

A photograph of a solar farm showing many rows of blue solar panels under a blue sky with white clouds.

## Glint and Glare Assessment

*Heber 1 Parasitic Solar Project*

Prepared for: Imperial County Planning & Development Services

Submitted by: Catalyst Environmental Solutions (on behalf of  
ORMAT)

**April 22, 2024**

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# Introduction

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The Heber Field Company (the “Applicant” and a wholly owned subsidiary of ORMAT Inc. [Ormat]) proposes to construct, operate, and maintain the Heber 1 Solar Energy Project (project). The project is located roughly 1.4 miles south of Heber and approximately 0.5 miles northeast of Calexico in Imperial County, California. The project area stretches approximately half a mile east to west adjacent to Willoughby Road and 0.7-miles north to south adjacent to Dogwood Road, and 0.2-miles north south adjacent to Beech Drain. Project features include temporary and permanent access roads, solar trackers, junction boxes, medium cable transmission lines, and a step-up transformer/onsite substation. The landscape in the vicinity of the project is characterized by flat terrain mostly consisting of agriculture, industrial land use, and mostly dispersed low-density single-family residences. Primary travel routes near the project include Dogwood Road, Willoughby Road, and Imperial Avenue, with secondary travel routes that support access to local residences and agriculture. There are four airports that surround the project area; the proposed project area is approximately 2.4 miles north of Calexico International Airport, 9.0 miles southeast of the Imperial County Airport, 10.5 miles southeast of El Centro Naval Air Facility, and 17.5 miles southwest of the Holtville Airport.

## Purpose

The purpose of this technical memorandum is to summarize potential glint and glare effects of the project. Based on the results of these effects, potential health, safety, and visual mitigation measures associated with glint and glare effects may be proposed. For the purposes of this technical memorandum, glint is defined as a bright, momentary flash of light; glare is defined as a more continuous and sustained presence of light that may appear to “sparkle” from public viewing locations.

The source of potential glint and glare for the project is the proposed photovoltaic (PV) panels. However, PV panel surfaces are designed specifically not to reflect light, thus reducing the potential for glint and glare.

## Glint and Glare Analysis

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The analysis focused on potential glare effects on observation points (OPs) and linear travel routes. An inventory of visual receptors was conducted by reviewing publicly available geographic information system (GIS) data to determine OPs from airport landing and take-off points, residences, travel routes, recreation areas, Heber Elementary School, and the Mountain View Cemetery. Aircraft landing and approach were considered at the four airports listed above. Although the project is not located on airport property and therefore is not subject to Federal Aviation Administration jurisdiction under Federal Aviation Regulations Part 77 to protect airspace safety and is located beyond the 2-mile final approach as defined in the Review of Solar Energy System Projects on Federally-Obligated Airports, the applicant has sought to voluntarily apply Federal Aviation Administration ocular hazard standards (86 Federal Register 25801).

## Software

Analysis for the project was conducted using the GlareGauge model (also known as Solar Glare Hazard Analysis Tool [SGHAT]) developed by Forge Solar and the U.S. Department of Energy's Sandia National Laboratories to evaluate potential glare. GlareGauge employs an interactive Google map where the user can quickly locate a site, draw an outline of the proposed solar energy system, specify observer locations and, if needed, aircraft approach paths. Latitude, longitude, and elevation are automatically recorded through the Google interface, providing necessary information for sun position and vector calculations. Additional information regarding the orientation and tilt of the solar energy panels, reflectance, environment, and ocular factors are entered by the user.

If glare is found, the tool calculates the retinal irradiance and subtended source angle (size/distance) of the glare source to predict potential ocular hazards ranging from a temporary afterimage to retinal burn. The results are presented in a simple, easy-to-interpret plot that specifies when glare will occur throughout the year, with color codes indicating the potential ocular hazard. The tool can also predict relative energy production while evaluating alternative designs, layouts, and locations to identify configurations that maximize energy production while mitigating the impacts of glare.

## Assumptions

- The proposed solar project will operate 365 days per year, during daylight hours.
- “Green” glare is glare with low potential to cause an afterimage (flash blindness) when observed prior to a typical blink response time.
- “Yellow” glare is glare with potential to cause an afterimage (flash blindness) when observed prior to a typical blink response time.
- “Red” glare is glare with potential to cause retinal burn (permanent eye damage) when observed prior to a typical blink response time.
- Times associated with glare are denoted in standard time.
- Glare analyses do not account for physical obstructions between reflectors and receptors. This includes buildings, tree cover, and geographic obstructions.
- Several calculations use the PV array centroid, rather than the actual glare spot location, due to algorithm limitations. This may affect results for large PV footprints. Additional analyses of array subsections 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.
- 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.
- Actual ocular impact outcomes encompass a continuous, not discrete, spectrum.

- Panels are designed to absorb sunlight and will be treated with anti-reflective coatings that will absorb and transmit light rather than reflect it.<sup>1</sup>

### Input Parameters

The GlareGauge inputs the specifications of the array, including a single-axis tracking system with a north-south orientation, maximum tracking angle of 55-degrees, a 0-degree resting angle, a panel height of 5.3-feet above ground level, and a smooth panel surface with anti-reflective coating to provide maximum flexibility in module selection. Modeling was then undertaken for the applicable sensitive receptors. No air traffic control towers are located at airports assessed and therefore were not included in the analysis. Observation Points used a height of 6 feet (height of a person), and route receptors used a height of 4-feet (an average height of passenger cars, trucks, and diesel trucks).

### Results

The OPs and route receptors used in the analysis consisted of 16 residences, three parks, a cemetery, a school, and three travel routes (Table 1).

Table 1. Observation Points and Descriptions

Name	Description
<b>OP 1: Recreation</b>	Margarito Huerta Jr. Park
<b>OP 2: Recreation</b>	Heber Childrens Park
<b>OP 3: Residence</b>	Private residence near project area
<b>OP 4: Residence</b>	Private residence near project area
<b>OP 5: Residence</b>	Private residence near project area
<b>OP 6: School</b>	Heber Elementary School
<b>OP 7: Residence</b>	Private residence near project area
<b>OP 8: Residence</b>	Private residence near project area
<b>OP 9: Travel Receptor</b>	Intersection of Dogwood Road and Willoughby Road
<b>OP 10: Residence</b>	Private residence near project area
<b>OP 11: Residence</b>	Private residence near project area
<b>OP 12: Cemetery</b>	Mountain View Cemetery
<b>OP 13: Residence</b>	Private residence near project area
<b>OP 14: Residence</b>	Private residence near project area
<b>OP 15: Residence</b>	Private residence near project area

<sup>1</sup> Refer to [www.forgesolar.com/help/](http://www.forgesolar.com/help/) for assumptions and limitations not listed here.

<b>OP 16: Residence</b>	Private residence near project area
<b>OP 17: Residence</b>	Private residence near project area
<b>OP 18: Residence</b>	Private residence near project area
<b>OP 19: Residence</b>	Private residence near project area
<b>OP 20: Residence</b>	Private residence near project area
<b>OP 21: Recreation</b>	Las Casitas Park
<b>Route Receptor 1: Dogwood Road</b>	Two-way travel route
<b>Route Receptor 2: Imperial Avenue</b>	Main northbound travel route
<b>Route Receptor 3: Imperial Avenue</b>	Main southbound travel route.

#### Glint and Glare Effects Discussion

The project has the possibility to create low-potential afterimage (green ocular impact) glare and no potential for after-image (yellow ocular impact) glare. Observation point 4 will have the potential to experience glare up to 248 minutes per year; the glare would occur from November to December, between the hours of 6:15 a.m. and 7:00 a.m., for approximately 10 minutes per day.

OP 8 is likely to experience green ocular impact for 104 minutes per year; the glare would occur in October and the middle of November, between the hours of 6:00 a.m. and 7:00 a.m., for approximately 10 minutes per day.

OP 15 is likely to experience green ocular impact for 687 minutes per year; the glare would occur between the middle of April and May, the end of June till the end of July, and the beginning of September to the middle of the month, between the hours of 5:00 a.m. and 6:00 a.m., for approximately 10 minutes per day.

## Recommendations

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Mitigation measures such as the use of non-reflective materials, finishes, and surface treatments on project components would reduce contrast and glare. Visual barriers such as vegetation are the most effective at mitigating glare from solar arrays when the vegetation is located as close to the source as possible. If vegetation is used, native and naturalized plants should be specified to match or complement existing vegetation within the area. Existing vegetation within and surrounding the project area should be maintained and preserved to the greatest extent possible. Preserving existing vegetation will reduce the project's overall impact on soils, wildlife, cost, and visual aesthetics.

# ATTACHMENT A

## GlareGauge Output Model Report

# FORGESOLAR GLARE ANALYSIS

## Project: Heber 1 PV Project

PV analysis for Heber 1 proposed 12MW project.

## Site configuration: Heber1-Final

Analysis conducted by Adrian Gonzalez (agonzalez@ce.solutions) at 00:26 on 20 Apr, 2024.

## 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)	N/A	No ATCT receptors designated

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

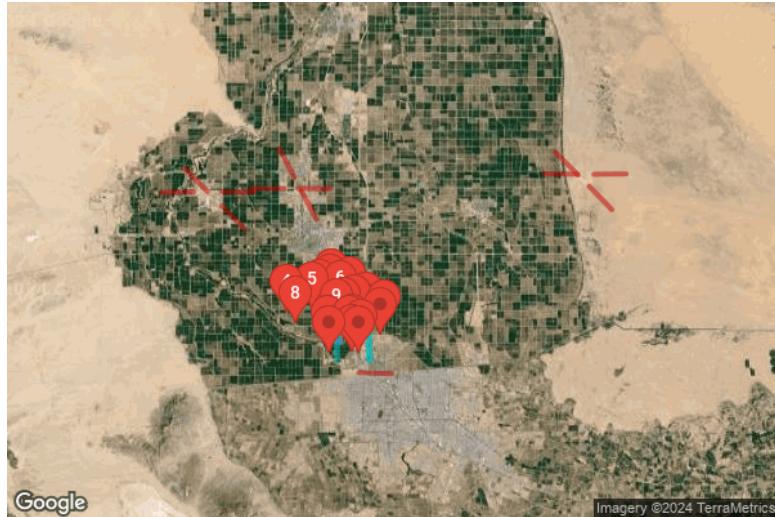
- Analysis time interval: 1 minute
- Ocular transmission coefficient: 0.5
- Pupil diameter: 0.002 meters
- Eye focal length: 0.017 meters
- Sun subtended angle: 9.3 milliradians

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<sup>2</sup>  
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: 117288.18925  
Methodology: V2



## PV Array(s)

**Name:** PV array 1  
**Axis tracking:** Single-axis rotation  
**Backtracking:** Shade-slope  
**Tracking axis orientation:** 180.0°  
**Max tracking angle:** 55.0°  
**Resting angle:** 0.0°  
**Ground Coverage Ratio:** 0.5  
**Rated power:** -  
**Panel material:** Smooth glass with AR coating  
**Reflectivity:** Vary with sun  
**Slope error:** correlate with material



Vertex	Latitude (°)	Longitude (°)	Ground elevation (ft)	Height above ground (ft)	Total elevation (ft)
1	32.703136	-115.533775	-4.64	5.30	0.66
2	32.703163	-115.525450	-2.22	5.30	3.08
3	32.701412	-115.525461	-2.17	5.30	3.13
4	32.701412	-115.529838	-5.02	5.30	0.28
5	32.694193	-115.529783	0.53	5.30	5.83
6	32.694188	-115.533836	1.16	5.30	6.46
7	32.696846	-115.533881	-3.13	5.30	2.17
8	32.696857	-115.532885	-4.67	5.30	0.63
9	32.697788	-115.532876	-2.12	5.30	3.18
10	32.697795	-115.533818	-2.16	5.30	3.14

## Flight Path Receptor(s)

**Name:** Calexico International Airport - R26

**Description:**

**Threshold height:** 50 ft

**Direction:** 272.0°

**Glide slope:** 3.0°

**Pilot view restricted?** Yes

**Vertical view:** 30.0°

**Azimuthal view:** 50.0°



Point	Latitude (°)	Longitude (°)	Ground elevation (ft)	Height above ground (ft)	Total elevation (ft)
Threshold	32.667303	-115.510018	0.00	50.00	50.00
Two-mile	32.666294	-115.475653	6.41	597.02	603.43

**Name:** El Centro Naval Air Facility - R08

**Description:**

**Threshold height:** 50 ft

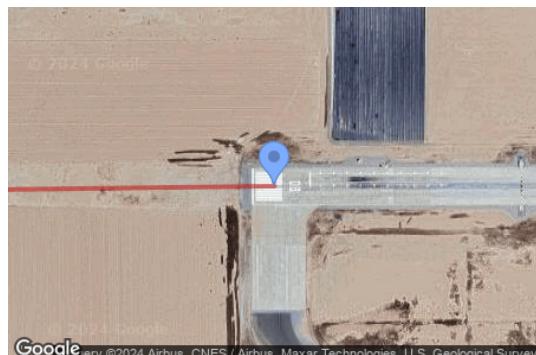
**Direction:** 89.3°

**Glide slope:** 3.0°

**Pilot view restricted?** Yes

**Vertical view:** 30.0°

**Azimuthal view:** 50.0°



Point	Latitude (°)	Longitude (°)	Ground elevation (ft)	Height above ground (ft)	Total elevation (ft)
Threshold	32.829143	-115.686704	-49.15	50.00	0.85
Two-mile	32.828780	-115.721149	-44.63	598.91	554.28

**Name:** El Centro Naval Air Facility - R12

**Description:**

**Threshold height:** 50 ft

**Direction:** 135.0°

**Glide slope:** 3.0°

**Pilot view restricted?** Yes

**Vertical view:** 30.0°

**Azimuthal view:** 50.0°



Point	Latitude (°)	Longitude (°)	Ground elevation (ft)	Height above ground (ft)	Total elevation (ft)
Threshold	32.829623	-115.671920	-49.25	50.00	0.75
Two-mile	32.850067	-115.696278	-54.25	608.43	554.18

**Name:** El Centro Naval Air Facility - R26

**Description:**

**Threshold height:** 50 ft

**Direction:** 270.0°

**Glide slope:** 3.0°

**Pilot view restricted?** Yes

**Vertical view:** 30.0°

**Azimuthal view:** 50.0°



Point	Latitude (°)	Longitude (°)	Ground elevation (ft)	Height above ground (ft)	Total elevation (ft)
Threshold	32.829173	-115.656720	-48.07	50.00	1.93
Two-mile	32.829162	-115.622272	-49.64	605.00	555.36

**Name:** El Centro Naval Air Facility - R30

**Description:**

**Threshold height:** 50 ft

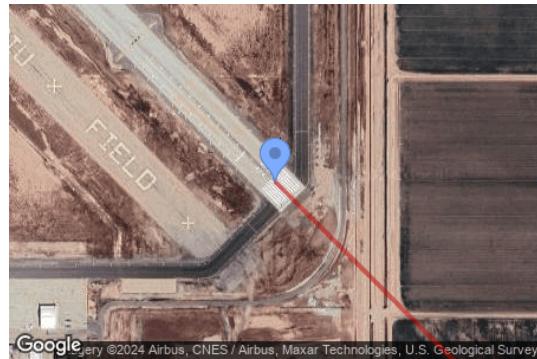
**Direction:** 315.0°

**Glide slope:** 3.0°

**Pilot view restricted?** Yes

**Vertical view:** 30.0°

**Azimuthal view:** 50.0°



Point	Latitude (°)	Longitude (°)	Ground elevation (ft)	Height above ground (ft)	Total elevation (ft)
Threshold	32.816758	-115.656758	-43.12	50.00	6.88
Two-mile	32.796303	-115.632415	-38.60	598.91	560.31

**Name:** Holtville Airport - East

**Description:**

**Threshold height:** 50 ft

**Direction:** 269.3°

**Glide slope:** 3.0°

**Pilot view restricted?** Yes

**Vertical view:** 30.0°

**Azimuthal view:** 50.0°



Point	Latitude (°)	Longitude (°)	Ground elevation (ft)	Height above ground (ft)	Total elevation (ft)
Threshold	32.844902	-115.259410	55.50	50.00	105.50
Two-mile	32.845276	-115.224959	77.74	581.19	658.93

**Name:** Holtville Airport - Northwest

**Description:**

**Threshold height:** 50 ft

**Direction:** 135.0°

**Glide slope:** 3.0°

**Pilot view restricted?** Yes

**Vertical view:** 30.0°

**Azimuthal view:** 50.0°



Point	Latitude (°)	Longitude (°)	Ground elevation (ft)	Height above ground (ft)	Total elevation (ft)
Threshold	32.844312	-115.276234	55.53	50.00	105.53
Two-mile	32.864756	-115.300597	-1.79	660.74	658.96

**Name:** Holtville Airport - Southeast

**Description:**

**Threshold height:** 50 ft

**Direction:** 315.8°

**Glide slope:** 3.0°

**Pilot view restricted?** Yes

**Vertical view:** 30.0°

**Azimuthal view:** 50.0°



Point	Latitude (°)	Longitude (°)	Ground elevation (ft)	Height above ground (ft)	Total elevation (ft)
Threshold	32.834114	-115.264399	39.58	50.00	89.58
Two-mile	32.813375	-115.240395	60.50	582.50	643.01

**Name:** Holtville Airport - West

**Description:**

**Threshold height:** 50 ft

**Direction:** 90.6°

**Glide slope:** 3.0°

**Pilot view restricted?** Yes

**Vertical view:** 30.0°

**Azimuthal view:** 50.0°



Point	Latitude (°)	Longitude (°)	Ground elevation (ft)	Height above ground (ft)	Total elevation (ft)
Threshold	32.845039	-115.277673	57.38	50.00	107.38
Two-mile	32.845362	-115.312125	-3.06	663.87	660.81

**Name:** Imperial County Airport - 14

**Description:**

**Threshold height:** 50 ft

**Direction:** 152.2°

**Glide slope:** 3.0°

**Pilot view restricted?** Yes

**Vertical view:** 30.0°

**Azimuthal view:** 50.0°



Point	Latitude (°)	Longitude (°)	Ground elevation (ft)	Height above ground (ft)	Total elevation (ft)
Threshold	32.842356	-115.579209	-58.54	50.00	-8.54
Two-mile	32.867927	-115.595288	-65.04	609.93	544.89

**Name:** Imperial County Airport - R08

**Description:**

**Threshold height:** 50 ft

**Direction:** 90.0°

**Glide slope:** 3.0°

**Pilot view restricted?** Yes

**Vertical view:** 30.0°

**Azimuthal view:** 50.0°



Point	Latitude (°)	Longitude (°)	Ground elevation (ft)	Height above ground (ft)	Total elevation (ft)
Threshold	32.832123	-115.590324	-57.23	50.00	-7.23
Two-mile	32.832123	-115.624773	-50.34	596.54	546.20

**Name:** Imperial County Airport - R26

**Description:**

**Threshold height:** 50 ft

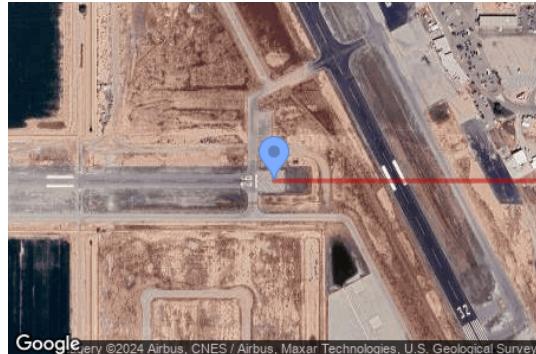
**Direction:** 270.0°

**Glide slope:** 3.0°

**Pilot view restricted?** Yes

**Vertical view:** 30.0°

**Azimuthal view:** 50.0°



Point	Latitude (°)	Longitude (°)	Ground elevation (ft)	Height above ground (ft)	Total elevation (ft)
Threshold	32.832123	-115.575193	-59.45	50.00	-9.45
Two-mile	32.832123	-115.540744	-61.27	605.25	543.98

**Name:** Imperial County Airport - R32

**Description:**

**Threshold height:** 50 ft

**Direction:** 332.0°

**Glide slope:** 3.0°

**Pilot view restricted?** Yes

**Vertical view:** 30.0°

**Azimuthal view:** 50.0°



Point	Latitude (°)	Longitude (°)	Ground elevation (ft)	Height above ground (ft)	Total elevation (ft)
Threshold	32.829795	-115.571534	-56.93	50.00	-6.93
Two-mile	32.804266	-115.555362	-46.37	592.88	546.50

## Discrete Observation Receptors

Name	ID	Latitude (°)	Longitude (°)	Elevation (ft)	Height (ft)
OP 1	1	32.735092	-115.539399	-19.68	6.00
OP 2	2	32.731032	-115.540429	-15.58	6.00
OP 3	3	32.726566	-115.551578	-13.94	6.00
OP 4	4	32.721809	-115.586715	-9.42	6.00
OP 5	5	32.723640	-115.559769	-9.20	6.00
OP 6	6	32.724655	-115.528982	-6.82	6.00
OP 7	7	32.727833	-115.519872	-6.18	6.00
OP 8	8	32.711059	-115.577585	-9.58	6.00
OP 9	9	32.708471	-115.534085	-6.10	6.00
OP 10	10	32.709388	-115.525057	-3.06	6.00
OP 11	11	32.712620	-115.513877	1.14	6.00
OP 12	12	32.714873	-115.501835	0.59	6.00
OP 13	13	32.707681	-115.482800	4.30	6.00
OP 14	14	32.700316	-115.486542	4.24	6.00
OP 15	15	32.694021	-115.542860	-1.02	6.00
OP 16	16	32.683998	-115.541948	-7.47	6.00
OP 17	17	32.693836	-115.519786	1.33	6.00
OP 18	18	32.694721	-115.516546	1.57	6.00
OP 19	19	32.690437	-115.508114	1.93	6.00
OP 20	20	32.685512	-115.516565	1.55	6.00
OP 21	21	32.684356	-115.510348	-0.85	6.00

## Route Receptor(s)

Name: Dogwood Road S33

Path type: Two-way

Observer view angle: 50.0°

**Note:** Route receptors are excluded from this FAA policy review. Use the 2-mile flight path receptor to simulate flight paths according to FAA guidelines.



Vertex	Latitude (°)	Longitude (°)	Ground elevation (ft)	Height above ground (ft)	Total elevation (ft)
1	32.679287	-115.533511	2.02	4.00	6.02
2	32.685120	-115.533661	-0.79	4.00	3.21
3	32.690466	-115.533876	-2.18	4.00	1.82
4	32.694041	-115.533983	0.17	4.00	4.17
5	32.697211	-115.534090	-3.05	4.00	0.95
6	32.701409	-115.534101	-4.93	4.00	-0.93
7	32.705092	-115.534069	-5.76	4.00	-1.76
8	32.708442	-115.534069	-6.42	4.00	-2.42
9	32.709227	-115.534101	-3.03	4.00	0.97
10	32.714508	-115.534197	-4.09	4.00	-0.09
11	32.718254	-115.534234	-8.81	4.00	-4.81
12	32.722893	-115.534310	-10.24	4.00	-6.24
13	32.727199	-115.534395	-10.16	4.00	-6.16
14	32.730656	-115.534470	-13.95	4.00	-9.95
15	32.732912	-115.534535	-13.39	4.00	-9.39
16	32.734884	-115.534610	-14.55	4.00	-10.55
17	32.737997	-115.534599	-14.24	4.00	-10.24
18	32.741860	-115.534685	-14.02	4.00	-10.02
19	32.744414	-115.534685	-15.08	4.00	-11.08

**Name:** Imperial Avenue - Northbound  
**Path type:** One-way (toward increasing index)  
**Observer view angle:** 50.0°

**Note:** Route receptors are excluded from this FAA policy review. Use the 2-mile flight path receptor to simulate flight paths according to FAA guidelines.



Vertex	Latitude (°)	Longitude (°)	Ground elevation (ft)	Height above ground (ft)	Total elevation (ft)
1	32.679104	-115.498682	3.66	4.00	7.66
2	32.681796	-115.498918	6.98	4.00	10.98
3	32.683240	-115.499069	6.22	4.00	10.22
4	32.685967	-115.499262	10.25	4.00	14.25
5	32.687105	-115.499219	9.53	4.00	13.53
6	32.692733	-115.499295	1.47	4.00	5.47
7	32.693961	-115.499273	2.99	4.00	6.99
8	32.698692	-115.499295	1.62	4.00	5.62
9	32.701545	-115.499359	3.39	4.00	7.39
10	32.713681	-115.499429	-0.94	4.00	3.06
11	32.715089	-115.499439	-1.71	4.00	2.29
12	32.716073	-115.499439	1.12	4.00	5.12
13	32.716705	-115.499482	0.72	4.00	4.72
14	32.717219	-115.499535	0.31	4.00	4.31
15	32.718203	-115.499686	0.85	4.00	4.85
16	32.719691	-115.499981	0.76	4.00	4.76
17	32.720223	-115.500088	1.27	4.00	5.27
18	32.720765	-115.500163	0.55	4.00	4.55
19	32.721243	-115.500228	0.09	4.00	4.09
20	32.721668	-115.500249	-0.30	4.00	3.70
21	32.723955	-115.500303	-0.88	4.00	3.12

**Name:** Imperial Avenue - Southbound  
**Path type:** One-way (toward increasing index)  
**Observer view angle:** 50.0°

**Note:** Route receptors are excluded from this FAA policy review. Use the 2-mile flight path receptor to simulate flight paths according to FAA guidelines.



Vertex	Latitude (°)	Longitude (°)	Ground elevation (ft)	Height above ground (ft)	Total elevation (ft)
1	32.723951	-115.500318	-0.88	4.00	3.12
2	32.722796	-115.500318	0.02	4.00	4.02
3	32.721604	-115.500253	-0.24	4.00	3.76
4	32.721207	-115.500253	0.12	4.00	4.12
5	32.720756	-115.500146	0.56	4.00	4.56
6	32.720250	-115.500124	1.20	4.00	5.20
7	32.719673	-115.500017	0.71	4.00	4.71
8	32.718265	-115.499631	0.92	4.00	4.92
9	32.717109	-115.499481	0.40	4.00	4.40
10	32.716658	-115.499481	0.75	4.00	4.75
11	32.716090	-115.499459	1.11	4.00	5.11
12	32.711588	-115.499564	-0.86	4.00	3.14
13	32.701477	-115.499392	3.39	4.00	7.39
14	32.698371	-115.499564	0.23	4.00	4.23
15	32.693749	-115.499564	1.48	4.00	5.48
16	32.692449	-115.499649	4.28	4.00	8.28
17	32.687248	-115.499392	8.74	4.00	12.74
18	32.685514	-115.499392	8.72	4.00	12.72
19	32.683130	-115.499220	6.68	4.00	10.68
20	32.681974	-115.499220	6.18	4.00	10.18
21	32.679084	-115.498877	5.32	4.00	9.32

# GLARE ANALYSIS RESULTS

## Summary of Glare

PV Array Name	Tilt (°)	Orient (°)	"Green" Glare min	"Yellow" Glare min	Energy kWh
PV array 1	SA tracking	SA tracking	1,039	0	-

*Total annual glare received by each receptor*

Receptor	Annual Green Glare (min)	Annual Yellow Glare (min)
Calexico International Airport - R26	0	0
El Centro Naval Air Facility - R08	0	0
El Centro Naval Air Facility - R12	0	0
El Centro Naval Air Facility - R26	0	0
El Centro Naval Air Facility - R30	0	0
Holtville Airport - East	0	0
Holtville Airport - Northwest	0	0
Holtville Airport - Southeast	0	0
Holtville Airport - West	0	0
Imperial County Airport - 14	0	0
Imperial County Airport - R08	0	0
Imperial County Airport - R26	0	0
Imperial County Airport - R32	0	0
OP 1	0	0
OP 2	0	0
OP 3	0	0
OP 4	248	0
OP 5	0	0
OP 6	0	0
OP 7	0	0
OP 8	104	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	687	0
OP 16	0	0
OP 17	0	0

Receptor	Annual Green Glare (min)	Annual Yellow Glare (min)
OP 18	0	0
OP 19	0	0
OP 20	0	0
OP 21	0	0
Dogwood Road S33	0	0
Imperial Avenue - Northbound	0	0
Imperial Avenue - Southbound	0	0

## Results for: PV array 1

Receptor	Green Glare (min)	Yellow Glare (min)
Calexico International Airport - R26	0	0
El Centro Naval Air Facility - R08	0	0
El Centro Naval Air Facility - R12	0	0
El Centro Naval Air Facility - R26	0	0
El Centro Naval Air Facility - R30	0	0
Holtville Airport - East	0	0
Holtville Airport - Northwest	0	0
Holtville Airport - Southeast	0	0
Holtville Airport - West	0	0
Imperial County Airport - 14	0	0
Imperial County Airport - R08	0	0
Imperial County Airport - R26	0	0
Imperial County Airport - R32	0	0
OP 1	0	0
OP 2	0	0
OP 3	0	0
OP 4	248	0
OP 5	0	0
OP 6	0	0
OP 7	0	0
OP 8	104	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	687	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
Dogwood Road S33	0	0
Imperial Avenue - Northbound	0	0
Imperial Avenue - Southbound	0	0

### Flight Path: Calexico International Airport - R26

0 minutes of yellow glare

0 minutes of green glare

## **Flight Path: El Centro Naval Air Facility - R08**

0 minutes of yellow glare

0 minutes of green glare

## **Flight Path: El Centro Naval Air Facility - R12**

0 minutes of yellow glare

0 minutes of green glare

## **Flight Path: El Centro Naval Air Facility - R26**

0 minutes of yellow glare

0 minutes of green glare

## **Flight Path: El Centro Naval Air Facility - R30**

0 minutes of yellow glare

0 minutes of green glare

## **Flight Path: Holtville Airport - East**

0 minutes of yellow glare

0 minutes of green glare

## **Flight Path: Holtville Airport - Northwest**

0 minutes of yellow glare

0 minutes of green glare

## **Flight Path: Holtville Airport - Southeast**

0 minutes of yellow glare

0 minutes of green glare

## **Flight Path: Holtville Airport - West**

0 minutes of yellow glare

0 minutes of green glare

## **Flight Path: Imperial County Airport - 14**

0 minutes of yellow glare

0 minutes of green glare

## **Flight Path: Imperial County Airport - R08**

0 minutes of yellow glare

0 minutes of green glare

## Flight Path: Imperial County Airport - R26

0 minutes of yellow glare

0 minutes of green glare

## Flight Path: Imperial County Airport - R32

0 minutes of yellow glare

0 minutes of green glare

## 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

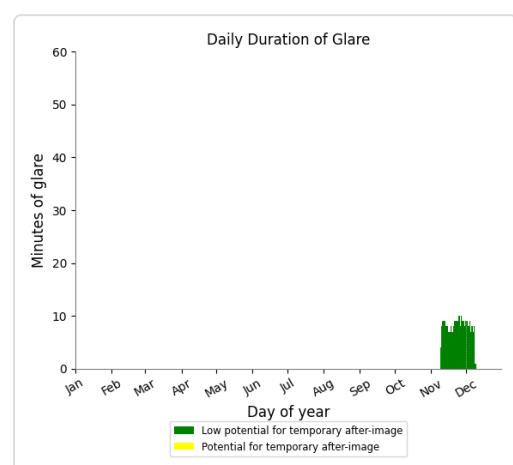
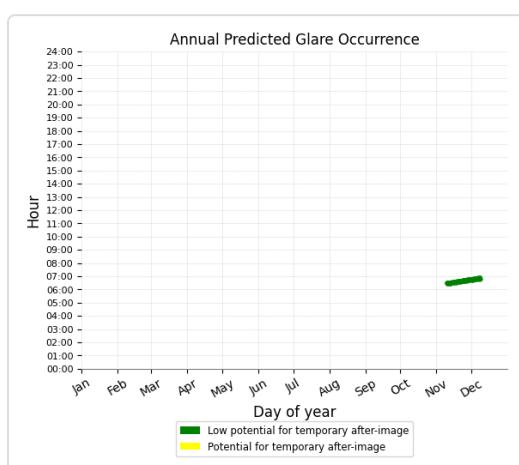
0 minutes of yellow glare

0 minutes of green glare

## Point Receptor: OP 4

0 minutes of yellow glare

248 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

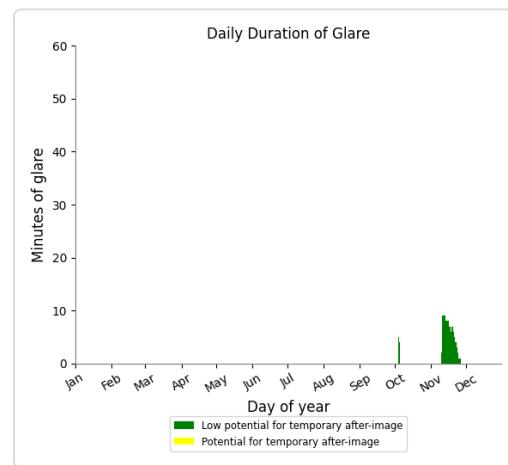
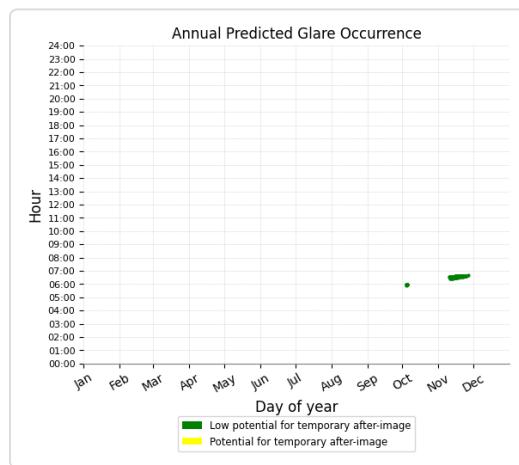
0 minutes of yellow glare

0 minutes of green glare

## Point Receptor: OP 8

0 minutes of yellow glare

104 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

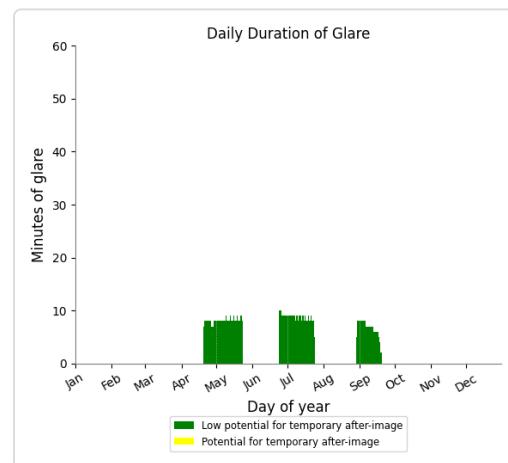
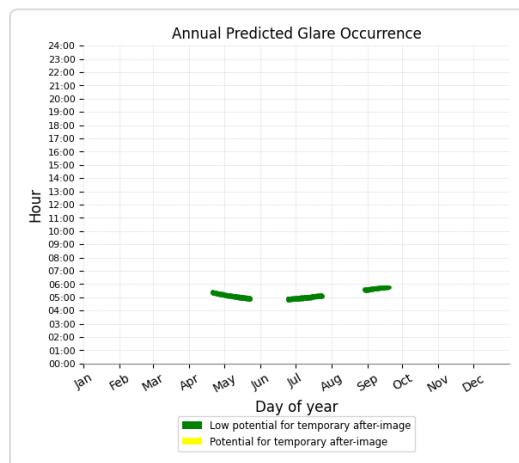
0 minutes of yellow glare

0 minutes of green glare

## Point Receptor: OP 15

0 minutes of yellow glare

687 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

## **Route: Dogwood Road S33**

0 minutes of yellow glare

0 minutes of green glare

## **Route: Imperial Avenue - Northbound**

0 minutes of yellow glare

0 minutes of green glare

## **Route: Imperial Avenue - Southbound**

0 minutes of yellow glare

0 minutes of green glare

# **Assumptions**

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"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/](http://www.forgesolar.com/help/) for assumptions and limitations not listed here.

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