

There are commercial aeroplane and helicopter services operating from the Mudgee Regional Airport.

The *Mudgee Regional Airport Masterplan, for Mid-Western Regional Council* (2018) indicates that the lighting distraction and glare be considered in areas within a six-kilometre radius of the airport. Refer to Section 7.5, p 52 (https://www.midwestern.nsw.gov.au/Services/Commercial-facilities/Mudgee-Airport). The proposed solar arrays are outside this area and as such an assessment of glare impact on aircraft has not been prepared.

There is a helipad at the Mudgee Health Services on Lewis Street in Mudgee. This helipad is about 4.2 kilometres from the proposal site. Aircraft approach paths are assessed for glint and glare risk because this is considered to be the most critical stage of the flight. The GlareGauge Solar Glare Analysis Tool includes a 2-mile approach tool for the purpose of assessing aircraft approach routes. As this helipad is beyond the 2-mile (3.2 kilometres) approach path of any helicopter approaching this helipad an assessment has not been prepared.

There are also commercial hot air balloon operations around Mudgee. It is our understanding, from a telephone interview with a hot air balloon pilot from *Balloons Aloft*, that these operations mainly operate over areas to the north of town, where the main concentration of wineries and scenic landscapes are located. There are, however, balloon operations to the south of Mudgee on occasions when there are unsuitable wind conditions to the north of Mudgee. One of the fields within the land holding of the subject site has been used in the past to land a hot air balloon. I understand that this is not a frequent occurrence.

The Civil Aviation Safety Authority (CASA) website (www.casa.gov.au) notes that balloon pilots can usually only land on private property if they have permission from the property owner. However, permission is not needed in an emergency or for a precautionary landing to avoid a possible emergency. The *Australian Ballooning Federation* and commercial operators maintain a register of sensitive zones where property owners request that pilots either do not land or observe a minimum height when flying overhead. (CASA, 2022) If approved, it is recommended that the local balloon operators be notified of the operations of the solar farm and if there is a concern that the balloons cannot safely land in the vicinity of the site, that the subject property be added to this *Australian Ballooning Federation* list to ensure a safe minimum height is maintained.

4. Summary of glare risk assessment

In summary, this assessment identifies a **low glare impact** at one dwelling (241 Rocky Creek Road) and **no glare risk** to all other surrounding residences, and **no glare risk** from surrounding roads.

The glare risk to aviation operations is **limited** due to the distance of the site from the Mudgee Airport and main operating area of commercial balloon operations.

5. Mitigation of glare risk

A resting angle of 2 degrees would be adopted initially for the project. It is recommended that when the screening vegetation establishes, and there would no longer be a direct line of sight to the solar farm from most locations surrounding the site, this restriction (which reduces the energy output of the solar farm) can be removed.

Attachment A

Solar Glare Hazard Analysis Tool (SGHAT) data – Private properties (Observer point 1-40)

Assumed panel height of 1.55 metres and 2 degrees resting angle.

ForgeSolar

Mudgee - Burrundulla Solar

Burrundulla - Dwellings

Created April 18, 2022
Updated May 2, 2022
Time-step 1 minute
Timezone offset UTC10
Site ID 68460.11608

Project type Advanced
Project status: active
Category 0 to 10 kW

Misc. Analysis Settings

DNI: **varies (1,000.0 W/m^2 peak)**
Ocular transmission coefficient: **0.5**
Pupil diameter: **0.002 m**
Eye focal length: **0.017 m**
Sun subtended angle: **9.3 mrad**

Analysis Methodologies:

- Observation point: **Version 2**
- 2-Mile Flight Path: **Version 2**
- Route: **Version 2**

Summary of Results No glare predicted!

PV Name	Tilt	Orientation	"Green" Glare	"Yellow" Glare	Energy Produced
	deg	deg	min	min	kWh
PV array 1	SA tracking	SA tracking	0	0	-
PV array 2	SA tracking	SA tracking	0	0	-

Component Data

PV Array(s)

Total PV footprint area: 227,837 m^2

Name: PV array 1
Footprint area: 131,237 m^2
Axis tracking: Single-axis rotation
Backtracking: Shade-slope
Tracking axis orientation: 180.0 deg
Maximum tracking angle: 60.0 deg
Resting angle: 2.0 deg
Ground Coverage Ratio: 0.36

Rated power: -
Panel material: Smooth glass with AR coating
Vary reflectivity with sun position? Yes
Correlate slope error with surface type? Yes
Slope error: 8.43 mrad

Vertex	Latitude	Longitude	Ground elevation	Height above ground	Total elevation
	deg	deg	m	m	m
1	-32.629411	149.622124	474.02	1.55	475.57
2	-32.633521	149.618128	481.21	1.55	482.76
3	-32.634700	149.618128	482.86	1.55	484.41
4	-32.635071	149.620780	481.27	1.55	482.82
5	-32.634280	149.621604	478.79	1.55	480.34
6	-32.632433	149.621641	476.52	1.55	478.07
7	-32.631403	149.622526	474.45	1.55	476.00

Name: PV array 2
Footprint area: 96,599 m^2
Axis tracking: Single-axis rotation
Backtracking: Shade-slope
Tracking axis orientation: 180.0 deg
Maximum tracking angle: 60.0 deg
Resting angle: 2.0 deg
Ground Coverage Ratio: 0.36

Rated power: -
Panel material: Smooth glass with AR coating
Vary reflectivity with sun position? Yes
Correlate slope error with surface type? Yes
Slope error: 8.43 mrad

Vertex	Latitude	Longitude	Ground elevation	Height above ground	Total elevation
	deg	deg	m	m	m
1	-32.631077	149.624283	472.84	1.55	474.39
2	-32.632920	149.622574	476.22	1.55	477.77
3	-32.633545	149.622737	477.91	1.55	479.46
4	-32.634200	149.622976	478.52	1.55	480.07
5	-32.634728	149.623630	480.30	1.55	481.85
6	-32.634745	149.625538	476.79	1.55	478.34
7	-32.633936	149.626053	474.34	1.55	475.89
8	-32.632504	149.626209	474.48	1.55	476.03

Discrete Observation Receptors

Number	Latitude	Longitude	Ground elevation	Height above ground	Total Elevation
	deg	deg	m	m	m
OP 1	-32.628558	149.620968	473.69	1.50	475.19
OP 2	-32.621832	149.623436	468.98	1.50	470.48
OP 3	-32.629680	149.629850	467.64	1.50	469.14
OP 4	-32.620374	149.625206	464.28	1.50	465.78
OP 5	-32.628039	149.630951	467.27	1.50	468.77
OP 6	-32.627978	149.629375	468.50	1.50	470.00
OP 7	-32.628606	149.633804	460.98	1.50	462.48
OP 8	-32.625998	149.628841	467.12	1.50	468.62
OP 9	-32.626604	149.630664	465.01	1.50	466.51
OP 10	-32.624779	149.628557	465.23	1.50	466.73
OP 11	-32.623970	149.626646	466.56	1.50	468.06
OP 12	-32.622595	149.626201	465.14	1.50	466.64
OP 13	-32.630956	149.635556	467.91	1.50	469.41
OP 14	-32.630529	149.636261	465.49	1.50	466.99
OP 15	-32.625677	149.629349	465.43	1.50	466.93
OP 16	-32.632247	149.640016	470.17	1.50	471.67
OP 17	-32.626001	149.629928	465.35	1.50	466.85
OP 18	-32.634086	149.641981	470.76	1.50	472.26
OP 19	-32.635353	149.639188	478.72	1.50	480.22
OP 20	-32.642103	149.634383	489.01	1.50	490.51
OP 21	-32.642069	149.620624	488.20	1.50	489.70
OP 22	-32.640090	149.612886	490.59	1.50	492.09
OP 23	-32.637845	149.624033	480.53	1.50	482.03
OP 24	-32.632800	149.602524	499.50	1.50	501.00
OP 25	-32.635452	149.608411	488.12	1.50	489.62
OP 26	-32.636090	149.608264	488.36	1.50	489.86
OP 27	-32.631127	149.614712	481.15	1.50	482.65
OP 28	-32.632715	149.612979	482.29	1.50	483.79
OP 29	-32.620219	149.616590	469.59	1.50	471.09
OP 30	-32.629633	149.603503	493.45	1.50	494.95
OP 31	-32.630469	149.603508	495.23	1.50	496.73
OP 32	-32.635096	149.602265	502.42	1.50	503.92
OP 33	-32.638630	149.601786	503.66	1.50	505.16
OP 34	-32.640053	149.606518	491.85	1.50	493.35
OP 35	-32.639645	149.607502	491.34	1.50	492.84
OP 36	-32.646718	149.620703	492.42	1.50	493.92
OP 37	-32.647457	149.622570	492.72	1.50	494.22
OP 38	-32.647872	149.624514	491.89	1.50	493.39
OP 39	-32.644431	149.626933	492.00	1.50	493.50
OP 40	-32.642556	149.628262	485.33	1.50	486.83

Summary of PV Glare Analysis

PV configuration and total predicted glare

PV Name	Tilt	Orientation	"Green" Glare	"Yellow" Glare	Energy Produced	Data File
	deg	deg	min	min	kWh	
PV array 1	SA tracking	SA tracking	0	0	-	
PV array 2	SA tracking	SA tracking	0	0	-	

PV & Receptor Analysis Results

Results for each PV array and receptor

PV array 1 no glare found

Component	Green glare (min)	Yellow glare (min)
OP: OP 1	0	0
OP: OP 2	0	0
OP: OP 3	0	0
OP: OP 4	0	0
OP: OP 5	0	0
OP: OP 6	0	0
OP: OP 7	0	0
OP: OP 8	0	0
OP: OP 9	0	0
OP: OP 10	0	0
OP: OP 11	0	0
OP: OP 12	0	0
OP: OP 13	0	0
OP: OP 14	0	0
OP: OP 15	0	0
OP: OP 16	0	0
OP: OP 17	0	0
OP: OP 18	0	0
OP: OP 19	0	0
OP: OP 20	0	0
OP: OP 21	0	0
OP: OP 22	0	0
OP: OP 23	0	0
OP: OP 24	0	0
OP: OP 25	0	0
OP: OP 26	0	0
OP: OP 27	0	0
OP: OP 28	0	0
OP: OP 29	0	0
OP: OP 30	0	0
OP: OP 31	0	0
OP: OP 32	0	0
OP: OP 33	0	0
OP: OP 34	0	0
OP: OP 35	0	0
OP: OP 36	0	0
OP: OP 37	0	0
OP: OP 38	0	0
OP: OP 39	0	0
OP: OP 40	0	0

No glare found

PV array 2 no glare found

Component	Green glare (min)	Yellow glare (min)
OP: OP 1	0	0
OP: OP 2	0	0
OP: OP 3	0	0
OP: OP 4	0	0
OP: OP 5	0	0
OP: OP 6	0	0
OP: OP 7	0	0
OP: OP 8	0	0
OP: OP 9	0	0
OP: OP 10	0	0
OP: OP 11	0	0
OP: OP 12	0	0
OP: OP 13	0	0
OP: OP 14	0	0
OP: OP 15	0	0
OP: OP 16	0	0
OP: OP 17	0	0
OP: OP 18	0	0
OP: OP 19	0	0
OP: OP 20	0	0
OP: OP 21	0	0
OP: OP 22	0	0
OP: OP 23	0	0
OP: OP 24	0	0
OP: OP 25	0	0
OP: OP 26	0	0
OP: OP 27	0	0
OP: OP 28	0	0
OP: OP 29	0	0
OP: OP 30	0	0
OP: OP 31	0	0
OP: OP 32	0	0
OP: OP 33	0	0
OP: OP 34	0	0
OP: OP 35	0	0
OP: OP 36	0	0
OP: OP 37	0	0
OP: OP 38	0	0
OP: OP 39	0	0
OP: OP 40	0	0

No glare found

Assumptions

- Times associated with glare are denoted in Standard time. For Daylight Savings, add one hour.
- Glare analyses do not account for physical obstructions between reflectors and receptors. This includes buildings, tree cover and geographic obstructions.
- Detailed system geometry is not rigorously simulated.
- The glare hazard determination relies on several approximations including observer eye characteristics, angle of view, and typical blink response time. Actual values and results may vary.

- The system output calculation is a DNI-based approximation that assumes clear, sunny skies year-round. It should not be used in place of more rigorous modeling methods.
- Several V1 calculations utilize the PV array centroid, rather than the actual glare spot location, due to algorithm limitations. This may affect results fo large PV footprints. Additional analyses of array sub-sections can provide additional information on expected glare.
- The subtended source angle (glare spot size) is constrained by the PV array footprint size. Partitioning large arrays into smaller sections will reduce the maximum potential subtended angle, potentially impacting results if actual glare spots are larger than the sub-array size. Additional analyses of the combined area of adjacent sub-arrays can provide more information on potential glare hazards. (See previous point on related limitations.)
- Hazard zone boundaries shown in the Glare Hazard plot are an approximation and visual aid. Actual ocular impact outcomes encompass a continuous, not discrete, spectrum.
- Glare locations displayed on receptor plots are approximate. Actual glare-spot locations may differ.
- Glare vector plots are simplified representations of analysis data. Actual glare emanations and results may differ.
- Refer to the **Help page** for detailed assumptions and limitations not listed here.

Attachment B

Solar Glare Hazard Analysis Tool (SGHAT) data – Private properties (Observer point 41-70)

Assumed panel height of 1.55 metres and 2 degrees resting angle

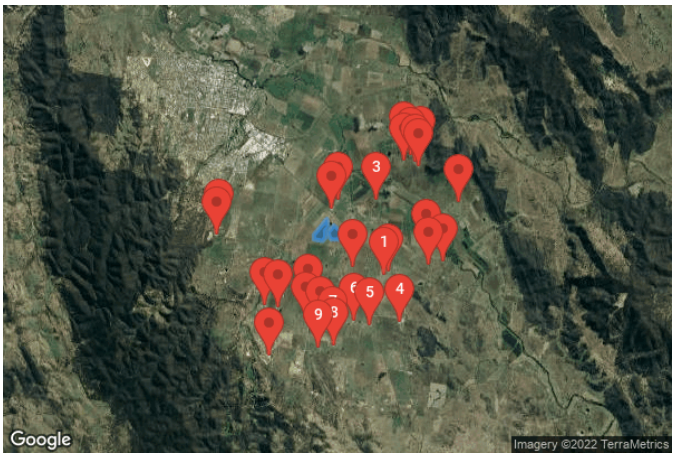
ForgeSolar

Mudgee - Burrundulla Solar

Burrundulla - Dwellings 40

Created May 2, 2022
Updated July 22, 2022
Time-step 1 minute
Timezone offset UTC10
Site ID 68573.11608

Project type Advanced
Project status: active
Category 0 to 10 kW



Misc. Analysis Settings

DNI: **varies (1,000.0 W/m^2 peak)**
Ocular transmission coefficient: **0.5**
Pupil diameter: **0.002 m**
Eye focal length: **0.017 m**
Sun subtended angle: **9.3 mrad**

Analysis Methodologies:

- Observation point: **Version 2**
- 2-Mile Flight Path: **Version 2**
- Route: **Version 2**

Summary of Results Glare with low potential for temporary after-image predicted

PV Name	Tilt	Orientation	"Green" Glare	"Yellow" Glare	Energy Produced
	deg	deg	min	min	kWh
PV array 1	SA tracking	SA tracking	170	0	-
PV array 2	SA tracking	SA tracking	0	0	-

Component Data

PV Array(s)

Total PV footprint area: 227,837 m^2

Name: PV array 1
Footprint area: 131,237 m^2
Axis tracking: Single-axis rotation
Backtracking: Shade-slope
Tracking axis orientation: 180.0 deg
Maximum tracking angle: 60.0 deg
Resting angle: 2.0 deg
Ground Coverage Ratio: 0.36

Rated power: -
Panel material: Smooth glass with AR coating
Vary reflectivity with sun position? Yes
Correlate slope error with surface type? Yes
Slope error: 8.43 mrad

Vertex	Latitude	Longitude	Ground elevation	Height above ground	Total elevation
	deg	deg	m	m	m
1	-32.629411	149.622124	474.02	1.55	475.57
2	-32.633521	149.618128	481.21	1.55	482.76
3	-32.634700	149.618128	482.86	1.55	484.41
4	-32.635071	149.620780	481.27	1.55	482.82
5	-32.634280	149.621604	478.79	1.55	480.34
6	-32.632433	149.621641	476.52	1.55	478.07
7	-32.631403	149.622526	474.45	1.55	476.00

Name: PV array 2
Footprint area: 96,599 m^2
Axis tracking: Single-axis rotation
Backtracking: Shade-slope
Tracking axis orientation: 180.0 deg
Maximum tracking angle: 60.0 deg
Resting angle: 2.0 deg
Ground Coverage Ratio: 0.36

Rated power: -
Panel material: Smooth glass with AR coating
Vary reflectivity with sun position? Yes
Correlate slope error with surface type? Yes
Slope error: 8.43 mrad

Vertex	Latitude	Longitude	Ground elevation	Height above ground	Total elevation
	deg	deg	m	m	m
1	-32.631077	149.624283	472.84	1.55	474.39
2	-32.632920	149.622574	476.22	1.55	477.77
3	-32.633545	149.622737	477.91	1.55	479.46
4	-32.634200	149.622976	478.52	1.55	480.07
5	-32.634728	149.623630	480.30	1.55	481.85
6	-32.634745	149.625538	476.79	1.55	478.34
7	-32.633936	149.626053	474.34	1.55	475.89
8	-32.632504	149.626209	474.48	1.55	476.03

Discrete Observation Receptors

Number	Latitude	Longitude	Ground elevation	Height above ground	Total Elevation
	deg	deg	m	m	m
OP 1	-32.643887	149.639955	482.32	1.50	483.82
OP 2	-32.643076	149.641253	481.92	1.50	483.42
OP 3	-32.624507	149.637333	462.89	1.50	464.39
OP 4	-32.656201	149.644761	517.23	1.50	518.73
OP 5	-32.656964	149.635501	501.36	1.50	502.86
OP 6	-32.655892	149.630410	494.51	1.50	496.01
OP 7	-32.659418	149.624069	506.30	1.50	507.80
OP 8	-32.662245	149.624358	514.67	1.50	516.17
OP 9	-32.662735	149.619646	539.97	1.50	541.47
OP 10	-32.656648	149.620081	507.28	1.50	508.78
OP 11	-32.655443	149.615685	508.09	1.50	509.59
OP 12	-32.650981	149.616599	501.31	1.50	502.81
OP 13	-32.652392	149.607211	512.04	1.50	513.54
OP 14	-32.664909	149.604365	554.57	1.50	556.07
OP 15	-32.651717	149.602984	508.32	1.50	509.82
OP 16	-32.633584	149.588271	536.85	1.50	538.35
OP 17	-32.631618	149.589008	529.20	1.50	530.70
OP 18	-32.614579	149.645814	511.98	1.50	513.48
OP 19	-32.614775	149.649261	559.66	1.50	561.16
OP 20	-32.613058	149.648070	533.40	1.50	534.90
OP 21	-32.611714	149.646063	513.83	1.50	515.33
OP 22	-32.612681	149.651257	557.59	1.50	559.09
OP 23	-32.625066	149.662715	486.89	1.50	488.39
OP 24	-32.636825	149.652934	466.63	1.50	468.13
OP 25	-32.640609	149.657829	481.65	1.50	483.15
OP 26	-32.641533	149.653694	508.01	1.50	509.51
OP 27	-32.626905	149.623832	470.76	1.50	472.26
OP 28	-32.624520	149.625806	467.34	1.50	468.84
OP 29	-32.641900	149.630141	483.21	1.50	484.71
OP 30	-32.615867	149.650381	587.26	0.00	587.26

Summary of PV Glare Analysis

PV configuration and total predicted glare

PV Name	Tilt	Orientation	"Green" Glare	"Yellow" Glare	Energy Produced	Data File
	deg	deg	min	min	kWh	
PV array 1	SA tracking	SA tracking	170	0	-	
PV array 2	SA tracking	SA tracking	0	0	-	

Distinct glare per month

Excludes overlapping glare from PV array for multiple receptors at matching time(s)

PV	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
pv-array-1 (green)	18	0	0	0	0	0	0	0	0	0	0	152
pv-array-1 (yellow)	0	0	0	0	0	0	0	0	0	0	0	0

PV & Receptor Analysis Results

Results for each PV array and receptor

PV array 1 low potential for temporary after-image

Component	Green glare (min)	Yellow glare (min)
OP: OP 1	0	0
OP: OP 2	0	0
OP: OP 3	0	0
OP: OP 4	0	0
OP: OP 5	0	0
OP: OP 6	0	0
OP: OP 7	0	0
OP: OP 8	0	0
OP: OP 9	0	0
OP: OP 10	0	0
OP: OP 11	0	0
OP: OP 12	0	0
OP: OP 13	0	0
OP: OP 14	0	0
OP: OP 15	0	0
OP: OP 16	0	0
OP: OP 17	0	0
OP: OP 18	0	0
OP: OP 19	0	0
OP: OP 20	0	0
OP: OP 21	0	0
OP: OP 22	0	0
OP: OP 23	0	0
OP: OP 24	0	0
OP: OP 25	0	0
OP: OP 26	0	0
OP: OP 27	0	0
OP: OP 28	0	0

OP: OP 29	0	0
OP: OP 30	170	0

PV array 1 - OP Receptor (OP 1)
No glare found

PV array 1 - OP Receptor (OP 2)
No glare found

PV array 1 - OP Receptor (OP 3)
No glare found

PV array 1 - OP Receptor (OP 4)
No glare found

PV array 1 - OP Receptor (OP 5)
No glare found

PV array 1 - OP Receptor (OP 6)
No glare found

PV array 1 - OP Receptor (OP 7)
No glare found

PV array 1 - OP Receptor (OP 8)
No glare found

PV array 1 - OP Receptor (OP 9)
No glare found

PV array 1 - OP Receptor (OP 10)
No glare found

PV array 1 - OP Receptor (OP 11)
No glare found

PV array 1 - OP Receptor (OP 12)
No glare found

PV array 1 - OP Receptor (OP 13)
No glare found

PV array 1 - OP Receptor (OP 14)
No glare found

PV array 1 - OP Receptor (OP 15)
No glare found

PV array 1 - OP Receptor (OP 16)
No glare found

PV array 1 - OP Receptor (OP 17)
No glare found

PV array 1 - OP Receptor (OP 18)
No glare found

PV array 1 - OP Receptor (OP 19)

No glare found

PV array 1 - OP Receptor (OP 20)

No glare found

PV array 1 - OP Receptor (OP 21)

No glare found

PV array 1 - OP Receptor (OP 22)

No glare found

PV array 1 - OP Receptor (OP 23)

No glare found

PV array 1 - OP Receptor (OP 24)

No glare found

PV array 1 - OP Receptor (OP 25)

No glare found

PV array 1 - OP Receptor (OP 26)

No glare found

PV array 1 - OP Receptor (OP 27)

No glare found

PV array 1 - OP Receptor (OP 28)

No glare found

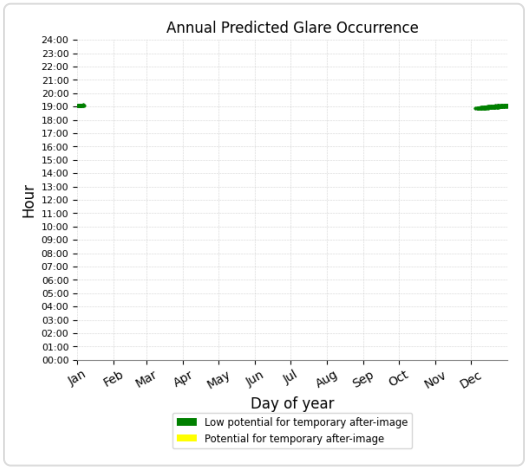
PV array 1 - OP Receptor (OP 29)

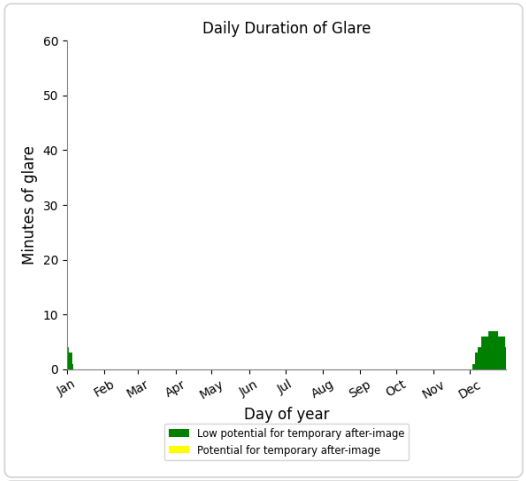
No glare found

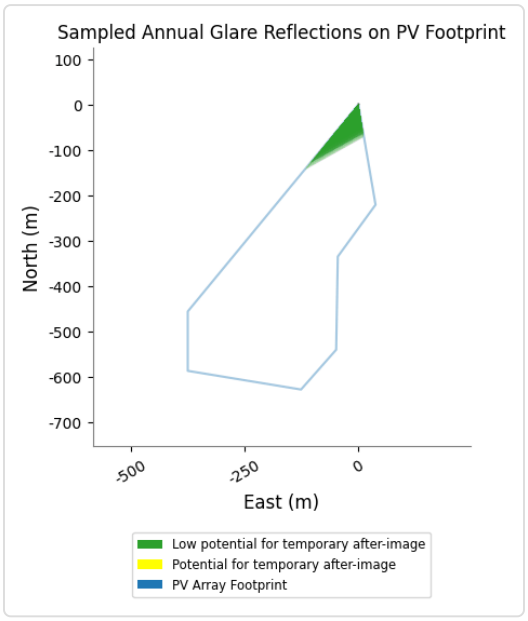
PV array 1 - OP Receptor (OP 30)

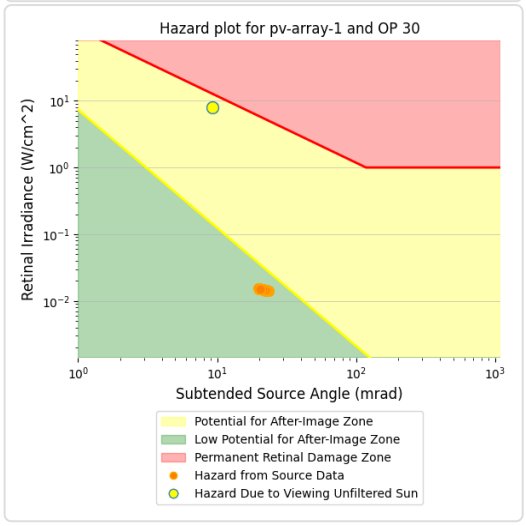
PV array is expected to produce the following glare for receptors at this location:

- 170 minutes of "green" glare with low potential to cause temporary after-image.
- 0 minutes of "yellow" glare with potential to cause temporary after-image.









PV array 2 no glare found

Component	Green glare (min)	Yellow glare (min)
OP: OP 1	0	0
OP: OP 2	0	0
OP: OP 3	0	0
OP: OP 4	0	0
OP: OP 5	0	0
OP: OP 6	0	0
OP: OP 7	0	0
OP: OP 8	0	0
OP: OP 9	0	0
OP: OP 10	0	0
OP: OP 11	0	0
OP: OP 12	0	0
OP: OP 13	0	0
OP: OP 14	0	0
OP: OP 15	0	0
OP: OP 16	0	0
OP: OP 17	0	0
OP: OP 18	0	0
OP: OP 19	0	0
OP: OP 20	0	0
OP: OP 21	0	0
OP: OP 22	0	0
OP: OP 23	0	0
OP: OP 24	0	0
OP: OP 25	0	0
OP: OP 26	0	0
OP: OP 27	0	0
OP: OP 28	0	0
OP: OP 29	0	0
OP: OP 30	0	0

No glare found

Assumptions

- Times associated with glare are denoted in Standard time. For Daylight Savings, add one hour.
- Glare analyses do not account for physical obstructions between reflectors and receptors. This includes buildings, tree cover and geographic obstructions.
- Detailed system geometry is not rigorously simulated.
- The glare hazard determination relies on several approximations including observer eye characteristics, angle of view, and typical blink response time. Actual values and results may vary.
- The system output calculation is a DNI-based approximation that assumes clear, sunny skies year-round. It should not be used in place of more rigorous modeling methods.
- Several V1 calculations utilize the PV array centroid, rather than the actual glare spot location, due to algorithm limitations. This may affect results fo large PV footprints. Additional analyses of array sub-sections can provide additional information on expected glare.
- The subtended source angle (glare spot size) is constrained by the PV array footprint size. Partitioning large arrays into smaller sections will reduce the maximum potential subtended angle, potentially impacting results if actual glare spots are larger than the sub-array size. Additional analyses of the combined area of adjacent sub-arrays can provide more information on potential glare hazards. (See previous point on related limitations.)
- Hazard zone boundaries shown in the Glare Hazard plot are an approximation and visual aid. Actual ocular impact outcomes encompass a continuous, not discrete, spectrum.
- Glare locations displayed on receptor plots are approximate. Actual glare-spot locations may differ.
- Glare vector plots are simplified representations of analysis data. Actual glare emanations and results may differ.
- Refer to the **Help page** for detailed assumptions and limitations not listed here.

Attachment C

Solar Glare Hazard Analysis Tool (SGHAT) data – Roads

Assumed panel height of 1.55 metres and 2 degrees resting angle

ForgeSolar

Mudgee - Burrundulla Solar

Burrundulla - Roads

Created April 7, 2022
Updated June 5, 2022
Time-step 1 minute
Timezone offset UTC10
Site ID 67865.11608

Project type Advanced
Project status: active
Category 0 to 10 kW

Misc. Analysis Settings

DNI: **varies (1,000.0 W/m^2 peak)**
Ocular transmission coefficient: **0.5**
Pupil diameter: **0.002 m**
Eye focal length: **0.017 m**
Sun subtended angle: **9.3 mrad**

Analysis Methodologies:

- Observation point: **Version 2**
- 2-Mile Flight Path: **Version 2**
- Route: **Version 2**

Summary of Results No glare predicted!

PV Name	Tilt	Orientation	"Green" Glare	"Yellow" Glare	Energy Produced
	deg	deg	min	min	kWh
PV array 1	SA tracking	SA tracking	0	0	-
PV array 2	SA tracking	SA tracking	0	0	-

Component Data

PV Array(s)

Total PV footprint area: 227,837 m^2

Name: PV array 1
Footprint area: 131,237 m^2
Axis tracking: Single-axis rotation
Backtracking: Shade-slope
Tracking axis orientation: 180.0 deg
Maximum tracking angle: 60.0 deg
Resting angle: 2.0 deg
Ground Coverage Ratio: 0.36

Rated power: -
Panel material: Smooth glass with AR coating
Vary reflectivity with sun position? Yes
Correlate slope error with surface type? Yes
Slope error: 8.43 mrad

Vertex	Latitude	Longitude	Ground elevation	Height above ground	Total elevation
	deg	deg	m	m	m
1	-32.629411	149.622124	474.02	1.55	475.57
2	-32.633521	149.618128	481.21	1.55	482.76
3	-32.634700	149.618128	482.86	1.55	484.41
4	-32.635071	149.620780	481.27	1.55	482.82
5	-32.634280	149.621604	478.79	1.55	480.34
6	-32.632433	149.621641	476.52	1.55	478.07
7	-32.631403	149.622526	474.45	1.55	476.00

Name: PV array 2
Footprint area: 96,599 m^2
Axis tracking: Single-axis rotation
Backtracking: Shade-slope
Tracking axis orientation: 180.0 deg
Maximum tracking angle: 60.0 deg
Resting angle: 2.0 deg
Ground Coverage Ratio: 0.36

Rated power: -
Panel material: Smooth glass with AR coating
Vary reflectivity with sun position? Yes
Correlate slope error with surface type? Yes
Slope error: 8.43 mrad

Vertex	Latitude	Longitude	Ground elevation	Height above ground	Total elevation
	deg	deg	m	m	m
1	-32.631077	149.624283	472.84	1.55	474.39
2	-32.632920	149.622574	476.22	1.55	477.77
3	-32.633545	149.622737	477.91	1.55	479.46
4	-32.634200	149.622976	478.52	1.55	480.07
5	-32.634728	149.623630	480.30	1.55	481.85
6	-32.634745	149.625538	476.79	1.55	478.34
7	-32.633936	149.626053	474.34	1.55	475.89
8	-32.632504	149.626209	474.48	1.55	476.03

Route Receptor(s)

Name: Burrundulla Road east
Route type Two-way
View angle: 50.0 deg

Vertex	Latitude	Longitude	Ground elevation	Height above ground	Total elevation
	deg	deg	m	m	m
1	-32.633215	149.639836	472.46	1.50	473.96
2	-32.632023	149.637991	467.94	1.50	469.44

Name: Burrundulla Road north
Route type Two-way
View angle: 50.0 deg

Vertex	Latitude	Longitude	Ground elevation	Height above ground	Total elevation
	deg	deg	m	m	m
1	-32.627799	149.631511	464.07	1.50	465.57
2	-32.626990	149.630393	466.40	1.50	467.90
3	-32.624057	149.627150	466.05	1.50	467.55

Name: Castlereagh Highway near first ridge
Route type Two-way
View angle: 50.0 deg

Vertex	Latitude	Longitude	Ground elevation	Height above ground	Total elevation
	deg	deg	m	m	m
1	-32.645056	149.652766	514.71	1.50	516.21
2	-32.643024	149.648582	492.37	1.50	493.87

Name: Castlereagh Highway north
Route type Two-way
View angle: 50.0 deg

Vertex	Latitude	Longitude	Ground elevation	Height above ground	Total elevation
	deg	deg	m	m	m
1	-32.631682	149.628406	471.39	1.50	472.89
2	-32.626967	149.622578	471.49	1.50	472.99

Name: Castlereagh Highway southeast
Route type Two-way
View angle: 50.0 deg

Vertex	Latitude	Longitude	Ground elevation	Height above ground	Total elevation
	deg	deg	m	m	m
1	-32.632616	149.629689	469.43	1.50	470.93
2	-32.633664	149.631062	473.22	1.50	474.72

Name: Rocky Waterhole Road
Route type Two-way
View angle: 50.0 deg

Vertex	Latitude	Longitude	Ground elevation	Height above ground	Total elevation
	deg	deg	m	m	m
1	-32.632806	149.631406	470.95	1.50	472.45
2	-32.633465	149.630880	472.65	1.50	474.15

Name: Spring Creek Road south
Route type Two-way
View angle: 50.0 deg

Vertex	Latitude	Longitude	Ground elevation	Height above ground	Total elevation
	deg	deg	m	m	m
1	-32.642588	149.619300	491.85	1.50	493.35
2	-32.641658	149.612734	497.54	1.50	499.04

Name: Spring Creek Road west
Route type Two-way
View angle: 50.0 deg

Vertex	Latitude	Longitude	Ground elevation	Height above ground	Total elevation
	deg	deg	m	m	m
1	-32.634412	149.604299	499.28	1.50	500.78
2	-32.629752	149.605187	491.00	1.50	492.50

Summary of PV Glare Analysis

PV configuration and total predicted glare

PV Name	Tilt	Orientation	"Green" Glare	"Yellow" Glare	Energy Produced	Data File
	deg	deg	min	min	kWh	
PV array 1	SA tracking	SA tracking	0	0	-	
PV array 2	SA tracking	SA tracking	0	0	-	

PV & Receptor Analysis Results

Results for each PV array and receptor

PV array 1 no glare found

Component	Green glare (min)	Yellow glare (min)
Route: Burrundulla Road east	0	0
Route: Burrundulla Road north	0	0
Route: Castlereagh Highway near first ridge	0	0
Route: Castlereagh Highway north	0	0
Route: Castlereagh Highway southeast	0	0
Route: Rocky Waterhole Road	0	0
Route: Spring Creek Road south	0	0
Route: Spring Creek Road west	0	0

No glare found

PV array 2 no glare found

Component	Green glare (min)	Yellow glare (min)
Route: Burrundulla Road east	0	0
Route: Burrundulla Road north	0	0
Route: Castlereagh Highway near first ridge	0	0
Route: Castlereagh Highway north	0	0
Route: Castlereagh Highway southeast	0	0
Route: Rocky Waterhole Road	0	0
Route: Spring Creek Road south	0	0
Route: Spring Creek Road west	0	0

No glare found

Assumptions

- Times associated with glare are denoted in Standard time. For Daylight Savings, add one hour.
- Glare analyses do not account for physical obstructions between reflectors and receptors. This includes buildings, tree cover and geographic obstructions.

- Detailed system geometry is not rigorously simulated.
- The glare hazard determination relies on several approximations including observer eye characteristics, angle of view, and typical blink response time. Actual values and results may vary.
- The system output calculation is a DNI-based approximation that assumes clear, sunny skies year-round. It should not be used in place of more rigorous modeling methods.
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- The subtended source angle (glare spot size) is constrained by the PV array footprint size. Partitioning large arrays into smaller sections will reduce the maximum potential subtended angle, potentially impacting results if actual glare spots are larger than the sub-array size. Additional analyses of the combined area of adjacent sub-arrays can provide more information on potential glare hazards. (See previous point on related limitations.)
- Hazard zone boundaries shown in the Glare Hazard plot are an approximation and visual aid. Actual ocular impact outcomes encompass a continuous, not discrete, spectrum.
- Glare locations displayed on receptor plots are approximate. Actual glare-spot locations may differ.
- Glare vector plots are simplified representations of analysis data. Actual glare emanations and results may differ.
- Refer to the **Help page** for detailed assumptions and limitations not listed here.