Grange Solar

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Enva Rathcoole Roof-mount PV Installation

Glint and Glare Assessment

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26/07/2022

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Grange Solar

1 Introduction

This assessment was completed in order to determine glint and glare levels for a roof-mount PV installation at Enva, 402 Grants Drive, Greenogue Business Park, Rathcoole, Dublin, D24 AP04. This installation is sized at approximately 140kW and covers the unobstructed sections of the roof, as shown below (Figure 1). This assessment is needed to evaluate glint and glare impacts at relevant surrounding receptors should the installation proceed. These relevant receptors include major roadways surrounding the installation and nearby aviation receptors such as airports, aerodromes and helicopter flight paths. These are chosen as, although there are currently no specific standards for assessing glint and glare in Ireland, the Federal Aviation Authority provide guidance, which has been adopted for use by the Irish Aviation Authority (IAA) [1].

Figure 1: Enva Rathcoole Site Layout

2 Glint and Glare Assessment Guidance

Glint and glare are reflections of sunlight from reflective surfaces. Glint is defined as "a momentary flash of bright light", whereas glare is defined as "a continuous source of bright light" [1]. This study evaluated the potentially hazardous effects that the solar PV installation may have on the surrounding environment. These hazardous effects can be a "temporary visual interference that persists after the source of illumination has ceased" from glint" and a "brief loss of vision" from glare [2] [1]. Glint comes as a result of specular sunlight reflections, whereas, glare comes as a result of defused sunlight reflections, which is shown below (Figure 2) [1]. These effects are minimised through the use of modern solar PV modules which can use textured glass and anti-reflective coatings.

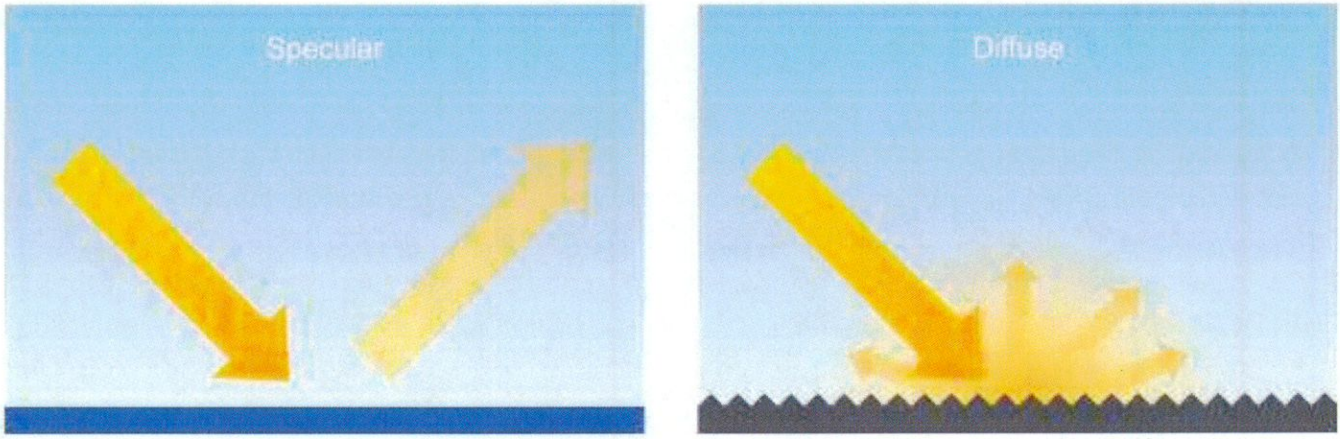


Figure 2: Sunlight Reflection Types

For the majority, glint and glare reflections from solar PV modules is of a similar level to water. This is due to solar modules being designed to absorb light and not to reflect it. The solar reflectance of solar modules is less than other commonly seen materials in urban environments such as Aluminium, steel and unpainted concrete, as seen below (Figure 3).

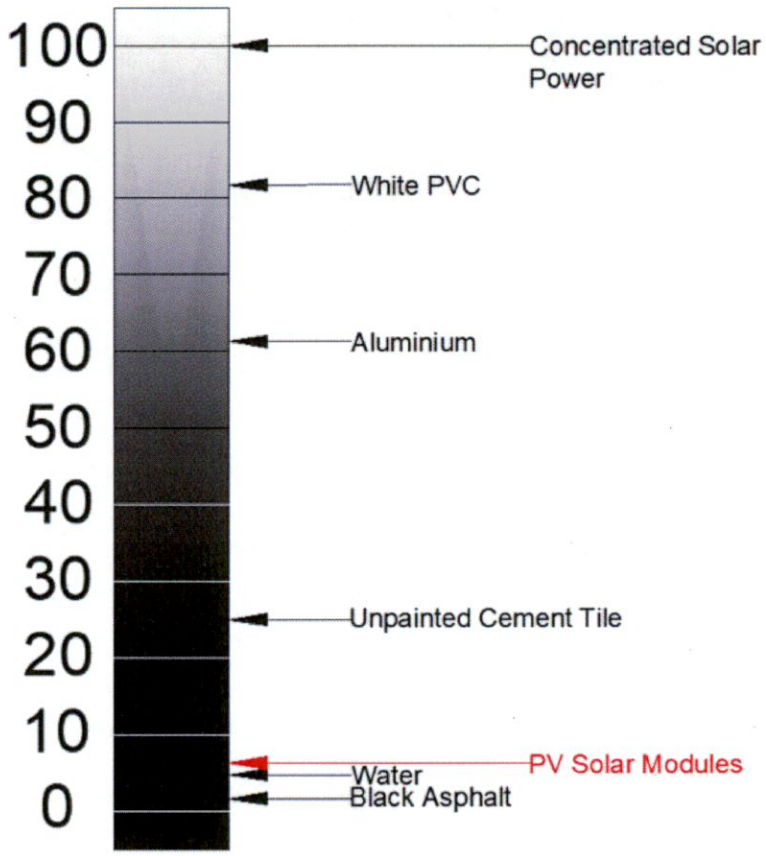


Figure 3: Typical Roof Material Solar Reflectance

2.1 Glint and Glare Assessment Scope

2.1.1 Assessment Methodology

The methodology used for this glint and glare assessment, and all similar assessments by Grange Solar, follows a standard procedure of steps;

1. Identify all relevant aviation receptors surrounding the planned installation: Grange solar uses a distance of 15km from the planned installation for glint and glare assessments. Any airports, aerodromes or helicopter landing pads which are situated 15km or less from the installation must be assessed. This approach is used as guidance provided by the DAA states that any solar PV installation within 15km of Dublin or Cork airports requires a glint and glare survey to be completed. In addition, the IAA states that consultation must take place for any installation within 10km of any other airport or aerodrome. For this, approaches by airplanes or helicopters to runways or landing pads and air traffic control towers must be assessed to ensure there is no effect from glint and glare to visibility.
2. Identify all relevant ground-based receptors surrounding the planned installation: Any major roads surrounding the installation, which the installation is visible to, should be identified and evaluated to ensure glint and glare have no effect.
3. Use an FAA approved Solar Glare Hazard Analysis Tool (SGHAT): This tool should be used to input the identified receptors and evaluate the effect glare may cause. Levels of glare on the receptors is measured by the tool throughout a year timeline and shown so further action can be taken.
4. Integrate appropriate control measures: Following the analysis, any necessary control measures can be taken to mitigate the effects of glint and glare to the receptors. These control measures could include rotating the PV modules, removing effecting PV modules or erecting screening between receptors and the installation. This ensures that the installation can be approved by the IAA.

2.1.2 Aviation Receptors

Due to the proximity of the planned PV installation to Casement Aerodrome, Weston Aerodrome and Tallaght Hospital, glint and glare from the planned PV installation is a potential issue for aviation in the area. Aviation receptors must be set out at the approaches to runways and helipads in the surrounding areas, as well as at any air traffic control towers. This comes as a result of guidance on the potential hazards that solar developments have upon aviation activities, prepared by the US Federal Aviation Authority (FAA). In accordance with this guidance, Solar Glare Hazards Analysis Tools (SGHAT) have been developed which can be used internationally as an online resource. For the assessment of these aviation receptors, a SGHAT tool has been used.

2.1.3 Ground Based Receptors

Due to the factors regarding this installation, glint and glare will cause no impact where ground-based receptors are concerned. These factors include the overall height of the building, at approximately 11m, onto which the PV modules will be installed, the 2m setback of the modules from the roof edge and the in plane installation of the modules relative to the roof. These factors will ensure that the modules are not visible from the ground in the surrounding areas. In addition, due to the trajectory of the sun in Ireland, solar reflection from these modules will be due north for the most part. Although major roads such as the N7 runs to the south and east of this installation respectively, any potential view from the ground is obstructed by the building itself, other industrial high-rise buildings, walls and trees. It can therefore be concluded that further consideration of glint and glare impacts to ground based receptors was unnecessary. Examples of this can be seen below (Figure 4) (Figure 5) (Figure 6)

Figure 4: Image at Street level from the adjacent lot (roof surface not visible)

Figure 5: Image From Street level on overpass at Exit 3 on the N7 (building screened by trees)

Figure 6: Image From Street Level on the N7 (building screened by trees and other buildings)

3 Relevant Installation Parameters

The proposed installation is situated on the roof of Enva, 402 Grants Drive, Greenogue Business Park, Rathcoole, Dublin, D24 AP04. This installation is situated approximately 18.5km southwest of Dublin Airport, 6km Southeast of Weston Aerodrome, 1km Southwest of Casement Aerodrome and 6.5km West of Tallaght Hospital, as shown below (Figure 7). The installation is situated approximately 1.7km North of

the N7. However, visibility to the modules from this major roads is obstructed by trees, walls, and other buildings. The installation comprises of 794 modules, in plane with the roof. The roof slopes are aligned at an azimuth of 288 & 108 degrees, as shown below (Figure 8). For the purposes of identification in the simulation the modules on the West side of the building are designated PV array 1 and the modules on the east side are designated PV array 2.

Figure 7: Surrounding Aviation Receptors

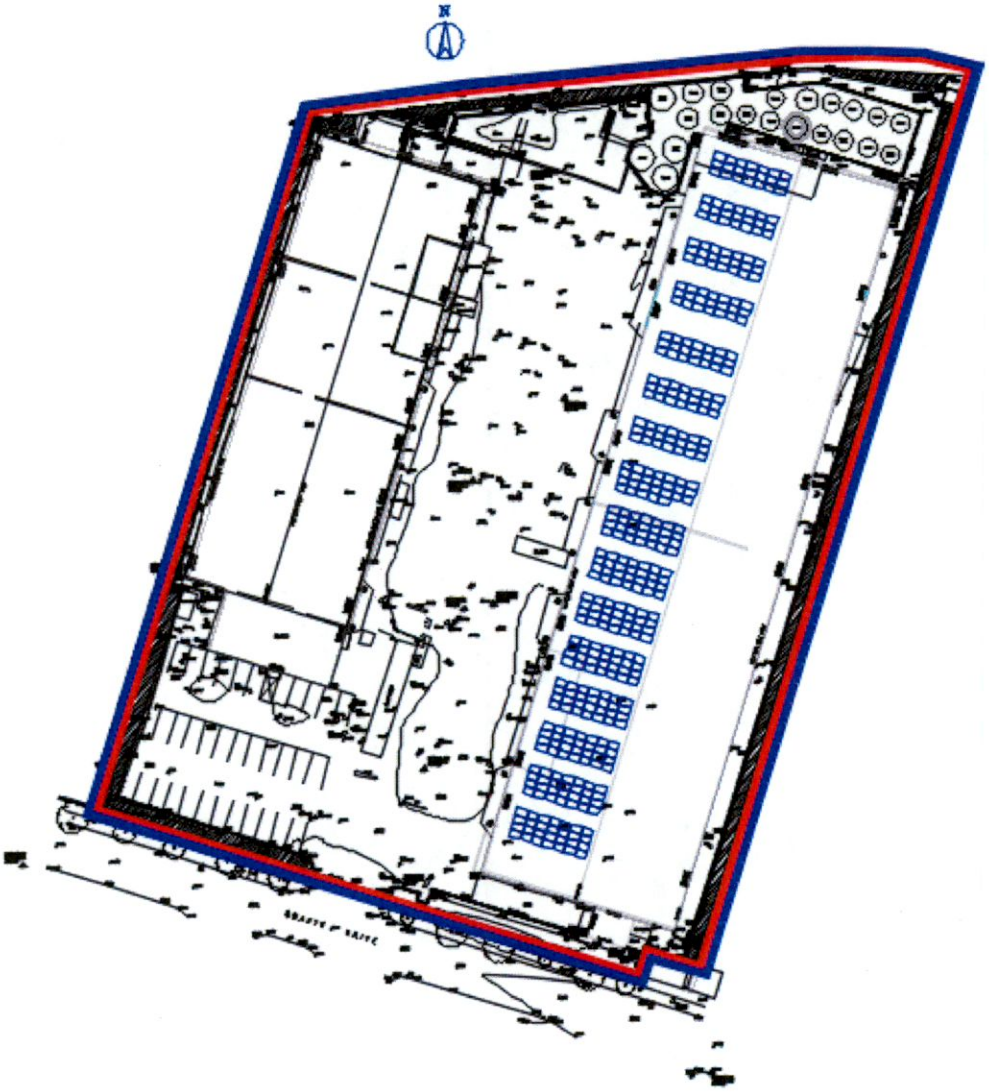


Figure 8: Installation Layout

3.1.1 Relevant Receptor Indication

The following are the relevant receptors for the planned solar PV installation at Enva Rathcoole:

1. Casement Aerodrome:

Casement Aerodrome is situated 6km south-west of the installation. It uses two operational runways: 05/23 and 11/29. 2-mile flight path receptors were used for the approach to each side of these runways. The air traffic control tower for this aerodrome is situated approximately 200m south of the hangar buildings and has a structural elevation of approximately 9m. There is no clear site line from the ATCT to the roof of Enva Rathcoole. An indication of the valid receptors can be seen below (Figure 9) and the results for these can be seen in Appendix A.

Figure 9: Aviation Receptors at Casement Aerodrome

2. Weston Aerodrome:

Weston Aerodrome is situated 6km west of the installation. It uses one operational runways: 07/25. 2-mile flight path receptors were used for the approach to each side of this runway. The air traffic control tower for this aerodrome is situated approximately 50m southwest of the hangar building and has a structural elevation of approximately 15m. An indication of these receptors can be seen below (Figure 10) and the results for these can be seen in Appendix A.

Figure 10: Aviation Receptors at Weston Aerodrome

3. Tallaght Hospital:

Tallaght Hospital is situated approximately 6km south of the installation. The hospital has a helicopter pad which is frequently used for the transport of patients. Point receptors were used for the approaches to this. These were spaced at 500m in all cardinal directions (N, NE, E, SE, etc.) These receptors were evaluated at increments of 30m to a maximum of 180m above the helipad. This will cover all possible approaches to the helipad. An indication of these receptors is shown below (Figure 11) and the results for these can be seen in Appendix B.

Figure 11: Helipad Receptor Locations at Tallaght Hospital

An indication of the points used for the SGHAT analysis can be seen on the table below (Table 1).

Item Identification	Indication
PV Array 1	PV modules on West slope
CA 04-22	Casement Aerodrome Runway 04/22
CA 10-28	Casement Aerodrome Runway 10/28
CA 22-04	Casement Aerodrome Runway 22/04
CA 28-10	Casement Aerodrome Runway 28/10
WA 07-25	Weston Aerodrome Runway 07/25
WA 25-07	Weston Aerodrome Runway 25/07
1-ATCT	Weston Aerodrome Air Traffic Control Tower
2.ATCT	Casement Aerodrome Air Traffic Control Tower
OP 1	Tallaght Hospital Helipad Location
OP 2	500m North
OP 3	1km North
OP 4	500m South
OP 5	1km South
OP 6	500m East
OP 7	1km East
OP 8	500m West

Item Identification	Indication
OP 9	1km West
OP 10	500m North-East
OP 11	1km North-East
OP 12	500m South-East
OP 13	1km South-East
OP 14	500m South-West
OP 15	1km South-West
OP 16	500m North-West
OP 17	1km North-West
OP 18	1.5km North
OP 19	1.5km North-East
OP 20	1.5km East
OP 21	1.5km South-East
OP 22	1.5km South
OP 23	1.5km South-West
OP 24	1.5km West
OP 25	1.5km North-West

Table 1: Receptor Point Indication

4 Results of Glint and Glare Assessment at Receptors

In order to assess the effects of glint and glare of the Installation at Enva, 402 Grants Drive, Greenogue Business Park, Rathcoole, Dublin, D24 AP04, a Solar Glare Hazard Analysis Tool (SGHAT) was used. This tool is used to due the current lack of guidance in Ireland to glint and glare effects. However, the tool is endorsed by the Federal Aviation Authority (FAA) as "the standard for measuring the ocular impact of any proposed solar energy system on a federally- obligated airport". It is regarded as the accepted standard by aviation authorities when evaluating glint and glare upon aviation receptors. The SGHAT results of this assessment can be seen in Appendix A and B.

The level of magnitude of glint and glare which this report is designed to are outlined in the FAA's interim policy [3] which states "to obtain FAA approval to revise an airport layout plan to depict a solar installation and/or a "no objection" to a Notice of Proposed Construction From 7460-1, the airport sponsor will be required to demonstrate that the proposed solar energy system meets the following standards:

- No potential for glint and glare in the existing or planned Airport Traffic Control Tower (ATCT) cab, and
- No potential for glare or "low potential for after-image" along the final approach path for any existing landing threshold or future landing thresholds (including any planned interim phases of the landing thresholds) as shown on the current FAA-approved Airport Layout Plan (ALP). The final approach path is defined as two (2) miles from fifty (50) feet above the landing threshold using a standard three (3) degree glidepath."

Therefore, the specifications for this evaluation were no glare to air traffic control towers and a maximum of "low potential for after-image", or green, glare on approaches to runways or helipads. Any potential for after-image or potential, yellow, for permanent eye damage, red, glare should be removed. The SGHAT analyses the impact of glare over a calendar year for each minute that the sun is above the horizon. It analyses this using a solar glare ocular hazard plot, shown below (Figure 12), which give the level of glare for each minute that the sun is visible.

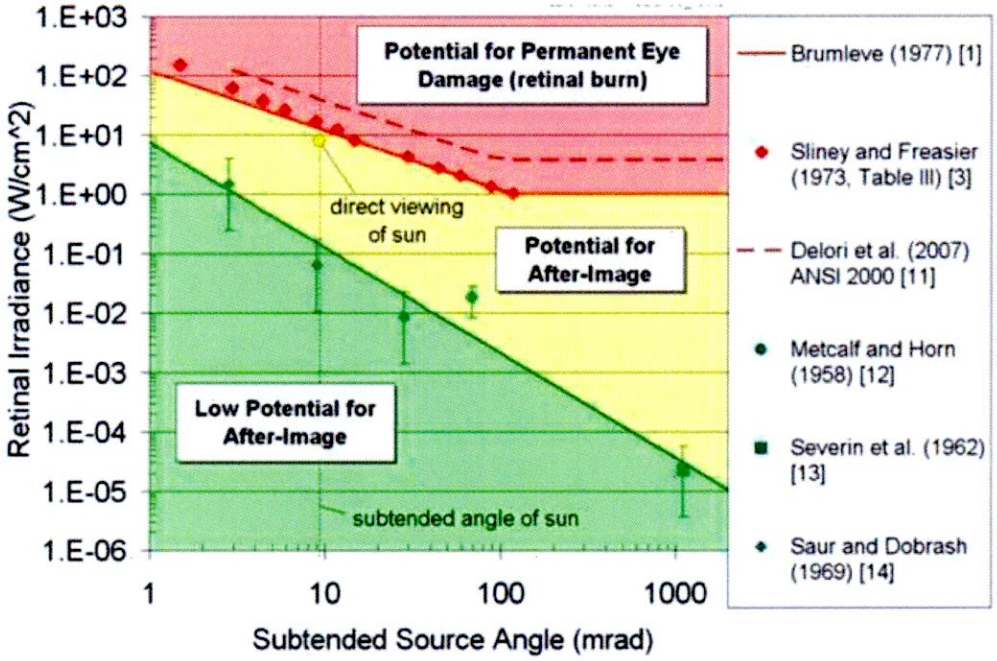


Figure 12: Solar Glare Ocular Hazard Plot

4.1 SGHAT Results

1. Casement Aerodrome: Results from SGHAT indicate the potential for "green glare" or glare with a "low potential for temporary after image" to occur along the approach to the 10/28 runway. There is no potential for glare of any type to occur at the other runway approaches or to the air traffic control tower. This is shown in Appendix A.
2. Weston Aerodrome: Results from SGHAT indicate there is no potential for glare of any type to occur on either runway approach or to the air traffic control tower. This is shown in Appendix A.
3. Tallaght Hospital Helipad: Results from SGHAT indicate no potential for glare to occur at any points modelled. This is shown in Appendix B.

5 Glint and Glare Assessment Conclusion

The results from using the SGHAT for the planned solar PV installation at Enva, 402 Grants Drive, Greenogue Business Park, Rathcoole, Dublin, D24 AP04 show that there is no potential for hazardous effects due to glare at any of the receptors used. The only glare detected was "low potential for after-image", or green, glare along one runway approach at Casement. However, this level of glare is considered acceptable for runway approaches. Therefore, no further mitigation measures are needed and the installation falls within a suitable environment for landing activities.

6 References

[1] M. Lawrance and P. W. Magnotta, "Technical Guidance for Evaluating Selected Solar Technologies on Airports," Federal Aviation Administration, Washington D.C., 2018.

[2] Federal Aviation Administration, "JO 7400.2N - Procedures for Handling Airspace Matters," U.S. Department of Transportation, Washington D.C., 2021.

[3] Federal Aviation Authority (FAA), "Review of Solar Energy System Projects on Federally Obligated Airports," *Department of Transportation - Federal Aviation Authority Interm Policy,* vol. 78, no. 205, pp. 63276 - 63279, 2013.

APPENDIX A:

SGHAT Results

All ATCT receptors

All Runway approach receptors

FORGESOLAR GLARE ANALYSIS

Project: **Enva Rathcoole**
Site configuration: **FP and ATCT**
Analysis conducted by Cormac Connell (cormac.connell@grange-solar.com) at 11:11 on 29 Jul, 2022.

U.S. FAA 2013 Policy Adherence

The following table summarizes the policy adherence of the glare analysis based on the 2013 U.S. Federal Aviation Administration Interim Policy 78 FR 63276. This policy requires the following criteria be met for solar energy systems on airport property:

- No "yellow" glare (potential for after-image) for any flight path from threshold to 2 miles
- No glare of any kind for Air Traffic Control Tower(s) ("ATCT") at cab height.
- Default analysis and observer characteristics (see list below)

ForgeSolar does not represent or speak officially for the FAA and cannot approve or deny projects. Results are informational only.

COMPONENT	STATUS	DESCRIPTION
Analysis parameters	PASS	Analysis time interval and eye characteristics used are acceptable
2-mile flight path(s)	PASS	Flight path receptor(s) do not receive yellow glare
ATCT(s)	PASS	Receptor(s) marked as ATCT do not receive glare

Default glare analysis parameters and observer eye characteristics (for reference only):

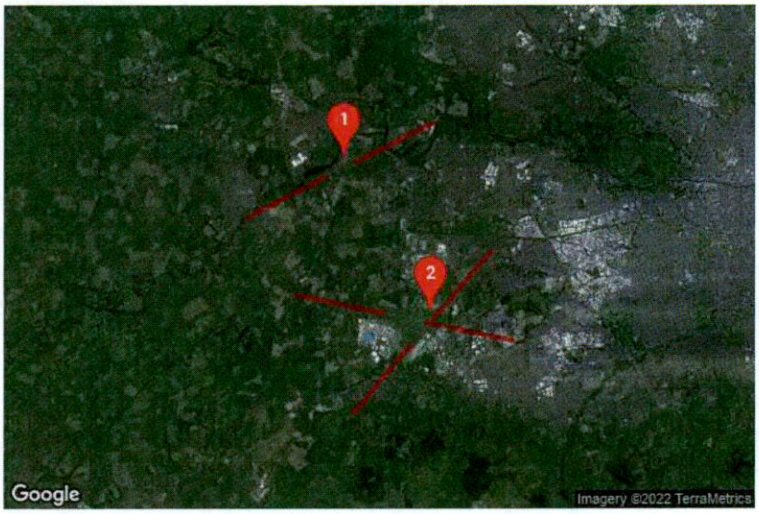
- Analysis time interval: 1 minute
- Ocular transmission coefficient: 0.5
- Pupil diameter: 0.002 meters
- Eye focal length: 0.017 meters
- Sun subtended angle: 9.3 milliradians

FAA Policy 78 FR 63276 can be read at https://www.federalregister.gov/d/2013-24729

SITE CONFIGURATION

Analysis Parameters

DNI: peaks at 1,000.0 W/m^2
Time interval: 1 min
Ocular transmission coefficient: 0.5
Pupil diameter: 0.002 m
Eye focal length: 0.017 m
Sun subtended angle: 9.3 mrad
Site Config ID: 73319.12843
Methodology: V2



PV Array(s)

Name: PV array 1
Axis tracking: Fixed (no rotation)
Tilt: 6.0°
Orientation: 288.0°
Rated power: -
Panel material: Smooth glass with AR coating
Reflectivity: Vary with sun
Slope error: correlate with material

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
1	53.297766	-6.476425	90.42	10.90	101.32
2	53.297721	-6.476199	90.55	12.30	102.85
3	53.296688	-6.476746	91.25	12.30	103.55
4	53.296736	-6.476993	91.05	10.90	101.95

Flight Path Receptor(s)

Name: CA 04-22
Description:
Threshold height: 15 m
Direction: 40.2°
Glide slope: 3.0°
Pilot view restricted? Yes
Vertical view: 30.0°
Azimuthal view: 50.0°

Point	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
Threshold	53.294263	-6.452825	97.99	15.24	113.23
Two-mile	53.272183	-6.484090	153.65	128.26	281.91

Name: CA 10-28
Description:
Threshold height: 15 m
Direction: 102.2°
Glide slope: 3.0°
Pilot view restricted? Yes
Vertical view: 30.0°
Azimuthal view: 50.0°

Point	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
Threshold	53.304511	-6.467367	87.10	15.24	102.34
Two-mile	53.310626	-6.514712	72.75	198.27	271.02

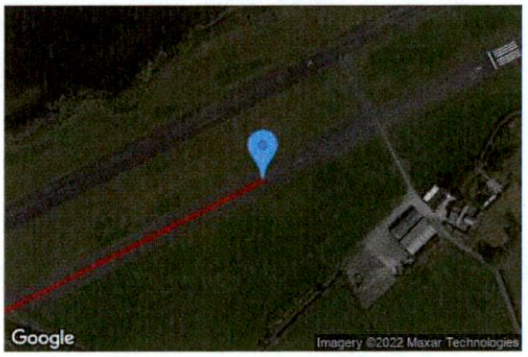
Name: CA 22-04
Description:
Threshold height: 15 m
Direction: 220.7°
Glide slope: 3.0°
Pilot view restricted? Yes
Vertical view: 30.0°
Azimuthal view: 50.0°

Point	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
Threshold	53.302839	-6.440417	94.75	15.24	109.99
Two-mile	53.324769	-6.408850	63.90	214.78	278.67

Name: CA 28-10
Description:
Threshold height: 15 m
Direction: 282.0°
Glide slope: 3.0°
Pilot view restricted? Yes
Vertical view: 30.0°
Azimuthal view: 50.0°

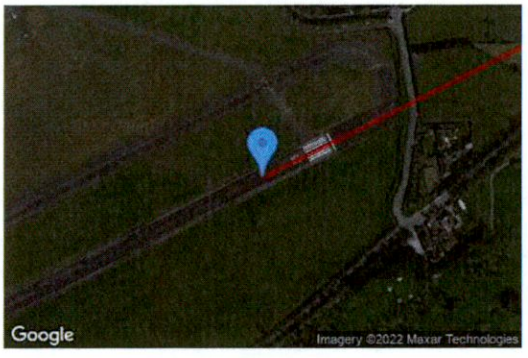
Point	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
Threshold	53.301589	-6.444275	96.12	15.24	111.36
Two-mile	53.295578	-6.396896	107.39	172.65	280.04

Name: WA 07-25
Description:
Threshold height: 15 m
Direction: 63.1°
Glide slope: 3.0°
Pilot view restricted? Yes
Vertical view: 30.0°
Azimuthal view: 50.0°



Point	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
Threshold	53.349113	-6.498760	47.43	15.24	62.67
Two-mile	53.336050	-6.542020	50.30	181.05	231.35

Name: WA 25-07
Description:
Threshold height: 15 m
Direction: 243.3°
Glide slope: 3.0°
Pilot view restricted? Yes
Vertical view: 30.0°
Azimuthal view: 50.0°



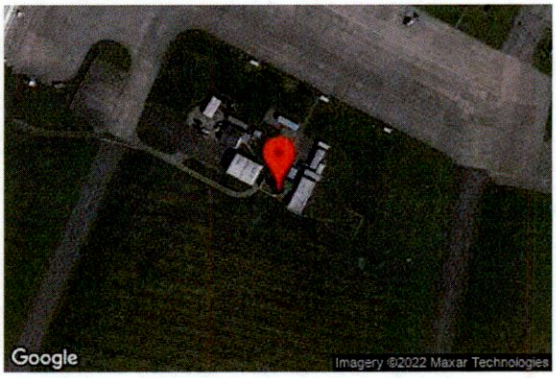
Point	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
Threshold	53.353791	-6.483418	46.75	15.24	61.99
Two-mile	53.366791	-6.440099	36.95	193.72	230.68

Discrete Observation Receptors

Name	ID	Latitude (°)	Longitude (°)	Elevation (m)	Height (m)
1-ATCT	1	53.355566	-6.489431	49.66	15.00
2-ATCT	2	53.305503	-6.441797	93.51	9.00

Map image of 1-ATCT

Map image of 2-ATCT



GLARE ANALYSIS RESULTS

Summary of Glare

PV Array Name	Tilt (°)	Orient (°)	"Green" Glare min	"Yellow" Glare min	Energy kWh
PV array 1	6.0	288.0	7,531	0	-

Total annual glare received by each receptor

Receptor	Annual Green Glare (min)	Annual Yellow Glare (min)
CA 04-22	0	0
CA 10-28	7531	0
CA 22-04	0	0
CA 28-10	0	0
WA 07-25	0	0
WA 25-07	0	0
1-ATCT	0	0
2-ATCT	0	0

Results for: PV array 1

Receptor	Green Glare (min)	Yellow Glare (min)
CA 04-22	0	0
CA 10-28	7531	0
CA 22-04	0	0
CA 28-10	0	0
WA 07-25	0	0
WA 25-07	0	0
1-ATCT	0	0
2-ATCT	0	0

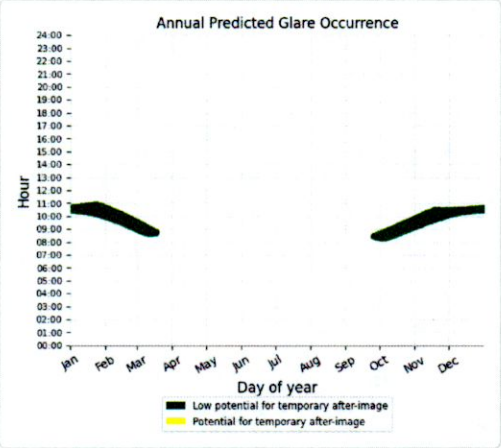
Flight Path: CA 04-22

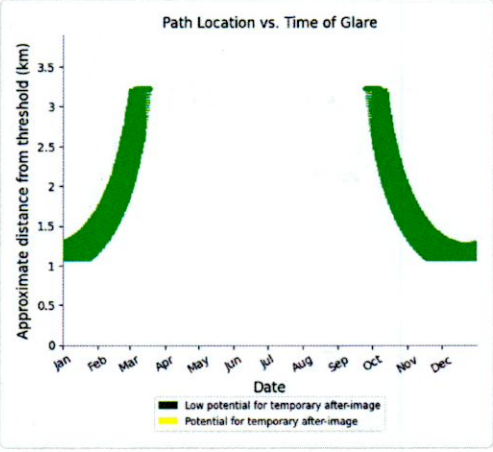
0 minutes of yellow glare
0 minutes of green glare

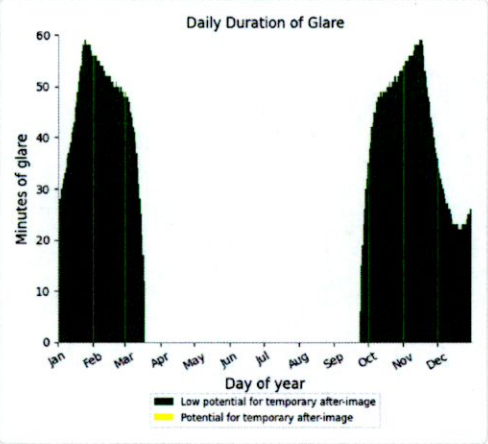
Flight Path: CA 10-28

0 minutes of yellow glare

7531 minutes of green glare







Flight Path: CA 22-04

0 minutes of yellow glare

0 minutes of green glare

Flight Path: CA 28-10

0 minutes of yellow glare

0 minutes of green glare

Flight Path: WA 07-25

0 minutes of yellow glare

0 minutes of green glare

Flight Path: WA 25-07

0 minutes of yellow glare

0 minutes of green glare

Point Receptor: 1-ATCT

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: 2-ATCT

0 minutes of yellow glare
0 minutes of green glare

Assumptions

"Green" glare is glare with low potential to cause an after-image (flash blindness) when observed prior to a typical blink response time.
"Yellow" glare is glare with potential to cause an after-image (flash blindness) when observed prior to a typical blink response time.
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.
Several calculations utilize the PV array centroid, rather than the actual glare spot location, due to V1 algorithm limitations. This may affect results for 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.)
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.
The glare hazard determination relies on several approximations including observer eye characteristics, angle of view, and typical blink response time. Actual results and glare occurrence may differ.
Hazard zone boundaries shown in the Glare Hazard plot are an approximation and visual aid based on aggregated research data. Actual ocular impact outcomes encompass a continuous, not discrete, spectrum.
Refer to the Help page at **www.forgesolar.com/help/** for assumptions and limitations not listed here.

Grange Solar

APPENDIX B:

SGHAT Results

All Helipad approach receptors

FORGESOLAR GLARE ANALYSIS

Project: **Enva Rathcoole**
Site configuration: **Helipad Ground**
Analysis conducted by Cormac Connell (cormac.connell@grange-solar.com) at 10:56 on 29 Jul, 2022.

U.S. FAA 2013 Policy Adherence

The following table summarizes the policy adherence of the glare analysis based on the 2013 U.S. Federal Aviation Administration Interim Policy 78 FR 63276. This policy requires the following criteria be met for solar energy systems on airport property:

- No "yellow" glare (potential for after-image) for any flight path from threshold to 2 miles
- No glare of any kind for Air Traffic Control Tower(s) ("ATCT") at cab height.
- Default analysis and observer characteristics (see list below)

ForgeSolar does not represent or speak officially for the FAA and cannot approve or deny projects. Results are informational only.

COMPONENT	STATUS	DESCRIPTION
Analysis parameters	PASS	Analysis time interval and eye characteristics used are acceptable
2-mile flight path(s)	N/A	No flight paths analyzed
ATCT(s)	N/A	No ATCT receptors designated

Default glare analysis parameters and observer eye characteristics (for reference only):

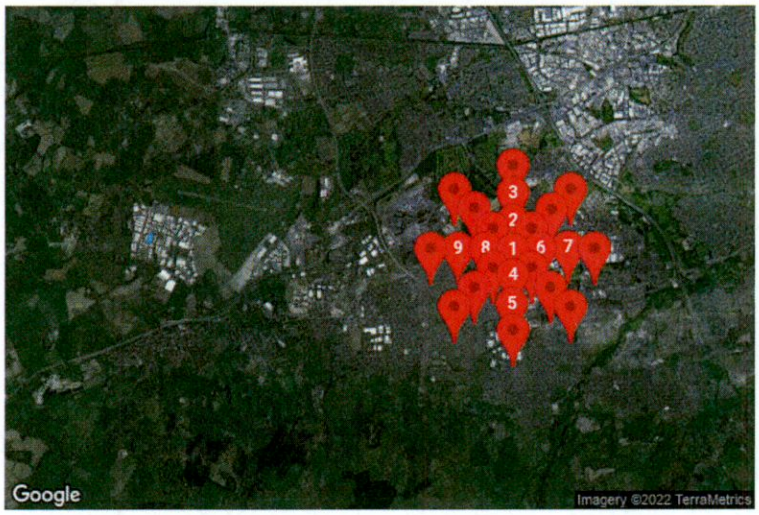
- Analysis time interval: 1 minute
- Ocular transmission coefficient: 0.5
- Pupil diameter: 0.002 meters
- Eye focal length: 0.017 meters
- Sun subtended angle: 9.3 milliradians

FAA Policy 78 FR 63276 can be read at https://www.federalregister.gov/d/2013-24729

SITE CONFIGURATION

Analysis Parameters

DNI: peaks at 1,000.0 W/m^2
Time interval: 1 min
Ocular transmission coefficient: 0.5
Pupil diameter: 0.002 m
Eye focal length: 0.017 m
Sun subtended angle: 9.3 mrad
Site Config ID: 73099.12843
Methodology: V2



PV Array(s)

Name: PV array 1
Axis tracking: Fixed (no rotation)
Tilt: 6.0°
Orientation: 288.0°
Rated power: -
Panel material: Smooth glass with AR coating
Reflectivity: Vary with sun
Slope error: correlate with material

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
1	53.297766	-6.476425	90.42	10.90	101.32
2	53.297721	-6.476199	90.55	12.30	102.85
3	53.296688	-6.476746	91.25	12.30	103.55
4	53.296736	-6.476993	91.05	10.90	101.95

Discrete Observation Receptors

Name	ID	Latitude (°)	Longitude (°)	Elevation (m)	Height (m)
OP 1	1	53.289280	-6.376776	100.00	0.00
OP 2	2	53.294040	-6.376778	100.00	0.00
OP 3	3	53.298492	-6.376794	100.00	0.00
OP 4	4	53.285054	-6.376866	100.00	0.00
OP 5	5	53.280491	-6.376896	100.00	0.00
OP 6	6	53.289509	-6.369274	100.00	0.00
OP 7	7	53.289544	-6.361742	100.00	0.00
OP 8	8	53.289510	-6.384211	100.00	0.00
OP 9	9	53.289518	-6.391710	100.00	0.00
OP 10	10	53.292678	-6.371512	100.00	0.00
OP 11	11	53.295880	-6.366117	100.00	0.00
OP 12	12	53.286315	-6.371496	100.00	0.00
OP 13	13	53.283042	-6.366522	100.00	0.00
OP 14	14	53.286329	-6.382116	100.00	0.00
OP 15	15	53.283136	-6.387412	100.00	0.00
OP 16	16	53.292644	-6.382036	100.00	0.00
OP 17	17	53.295906	-6.387304	100.00	0.00
OP 18	18	53.303015	-6.376800	100.00	0.00
OP 19	19	53.299100	-6.360788	100.00	0.00
OP 20	20	53.289502	-6.354357	100.00	0.00
OP 21	21	53.279976	-6.360930	100.00	0.00
OP 22	22	53.276006	-6.376774	100.00	0.00
OP 23	23	53.279996	-6.392722	100.00	0.00
OP 24	24	53.289516	-6.399241	100.00	0.00
OP 25	25	53.299038	-6.392723	100.00	0.00

GLARE ANALYSIS RESULTS

Summary of Glare

PV Array Name	Tilt (°)	Orient (°)	"Green" Glare min	"Yellow" Glare min	Energy kWh
PV array 1	6.0	288.0	0	0	-

Total annual glare received by each receptor

Receptor	Annual Green Glare (min)	Annual Yellow Glare (min)
OP 1	0	0
OP 2	0	0
OP 3	0	0
OP 4	0	0
OP 5	0	0
OP 6	0	0
OP 7	0	0
OP 8	0	0
OP 9	0	0
OP 10	0	0
OP 11	0	0
OP 12	0	0
OP 13	0	0
OP 14	0	0
OP 15	0	0
OP 16	0	0
OP 17	0	0
OP 18	0	0
OP 19	0	0
OP 20	0	0
OP 21	0	0
OP 22	0	0
OP 23	0	0
OP 24	0	0
OP 25	0	0

Results for: PV array 1

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

Point Receptor: OP 1

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 2

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 3

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 4

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 5

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 6

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 7

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 8

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 9

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 10

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 11

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 12

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 13

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 14

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 15

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 16

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 17

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 18

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 19

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 20

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 21

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 22

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 23

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 24

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 25

0 minutes of yellow glare
0 minutes of green glare

Assumptions

"Green" glare is glare with low potential to cause an after-image (flash blindness) when observed prior to a typical blink response time.
"Yellow" glare is glare with potential to cause an after-image (flash blindness) when observed prior to a typical blink response time.
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.
Several calculations utilize the PV array centroid, rather than the actual glare spot location, due to V1 algorithm limitations. This may affect results for 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.)
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.
The glare hazard determination relies on several approximations including observer eye characteristics, angle of view, and typical blink response time. Actual results and glare occurrence may differ.
Hazard zone boundaries shown in the Glare Hazard plot are an approximation and visual aid based on aggregated research data. Actual ocular impact outcomes encompass a continuous, not discrete, spectrum.
Refer to the Help page at **www.forgesolar.com/help/** for assumptions and limitations not listed here.

FORGESOLAR GLARE ANALYSIS

Project: **Enva Rathcoole**
Site configuration: **Helipad 60m**
Analysis conducted by Cormac Connell (cormac.connell@grange-solar.com) at 10:58 on 29 Jul, 2022.

U.S. FAA 2013 Policy Adherence

The following table summarizes the policy adherence of the glare analysis based on the 2013 U.S. Federal Aviation Administration Interim Policy 78 FR 63276. This policy requires the following criteria be met for solar energy systems on airport property:

- No "yellow" glare (potential for after-image) for any flight path from threshold to 2 miles
- No glare of any kind for Air Traffic Control Tower(s) ("ATCT") at cab height.
- Default analysis and observer characteristics (see list below)

ForgeSolar does not represent or speak officially for the FAA and cannot approve or deny projects. Results are informational only.

COMPONENT	STATUS	DESCRIPTION
Analysis parameters	PASS	Analysis time interval and eye characteristics used are acceptable
2-mile flight path(s)	N/A	No flight paths analyzed
ATCT(s)	N/A	No ATCT receptors designated

Default glare analysis parameters and observer eye characteristics (for reference only):

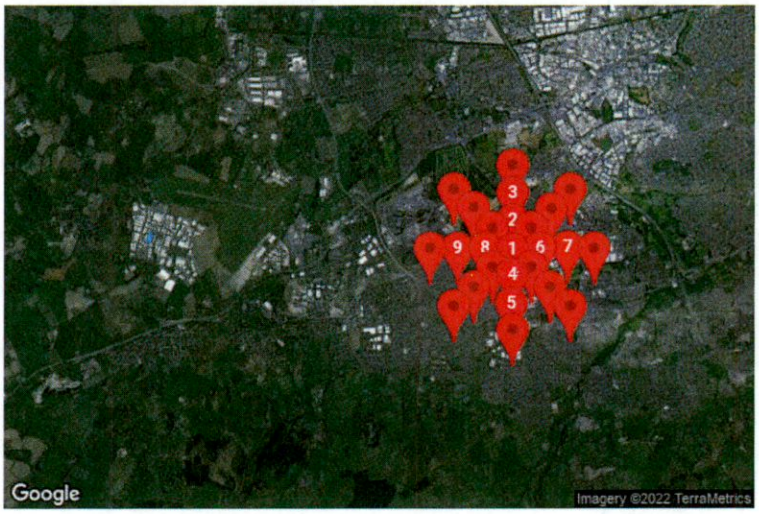
- Analysis time interval: 1 minute
- Ocular transmission coefficient: 0.5
- Pupil diameter: 0.002 meters
- Eye focal length: 0.017 meters
- Sun subtended angle: 9.3 milliradians

FAA Policy 78 FR 63276 can be read at https://www.federalregister.gov/d/2013-24729

SITE CONFIGURATION

Analysis Parameters

DNI: peaks at 1,000.0 W/m^2
Time interval: 1 min
Ocular transmission coefficient: 0.5
Pupil diameter: 0.002 m
Eye focal length: 0.017 m
Sun subtended angle: 9.3 mrad
Site Config ID: 73320.12843
Methodology: V2



PV Array(s)

Name: PV array 1
Axis tracking: Fixed (no rotation)
Tilt: 6.0°
Orientation: 288.0°
Rated power: -
Panel material: Smooth glass with AR coating
Reflectivity: Vary with sun
Slope error: correlate with material

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
1	53.297766	-6.476425	90.42	10.90	101.32
2	53.297721	-6.476199	90.55	12.30	102.85
3	53.296688	-6.476746	91.25	12.30	103.55
4	53.296736	-6.476993	91.05	10.90	101.95

Discrete Observation Receptors

Name	ID	Latitude (°)	Longitude (°)	Elevation (m)	Height (m)
OP 1	1	53.289280	-6.376776	160.00	0.00
OP 2	2	53.294040	-6.376778	160.00	0.00
OP 3	3	53.298492	-6.376794	160.00	0.00
OP 4	4	53.285054	-6.376866	160.00	0.00
OP 5	5	53.280491	-6.376896	160.00	0.00
OP 6	6	53.289509	-6.369274	160.00	0.00
OP 7	7	53.289544	-6.361742	160.00	0.00
OP 8	8	53.289510	-6.384211	160.00	0.00
OP 9	9	53.289518	-6.391710	160.00	0.00
OP 10	10	53.292678	-6.371512	160.00	0.00
OP 11	11	53.295880	-6.366117	160.00	0.00
OP 12	12	53.286315	-6.371496	160.00	0.00
OP 13	13	53.283042	-6.366522	160.00	0.00
OP 14	14	53.286329	-6.382116	160.00	0.00
OP 15	15	53.283136	-6.387412	160.00	0.00
OP 16	16	53.292644	-6.382036	160.00	0.00
OP 17	17	53.295906	-6.387304	160.00	0.00
OP 18	18	53.303015	-6.376800	160.00	0.00
OP 19	19	53.299100	-6.360788	160.00	0.00
OP 20	20	53.289502	-6.354357	160.00	0.00
OP 21	21	53.279976	-6.360930	160.00	0.00
OP 22	22	53.276006	-6.376774	160.00	0.00
OP 23	23	53.279996	-6.392722	160.00	0.00
OP 24	24	53.289516	-6.399241	160.00	0.00
OP 25	25	53.299038	-6.392723	160.00	0.00

GLARE ANALYSIS RESULTS

Summary of Glare

PV Array Name	Tilt (°)	Orient (°)	"Green" Glare min	"Yellow" Glare min	Energy kWh
PV array 1	6.0	288.0	0	0	-

Total annual glare received by each receptor

Receptor	Annual Green Glare (min)	Annual Yellow Glare (min)
OP 1	0	0
OP 2	0	0
OP 3	0	0
OP 4	0	0
OP 5	0	0
OP 6	0	0
OP 7	0	0
OP 8	0	0
OP 9	0	0
OP 10	0	0
OP 11	0	0
OP 12	0	0
OP 13	0	0
OP 14	0	0
OP 15	0	0
OP 16	0	0
OP 17	0	0
OP 18	0	0
OP 19	0	0
OP 20	0	0
OP 21	0	0
OP 22	0	0
OP 23	0	0
OP 24	0	0
OP 25	0	0

Results for: PV array 1

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

Point Receptor: OP 1

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 2

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 3

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 4

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 5

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 6

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 7

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 8

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 9

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 10

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 11

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 12

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 13

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 14

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 15

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 16

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 17

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 18

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 19

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 20

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 21

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 22

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 23

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 24

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 25

0 minutes of yellow glare
0 minutes of green glare

Assumptions

"Green" glare is glare with low potential to cause an after-image (flash blindness) when observed prior to a typical blink response time.
"Yellow" glare is glare with potential to cause an after-image (flash blindness) when observed prior to a typical blink response time.
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.
Several calculations utilize the PV array centroid, rather than the actual glare spot location, due to V1 algorithm limitations. This may affect results for 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.)
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.
The glare hazard determination relies on several approximations including observer eye characteristics, angle of view, and typical blink response time. Actual results and glare occurrence may differ.
Hazard zone boundaries shown in the Glare Hazard plot are an approximation and visual aid based on aggregated research data. Actual ocular impact outcomes encompass a continuous, not discrete, spectrum.
Refer to the Help page at **www.forgesolar.com/help/** for assumptions and limitations not listed here.

FORGESOLAR GLARE ANALYSIS

Project: **Enva Rathcoole**
Site configuration: **Helipad 90m**
Analysis conducted by Cormac Connell (cormac.connell@grange-solar.com) at 10:57 on 29 Jul, 2022.

U.S. FAA 2013 Policy Adherence

The following table summarizes the policy adherence of the glare analysis based on the 2013 U.S. Federal Aviation Administration Interim Policy 78 FR 63276. This policy requires the following criteria be met for solar energy systems on airport property:

- No "yellow" glare (potential for after-image) for any flight path from threshold to 2 miles
- No glare of any kind for Air Traffic Control Tower(s) ("ATCT") at cab height.
- Default analysis and observer characteristics (see list below)

ForgeSolar does not represent or speak officially for the FAA and cannot approve or deny projects. Results are informational only.

COMPONENT	STATUS	DESCRIPTION
Analysis parameters	PASS	Analysis time interval and eye characteristics used are acceptable
2-mile flight path(s)	N/A	No flight paths analyzed
ATCT(s)	N/A	No ATCT receptors designated

Default glare analysis parameters and observer eye characteristics (for reference only):

- Analysis time interval: 1 minute
- Ocular transmission coefficient: 0.5
- Pupil diameter: 0.002 meters
- Eye focal length: 0.017 meters
- Sun subtended angle: 9.3 milliradians

FAA Policy 78 FR 63276 can be read at https://www.federalregister.gov/d/2013-24729

SITE CONFIGURATION

Analysis Parameters

DNI: peaks at 1,000.0 W/m^2
Time interval: 1 min
Ocular transmission coefficient: 0.5
Pupil diameter: 0.002 m
Eye focal length: 0.017 m
Sun subtended angle: 9.3 mrad
Site Config ID: 73104.12843
Methodology: V2

PV Array(s)

Name: PV array 1
Axis tracking: Fixed (no rotation)
Tilt: 6.0°
Orientation: 288.0°
Rated power: -
Panel material: Smooth glass with AR coating
Reflectivity: Vary with sun
Slope error: correlate with material

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
1	53.297766	-6.476425	90.42	10.90	101.32
2	53.297721	-6.476199	90.55	12.30	102.85
3	53.296688	-6.476746	91.25	12.30	103.55
4	53.296736	-6.476993	91.05	10.90	101.95

Discrete Observation Receptors

Name	ID	Latitude (°)	Longitude (°)	Elevation (m)	Height (m)
OP 1	1	53.289280	-6.376776	190.00	0.00
OP 2	2	53.294040	-6.376778	190.00	0.00
OP 3	3	53.298492	-6.376794	190.00	0.00
OP 4	4	53.285054	-6.376866	190.00	0.00
OP 5	5	53.280491	-6.376896	190.00	0.00
OP 6	6	53.289509	-6.369274	190.00	0.00
OP 7	7	53.289544	-6.361742	190.00	0.00
OP 8	8	53.289510	-6.384211	190.00	0.00
OP 9	9	53.289518	-6.391710	190.00	0.00
OP 10	10	53.292678	-6.371512	190.00	0.00
OP 11	11	53.295880	-6.366117	190.00	0.00
OP 12	12	53.286315	-6.371496	190.00	0.00
OP 13	13	53.283042	-6.366522	190.00	0.00
OP 14	14	53.286329	-6.382116	190.00	0.00
OP 15	15	53.283136	-6.387412	190.00	0.00
OP 16	16	53.292644	-6.382036	190.00	0.00
OP 17	17	53.295906	-6.387304	190.00	0.00
OP 18	18	53.303015	-6.376800	190.00	0.00
OP 19	19	53.299100	-6.360788	190.00	0.00
OP 20	20	53.289502	-6.354357	190.00	0.00
OP 21	21	53.279976	-6.360930	190.00	0.00
OP 22	22	53.276006	-6.376774	190.00	0.00
OP 23	23	53.279996	-6.392722	190.00	0.00
OP 24	24	53.289516	-6.399241	190.00	0.00
OP 25	25	53.299038	-6.392723	190.00	0.00

GLARE ANALYSIS RESULTS

Summary of Glare

PV Array Name	Tilt (°)	Orient (°)	"Green" Glare min	"Yellow" Glare min	Energy kWh
PV array 1	6.0	288.0	0	0	-

Total annual glare received by each receptor

Receptor	Annual Green Glare (min)	Annual Yellow Glare (min)
OP 1	0	0
OP 2	0	0
OP 3	0	0
OP 4	0	0
OP 5	0	0
OP 6	0	0
OP 7	0	0
OP 8	0	0
OP 9	0	0
OP 10	0	0
OP 11	0	0
OP 12	0	0
OP 13	0	0
OP 14	0	0
OP 15	0	0
OP 16	0	0
OP 17	0	0
OP 18	0	0
OP 19	0	0
OP 20	0	0
OP 21	0	0
OP 22	0	0
OP 23	0	0
OP 24	0	0
OP 25	0	0

Results for: PV array 1

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

Point Receptor: OP 1

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 2

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 3

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 4

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 5

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 6

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 7

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 8

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 9

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 10

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 11

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 12

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 13

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 14

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 15

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 16

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 17

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 18

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 19

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 20

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0 minutes of green glare

Point Receptor: OP 21

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 22

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Point Receptor: OP 23

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 24

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 25

0 minutes of yellow glare
0 minutes of green glare

Assumptions

"Green" glare is glare with low potential to cause an after-image (flash blindness) when observed prior to a typical blink response time.
"Yellow" glare is glare with potential to cause an after-image (flash blindness) when observed prior to a typical blink response time.
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Glare analyses do not account for physical obstructions between reflectors and receptors. This includes buildings, tree cover and geographic obstructions.
Several calculations utilize the PV array centroid, rather than the actual glare spot location, due to V1 algorithm limitations. This may affect results for 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.)
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.
The glare hazard determination relies on several approximations including observer eye characteristics, angle of view, and typical blink response time. Actual results and glare occurrence may differ.
Hazard zone boundaries shown in the Glare Hazard plot are an approximation and visual aid based on aggregated research data. Actual ocular impact outcomes encompass a continuous, not discrete, spectrum.
Refer to the Help page at **www.forgesolar.com/help/** for assumptions and limitations not listed here.

FORGESOLAR GLARE ANALYSIS

Project: **Enva Rathcoole**
Site configuration: **Helipad 120m**
Analysis conducted by Cormac Connell (cormac.connell@grange-solar.com) at 10:58 on 29 Jul, 2022.

U.S. FAA 2013 Policy Adherence

The following table summarizes the policy adherence of the glare analysis based on the 2013 U.S. Federal Aviation Administration Interim Policy 78 FR 63276. This policy requires the following criteria be met for solar energy systems on airport property:

- No "yellow" glare (potential for after-image) for any flight path from threshold to 2 miles
- No glare of any kind for Air Traffic Control Tower(s) ("ATCT") at cab height.
- Default analysis and observer characteristics (see list below)

ForgeSolar does not represent or speak officially for the FAA and cannot approve or deny projects. Results are informational only.

COMPONENT	STATUS	DESCRIPTION
Analysis parameters	PASS	Analysis time interval and eye characteristics used are acceptable
2-mile flight path(s)	N/A	No flight paths analyzed
ATCT(s)	N/A	No ATCT receptors designated

Default glare analysis parameters and observer eye characteristics (for reference only):

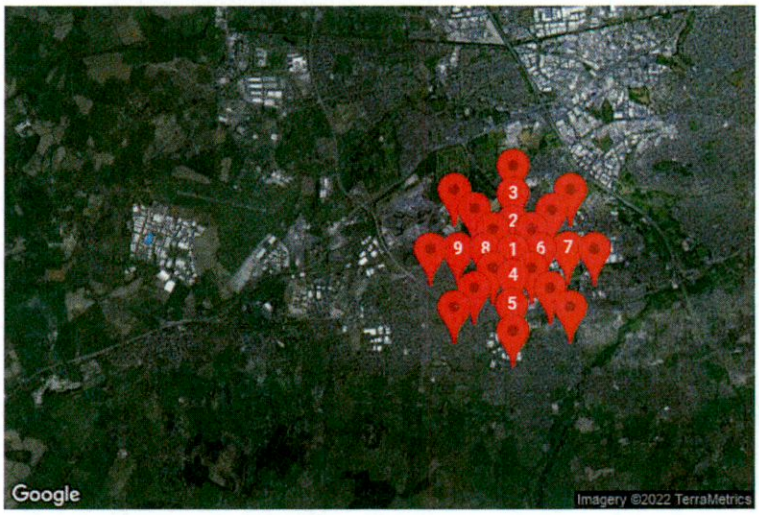
- Analysis time interval: 1 minute
- Ocular transmission coefficient: 0.5
- Pupil diameter: 0.002 meters
- Eye focal length: 0.017 meters
- Sun subtended angle: 9.3 milliradians

FAA Policy 78 FR 63276 can be read at https://www.federalregister.gov/d/2013-24729

SITE CONFIGURATION

Analysis Parameters

DNI: peaks at 1,000.0 W/m^2
Time interval: 1 min
Ocular transmission coefficient: 0.5
Pupil diameter: 0.002 m
Eye focal length: 0.017 m
Sun subtended angle: 9.3 mrad
Site Config ID: 73105.12843
Methodology: V2



PV Array(s)

Name: PV array 1
Axis tracking: Fixed (no rotation)
Tilt: 6.0°
Orientation: 288.0°
Rated power: -
Panel material: Smooth glass with AR coating
Reflectivity: Vary with sun
Slope error: correlate with material

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
1	53.297766	-6.476425	90.42	10.90	101.32
2	53.297721	-6.476199	90.55	12.30	102.85
3	53.296688	-6.476746	91.25	12.30	103.55
4	53.296736	-6.476993	91.05	10.90	101.95

Discrete Observation Receptors

Name	ID	Latitude (°)	Longitude (°)	Elevation (m)	Height (m)
OP 1	1	53.289280	-6.376776	220.00	0.00
OP 2	2	53.294040	-6.376778	220.00	0.00
OP 3	3	53.298492	-6.376794	220.00	0.00
OP 4	4	53.285054	-6.376866	220.00	0.00
OP 5	5	53.280491	-6.376896	220.00	0.00
OP 6	6	53.289509	-6.369274	220.00	0.00
OP 7	7	53.289544	-6.361742	220.00	0.00
OP 8	8	53.289510	-6.384211	220.00	0.00
OP 9	9	53.289518	-6.391710	220.00	0.00
OP 10	10	53.292678	-6.371512	220.00	0.00
OP 11	11	53.295880	-6.366117	220.00	0.00
OP 12	12	53.286315	-6.371496	220.00	0.00
OP 13	13	53.283042	-6.366522	220.00	0.00
OP 14	14	53.286329	-6.382116	220.00	0.00
OP 15	15	53.283136	-6.387412	220.00	0.00
OP 16	16	53.292644	-6.382036	220.00	0.00
OP 17	17	53.295906	-6.387304	220.00	0.00
OP 18	18	53.303015	-6.376800	220.00	0.00
OP 19	19	53.299100	-6.360788	220.00	0.00
OP 20	20	53.289502	-6.354357	220.00	0.00
OP 21	21	53.279976	-6.360930	220.00	0.00
OP 22	22	53.276006	-6.376774	220.00	0.00
OP 23	23	53.279996	-6.392722	220.00	0.00
OP 24	24	53.289516	-6.399241	220.00	0.00
OP 25	25	53.299038	-6.392723	220.00	0.00

GLARE ANALYSIS RESULTS

Summary of Glare

PV Array Name	Tilt (°)	Orient (°)	"Green" Glare min	"Yellow" Glare min	Energy kWh
PV array 1	6.0	288.0	0	0	-

Total annual glare received by each receptor

Receptor	Annual Green Glare (min)	Annual Yellow Glare (min)
OP 1	0	0
OP 2	0	0
OP 3	0	0
OP 4	0	0
OP 5	0	0
OP 6	0	0
OP 7	0	0
OP 8	0	0
OP 9	0	0
OP 10	0	0
OP 11	0	0
OP 12	0	0
OP 13	0	0
OP 14	0	0
OP 15	0	0
OP 16	0	0
OP 17	0	0
OP 18	0	0
OP 19	0	0
OP 20	0	0
OP 21	0	0
OP 22	0	0
OP 23	0	0
OP 24	0	0
OP 25	0	0

Results for: PV array 1

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

Point Receptor: OP 1

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 2

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 3

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 4

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 5

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 6

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 7

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 8

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 9

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 10

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 11

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 12

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 13

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 14

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 15

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 16

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 17

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 18

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 19

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 20

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 21

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 22

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 23

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 24

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 25

0 minutes of yellow glare
0 minutes of green glare

Assumptions

"Green" glare is glare with low potential to cause an after-image (flash blindness) when observed prior to a typical blink response time.
"Yellow" glare is glare with potential to cause an after-image (flash blindness) when observed prior to a typical blink response time.
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.
Several calculations utilize the PV array centroid, rather than the actual glare spot location, due to V1 algorithm limitations. This may affect results for 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.)
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.
The glare hazard determination relies on several approximations including observer eye characteristics, angle of view, and typical blink response time. Actual results and glare occurrence may differ.
Hazard zone boundaries shown in the Glare Hazard plot are an approximation and visual aid based on aggregated research data. Actual ocular impact outcomes encompass a continuous, not discrete, spectrum.
Refer to the Help page at **www.forgesolar.com/help/** for assumptions and limitations not listed here.

FORGESOLAR GLARE ANALYSIS

Project: **Enva Rathcoole**
Site configuration: **Helipad 150m-temp-5**
Analysis conducted by Cormac Connell (cormac.connell@grange-solar.com) at 11:00 on 29 Jul, 2022.

U.S. FAA 2013 Policy Adherence

The following table summarizes the policy adherence of the glare analysis based on the 2013 U.S. Federal Aviation Administration Interim Policy 78 FR 63276. This policy requires the following criteria be met for solar energy systems on airport property:

- No "yellow" glare (potential for after-image) for any flight path from threshold to 2 miles
- No glare of any kind for Air Traffic Control Tower(s) ("ATCT") at cab height.
- Default analysis and observer characteristics (see list below)

ForgeSolar does not represent or speak officially for the FAA and cannot approve or deny projects. Results are informational only.

COMPONENT	STATUS	DESCRIPTION
Analysis parameters	PASS	Analysis time interval and eye characteristics used are acceptable
2-mile flight path(s)	N/A	No flight paths analyzed
ATCT(s)	N/A	No ATCT receptors designated

Default glare analysis parameters and observer eye characteristics (for reference only):

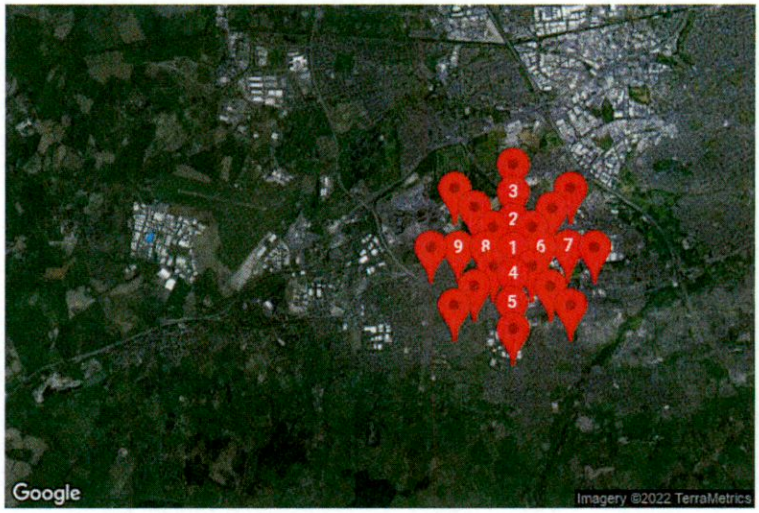
- Analysis time interval: 1 minute
- Ocular transmission coefficient: 0.5
- Pupil diameter: 0.002 meters
- Eye focal length: 0.017 meters
- Sun subtended angle: 9.3 milliradians

FAA Policy 78 FR 63276 can be read at https://www.federalregister.gov/d/2013-24729

SITE CONFIGURATION

Analysis Parameters

DNI: peaks at 1,000.0 W/m^2
Time interval: 1 min
Ocular transmission coefficient: 0.5
Pupil diameter: 0.002 m
Eye focal length: 0.017 m
Sun subtended angle: 9.3 mrad
Site Config ID: 73321.12843
Methodology: V2



PV Array(s)

Name: PV array 1
Axis tracking: Fixed (no rotation)
Tilt: 6.0°
Orientation: 288.0°
Rated power: -
Panel material: Smooth glass with AR coating
Reflectivity: Vary with sun
Slope error: correlate with material

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
1	53.297766	-6.476425	90.42	10.90	101.32
2	53.297721	-6.476199	90.55	12.30	102.85
3	53.296688	-6.476746	91.25	12.30	103.55
4	53.296736	-6.476993	91.05	10.90	101.95

Discrete Observation Receptors

Name	ID	Latitude (°)	Longitude (°)	Elevation (m)	Height (m)
OP 1	1	53.289280	-6.376776	250.00	0.00
OP 2	2	53.294040	-6.376778	250.00	0.00
OP 3	3	53.298492	-6.376794	250.00	0.00
OP 4	4	53.285054	-6.376866	250.00	0.00
OP 5	5	53.280491	-6.376896	250.00	0.00
OP 6	6	53.289509	-6.369274	250.00	0.00
OP 7	7	53.289544	-6.361742	250.00	0.00
OP 8	8	53.289510	-6.384211	250.00	0.00
OP 9	9	53.289518	-6.391710	250.00	0.00
OP 10	10	53.292678	-6.371512	250.00	0.00
OP 11	11	53.295880	-6.366117	250.00	0.00
OP 12	12	53.286315	-6.371496	250.00	0.00
OP 13	13	53.283042	-6.366522	250.00	0.00
OP 14	14	53.286329	-6.382116	250.00	0.00
OP 15	15	53.283136	-6.387412	250.00	0.00
OP 16	16	53.292644	-6.382036	250.00	0.00
OP 17	17	53.295906	-6.387304	250.00	0.00
OP 18	18	53.303015	-6.376800	250.00	0.00
OP 19	19	53.299100	-6.360788	250.00	0.00
OP 20	20	53.289502	-6.354357	250.00	0.00
OP 21	21	53.279976	-6.360930	250.00	0.00
OP 22	22	53.276006	-6.376774	250.00	0.00
OP 23	23	53.279996	-6.392722	250.00	0.00
OP 24	24	53.289516	-6.399241	250.00	0.00
OP 25	25	53.299038	-6.392723	250.00	0.00

GLARE ANALYSIS RESULTS

Summary of Glare

PV Array Name	Tilt (°)	Orient (°)	"Green" Glare min	"Yellow" Glare min	Energy kWh
PV array 1	6.0	288.0	0	0	-

Total annual glare received by each receptor

Receptor	Annual Green Glare (min)	Annual Yellow Glare (min)
OP 1	0	0
OP 2	0	0
OP 3	0	0
OP 4	0	0
OP 5	0	0
OP 6	0	0
OP 7	0	0
OP 8	0	0
OP 9	0	0
OP 10	0	0
OP 11	0	0
OP 12	0	0
OP 13	0	0
OP 14	0	0
OP 15	0	0
OP 16	0	0
OP 17	0	0
OP 18	0	0
OP 19	0	0
OP 20	0	0
OP 21	0	0
OP 22	0	0
OP 23	0	0
OP 24	0	0
OP 25	0	0

Results for: PV array 1

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

Point Receptor: OP 1

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 2

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 3

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 4

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 5

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 6

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 7

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 8

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 9

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 10

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 11

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 12

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 13

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 14

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 15

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 16

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 17

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 18

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 19

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 20

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 21

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 22

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 23

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 24

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 25

0 minutes of yellow glare
0 minutes of green glare

Assumptions

"Green" glare is glare with low potential to cause an after-image (flash blindness) when observed prior to a typical blink response time.
"Yellow" glare is glare with potential to cause an after-image (flash blindness) when observed prior to a typical blink response time.
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.
Several calculations utilize the PV array centroid, rather than the actual glare spot location, due to V1 algorithm limitations. This may affect results for 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.)
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.
The glare hazard determination relies on several approximations including observer eye characteristics, angle of view, and typical blink response time. Actual results and glare occurrence may differ.
Hazard zone boundaries shown in the Glare Hazard plot are an approximation and visual aid based on aggregated research data. Actual ocular impact outcomes encompass a continuous, not discrete, spectrum.
Refer to the Help page at **www.forgesolar.com/help/** for assumptions and limitations not listed here.

FORGESOLAR GLARE ANALYSIS

Project: **Enva Rathcoole**
Site configuration: **Helipad 180m**
Analysis conducted by Cormac Connell (cormac.connell@grange-solar.com) at 11:15 on 29 Jul, 2022.

U.S. FAA 2013 Policy Adherence

The following table summarizes the policy adherence of the glare analysis based on the 2013 U.S. Federal Aviation Administration Interim Policy 78 FR 63276. This policy requires the following criteria be met for solar energy systems on airport property:

- No "yellow" glare (potential for after-image) for any flight path from threshold to 2 miles
- No glare of any kind for Air Traffic Control Tower(s) ("ATCT") at cab height.
- Default analysis and observer characteristics (see list below)

ForgeSolar does not represent or speak officially for the FAA and cannot approve or deny projects. Results are informational only.

COMPONENT	STATUS	DESCRIPTION
Analysis parameters	PASS	Analysis time interval and eye characteristics used are acceptable
2-mile flight path(s)	N/A	No flight paths analyzed
ATCT(s)	N/A	No ATCT receptors designated

Default glare analysis parameters and observer eye characteristics (for reference only):

- Analysis time interval: 1 minute
- Ocular transmission coefficient: 0.5
- Pupil diameter: 0.002 meters
- Eye focal length: 0.017 meters
- Sun subtended angle: 9.3 milliradians

FAA Policy 78 FR 63276 can be read at https://www.federalregister.gov/d/2013-24729

SITE CONFIGURATION

Analysis Parameters

DNI: peaks at 1,000.0 W/m^2
Time interval: 1 min
Ocular transmission coefficient: 0.5
Pupil diameter: 0.002 m
Eye focal length: 0.017 m
Sun subtended angle: 9.3 mrad
Site Config ID: 73107.12843
Methodology: V2

PV Array(s)

Name: PV array 1
Axis tracking: Fixed (no rotation)
Tilt: 6.0°
Orientation: 288.0°
Rated power: -
Panel material: Smooth glass with AR coating
Reflectivity: Vary with sun
Slope error: correlate with material

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
1	53.297766	-6.476425	90.42	10.90	101.32
2	53.297721	-6.476199	90.55	12.30	102.85
3	53.296688	-6.476746	91.25	12.30	103.55
4	53.296736	-6.476993	91.05	10.90	101.95

Discrete Observation Receptors

Name	ID	Latitude (°)	Longitude (°)	Elevation (m)	Height (m)
OP 1	1	53.289280	-6.376776	280.00	0.00
OP 2	2	53.294040	-6.376778	280.00	0.00
OP 3	3	53.298492	-6.376794	280.00	0.00
OP 4	4	53.285054	-6.376866	280.00	0.00
OP 5	5	53.280491	-6.376896	280.00	0.00
OP 6	6	53.289509	-6.369274	280.00	0.00
OP 7	7	53.289544	-6.361742	280.00	0.00
OP 8	8	53.289510	-6.384211	280.00	0.00
OP 9	9	53.289518	-6.391710	280.00	0.00
OP 10	10	53.292678	-6.371512	280.00	0.00
OP 11	11	53.295880	-6.366117	280.00	0.00
OP 12	12	53.286315	-6.371496	280.00	0.00
OP 13	13	53.283042	-6.366522	280.00	0.00
OP 14	14	53.286329	-6.382116	280.00	0.00
OP 15	15	53.283136	-6.387412	280.00	0.00
OP 16	16	53.292644	-6.382036	280.00	0.00
OP 17	17	53.295906	-6.387304	280.00	0.00
OP 18	18	53.303015	-6.376800	280.00	0.00
OP 19	19	53.299100	-6.360788	280.00	0.00
OP 20	20	53.289502	-6.354357	280.00	0.00
OP 21	21	53.279976	-6.360930	280.00	0.00
OP 22	22	53.276006	-6.376774	280.00	0.00
OP 23	23	53.279996	-6.392722	280.00	0.00
OP 24	24	53.289516	-6.399241	280.00	0.00
OP 25	25	53.299038	-6.392723	280.00	0.00

GLARE ANALYSIS RESULTS

Summary of Glare

PV Array Name	Tilt (°)	Orient (°)	"Green" Glare min	"Yellow" Glare min	Energy kWh
PV array 1	6.0	288.0	0	0	-

Total annual glare received by each receptor

Receptor	Annual Green Glare (min)	Annual Yellow Glare (min)
OP 1	0	0
OP 2	0	0
OP 3	0	0
OP 4	0	0
OP 5	0	0
OP 6	0	0
OP 7	0	0
OP 8	0	0
OP 9	0	0
OP 10	0	0
OP 11	0	0
OP 12	0	0
OP 13	0	0
OP 14	0	0
OP 15	0	0
OP 16	0	0
OP 17	0	0
OP 18	0	0
OP 19	0	0
OP 20	0	0
OP 21	0	0
OP 22	0	0
OP 23	0	0
OP 24	0	0
OP 25	0	0

Results for: PV array 1

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

Point Receptor: OP 1

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 2

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 3

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 4

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 5

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 6

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 7

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 8

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 9

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 10

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 11

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 12

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 13

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 14

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 15

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 16

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 17

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 18

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 19

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 20

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 21

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 22

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 23

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 24

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 25

0 minutes of yellow glare
0 minutes of green glare

Assumptions

"Green" glare is glare with low potential to cause an after-image (flash blindness) when observed prior to a typical blink response time.
"Yellow" glare is glare with potential to cause an after-image (flash blindness) when observed prior to a typical blink response time.
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.
Several calculations utilize the PV array centroid, rather than the actual glare spot location, due to V1 algorithm limitations. This may affect results for 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.)
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.
The glare hazard determination relies on several approximations including observer eye characteristics, angle of view, and typical blink response time. Actual results and glare occurrence may differ.
Hazard zone boundaries shown in the Glare Hazard plot are an approximation and visual aid based on aggregated research data. Actual ocular impact outcomes encompass a continuous, not discrete, spectrum.
Refer to the Help page at **www.forgesolar.com/help/** for assumptions and limitations not listed here.