

September 17, 2025

Glare Study Narrative CFP IL Bluestem Solar LLC Kane County, Illinois 21 MW DC (15 MW AC) Community Solar Facility

PURPOSE

This Glint and Glare Study has been prepared for the proposed Bluestem Solar Project (Project). The purpose of this study is to determine the following:

- Will glint and glare be visible to off-site viewers?
- If glint and glare is visible how long will it occur?
- What is the intensity of the glint and glare?

PROJECT LOCATION

The Project is located in Sugar Grove, IL bordered on the south by Jericho Road; on the north by Prairie Street; on the west by Route 30; and on the east by South Barnes Road.

PROPOSED ACTION

The Project includes the construction, operation, maintenance, and decommissioning of an approximately 21-megawatt (MW) direct current (MWdc) photovoltaic (PV) solar project and ancillary facilities on approximately 77.75 acres of a 134-acre site area. Photovoltaic panels are designed to absorb as much of the solar spectrum as feasible to convert solar energy into electricity. The panels would be installed on single-axis, horizontal trackers. With a horizontal tracker mounting system, the panel arrays are arranged in north-south oriented rows and drive motors would rotate the horizontally mounted solar panels from east to west to follow the sun (on a single axis) throughout the day. The highest point for a horizontal tracker would be achieved during the morning and evening hours when the trackers are tilted at their maximum angle and would be a maximum of 8.46 feet (2.58 meters) above the ground surface, in areas constructed using traditional methods, depending on the grade where the posts are installed.

When solar modules are roughly parallel to the ground, the overall height of the tracker unit would be a maximum of 6 feet (1.8 meters) above the ground surface in areas developed using traditional methods, depending on factors including the grade where the posts are installed and flood flow depths.

GLINT AND GLARE DEFINITIONS

Glint and glare may occur when direct normal irradiance ([DNI] sunlight) reflects off a surface and a receptor is exposed to it. Glint, also referred to as specular reflection, is a momentary flash of light produced as a direct reflection of the sun in the surface of an object, such as a PV panel. Glare is a continuous source of brightness relative to the ambient lighting. Glare is not a direct reflection of the sun, but rather a reflection of the bright sky around the sun. Glare is significantly less intense than glint.

REFLECTIVE SURFACES

The intensity of the glare produced by reflective surfaces varies depending on the type of surface. Specular surfaces (mirror-like) create intense glare that can be visually debilitating. Albedo is a term used to quantify the way surfaces reflect DNI. Solar panels have a very low albedo, similar to water. Advancements in solar panels have increased absorption of incident radiation. The solar cells typically have anti-reflection coating (ARC) treatment to diffuse the incident rays, thereby reducing the intensity of the reflected ray.

INCIDENT SUN ANGLES AND GLARE

The incident angle of the sun's DNI changes continuously throughout the day as the sun makes its apparent movement across the sky. As the Law of Refection predicates: when its incident angle is low, the reflected angle will be equally low. Conversely, when the incident angle is high, the reflected angle will be equally high. When incident rays are lowest, after dawn and before sunset, the potential for a receptor being subjected to fugitive glare is higher. When the incident angles are high, the glare that is produced is reflected back steeply into the sky and terrestrial receptors are not affected.

GEOSPATIAL CONSIDERATIONS

A receptor's position in relation to the sun and a specular surface affects the potential to be exposed to glare. For example, a solar field with north-to-south rows of single-axis trackers, like the Project, would be more likely to create glare to receptors north of the Project. At this latitude, the sun is always in the southern sky, so the incident angle is southerly; the reflection will be northerly. Similarly, a receptor at a more topographically superior (higher) location than the specular solar array is more likely to experience glare than a receptor at an inferior (lower) topographic perspective.

GLINT AND GLARE HAZARD

Glint and glare have the potential to cause damage to retinas or an after-image temporarily blinding or distracting an individual. Glint and glare can pose a hazard to drivers and pilots. Glare from a solar field is dependent upon many factors. Critical factors include the tilt of the panels, type of panel, location of viewers, and type of screening (e.g., topography, vegetation). GlareGauge broadly categorizes glare as having a low potential for after-image, potential for after-image, and potential for permanent eye damage.

A glint and glare hazard is considered to occur if there is a potential for after-image or eye damage. Low-level glare, or glint, from a specular surface viewed from a considerable distance could be a distraction. The next level of ocular impact is called temporary after-image, sometimes referred to as flash blindness. The intensity and duration of the glare from the setting sun may induce a reaction to squint, a natural reaction to protect the retina. The most serious ocular impact is called retinal burn or photic retinopathy. This condition is rare because of the reflex of looking away from intense brightness. Optical burn could occur if one where to try to watch a solar eclipse with the naked eye. Reduced ocular acuity may be experienced until the retina is healed, which could be months or longer.

GLINT AND GLARE MODELLING TOOL

ForgeSolar's comprehensive solar glare analysis tool, called GlareGauge, is compatible with Federal Aviation Administration (FAA) glare guidelines and is a licensed Solar Glare Hazard Analysis Tool (SGHAT) application. GlareGauge is used to conduct the modeling of glint and glare at each Observation Point.

MODEL INPUTS AND ASSUMPTIONS

The solar panels would be mounted on single-axis, horizontal tilt trackers. Part of the input data needed for the model is the type of PV panel proposed for use. While the panels have not yet been purchased, they will have anti-reflective coating (ARC) The model was run assuming solar panel development in the specified area shown in the accompanying maps.

FLIGHT PATH RECEPTORS, ROADS, AND OBSERVATION POINTS

Each of the 6 runways (Runways 9, 15, 18, 27, 33, and 36) were analyzed, using a standard 2-mile flight path for each. The de facto perimeter road around the project, consisting of Jericho Road, Route 30, Prairie Street, and S. Barnes Road was similarly considered for potential impact to passing motorists. Finally, Observation Points are used in the glint and glare analysis. The model identifies the level of glint and glare at each Observation Point. For this Project, 25 Observation Points were selected, 1 of which was the Air

Traffic Control Tower at Aurora Municipal Airport, while the remaining 24 were nearby residences and residential areas.

Also considered in the analysis was the existing tree cover in relevant locations.

MODEL LIMITATIONS

GlareGauge has several limitations, generally resulting in conservative outputs:

- The proposed Project will have significant vegetative screening installed around the perimeter of the project, which is not factored into this analysis but will drastically reduce glint and glare.
- There is significant existing tree cover throughout the surrounding acreage, none of which was considered in this analysis. Consequently, the actual glint and glare will be less than shown here, even if the additional vegetative screening were not installed.
- The glint and glare from panels are modeled using a typical clear-day solar irradiance profile, which accounts for the worst-case scenario. Actual irradiance levels on a given day can be affected by cloud cover and other environmental factors.
- Backtracking control, which is used in the early morning and late afternoon to prevent panels from shading one another, is not accounted for. The model conducts an analysis every minute, resulting in a modeled incidence of glint or glare of at least one minute

RESULTS

Green glare was present at 7 points, clustered in 2 areas:

- Cluster 1: In the northeast (Observation Points 18-23) along Prairie Street, both west and south/southeast of where it intersects Gordon Rd
- Perimeter Road: minimally in the southwest, near Observation Point 10 and more prevalent in the northeast, near Observation Points 18-23

It should be reiterated that the FAA has typically accepted green glare as not enough of a hazard to pilots to adjust or prevent projects. Conversely, any glint or glare observable from an air traffic control tower would typically prevent a project. The detailed results are presented in the corresponding ForgeSolar report.

Yellow glint and glare caused by the Project would be visible in two places:

- Observation Point 23: in the northeast for 920 minutes at various times in summer and fall
- Perimeter Road: in the northeast, near Observation Points 18-23 for 1575 minutes at various times from mid-February through mid-October, but excluding mid-summer

For those various times in late spring through early fall, adverse effects on motorists could occur. The motorists would need to be traveling in the direction of the Project site and be looking at the solar arrays during the precise minute when glint and glare is modeled to occur. Motorists would be in motion, limiting the time period in which they could experience glint and glare. Many Observation Points along the same roadways or general area as those affected, would not experience glint and glare. The potential for an after image to be experienced by a motorist is limited due to the conservative analysis, distance, terrain, and that a motorist must be viewing the Project at the moment glint and glare occurs. The likelihood of the Project causing a hazard to motorists is low. The adverse effect would be minimized with incorporation of recommendations below.

AIR TRAFFIC

The FAA will be notified of the Project, in accordance with recommendations identified in the Technical Guidance for Evaluating Selected Solar Technologies on Airports (FAA, 2010).

RECOMMENDATIONS

In addition to the federally required submittal to the FAA, it is recommended that vegetative screening be installed around the perimeter of the project site, as is currently planned.



ForgeSolar

Bluestem Solar

Created Sep 06, 2025 Updated Sep 15, 2025 Time-step 1 minute Timezone offset UTC-6 Minimum sun altitude 0.0 deg Site ID 158780.26606

Project type Advanced
Project status: active
Category 10 MW to 100 MW



Misc. Analysis Settings

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

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

PV Name	Tilt	Orientation	"Green" Glare	"Yellow" Glare	Energy Produced
	deg	deg	min	min	kWh
PV array 1 Bluestem Solar	SA tracking	SA tracking	4,770	2,495	-

Component Data

PV Array(s)

Total PV footprint area: 75.2 acres

Name: PV array 1 Bluestem Solar Footprint area: 75.2 acres Axis tracking: Single-axis rotation Backtracking: Shade

Tracking axis orientation: 180.0 deg
Maximum tracking angle: 60.0 deg

Resting angle: 0.0 deg Ground Coverage Ratio: 0.43

Rated power: -

Panel material: Smooth glass with AR coating Vary reflectivity with sun position? Yes Correlate slope error with surface type? Yes

Slope error: 8.43 mrad



Vertex	Latitude	Longitude	Height above ground	ground Total elevation		
	deg	deg	ft	ft	ft	
1	41.753683	-88.408229	703.71	0.00	703.71	
2	41.748179	-88.409271	705.50	0.00	705.50	
3	41.747283	-88.409271	687.94	0.00	687.94	
4	41.747299	-88.406894	696.56	0.00	696.56	
5	41.744849	-88.406932	682.74	0.00	682.74	
6	41.744704	-88.406646	679.36	0.00	679.36	
7	41.744494	-88.406565	676.57	0.00	676.57	
8	41.743565	-88.406543	678.26	0.00	678.26	
9	41.743573	-88.407895	667.06	0.00	667.06	
10	41.741188	-88.407885	662.00	0.00	662.00	
11	41.741180	-88.404903	662.28	0.00	662.28	
12	41.751442	-88.405117	712.59	0.00	712.59	
13	41.751442	-88.407091	713.87	0.00	713.87	
14	41.753683	-88.407091	703.68	0.00	703.68	

2-Mile Flight Path Receptor(s)

Name: FP 1 Runway 33 Description: Threshold height : 50 ft Direction: 330.0 deg Glide slope: 3.0 deg

Pilot view restricted? Yes Vertical view restriction: 30.0 deg Azimuthal view restriction: 50.0 deg

Point	Latitude	Longitude	Ground elevation	Height above ground	Total elevation	
	deg	deg	ft	ft	ft	
Threshold	41.767324	-88.475039	697.40	50.00	747.40	
2-mile point	41.742285	-88.455634	676.65	624.18	1300.83	



Name: FP 2 Runway 15

Description:

Threshold height: 50 ft Direction: 150.0 deg Glide slope: 3.0 deg Pilot view restricted? Yes Vertical view restriction: 30.0 deg Azimuthal view restriction: 50.0 deg

Point	Latitude	Longitude	Ground elevation	Height above ground	Total elevation
	deg	deg	ft	ft	ft
Threshold	41.780116	-88.486405	710.32	50.00	760.32
2-mile point	41.805155	-88.505814	729.43	584.32	1313.74

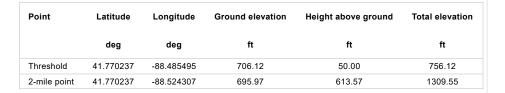


Name: FP 3 Runway 27
Description:
Threshold height: 50 ft
Direction: 270.0 deg
Glide slope: 3.0 deg
Pilot view restricted? Yes
Vertical view restriction: 30.0 deg
Azimuthal view restriction: 50.0 deg



Point	Latitude	Longitude	Ground elevation	Height above ground	Total elevation
	deg	deg	ft	ft	ft
Threshold	41.770429	-88.459784	705.89	50.00	755.89
2-mile point	41.770429	-88.420973	691.79	617.52	1309.32

Name: FP 4 Runway 9
Description:
Threshold height: 50 ft
Direction: 90.0 deg
Glide slope: 3.0 deg
Pilot view restricted? Yes
Vertical view restriction: 30.0 deg
Azimuthal view restriction: 50.0 deg





Name: FP 5 Runway 36
Description:
Threshold height: 50 ft
Direction: 0.0 deg
Glide slope: 3.0 deg
Pilot view restricted? Yes

Vertical view restriction: 30.0 deg
Azimuthal view restriction: 50.0 deg

Point	Latitude	Longitude	Ground elevation	Height above ground	Total elevation
	deg	deg	ft	ft	ft
Threshold	41.767772	-88.471652	699.73	50.00	749.73
2-mile point	41.738859	-88.471652	695.26	607.91	1303.16



Name: FP 6 Runway 18 Description:

Threshold height : 50 ft Direction: 180.0 deg

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		Ì	
		1	
	estriction	estriction: 30.0 de	estriction: 30.0 deg or restriction: 50.0 deg

Point	Latitude Longitude		Ground elevation	Height above ground	Total elevation
	deg	deg	ft	ft	ft
Threshold	41.776670	-88.471652	700.20	50.00	750.20
2-mile point	41.805582	-88.471652	735.00	568.63	1303.63

Route Receptor(s)

Name: Route 1

Route type Two-way
Azimuthal view angle: 50.0 deg
Downward view angle: 90.0 deg



Vertex	Latitude	Longitude	Ground elevation	Height above ground	Total elevation
	deg	deg	ft	ft	ft
1	41.757638	-88.408124	717.23	0.00	717.23
2	41.755333	-88.408553	712.15	0.00	712.15
3	41.753781	-88.406707	710.80	0.00	710.80
4	41.752628	-88.404733	715.48	0.00	715.48
5	41.751380	-88.399841	710.31	0.00	710.31
6	41.751508	-88.392135	696.71	0.00	696.71
7	41.749651	-88.391878	678.61	0.00	678.61
8	41.746161	-88.388874	669.10	0.00	669.10
9	41.743007	-88.387415	669.51	0.00	669.51
10	41.740269	-88.385269	667.23	0.00	667.23
11	41.734889	-88.408186	668.75	0.00	668.75
12	41.732135	-88.419153	677.37	0.00	677.37
13	41.730677	-88.424026	700.29	0.00	700.29
14	41.727026	-88.432609	667.22	0.00	667.22
15	41.726161	-88.438360	656.11	0.00	656.11
16	41.727282	-88.443595	671.78	0.00	671.78
17	41.754533	-88.443681	714.91	0.00	714.91
18	41.757959	-88.414671	715.61	0.00	715.61
19	41.758215	-88.412844	714.92	0.00	714.92
20	41.757638	-88.408124	717.23	0.00	717.23

Discrete Observation Receptors

Number	Latitude	Latitude Longitude Ground elevation		Height above ground	Total Elevation	
	deg	deg	ft	ft	ft	
OP 1	41.756678	-88.411514	718.27	0.00	718.27	
OP 2	41.756294	-88.413960	718.53	0.00	718.53	
OP 3	41.755494	-88.429991	700.97	0.00	700.97	
OP 4	41.754341	-88.433725	687.95	13.00	700.95	
OP 5	41.753284	-88.433725	689.02	12.00	701.02	
OP 6	41.752196	-88.433854	690.71	13.00	703.71	
OP 7	41.750931	-88.433854	686.77	13.00	699.77	
OP 8	41.749971	-88.433897	687.95	11.00	698.95	
OP 9	41.748274	-88.439991	696.56	13.00	709.56	
OP 10	41.728756	-88.441664	652.60	10.00	662.60	
OP 11	41.729845	-88.428060	667.92	13.00	680.92	
OP 12	41.733015	-88.420679	682.69	13.00	695.69	
OP 13	41.729621	-88.415548	670.70	15.00	685.70	
OP 14	41.729717	-88.411085	671.45	15.00	686.45	
OP 15	41.729813	-88.406579	665.06	13.00	678.06	
OP 16	41.729973	-88.402545	667.25	14.00	681.25	
OP 17	41.736266	-88.404347	669.31	12.00	681.31	
OP 18	41.737963	-88.397028	666.61	14.00	680.61	
OP 19	41.740173	-88.390204	671.00	9.00	680.00	
OP 20	41.748626	-88.394453	676.92	14.00	690.92	
OP 21	41.747986	-88.398229	681.79	2.00	683.79	
OP 22	41.750099	-88.399345	688.89	11.00	699.89	
OP 23	41.751956	-88.405763	714.28	14.00	728.28	
OP 24	41.756198	-88.411857	717.56	13.00	730.56	
25-ATCT	41.768229	-88.466981	707.58	55.00	762.58	

25-ATCT map image



Summary of PV Glare Analysis

PV configuration and total predicted glare

PV Name	Tilt	Orientation	"Green" Glare	"Yellow" Glare	Energy Produced	Data File
	deg	deg	min	min	kWh	
PV array 1 Bluestem Solar	SA tracking	SA tracking	4,770	2,495	-	-

Distinct glare per month

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

PV	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
pv-array-1-b (green)	0	9	44	48	255	445	418	178	42	54	0	0
pv-array-1-b (yellow)	0	19	194	350	273	72	130	377	252	72	0	0

PV & Receptor Analysis Results

Results for each PV array and receptor

PV array 1 Bluestem Solar potential temporary after-image

Component	Green glare (min)	Yellow glare (min)
FP: FP 1 Runway 33	0	0
FP: FP 2 Runway 15	0	0
FP: FP 3 Runway 27	0	0
FP: FP 4 Runway 9	0	0
FP: FP 5 Runway 36	0	0
FP: FP 6 Runway 18	0	0
OP: OP 1	0	0
OP: OP 2	0	0
OP: OP 3	0	0
OP: OP 4	0	0
OP: OP 5	0	0
OP: OP 6	0	0
OP: OP 7	0	0
OP: OP 8	0	0
OP: OP 9	0	0
OP: OP 10	0	0
OP: OP 11	0	0
OP: OP 12	0	0
OP: OP 13	0	0
OP: OP 14	0	0
OP: OP 15	0	0
OP: OP 16	0	0
OP: OP 17	0	0

OP: OP 18	461	0
OP: OP 19	538	0
OP: OP 20	439	0
OP: OP 21	506	0
OP: OP 22	494	0
OP: OP 23	928	920
OP: OP 24	0	0
OP: 25-ATCT	0	0
Route: Route 1	1404	1575

PV array 1 Bluestem Solar: FP 1 Runway 33

No glare found

PV array 1 Bluestem Solar: FP 2 Runway 15

No glare found

PV array 1 Bluestem Solar: FP 3 Runway 27

No glare found

PV array 1 Bluestem Solar: FP 4 Runway 9

No glare found

PV array 1 Bluestem Solar: FP 5 Runway 36

No glare found

PV array 1 Bluestem Solar: FP 6 Runway 18

No glare found

PV array 1 Bluestem Solar: OP 1

No glare found

PV array 1 Bluestem Solar: OP 2

No glare found

PV array 1 Bluestem Solar: OP 3

No glare found

PV array 1 Bluestem Solar: OP 4

No glare found

PV array 1 Bluestem Solar: OP 5

No glare found

PV array 1 Bluestem Solar: OP 6

No glare found

No glare found

PV array 1 Bluestem Solar: OP 8

No glare found

PV array 1 Bluestem Solar: OP 9

No glare found

PV array 1 Bluestem Solar: OP 10

No glare found

PV array 1 Bluestem Solar: OP 11

No glare found

PV array 1 Bluestem Solar: OP 12

No glare found

PV array 1 Bluestem Solar: OP 13

No glare found

PV array 1 Bluestem Solar: OP 14

No glare found

PV array 1 Bluestem Solar: OP 15

No glare found

PV array 1 Bluestem Solar: OP 16

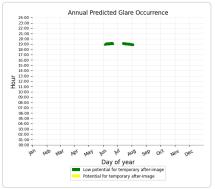
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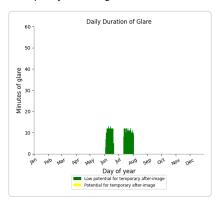
PV array 1 Bluestem Solar: OP 17

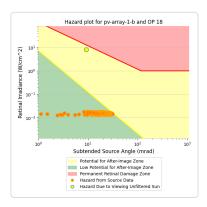
No glare found

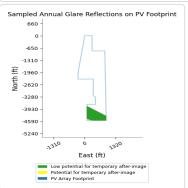
- PV array is expected to produce the following glare for this receptor:

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





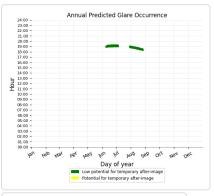


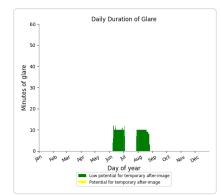


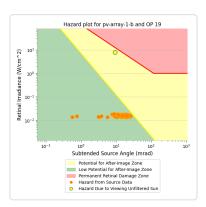
PV array 1 Bluestem Solar: OP 19

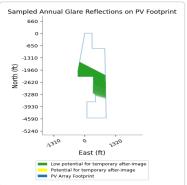
PV array is expected to produce the following glare for this receptor:

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



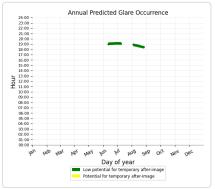


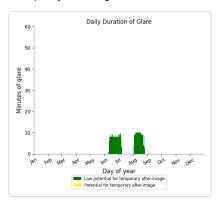


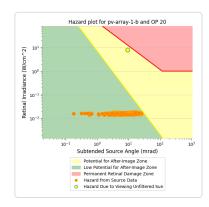


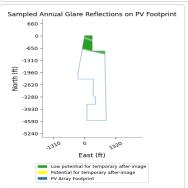
- PV array is expected to produce the following glare for this receptor:

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





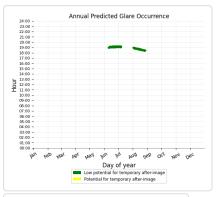


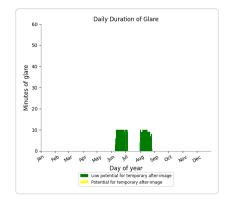


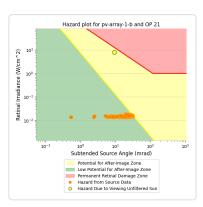
PV array 1 Bluestem Solar: OP 21

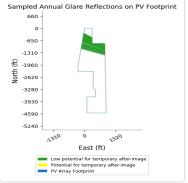
PV array is expected to produce the following glare for this receptor:

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



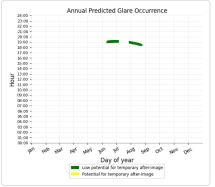


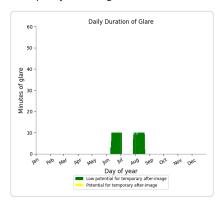


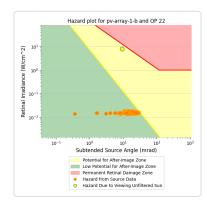


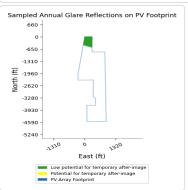
- PV array is expected to produce the following glare for this receptor:

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





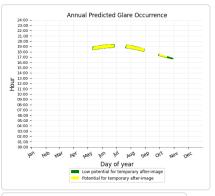


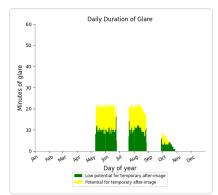


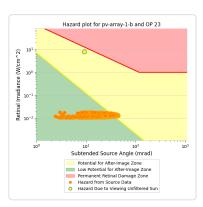
PV array 1 Bluestem Solar: OP 23

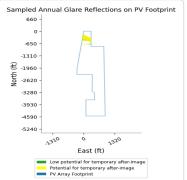
PV array is expected to produce the following glare for this receptor:

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









No glare found

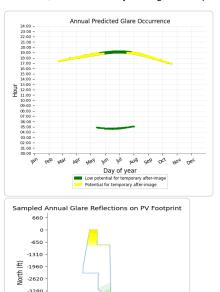
PV array 1 Bluestem Solar: 25-ATCT

No glare found

PV array 1 Bluestem Solar: Route 1

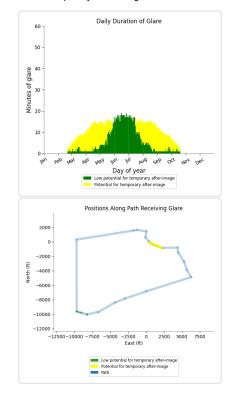
PV array is expected to produce the following glare for this receptor:

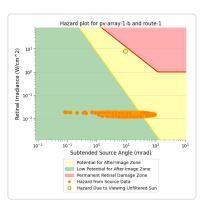
- 1,404 minutes of "green" glare with low potential to cause temporary after-image.
- 1,575 minutes of "yellow" glare with potential to cause temporary after-image.



East (ft)

Low potential for temporary after-image
Potential for temporary after-image
PV Array Footprint





Summary of Vertical Surface Glare Analysis

Assumptions

-3930

-5240

- Times associated with glare are denoted in Standard time. For Daylight Savings, add one hour.
- Glare analyses do not automatically account for physical obstructions between reflectors and receptors. This includes buildings, tree cover and geographi obstructions.
- Detailed system geometry is not rigorously simulated.
- The glare hazard determination relies on several approximations including observer eye characteristics, angle of view, and typical blink response time.
 Actual values and results may vary.
- The system output calculation is a DNI-based approximation that assumes clear, sunny skies year-round. It should not be used in place of more rigorous modeling methods.
- Several V1 calculations utilize the PV array centroid, rather than the actual glare spot location, due to algorithm limitations. This may affect results for larg PV footprints. Additional analyses of array sub-sections can provide additional information on expected glare.
- The subtended source angle (glare spot size) is constrained by the PV array footprint size. Partitioning large arrays into smaller sections will reduce the
 maximum potential subtended angle, potentially impacting results if actual glare spots are larger than the sub-array size. Additional analyses of the
 combined area of adjacent sub-arrays can provide more information on potential glare hazards. (See previous point on related limitations.)
- Hazard zone boundaries shown in the Glare Hazard plot are an approximation and visual aid. Actual ocular impact outcomes encompass a continuous, no discrete, spectrum.
- · Glare locations displayed on receptor plots are approximate. Actual glare-spot locations may differ.
- Refer to the **Help page** for detailed assumptions and limitations not listed here.