



macroworks

AVIATION GLINT AND GLARE ASSESSMENT

Proposed Roof Mounted Solar PV

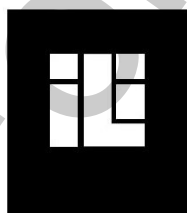
Tallaght, Co. Dublin.

Prepared by Macro Works Ltd

May 2026



1.	AVIATION GLINT AND GLARE ASSESSMENT	3
1.1	Introduction	3
1.2	Methodology	7
1.3	Results	8
1.4	Overall Conclusion	9
	Appendix A: SGHAT Results	A



Registered
Landscape
Architect



1. AVIATION GLINT AND GLARE ASSESSMENT

1.1 INTRODUCTION

This Glint and Glare Assessment was carried out by Macro Works Ltd to determine the potential for solar reflectance effects upon aviation receptors in respect of proposed roof-mounted solar PV installations on the roof the existing Tallaght Leisure Centre Complex in Tallaght in County Dublin. The proposed panels will remain in a fixed position throughout the day and year (i.e. they will not rotate to track the movement of the sun). The proposed panels will be angled facing southeast. Figure 1.1 and Figure 1.2 refer.



Figure 1.1 Aerial view indicating the location of the proposed PV panels



Figure 1.2 Extract from drawing “SDC2401-ALT-TAL-XX-DR-U-01007” showing the roof layout with the proposed PV panels.

1.1.1 **Statement of Authority**

Macro Works’ relevant experience includes twenty years of analysing the visual effects of a wide range of infrastructural and commercial development types. This experience includes numerous domestic and international wind and solar energy developments.

1.1.2 **Guidance and Best Practice**

The Irish Aviation Authority (IAA) has not published any specific guidance on solar PV developments. The IAA identifies the need to ensure safety in relation to potential reflectance effects emitting from solar developments and highlights the potential for an ocular assessment to be requested.¹ The European Union Aviation Safety Authority (EASA) requires an assessment of the luminance of proposed PV panels, rather than by ocular irradiance, so as not to dazzle air traffic controllers to the extent of a reduction in visual perception of airport operations.² EASA found that 20,000 cd/m² was the maximum acceptable luminance value for solar PV arrays in the vicinity of an aviation receptor. As the IAA refer to the need for an ocular assessment, this analysis will focus on potential ocular effects.

¹ Irish Aviation Authority. (2025). IAA - National Aviation Safeguarding Framework, Consultation Document, p. 30.

² European Union Aviation Safety Agency. (2025). Certification Specifications and Guidance Material for Aerodrome Design (CS-ADR-DSN). Issue 7. Page 161. https://www.easa.europa.eu/en/document-library/certification-specifications/group/cs-adr-dsn-aerodromes-design?utm_source=chatgpt.com#cs-adr-dsn-aerodromes-design.

The sequence of guidance developed by the United States Federal Aviation Administration (FAA) to address the potential hazards that solar developments may pose to aviation activities, is considered the most comprehensive for the purposes of assessment of solar developments near aerodromes. The initial guidance was prepared in 2010 (entitled 'Technical Guidance for Evaluating Selected Solar Technologies on Airports' (archived)), was subsequently updated in 2013³ (entitled 'Interim Policy, FAA Review of Solar Energy System Projects on Federally Obligated Airports'). The most current version of the guidance (Version 1.1) 'Technical Guidance for Evaluating Selected Solar Technologies on Airports' was released in 2018.⁴

The SGHAT was developed in conjunction with the FAA in harmony with this guidance and is adopted as the standard for measuring the ocular impact of solar developments. Furthermore, it is commonly regarded as the accepted industry standard by aviation authorities internationally when considering the glint and glare effects upon aviation-related receptors.

There is currently no aviation-authority guidance from either the IAA, FAA or EASA that specifically addresses glint and glare impacts from solar installations in relation to helipads or heliports. Existing guidance and policy documents are primarily framed around fixed-wing aircraft operations at aerodromes, with a focus on potential ocular impacts to pilots and air traffic controllers during critical phases of flight. In the absence of helipad-specific criteria, it is best practice to apply the same underlying aviation safety principles to helicopter operations, namely that reflections from solar panels should not result in distracting or hazardous glare that could impair pilot vision during approach, landing, take-off or departure.

By virtue of their efficiency, the intensity of reflected light from modern PV solar panels is deliberately low and currently equates with that of the reflection from still water. Recent studies generally agree, however, that there still exists the potential for hazard or nuisance upon surrounding receptors. Macro Works' glint and glare analysis methods and determination of effects are based on a combination of available studies and established best practice. This methodology has been successfully implemented on numerous previous solar farm projects that met with the approval of various Planning Authorities

Federal Aviation Authority

Within the FAA's interim policy, a 'Review of Solar Energy System Projects on Federally Obligated Airports' it 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 Form 7460-1, the airport sponsor will be required to demonstrate that the proposed solar energy system meets the following standards:

No potential for glint or glare in the existing or planned Airport Traffic Control Tower (ATCT) cab, and

³ Interim Policy, FAA Review of Solar Energy System Projects on Federally Obligated Airports, Department of Transportation, Federal Aviation Administration, date: 10/2013

⁴ Technical Guidance for Evaluating Selected Solar Technologies on Airports, Federal Aviation Administration (FAA), date: 04/2018

⁵ Federal Aviation Administration (FAA). (2013). Department of Transportation - Federal Aviation Administration. Interim Policy, FAA Review of Solar Energy System Projects on Federally Obligated Airports. Vol 78 (No 205), 63276-63279. Available at: <https://www.federalregister.gov/documents/2013/10/23/2013-24729/interim-policy-faa-review-of-solar-energy-system-projects-on-federally-obligated-airports>

No potential for glare or “low potential for after-image” (shown in green in Figure 1[Figure 1.3 refers]) 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.”

An update of the policy in 2021⁶ replaced this interim policy, with the key amendment of deprioritising runway approaches as critical aviation receptors, citing the following;

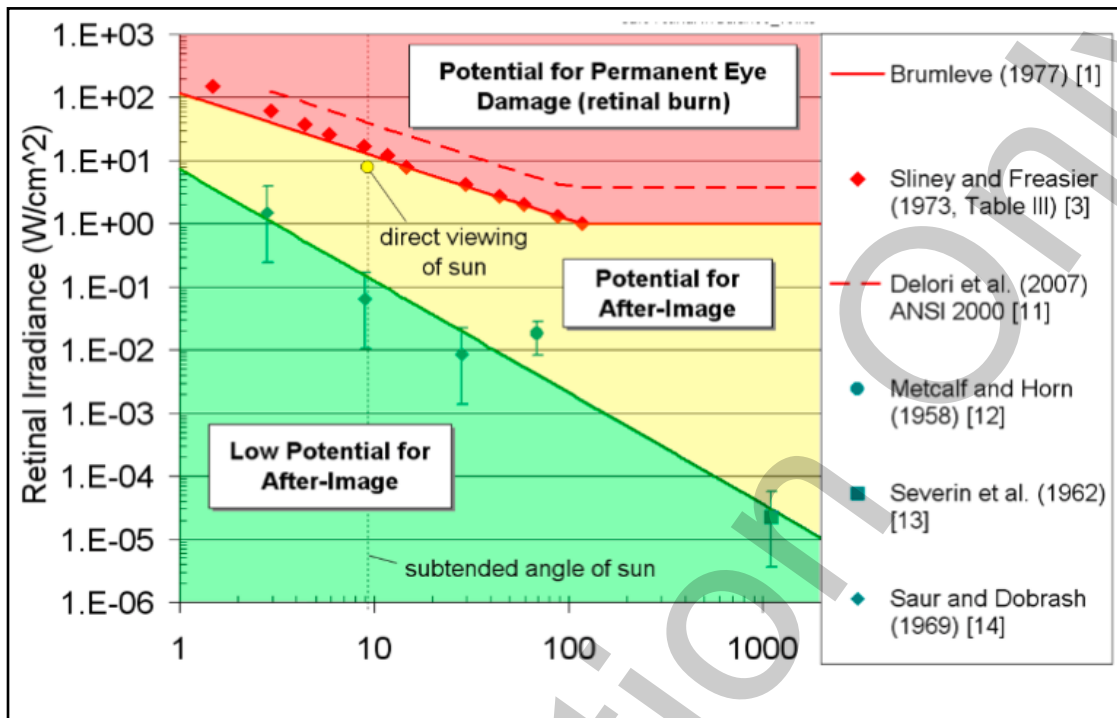
“Initially, FAA believed that solar energy systems could introduce a novel glint and glare effect to pilots on final approach. FAA has subsequently concluded that in most cases, the glint and glare from solar energy systems to pilots on final approach is similar to glint and glare pilots routinely experience from water bodies, glass-façade buildings, parking lots, and similar features. However, FAA has continued to receive reports of potential glint and glare from on-airport solar energy systems on personnel working in ATCT cabs. Therefore, FAA has determined the scope of agency policy should be focused on the impact of on-airport solar energy systems to federally-obligated towered airports, specifically the airport's ATCT” (Federal Aviation Administration 05/11/2021).

In summary, glare at an ATCT is not acceptable and while still relevant glare with a “low potential for after-image” is generally acceptable along final approach paths to runways in most instances.

Solar Glare Hazard Analysis Tool

The SGHAT was designed to determine whether a proposed solar energy project would result in the potential for ocular impact as depicted on the Solar Glare Hazard Analysis Plot (Figure 1.3 refers). SGHAT analyses ocular impact over the entire calendar year in one minute intervals from when the sun rises above the horizon until the sun sets below the horizon. One of the principal outputs from the SGHAT report is a glare plot per receptor that indicates the time of day and days per year that glare has the potential to occur. SGHAT plot classifies the intensity of ocular impact as either Green Glare, Yellow Glare or Red Glare. These colour classifications are equivalent to the FAA’s definitions regarding the level of ocular impact e.g. ‘Green Glare’ in the SGHAT is synonymous to the FAA’s “low potential for after-image”, and so forth. The various correlations are illustrated on the Solar Glare Hazard Analysis Plot.

⁶ Federal Aviation Administration Policy: Review of Solar Energy System Projects on Federally-Obligated Airports; date: 11/2021



Solar Glare Ocular Hazard Plot: The potential ocular hazard from solar glare is a function of retinal irradiance and the subtended angle (size/distance) of the glare source. It should be noted that the ratio of spectrally weighted solar illuminance to solar irradiance at the earth's surface yields a conversion factor of ~100 lumens/W. Plot adapted from Ho et al., 2011.

Chart References: Ho, C.K., C.M. Ghanbari, and R.B. Diver, 2011, Methodology to Assess Potential Glint and Glare Hazards from Concentrating Solar Power Plants: Analytical Models and Experimental Validation, J. Solar Energy Engineering, August 2011, Vol. 133, 031021-1 – 031021-9.

Figure 1.3 - Figure 1 from the FAA Interim Policy, FAA Review of Solar Energy System Projects on Federally Obligated Airports

1.2 METHODOLOGY

The process for dealing with aviation receptors is as follows:

1. The Federal Aviation Administration (FAA) approved Solar Glare Hazard Analysis Tool (SGHAT) is used to determine if any of these aviation receptors has the potential to theoretically experience glint or glare. This tool also calculates the intensity of such reflectance and whether it is acceptable by FAA standards.
2. SGHAT does not account for terrain screening or screening provided by surface elements such as existing vegetation or buildings, therefore the results of the SGHAT may need to be considered, in conjunction with an assessment of existing intervening screening that may be present, to establish if reflectance can actually be experienced at the receptors.
3. Finally, if necessary, additional assessment is undertaken using Macro Works' bespoke model which would into account any screening provided by any proposed mitigation measures.

1.2.1 Identification of Relevant Receptors

The Planning and Development (Solar Safeguarding Zone) Regulations 2022 set out 43 Solar Safeguarding Zones (SSZs). A SSZ is an area around an airport, aerodrome or helipad in which there is a potential for glint or glare from solar panels to impact aviation safety.

Runways & Air Traffic Control Towers

This SGHAT analysis was produced to assess the potential for impacts upon aviation receptors, resulting from the proposed solar installation. Casement Aerodrome is located approximately 3.7km northwest of the proposed development and comprises 2 runways.

Observation Points

Tallaght Hospital helipad is situated approximately 1.3km northeast of the proposed development. Thirteen Observation Points (OP), with heights ranging from 1.7m to 300m, were assessed for potential reflectance.



Figure 1.4 Map showing the location of the proposed development relative to the identified aviation receptor.

1.3 RESULTS

1.3.1 Observation Points (OP 1 - 13)

The SGHAT results are contained in Appendix A and show that all of the 13 OPs analysed had potential for Green Glare to occur but not Yellow Glare. OP4 has the highest potential minutes of green glare of the 13 Ops, with the potential for 684 minutes of reflectance over an entire year.

None of the 13 OPs analysed showed any potential for Yellow Glare to occur. The absence of Yellow Glare is regarded as a 'Pass' in this assessment as there would only be low potential for after-image

1.3.2 **Runway Approaches**

None of the four runway approaches showed any potential for Green or Yellow Glare as a result of the proposed solar panels. The absence of Yellow Glare is regarded as a 'Pass' in this assessment as there would only be low potential for after-image.

1.3.3 **Air Traffic Control Towers**

The SGHAT results contained in Appendix A also show there is no theoretical potential for glare at the ATCT as a result of the proposed development. The absence of Green or Yellow Glare on the ATCT constitutes a 'Pass' in this assessment.

1.4 **OVERALL CONCLUSION**

From the analysis and discussions contained herein, it is considered that the proposed PV arrays at the existing Tallaght Leisure Centre complex in County Dublin results in a 'Pass' at both Casement Aerodrome and Tallaght Hospital.

APPENDIX A: SGHAT RESULTS

For Information Only

FORGESOLAR GLARE ANALYSIS

Project: **Tallagh Hospital - Helipad**

Site configuration: **Tallagh_Leisure_Centre**

Analysis conducted by Luis Dominguez (luis@macroworks.ie) at 15:23 on 20 May, 2026.

Calculated via ForgeSolar Radiometric Physics Engine v3.1.3

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/m²
 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: 178750.9959



PV Array(s)

Name: PV array 1
Axis tracking: Fixed (no rotation)
Tilt: 10.0°
Orientation: 121.224°
Rated power: -
Panel material: Smooth glass without AR coating



Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
1	53.283336	-6.393405	108.00	8.50	116.50
2	53.283182	-6.393160	108.00	8.50	116.50
3	53.283171	-6.393183	108.00	8.50	116.50
4	53.283124	-6.393108	108.00	8.50	116.50
5	53.283186	-6.393002	108.00	8.50	116.50
6	53.283156	-6.392957	108.00	8.50	116.50
7	53.283145	-6.392980	108.00	8.50	116.50
8	53.283113	-6.392932	108.00	8.50	116.50
9	53.283393	-6.392441	108.00	8.50	116.50
10	53.283483	-6.392585	108.00	8.50	116.50
11	53.283466	-6.392610	108.00	8.50	116.50
12	53.283485	-6.392637	108.00	8.50	116.50
13	53.283449	-6.392699	108.00	8.50	116.50
14	53.283606	-6.392955	108.00	8.50	116.50
15	53.283342	-6.393411	108.00	8.50	116.50

Flight Path Receptor(s)

Name: Casement 04 Runway

Description: None

Threshold height: 15 m

Direction: 41.3°

Glide slope: 4.3°

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	53.293830	-6.453465	98.30	15.20	113.50
Two-mile	53.272113	-6.485435	154.40	127.80	282.20

Name: Casement 10 Runway

Description: None

Threshold height: 15 m

Direction: 101.8°

Glide slope: 3.42°

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	53.304622	-6.468287	86.30	15.30	101.60
Two-mile	53.310549	-6.515700	73.60	196.60	270.20

Name: Casement 22 Runway

Description: None

Threshold height: 15 m

Direction: 220.9°

Glide slope: 4.3°

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	53.303267	-6.439788	93.40	15.20	108.60
Two-mile	53.325107	-6.408047	62.50	214.80	277.30

Name: Casement 28 Runway

Description: None

Threshold height: 15 m

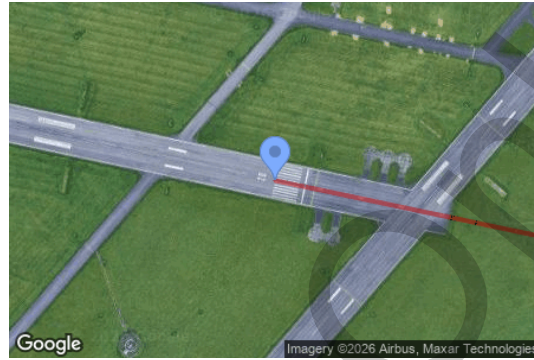
Direction: 281.8°

Glide slope: 3.0°

Pilot view restricted? Yes

Vertical view: 30.0°

Azimuthal view: 50.0°

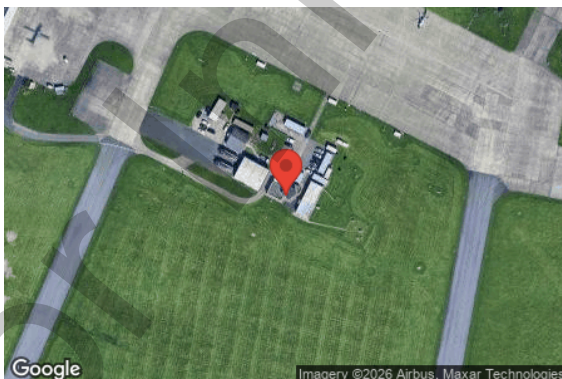


Point	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
Threshold	53.301696	-6.445153	96.10	15.20	111.30
Two-mile	53.295759	-6.397747	106.20	173.80	280.00

Discrete Observation Receptors

Name	ID	Latitude (°)	Longitude (°)	Elevation (m)	Height (m)
OP 1	1	53.289501	-6.376776	104.60	1.70
OP 2	2	53.289501	-6.376776	104.60	25.00
OP 3	3	53.289501	-6.376776	104.60	50.00
OP 4	4	53.289501	-6.376776	104.60	75.00
OP 5	5	53.289501	-6.376776	104.60	100.00
OP 6	6	53.289501	-6.376776	104.60	125.00
OP 7	7	53.289501	-6.376776	104.60	150.00
OP 8	8	53.289501	-6.376776	104.60	175.00
OP 9	9	53.289501	-6.376776	104.60	200.00
OP 10	10	53.289501	-6.376776	104.60	225.00
OP 11	11	53.289501	-6.376776	104.60	250.00
OP 12	12	53.289501	-6.376776	104.60	275.00
OP 13	13	53.289501	-6.376776	104.60	300.00
14-ATCT	14	53.305496	-6.441790	93.50	9.00

Map image of 14-ATCT



GLARE ANALYSIS RESULTS

Summary of Glare

PV Array Name	Tilt (°)	Orient (°)	"Green" Glare min	"Yellow" Glare min	Energy kWh
PV array 1	10.0	121.224	7,975	0	-

Total annual glare received by each receptor

Receptor	Annual Green Glare (min)	Annual Yellow Glare (min)
Casement 04 Runway	0	0
Casement 10 Runway	0	0
Casement 22 Runway	0	0
Casement 28 Runway	0	0
OP 1	418	0
OP 2	421	0
OP 3	581	0
OP 4	684	0
OP 5	676	0
OP 6	663	0
OP 7	657	0
OP 8	655	0
OP 9	649	0
OP 10	646	0
OP 11	644	0
OP 12	643	0
OP 13	638	0
14-ATCT	0	0

Results for: PV array 1

Receptor	Green Glare (min)	Yellow Glare (min)
Casement 04 Runway	0	0
Casement 10 Runway	0	0
Casement 22 Runway	0	0
Casement 28 Runway	0	0
OP 1	418	0
OP 2	421	0
OP 3	581	0
OP 4	684	0
OP 5	676	0
OP 6	663	0
OP 7	657	0
OP 8	655	0
OP 9	649	0
OP 10	646	0
OP 11	644	0
OP 12	643	0
OP 13	638	0
14-ATCT	0	0

Flight Path: Casement 04 Runway

0 minutes of yellow glare

0 minutes of green glare

Flight Path: Casement 10 Runway

0 minutes of yellow glare

0 minutes of green glare

Flight Path: Casement 22 Runway

0 minutes of yellow glare

0 minutes of green glare

Flight Path: Casement 28 Runway

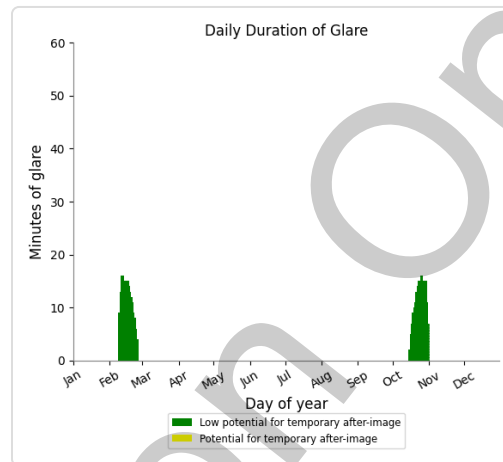
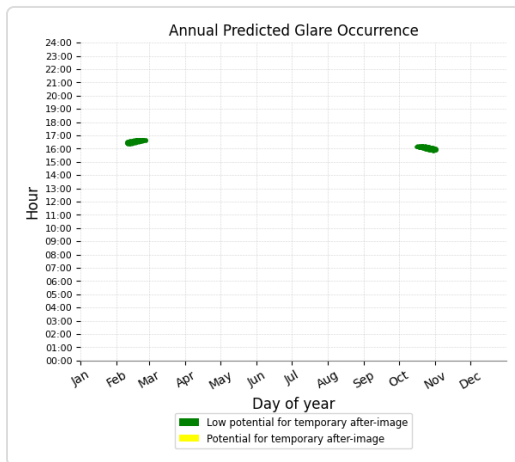
0 minutes of yellow glare

0 minutes of green glare

Point Receptor: OP 1

0 minutes of yellow glare

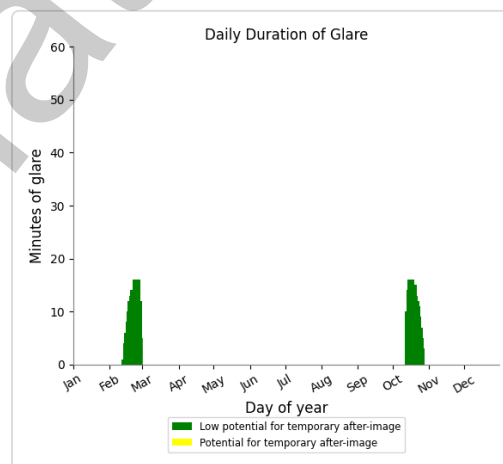
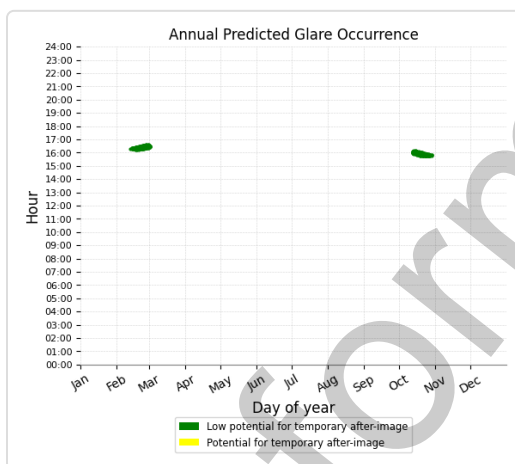
418 minutes of green glare



Point Receptor: OP 2

0 minutes of yellow glare

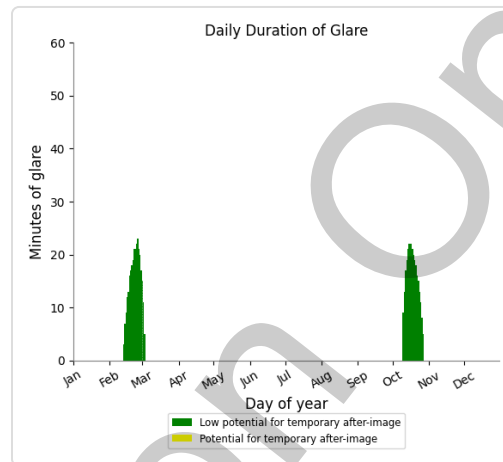
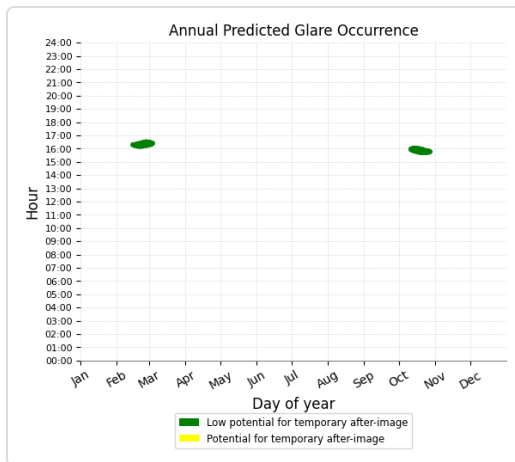
421 minutes of green glare



Point Receptor: OP 3

0 minutes of yellow glare

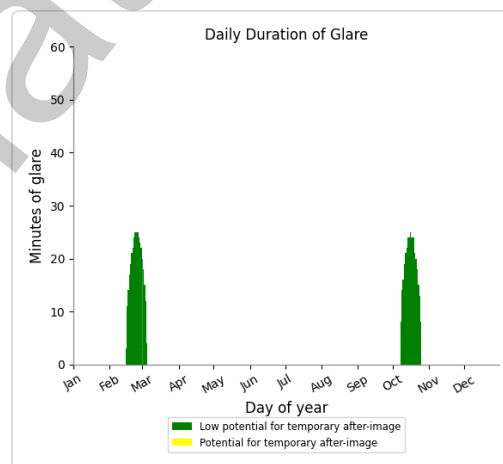
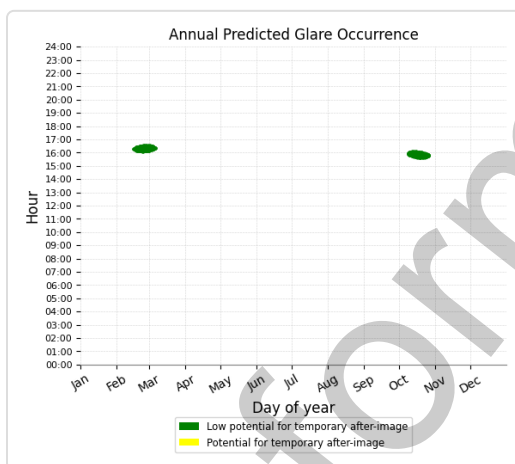
581 minutes of green glare



Point Receptor: OP 4

0 minutes of yellow glare

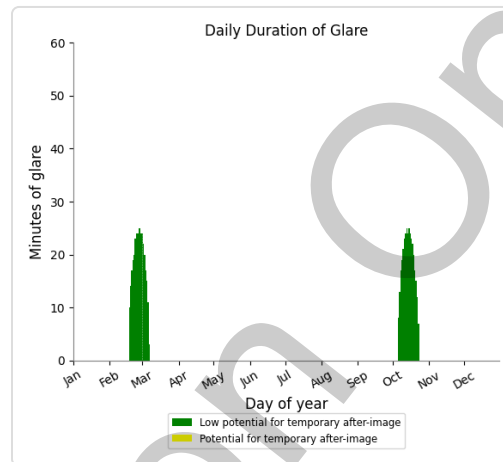
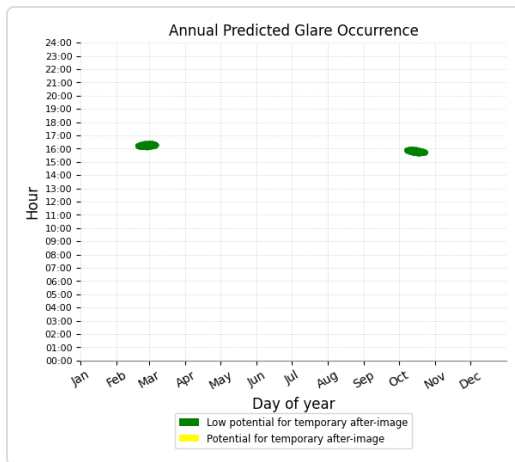
684 minutes of green glare



Point Receptor: OP 5

0 minutes of yellow glare

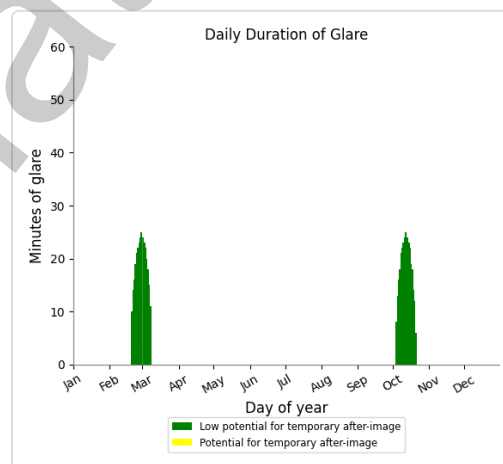
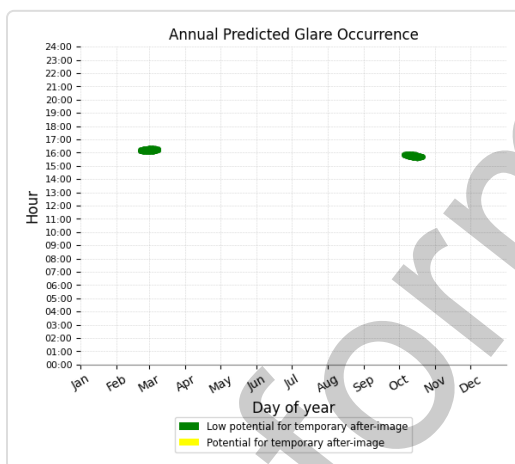
676 minutes of green glare



Point Receptor: OP 6

0 minutes of yellow glare

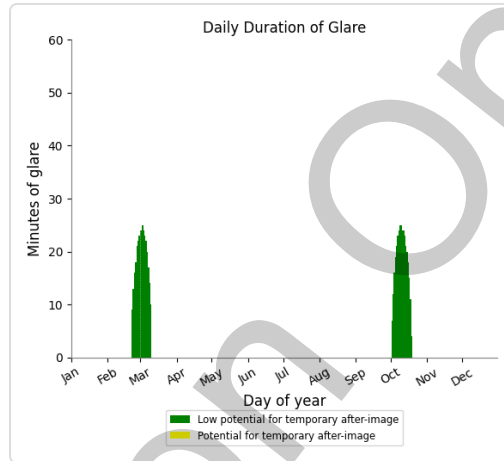
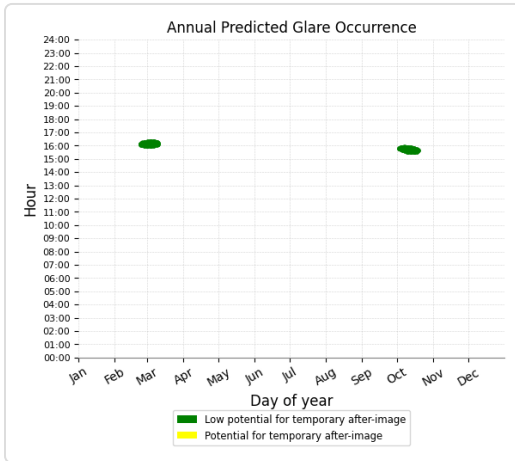
663 minutes of green glare



Point Receptor: OP 7

0 minutes of yellow glare

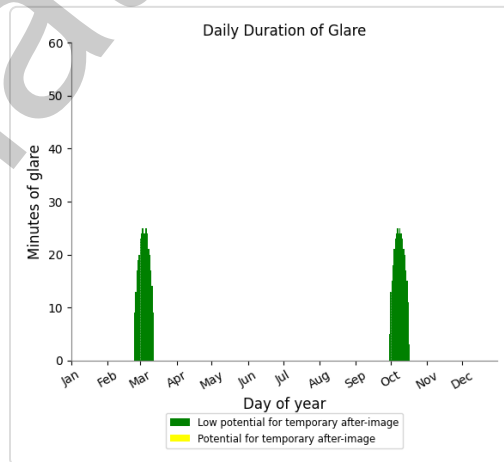
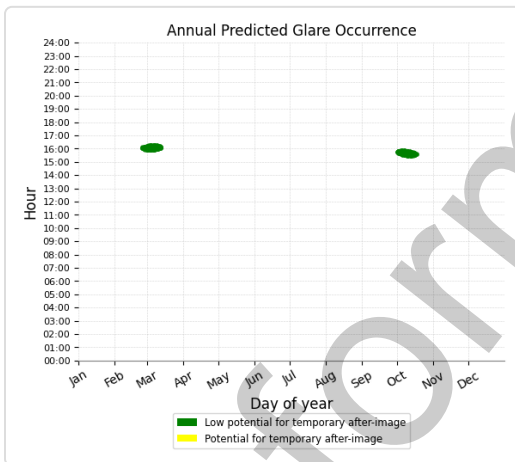
657 minutes of green glare



Point Receptor: OP 8

0 minutes of yellow glare

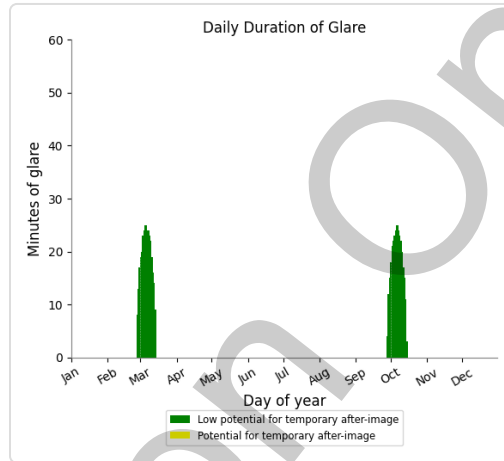
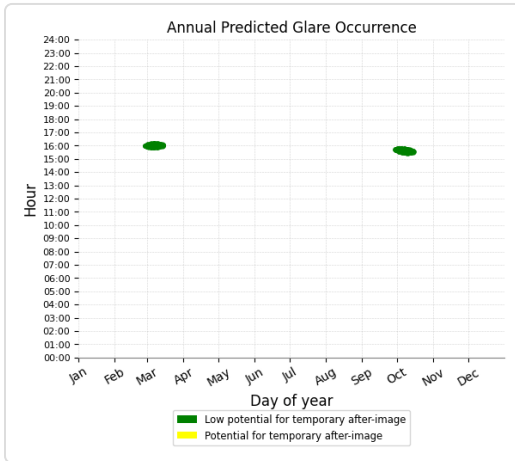
655 minutes of green glare



Point Receptor: OP 9

0 minutes of yellow glare

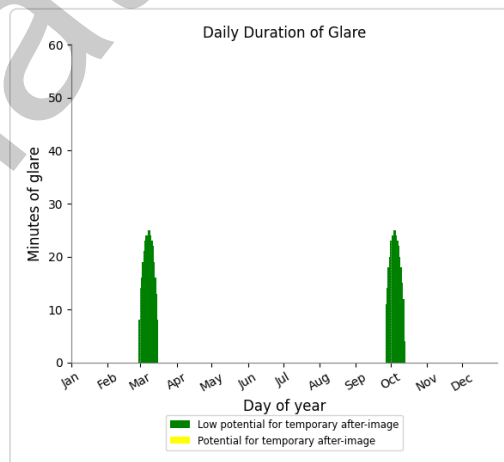
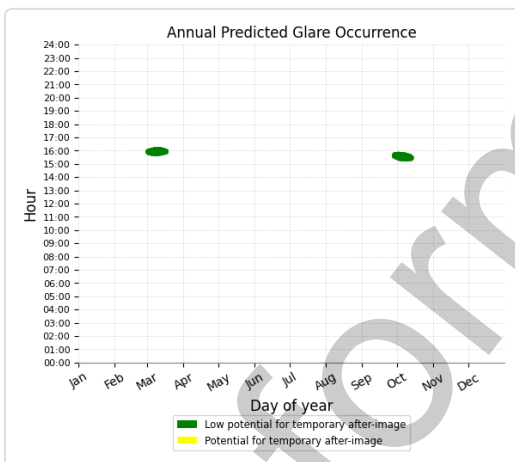
649 minutes of green glare



Point Receptor: OP 10

0 minutes of yellow glare

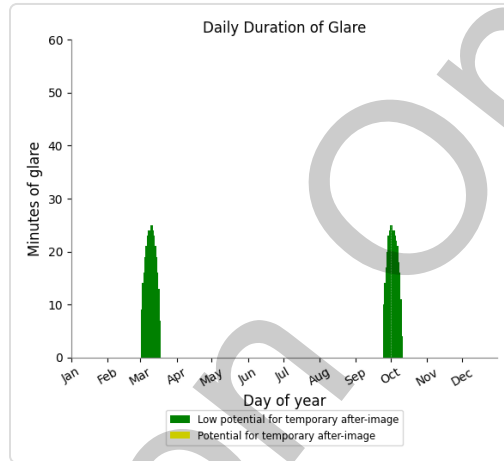
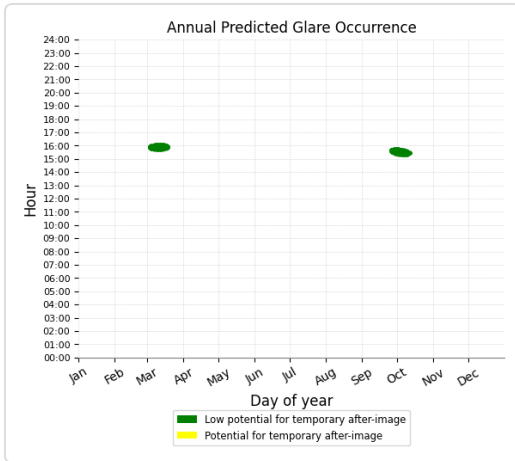
646 minutes of green glare



Point Receptor: OP 11

0 minutes of yellow glare

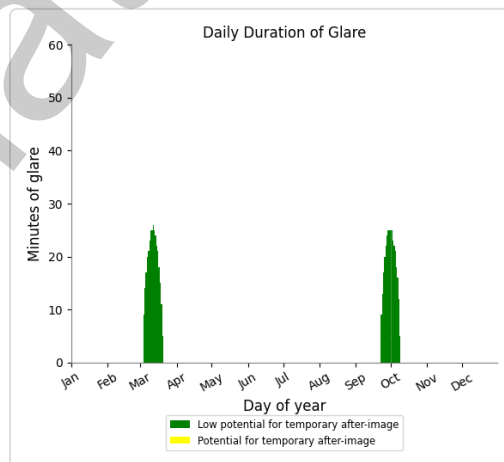
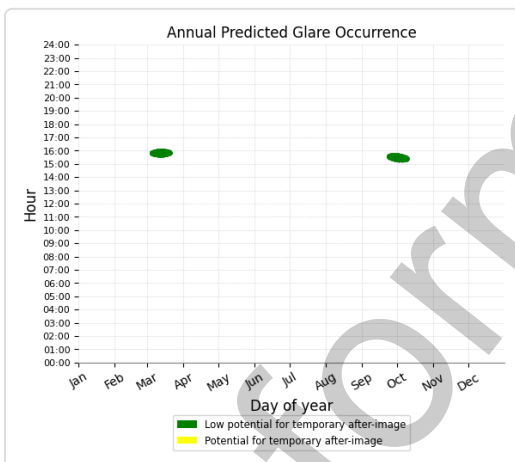
644 minutes of green glare



Point Receptor: OP 12

0 minutes of yellow glare

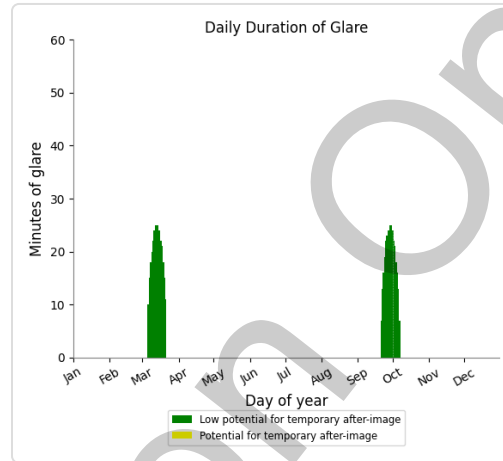
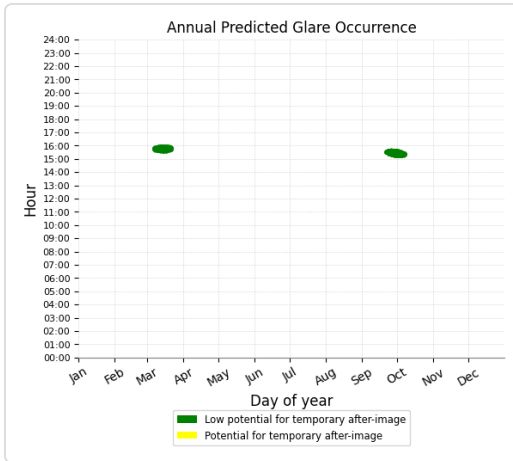
643 minutes of green glare



Point Receptor: OP 13

0 minutes of yellow glare

638 minutes of green glare



Point Receptor: 14-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.

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.

© 2026 Sims Industries d/b/a ForgeSolar, All Rights Reserved.

This analysis was conducted using the best available radiometric modeling at the time of generation. Future updates to the modeling methodology may yield different results.