

Appendix D

Glare Analysis

FORGESOLAR GLARE ANALYSIS

Project: **Hellman Solar Project**

Solar Project at Hellman Oil Field in Seal Beach CA

Site configuration: **Hellman Solar Field-temp-0**

Created 10 Apr, 2024

Updated 25 Apr, 2024

Time-step 1 minute

Timezone offset UTC-8

Minimum sun altitude 0.0 deg

DNI peaks at 1,000.0 W/m²

Category 1 MW to 5 MW

Site ID 116479.20058

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 V2



Summary of Results

Glare with low potential for temporary after-image predicted

PV Array	Tilt °	Orient °	Annual Green Glare		Annual Yellow Glare		Energy kWh
			min	hr	min	hr	
Central Array	10.0	180.0	0	0.0	0	0.0	-
Eastern Array 1	10.0	180.0	1,597	26.6	0	0.0	-
Eastern Array 2	10.0	180.0	1,596	26.6	0	0.0	-
Western Array	10.0	180.0	1,185	19.8	0	0.0	-

Total glare received by each receptor; may include duplicate times of glare from multiple reflective surfaces.

Receptor	Annual Green Glare		Annual Yellow Glare	
	min	hr	min	hr
OP 1	0	0.0	0	0.0
OP 2	0	0.0	0	0.0
OP 3	0	0.0	0	0.0
OP 4	0	0.0	0	0.0
OP 5	0	0.0	0	0.0
OP 6	0	0.0	0	0.0
OP 7	0	0.0	0	0.0
OP 8	0	0.0	0	0.0
OP 9	0	0.0	0	0.0
OP 10	0	0.0	0	0.0
OP 11	0	0.0	0	0.0
OP 12	0	0.0	0	0.0

Receptor	Annual Green Glare		Annual Yellow Glare	
	min	hr	min	hr
OP 13	0	0.0	0	0.0
OP 14	0	0.0	0	0.0
OP 15	0	0.0	0	0.0
OP 16	0	0.0	0	0.0
OP 17	0	0.0	0	0.0
OP 18	0	0.0	0	0.0
OP 19	0	0.0	0	0.0
OP 20	1,185	19.8	0	0.0
OP 21	0	0.0	0	0.0
OP 22	0	0.0	0	0.0
OP 23	0	0.0	0	0.0
OP 24	0	0.0	0	0.0
OP 25	0	0.0	0	0.0
OP 26	0	0.0	0	0.0
OP 27	0	0.0	0	0.0
OP 28	0	0.0	0	0.0
OP 29	3,193	53.2	0	0.0
OP 30	0	0.0	0	0.0
OP 31	0	0.0	0	0.0
OP 32	0	0.0	0	0.0
OP 33	0	0.0	0	0.0
OP 34	0	0.0	0	0.0

Component Data

PV Arrays

Name: Central Array

Axis tracking: Fixed (no rotation)

Tilt: 10.0°

Orientation: 180.0°

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	33.754039	-118.093793	4.00	1.00	5.00
2	33.753731	-118.093800	4.00	1.00	5.00
3	33.753726	-118.093545	4.00	1.00	5.00
4	33.753631	-118.093547	4.00	1.00	5.00
5	33.753627	-118.093275	4.00	1.00	5.00
6	33.753484	-118.093276	4.00	1.00	5.00
7	33.753483	-118.092995	4.00	1.00	5.00
8	33.753799	-118.092995	4.00	1.00	5.00
9	33.753800	-118.093269	4.00	1.00	5.00
10	33.753903	-118.093269	4.00	1.00	5.00
11	33.753908	-118.093539	4.00	1.00	5.00
12	33.754034	-118.093536	4.00	1.00	5.00

Name: Eastern Array 1

Axis tracking: Fixed (no rotation)

Tilt: 10.0°

Orientation: 180.0°

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	33.753167	-118.092573	3.00	1.00	4.00
2	33.753160	-118.092011	3.00	1.00	4.00
3	33.752949	-118.092015	3.00	1.00	4.00
4	33.752955	-118.092298	3.00	1.00	4.00
5	33.753005	-118.092296	3.00	1.00	4.00
6	33.753011	-118.092573	3.00	1.00	4.00

Name: Eastern Array 2

Axis tracking: Fixed (no rotation)

Tilt: 10.0°

Orientation: 180.0°

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	33.752889	-118.092570	3.00	1.00	4.00
2	33.752886	-118.092302	3.00	1.00	4.00
3	33.752840	-118.092304	3.00	1.00	4.00
4	33.752840	-118.092023	3.00	1.00	4.00
5	33.752733	-118.092022	3.00	1.00	4.00
6	33.752736	-118.092302	3.00	1.00	4.00
7	33.752440	-118.092300	3.00	1.00	4.00
8	33.752436	-118.092569	3.00	1.00	4.00

Name: Western Array

Axis tracking: Fixed (no rotation)

Tilt: 10.0°

Orientation: 180.0°

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	33.754786	-118.094476	4.00	1.00	5.00
2	33.754214	-118.094492	4.00	1.00	5.00
3	33.754200	-118.094136	4.00	1.00	5.00
4	33.754055	-118.094141	4.00	1.00	5.00
5	33.754070	-118.094498	4.00	1.00	5.00
6	33.754171	-118.094494	4.00	1.00	5.00
7	33.754176	-118.094632	4.00	1.00	5.00
8	33.754220	-118.094630	4.00	1.00	5.00
9	33.754223	-118.094854	4.00	1.00	5.00
10	33.754388	-118.094847	4.00	1.00	5.00
11	33.754401	-118.095211	4.00	1.00	5.00
12	33.754987	-118.095183	4.00	1.00	5.00
13	33.754972	-118.094822	4.00	1.00	5.00
14	33.754800	-118.094827	4.00	1.00	5.00

Discrete Observation Point Receptors

Name	ID	Latitude (°)	Longitude (°)	Elevation (ft)	Height (ft)
OP 1	1	33.752786	-118.090415	19.90	6.00
OP 2	2	33.752664	-118.090452	20.90	6.00
OP 3	3	33.752483	-118.090526	20.10	6.00
OP 4	4	33.752349	-118.090572	20.70	6.00
OP 5	5	33.752221	-118.090671	20.10	6.00
OP 6	6	33.752001	-118.090726	21.40	6.00
OP 7	7	33.751856	-118.090778	20.70	6.00
OP 8	8	33.751711	-118.090802	19.40	6.00
OP 9	9	33.751555	-118.090855	18.80	6.00
OP 10	10	33.751427	-118.090952	18.60	6.00
OP 11	11	33.751281	-118.091064	19.50	6.00
OP 12	12	33.751154	-118.091143	19.30	6.00
OP 13	13	33.750790	-118.091390	18.40	6.00
OP 14	14	33.750686	-118.091528	16.70	6.00
OP 15	15	33.750462	-118.091751	16.70	6.00
OP 16	16	33.750276	-118.091899	17.90	6.00
OP 17	17	33.750079	-118.091991	22.50	6.00
OP 18	18	33.750014	-118.092097	21.80	6.00
OP 19	19	33.755464	-118.097277	4.70	6.00
OP 20	20	33.754507	-118.097738	4.70	6.00
OP 21	21	33.758793	-118.099999	6.00	6.00
OP 22	22	33.757536	-118.101222	5.70	0.00
OP 23	23	33.756046	-118.103196	5.40	0.00
OP 24	24	33.755903	-118.098798	3.90	0.00
OP 25	25	33.754806	-118.100407	7.60	0.00
OP 26	26	33.752598	-118.091390	3.94	6.00
OP 27	27	33.751705	-118.091411	9.67	6.00
OP 28	28	33.752156	-118.092389	10.19	6.00
OP 29	29	33.752155	-118.095105	5.89	6.00
OP 30	30	33.751359	-118.093174	10.15	0.00
OP 31	31	33.750146	-118.094132	6.70	6.00
OP 32	32	33.749344	-118.093136	44.72	6.00
OP 33	33	33.749395	-118.095200	43.91	6.00
OP 34	34	33.749395	-118.097384	32.25	6.00

Obstruction Components

Name: Bushes and Trees Along Fence Line
Top height: 7.0 ft



Vertex	Latitude (°)	Longitude (°)	Ground elevation (ft)
1	33.752566	-118.091458	3.15
2	33.752753	-118.091404	3.96
3	33.752958	-118.091458	3.92

Name: Tree Line
Top height: 20.0 ft



Vertex	Latitude (°)	Longitude (°)	Ground elevation (ft)
1	33.752920	-118.090578	7.16
2	33.752090	-118.090894	11.62
3	33.751769	-118.090927	13.51
4	33.751140	-118.091350	14.68

Glare Analysis Results

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

PV Array	Tilt	Orient	Annual Green Glare		Annual Yellow Glare		Energy
	°	°	min	hr	min	hr	kWh
Central Array	10.0	180.0	0	0.0	0	0.0	-
Eastern Array 1	10.0	180.0	1,597	26.6	0	0.0	-
Eastern Array 2	10.0	180.0	1,596	26.6	0	0.0	-
Western Array	10.0	180.0	1,185	19.8	0	0.0	-

Total glare received by each receptor; may include duplicate times of glare from multiple reflective surfaces.

Receptor	Annual Green Glare		Annual Yellow Glare	
	min	hr	min	hr
OP 1	0	0.0	0	0.0
OP 2	0	0.0	0	0.0
OP 3	0	0.0	0	0.0
OP 4	0	0.0	0	0.0
OP 5	0	0.0	0	0.0
OP 6	0	0.0	0	0.0
OP 7	0	0.0	0	0.0
OP 8	0	0.0	0	0.0
OP 9	0	0.0	0	0.0
OP 10	0	0.0	0	0.0
OP 11	0	0.0	0	0.0
OP 12	0	0.0	0	0.0
OP 13	0	0.0	0	0.0
OP 14	0	0.0	0	0.0
OP 15	0	0.0	0	0.0
OP 16	0	0.0	0	0.0
OP 17	0	0.0	0	0.0
OP 18	0	0.0	0	0.0
OP 19	0	0.0	0	0.0
OP 20	1,185	19.8	0	0.0
OP 21	0	0.0	0	0.0
OP 22	0	0.0	0	0.0
OP 23	0	0.0	0	0.0
OP 24	0	0.0	0	0.0
OP 25	0	0.0	0	0.0
OP 26	0	0.0	0	0.0
OP 27	0	0.0	0	0.0
OP 28	0	0.0	0	0.0
OP 29	3,193	53.2	0	0.0

Receptor	Annual Green Glare		Annual Yellow Glare	
	min	hr	min	hr
OP 30	0	0.0	0	0.0
OP 31	0	0.0	0	0.0
OP 32	0	0.0	0	0.0
OP 33	0	0.0	0	0.0
OP 34	0	0.0	0	0.0

PV: Central Array no glare found

Receptor results ordered by category of glare

Receptor	Annual Green Glare		Annual Yellow Glare	
	min	hr	min	hr
OP 1	0	0.0	0	0.0
OP 2	0	0.0	0	0.0
OP 3	0	0.0	0	0.0
OP 4	0	0.0	0	0.0
OP 5	0	0.0	0	0.0
OP 6	0	0.0	0	0.0
OP 7	0	0.0	0	0.0
OP 8	0	0.0	0	0.0
OP 9	0	0.0	0	0.0
OP 10	0	0.0	0	0.0
OP 11	0	0.0	0	0.0
OP 12	0	0.0	0	0.0
OP 13	0	0.0	0	0.0
OP 14	0	0.0	0	0.0
OP 15	0	0.0	0	0.0
OP 16	0	0.0	0	0.0
OP 17	0	0.0	0	0.0
OP 18	0	0.0	0	0.0
OP 19	0	0.0	0	0.0
OP 20	0	0.0	0	0.0
OP 21	0	0.0	0	0.0
OP 22	0	0.0	0	0.0
OP 23	0	0.0	0	0.0
OP 24	0	0.0	0	0.0
OP 25	0	0.0	0	0.0
OP 26	0	0.0	0	0.0
OP 27	0	0.0	0	0.0
OP 28	0	0.0	0	0.0
OP 29	0	0.0	0	0.0
OP 30	0	0.0	0	0.0
OP 31	0	0.0	0	0.0
OP 32	0	0.0	0	0.0
OP 33	0	0.0	0	0.0
OP 34	0	0.0	0	0.0

Central Array and OP 1

No glare found

Central Array and OP 2

No glare found

Central Array and OP 3

No glare found

Central Array and OP 4

No glare found

Central Array and OP 5

No glare found

Central Array and OP 6

No glare found

Central Array and OP 7

No glare found

Central Array and OP 8

No glare found

Central Array and OP 9

No glare found

Central Array and OP 10

No glare found

Central Array and OP 11

No glare found

Central Array and OP 12

No glare found

Central Array and OP 13

No glare found

Central Array and OP 14

No glare found

Central Array and OP 15

No glare found

Central Array and OP 16

No glare found

Central Array and OP 17

No glare found

Central Array and OP 18

No glare found

Central Array and OP 19

No glare found

Central Array and OP 20

No glare found

Central Array and OP 21

No glare found

Central Array and OP 22

No glare found

Central Array and OP 23

No glare found

Central Array and OP 24

No glare found

Central Array and OP 25

No glare found

Central Array and OP 26

No glare found

Central Array and OP 27

No glare found

Central Array and OP 28

No glare found

Central Array and OP 29

No glare found

Central Array and OP 30

No glare found

Central Array and OP 31

No glare found

Central Array and OP 32

No glare found

Central Array and OP 33

No glare found

Central Array and OP 34

No glare found

PV: Eastern Array 1 low potential for temporary after-image

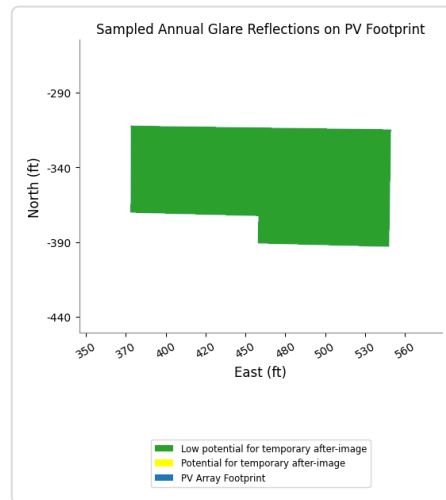
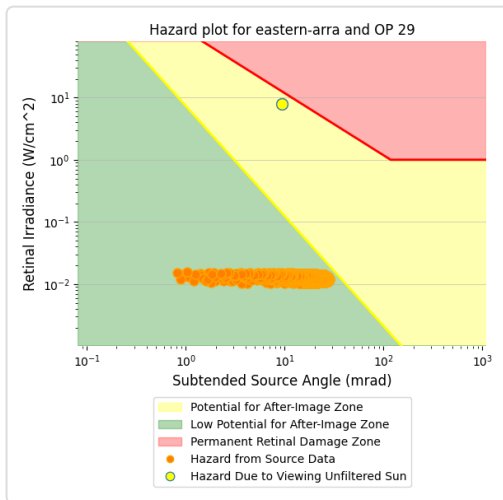
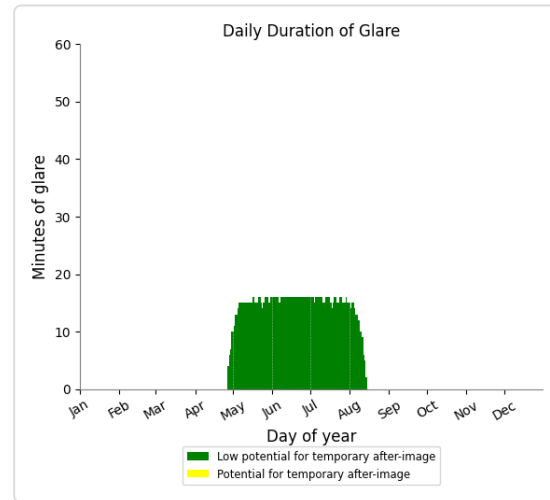
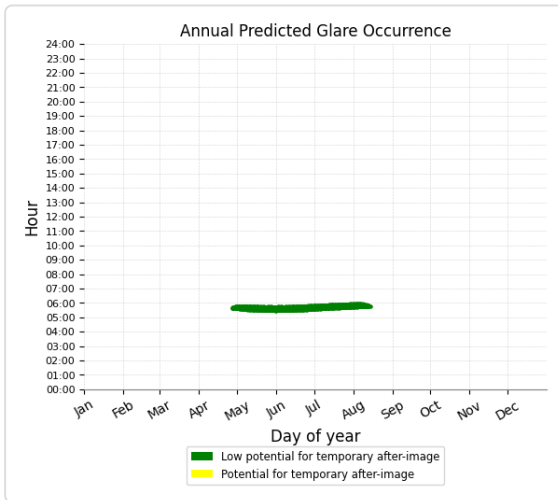
Receptor results ordered by category of glare

Receptor	Annual Green Glare		Annual Yellow Glare	
	min	hr	min	hr
OP 29	1,597	26.6	0	0.0
OP 1	0	0.0	0	0.0
OP 2	0	0.0	0	0.0
OP 3	0	0.0	0	0.0
OP 4	0	0.0	0	0.0
OP 5	0	0.0	0	0.0
OP 6	0	0.0	0	0.0
OP 7	0	0.0	0	0.0
OP 8	0	0.0	0	0.0
OP 9	0	0.0	0	0.0
OP 10	0	0.0	0	0.0
OP 11	0	0.0	0	0.0
OP 12	0	0.0	0	0.0
OP 13	0	0.0	0	0.0
OP 14	0	0.0	0	0.0
OP 15	0	0.0	0	0.0
OP 16	0	0.0	0	0.0
OP 17	0	0.0	0	0.0
OP 18	0	0.0	0	0.0
OP 19	0	0.0	0	0.0
OP 20	0	0.0	0	0.0
OP 21	0	0.0	0	0.0
OP 22	0	0.0	0	0.0
OP 23	0	0.0	0	0.0
OP 24	0	0.0	0	0.0
OP 25	0	0.0	0	0.0
OP 26	0	0.0	0	0.0
OP 27	0	0.0	0	0.0
OP 28	0	0.0	0	0.0
OP 30	0	0.0	0	0.0
OP 31	0	0.0	0	0.0
OP 32	0	0.0	0	0.0
OP 33	0	0.0	0	0.0
OP 34	0	0.0	0	0.0

Eastern Array 1 and OP 29

Yellow glare: none

Green glare: 1,597 min.



Eastern Array 1 and OP 1

No glare found

Eastern Array 1 and OP 2

No glare found

Eastern Array 1 and OP 3

No glare found

Eastern Array 1 and OP 4

No glare found

Eastern Array 1 and OP 5

No glare found

Eastern Array 1 and OP 6

No glare found

Eastern Array 1 and OP 7

No glare found

Eastern Array 1 and OP 8

No glare found

Eastern Array 1 and OP 9

No glare found

Eastern Array 1 and OP 10

No glare found

Eastern Array 1 and OP 11

No glare found

Eastern Array 1 and OP 12

No glare found

Eastern Array 1 and OP 13

No glare found

Eastern Array 1 and OP 14

No glare found

Eastern Array 1 and OP 15

No glare found

Eastern Array 1 and OP 16

No glare found

Eastern Array 1 and OP 17

No glare found

Eastern Array 1 and OP 18

No glare found

Eastern Array 1 and OP 19

No glare found

Eastern Array 1 and OP 20

No glare found

Eastern Array 1 and OP 21

No glare found

Eastern Array 1 and OP 22

No glare found

Eastern Array 1 and OP 23

No glare found

Eastern Array 1 and OP 24

No glare found

Eastern Array 1 and OP 25

No glare found

Eastern Array 1 and OP 26

No glare found

Eastern Array 1 and OP 27

No glare found

Eastern Array 1 and OP 28

No glare found

Eastern Array 1 and OP 30

No glare found

Eastern Array 1 and OP 31

No glare found

Eastern Array 1 and OP 32

No glare found

Eastern Array 1 and OP 33

No glare found

Eastern Array 1 and OP 34

No glare found

PV: Eastern Array 2 low potential for temporary after-image

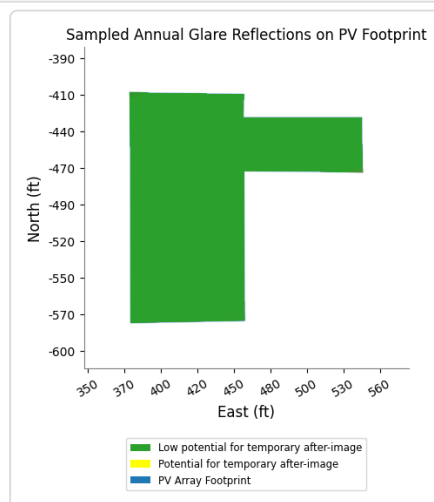
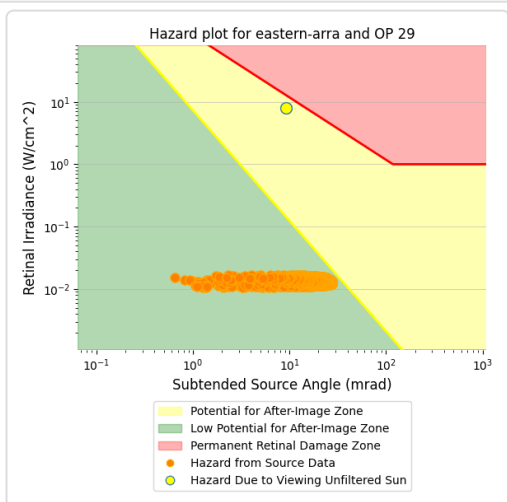
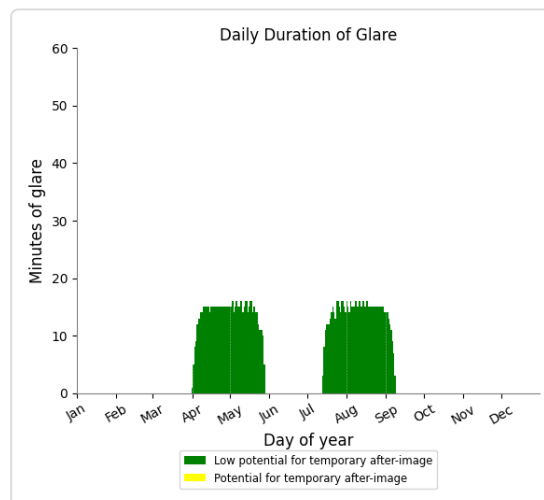
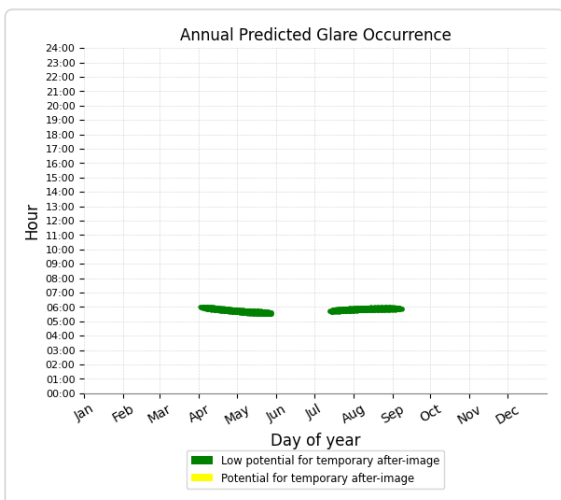
Receptor results ordered by category of glare

Receptor	Annual Green Glare		Annual Yellow Glare	
	min	hr	min	hr
OP 29	1,596	26.6	0	0.0
OP 1	0	0.0	0	0.0
OP 2	0	0.0	0	0.0
OP 3	0	0.0	0	0.0
OP 4	0	0.0	0	0.0
OP 5	0	0.0	0	0.0
OP 6	0	0.0	0	0.0
OP 7	0	0.0	0	0.0
OP 8	0	0.0	0	0.0
OP 9	0	0.0	0	0.0
OP 10	0	0.0	0	0.0
OP 11	0	0.0	0	0.0
OP 12	0	0.0	0	0.0
OP 13	0	0.0	0	0.0
OP 14	0	0.0	0	0.0
OP 15	0	0.0	0	0.0
OP 16	0	0.0	0	0.0
OP 17	0	0.0	0	0.0
OP 18	0	0.0	0	0.0
OP 19	0	0.0	0	0.0
OP 20	0	0.0	0	0.0
OP 21	0	0.0	0	0.0
OP 22	0	0.0	0	0.0
OP 23	0	0.0	0	0.0
OP 24	0	0.0	0	0.0
OP 25	0	0.0	0	0.0
OP 26	0	0.0	0	0.0
OP 27	0	0.0	0	0.0
OP 28	0	0.0	0	0.0
OP 30	0	0.0	0	0.0
OP 31	0	0.0	0	0.0
OP 32	0	0.0	0	0.0
OP 33	0	0.0	0	0.0
OP 34	0	0.0	0	0.0

Eastern Array 2 and OP 29

Yellow glare: none

Green glare: 1,596 min.



Eastern Array 2 and OP 1

No glare found

Eastern Array 2 and OP 2

No glare found

Eastern Array 2 and OP 3

No glare found

Eastern Array 2 and OP 4

No glare found

Eastern Array 2 and OP 5

No glare found

Eastern Array 2 and OP 6

No glare found

Eastern Array 2 and OP 7

No glare found

Eastern Array 2 and OP 8

No glare found

Eastern Array 2 and OP 9

No glare found

Eastern Array 2 and OP 10

No glare found

Eastern Array 2 and OP 11

No glare found

Eastern Array 2 and OP 12

No glare found

Eastern Array 2 and OP 13

No glare found

Eastern Array 2 and OP 14

No glare found

Eastern Array 2 and OP 15

No glare found

Eastern Array 2 and OP 16

No glare found

Eastern Array 2 and OP 17

No glare found

Eastern Array 2 and OP 18

No glare found

Eastern Array 2 and OP 19

No glare found

Eastern Array 2 and OP 20

No glare found

Eastern Array 2 and OP 21

No glare found

Eastern Array 2 and OP 22

No glare found

Eastern Array 2 and OP 23

No glare found

Eastern Array 2 and OP 24

No glare found

Eastern Array 2 and OP 25

No glare found

Eastern Array 2 and OP 26

No glare found

Eastern Array 2 and OP 27

No glare found

Eastern Array 2 and OP 28

No glare found

Eastern Array 2 and OP 30

No glare found

Eastern Array 2 and OP 31

No glare found

Eastern Array 2 and OP 32

No glare found

Eastern Array 2 and OP 33

No glare found

Eastern Array 2 and OP 34

No glare found

PV: Western Array low potential for temporary after-image

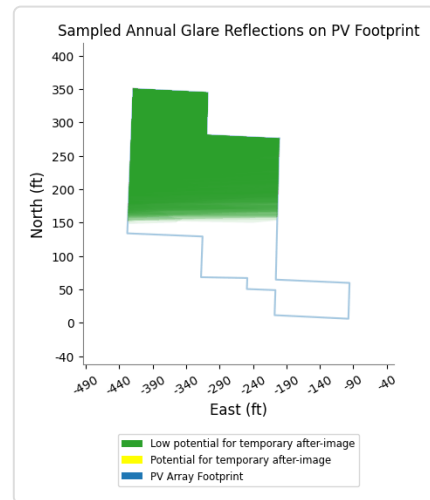
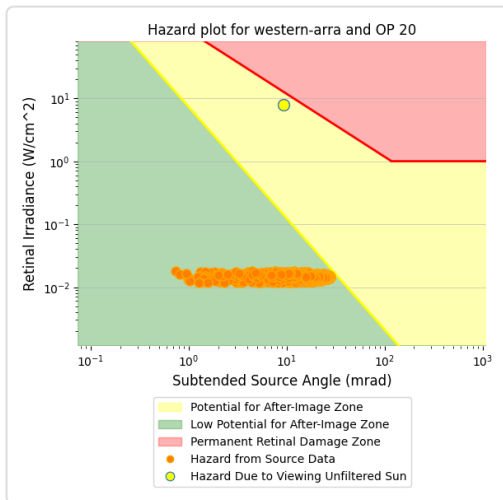
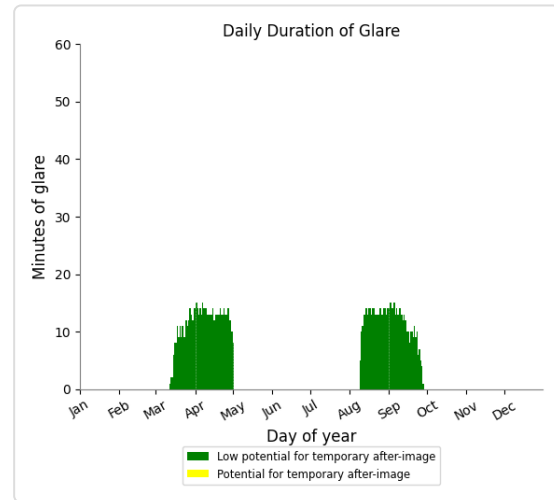
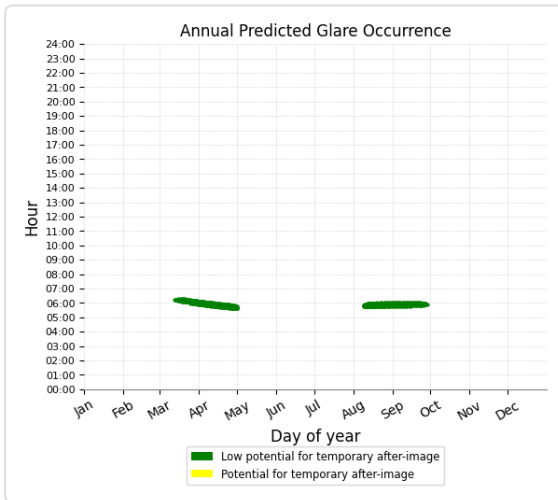
Receptor results ordered by category of glare

Receptor	Annual Green Glare		Annual Yellow Glare	
	min	hr	min	hr
OP 20	1,185	19.8	0	0.0
OP 1	0	0.0	0	0.0
OP 2	0	0.0	0	0.0
OP 3	0	0.0	0	0.0
OP 4	0	0.0	0	0.0
OP 5	0	0.0	0	0.0
OP 6	0	0.0	0	0.0
OP 7	0	0.0	0	0.0
OP 8	0	0.0	0	0.0
OP 9	0	0.0	0	0.0
OP 10	0	0.0	0	0.0
OP 11	0	0.0	0	0.0
OP 12	0	0.0	0	0.0
OP 13	0	0.0	0	0.0
OP 14	0	0.0	0	0.0
OP 15	0	0.0	0	0.0
OP 16	0	0.0	0	0.0
OP 17	0	0.0	0	0.0
OP 18	0	0.0	0	0.0
OP 19	0	0.0	0	0.0
OP 21	0	0.0	0	0.0
OP 22	0	0.0	0	0.0
OP 23	0	0.0	0	0.0
OP 24	0	0.0	0	0.0
OP 25	0	0.0	0	0.0
OP 26	0	0.0	0	0.0
OP 27	0	0.0	0	0.0
OP 28	0	0.0	0	0.0
OP 29	0	0.0	0	0.0
OP 30	0	0.0	0	0.0
OP 31	0	0.0	0	0.0
OP 32	0	0.0	0	0.0
OP 33	0	0.0	0	0.0
OP 34	0	0.0	0	0.0

Western Array and OP 20

Yellow glare: none

Green glare: 1,185 min.



Western Array and OP 1

No glare found

Western Array and OP 2

No glare found

Western Array and OP 3

No glare found

Western Array and OP 4

No glare found

Western Array and OP 5

No glare found

Western Array and OP 6

No glare found

Western Array and OP 7

No glare found

Western Array and OP 8

No glare found

Western Array and OP 9

No glare found

Western Array and OP 10

No glare found

Western Array and OP 11

No glare found

Western Array and OP 12

No glare found

Western Array and OP 13

No glare found

Western Array and OP 14

No glare found

Western Array and OP 15

No glare found

Western Array and OP 16

No glare found

Western Array and OP 17

No glare found

Western Array and OP 18

No glare found

Western Array and OP 19

No glare found

Western Array and OP 21

No glare found

Western Array and OP 22

No glare found

Western Array and OP 23

No glare found

Western Array and OP 24

No glare found

Western Array and OP 25

No glare found

Western Array and OP 26

No glare found

Western Array and OP 27

No glare found

Western Array and OP 28

No glare found

Western Array and OP 29

No glare found

Western Array and OP 30

No glare found

Western Array and OP 31

No glare found

Western Array and OP 32

No glare found

Western Array and OP 33

No glare found

Western Array and OP 34

No glare found

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.

The algorithm does not rigorously represent the detailed geometry of a system; detailed features such as gaps between modules, variable height of the PV array, and support structures may impact actual glare results. However, we have validated our models against several systems, including a PV array causing glare to the air-traffic control tower at Manchester-Boston Regional Airport and several sites in Albuquerque, and the tool accurately predicted the occurrence and intensity of glare at different times and days of the year.

Several V1 calculations utilize 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 sub-sections can provide additional information on expected glare. This primarily affects V1 analyses of path receptors.

Random number computations are utilized by various steps of the annual hazard analysis algorithm. Predicted minutes of glare can vary between runs as a result. This limitation primarily affects analyses of Observation Point receptors, including ATCTs. Note that the SGHAT/ ForgeSolar methodology has always relied on an analytical, qualitative approach to accurately determine the overall hazard (i.e. green vs. yellow) of expected glare on an annual basis.

The analysis does not automatically consider obstacles (either man-made or natural) between the observation points and the prescribed solar installation that may obstruct observed glare, such as trees, hills, buildings, etc.

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.)

The variable direct normal irradiance (DNI) feature (if selected) scales the user-prescribed peak DNI using a typical clear-day irradiance profile. This profile has a lower DNI in the mornings and evenings and a maximum at solar noon. The scaling uses a clear-day irradiance profile based on a normalized time relative to sunrise, solar noon, and sunset, which are prescribed by a sun-position algorithm and the latitude and longitude obtained from Google maps. The actual DNI on any given day can be affected by cloud cover, atmospheric attenuation, and other environmental factors.

The ocular hazard predicted by the tool depends on a number of environmental, optical, and human factors, which can be uncertain. We provide input fields and typical ranges of values for these factors so that the user can vary these parameters to see if they have an impact on the results. The speed of SGHAT allows expedited sensitivity and parametric analyses.

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.

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.

Glare locations displayed on receptor plots are approximate. Actual glare-spot locations may differ.

Refer to the Help page at www.forgesolar.com/help/ for assumptions and limitations not listed here.

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

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