CHIRON ENERGY SPV38

CHIRON ENERGY SPV 38 S.r.l.

VIA BIGLI N. 2 - MILANO

C.F. e P.IVA 12974590965

Firmato da Paolo Pesaresi
Data: il 10/04/2025
alle 09:15:11 CEST

Regione Emilia - Romagna

Comune di Forlì

Provincia di Forlì - Cesena

PROGETTO DEFINITIVO

Titolo:

Lotto di impianti di produzione di energia elettrica da fonte fotovoltaica

"FORLI' 1" - "FORLI' 2"

Via Rossellino, snc

Oggetto:	Num. Rif. Lista:	Codifica Elaborato:
STUDIO DI COMPATIBILITA' AERONAUTICA	-	R- AERO

Studio di progettazione:

Studio Jacopo Del Carlo
Via Poggio alle Viti 1187 55054 Massarosa (LU)
Tel 0584/361471 e-mail: gestione@jdcstudio.eu

Progettista:

Dott. Jacopo Del Carlo

Firmato digitalmente da: DEL CARLO IACOPO
Data: 09/04/2025 19:13:22

Incarico professionale ricevuto dalla Chiron Energy Asset Management S.r.l., società facente parte del Gruppo Chiron Energy.

Cod. File:	Scala:	Formato:	Codice:	Rev.:
-	-	-	PD	00

Rev.	Data	Descrizione revisione:	Redatto:	Controllato:	Approvato:
0	03/2025	Prima emissione	**Jacopo DEL CARLO**	**Jacopo DEL CARLO**	**Jacopo DEL CARLO**
1	-				
2	-				

Scopo

La presente relazione è presentata quale verifica preliminare di fattibilità per la creazione di un impianto fotovoltaico a terra nel Comune di Forlì nei pressi dell'aeroporto di Forlì (FC). L'impianto è stato sottoposto a valutazione quale pericolo alla navigazione aerea.
Il presente studio, al fine di soddisfare la valutazione necessaria individuata dalla LG–2022/002-APT – VALUTAZIONE DEGLI IMPIANTI FOTOVOLTAICI NEI DINTORNI AEROPORTUALI Ed. n. 1 del 26 aprile 2022 pubblicata da ENAC, è sviluppato secondo il seguente schema:

Analisi possibili effetti di abbagliamento

1. ***Analisi degli elementi pertinenti***
   a. Descrizione dell'attività e del progetto proposto
   b. Descrizione dell'area di collocazione
   c. Descrizione dell'aeroporto interessato.
2. ***Introduzione degli elementi pertinenti per l'analisi degli effetti da abbagliamento***
   a. Descrizione dei dati costruttivi dei pannelli e dell'impianto.
   b. Verifica di interesse aeronautico dell'impianto
3. ***Analisi degli elementi pertinenti per lo studio di abbagliamento***
   a. Metodologia utilizzata
   b. Analisi dei possibili effetti di abbagliamento per la torre di controllo.
   c. Analisi dei possibili effetti di abbagliamento per i piloti nelle varie fasi del volo.

Conclusioni

a. Compatibilità per possibili effetti di abbagliamento

Analisi possibili effetti di abbagliamento

1. Analisi degli elementi pertinenti

a. Descrizione dell'attività e del progetto proposto

Il progetto presentato è la nuova installazione di un impianto fotovoltaico a terra in un lotto di circa 113.313,69 m^2, con elevazione media di 21 m. sul livello del mare (s.l.m.) ed una massima di 22 m s.l.m.
L'installazione dei pannelli comporterà un incremento dell'altezza massima del terreno di 3.0 m per un'elevazione complessiva di 25 m s.l.m.
L'impianto si colloca a nord est del centro abitato del comune di Forlì (FC), in prossimità dell'area produttiva La Selva il cui accesso è da via Bernardo Rossellino. L'area di intervento è delimitata a sud dalla stessa via Rossellino e da lotti agricoli nelle altre direzioni.
Si riproduce una foto aerea esplicativa rimandando alla tavola di progetto (allegato 01).

b. Descrizione dell'area di collocazione

L'accesso all'installazione è da una strada della zona artigianale ed è inserita in una zona ad uso promiscuo con area artigianali e lotti agricoli, nel comune di Forlì a circa 4,45 Km a Nord (rilevamento 042°) dall'Airport Reference Point dell'aeroporto di Forlì-Luigi Ridolfi (ICAO: LIPK). La collocazione dell'impianto rispetto all'aeroporto è riportata con foto aerea in allegato 02.
L'impianto è all'interno della proiezione a terra della Superficie Conica (CS) associata all'aeroporto che coincide con la previsione dei 6 km attorno all'ARP del documento VERIFICA PRELIMINARE - VERIFICA POTENZIALI OSTACOLI E PERICOLI PER LA NAVIGAZIONE AEREA.
L'impianto si trova al di sotto della CS perché a meno di 6 km dall'ARP dell'aeroporto di Forlì.

c. Descrizione dell'aeroporto

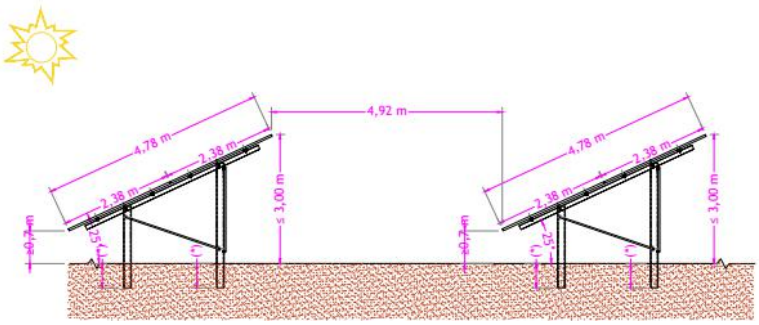
L'aeroporto di Forlì è un aeroporto civile aperto al traffico commerciale di linea. Dispone di una pista in asfalto lunga 2561 m, orientata RWY 12-30. Il codice ICAO è 4.
Il circuito di traffico è riportato in AIP Italia e prevede un circuito standard per RWY 30 ed uno non standard per RWY 12 (sud ovest dell'infrastruttura), ma per aerei con particolari caratteristiche di volo, la previsione potrebbe essere invertita su decisione della torre di controllo.
L'elevazione media dell'aeroporto è di 30 m. (s.l.m.) come da dato pubblicato.
È previsto un servizio ATS - TWR gestito da ENAV posizionato a sud del campo con altezza della torre di 53 m s.l.m. (altezza cautelativa perché si è considerata l'altezza della torre).

Si esclude la possibilità che l'impianto possa configurarsi quale ostacolo alla navigazione aerea in quanto l'elevazione totale è al di sotto dell'elevazione dell'aeroporto.

2. Introduzione degli elementi pertinenti per l'analisi degli effetti da abbagliamento

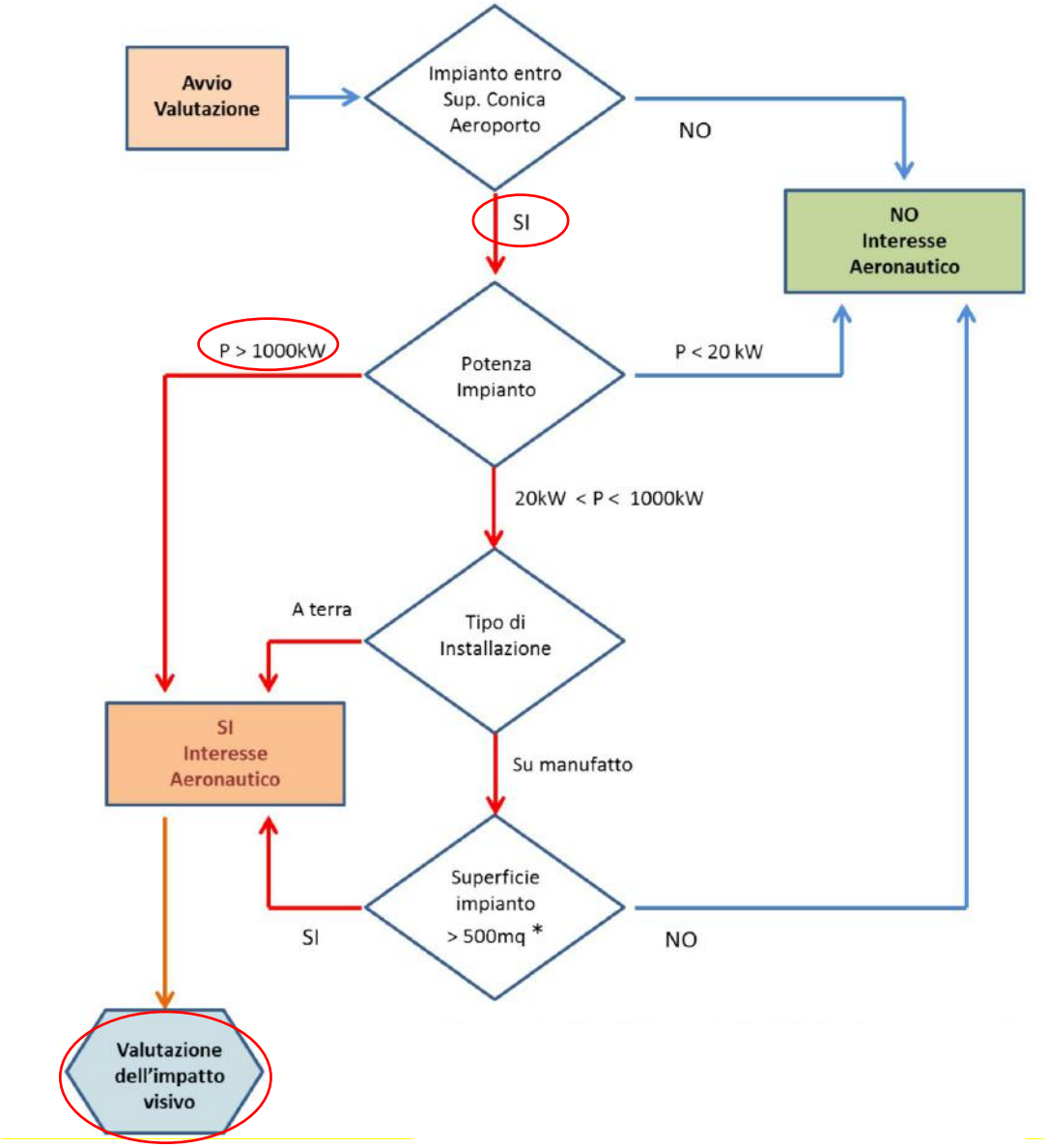
a. Descrizione dei dati costruttivi dei pannelli e dell'impianto.

Si tratta di due impianti fotovoltaici a terra su un unico lotto della potenza complessiva di 11.994,84 Kw costituito da un totale di 18.174 moduli fotovoltaici in silicio monocristallino di potenza 660 Wp (tipo LONGI LR7-72HYD-660M o similare).
La superficie attiva complessivamente installata di pannelli fotovoltaici risulterà di circa 49.091 m².
La superficie dei pannelli proiettata a terra risulterà pari a circa 44.492 m².
Ai fini della riflettività il pannello è stato considerato con le caratteristiche di un pannello light texture glass con pellicola antiriflesso. In allegato 03 la scheda tecnica del pannello.
L'impianto sarà di tipo fisso, senza parti in movimento (tracker).
L'orientamento dei pannelli è per sud (180°) con un'inclinazione rispetto al piano orizzontale di 25° come da figura seguente.



b. Verifica di interesse aeronautico dell'impianto

In base a quanto descritto ed utilizzando il diagramma di flusso del paragrafo 7.2. delle Linee Guida ENAC citate qui riportato,



si può concludere che

per la collocazione all'interno della superficie Conica e la potenzialità > 1000 kW, è presente l'interesse aeronautico per il quale si deve procedere alla valutazione dell'impatto visivo dell'impianto.

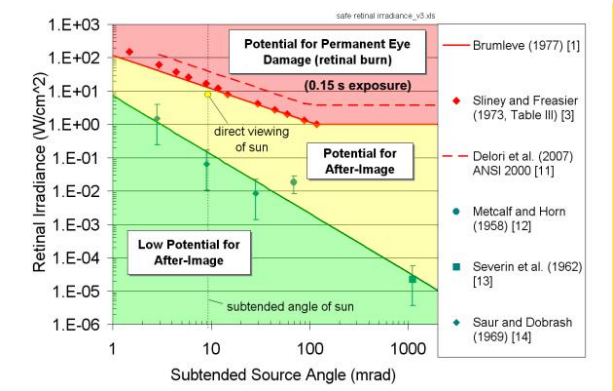
3. *Analisi degli elementi pertinenti per lo studio di abbagliamento*

a. Metodologia utilizzata:

Ai fini di una valutazione adeguata, vista la vicinanza con le installazioni aeroportuali, si è preferito ricorrere al software Forge solar by 2016 © Sims Industries indicato dalle Linee Guida sopra richiamate. Il software è risultato rispondente alle linee guida per l'analisi in quanto:

- utilizza il diagramma solare alla latitudine del luogo (per tutti i giorni dell'anno e per ogni minuto);
- costruisce il diagramma dei raggi riflessi a intervalli di un minuto secondo le leggi di riflessione e la legge di Fresnel;
- determina la collocazione nel diagramma dei raggi riflessi per i punti rappresentativi delle varie fasi del volo, in questo caso le fasi di avvicinamento per le piste e del circuito di traffico VFR;
- determina eventuali riflessi che interessano la Torre di controllo;
- valuta il tipo di visione interessata.

L'analisi è sviluppata non tenendo conto di eventuali ostacoli fisici frapposti privi di effetti di riflessione e non considera ombreggiamenti sulla superficie dell'impianto.
In questo caso per motivi di geometria dell'impianto lo studio è stato sviluppato dividendo il lotto rispetto ad un asse est - ovest ottenendo 4 lotti di dimensioni comparabili. I minuti di glare sono da considerarsi il massimo riportato nelle quattro analisi per periodo e recettore e non cumulativi.
Inoltre il software determina sulla base della classificazione FAA un yellow glare (potenziale abbagliamento) ed un green glare (riflesso con bassa potenzialità di abbagliamento). Il green glare è da considerarsi accettabile in base al seguente schema tratto dalla letteratura scientifica.



Il risultato del calcolo effettuato è riportato in allegato 4; di seguito se ne evidenziano le conclusioni.

b. Analisi dei possibili effetti di abbagliamento per la torre di controllo.

Non è riscontrabile alcuna riflessione che generi abbagliamento nei confronti della locale torre di controllo.

c. Analisi dei possibili effetti di abbagliamento per i piloti nelle varie fasi del volo.

L'analisi è stata condotta per il profilo che caratterizza l'avvicinamento alla pista 12 ed alla pista 30. La traiettoria impostata è quella da utilizzarsi per un avvicinamento (inclinazione di 3°) caratteristica per il traffico possibile per l'aeroporto in oggetto. La traiettoria è disegnata in maniera automatica dal software. Si è considerato, inoltre, un circuito di traffico a 1000 piedi AGL sia con virata a sinistra sia con virata a destra per entrambe le piste.
Per le traiettorie tracciate è assente la possibilità di generare effetti di abbagliamento (yellow)
Un effetto green glare è riscontrabile per un periodo limitato (prime ore del mattino) nei settori ovest del circuito di traffico e avvicinamento RWY 12.
La riflessione dei pannelli dell'impianto fotovoltaico non generano effetti di abbagliamento per i piloti in avvicinamento, in circuito ed in atterraggio presso l'aeroporto di Forlì.

Conclusioni

Lo scrivente sulla base di quanto sopra esaminato dichiara che:

a. Compatibilità per possibili effetti di abbagliamento

- ✓ *L'impianto si trova al di sotto della CS perché a meno di 6 km dall'ARP dell'aeroporto di Forlì.*
- ✓ *Si esclude la possibilità che l'impianto possa configurarsi quale ostacolo alla navigazione aerea in quanto l'elevazione totale è al di sotto dell'elevazione dell'aeroporto.*
- ✓ *Per la collocazione all'interno della superficie Conica e la potenzialità > 1000 kW, è presente l'interesse aeronautico per il quale si deve procedere alla valutazione dell'impatto visivo dell'impianto.*
- ✓ *Non è riscontrabile alcuna riflessione che generi abbagliamento nei confronti della locale torre di controllo.*
- ✓ *La riflessione dei pannelli dell'impianto fotovoltaico non generano effetti di abbagliamento per i piloti in avvicinamento, in circuito ed in atterraggio presso l'aeroporto di Forlì.*

Dott. Jacopo Del Carlo

Firmato digitalmente da: DEL CARLO IACOPO
Data: 09/04/2025 19:13:26

Allegati:

Asseverazione di valutazione di abbagliamento

01 Tavole di progetto del campo fotovoltaico,

02 Foto aerea della zona di collocazione impianto,

03 Scheda tecnica del pannello fotovoltaico utilizzato,

04 Relazione di calcolo riflessione con programma FORGE SOLAR Forlì est e Forlì ovest e nord.

Oggetto: Asseverazione di valutazione dell'abbagliamento nei confronti delle operazioni aeronautiche

Rif. Impianto fotovoltaico: CHIRON ENERGY SPV38 – Forlì 1-2 via Bernardo Rossellino Forlì (FC)

Rif. Aeroporto: Forlì (LIPK)

In relazione all'istanza presentata per la realizzazione dell'impianto fotovoltaico in oggetto, il sottoscritto Iacopo Del Carlo, nato a Pietrasanta (LU), il 6.6.1966, codice fiscale DLCCPI66H06G628B, in qualità di consulente aeronautico, consapevole che le dichiarazioni false, la falsità negli atti e l'uso di atti falsi comportano l'applicazione delle sanzioni penali previste dagli artt.75 e 76 del D.P.R. n. 445/2000,

DICHIARA

sotto la propria responsabilità, che:

- l'installazione si configura di "interesse aeronautico" in base alle seguenti caratteristiche:

- Distanza dall'aeroporto (ARP): 4,45 Km.
- Tipo di installazione: fotovoltaico a terra
- Estensione impianto: 44.492 m^2.
- Potenza impianto: 11.994,84 kW

- è stata condotta la valutazione di impatto visivo con verifica della non sussistenza di fenomeni di abbagliamento per i piloti e per gli operatori in torre di controllo secondo la modalità dell'analisi quantitativa con esito:

x Assenza di fenomeni di abbagliamento nelle direzioni di interesse aeronautico

Si allega alla presente asseverazione la seguente documentazione giustificativa:

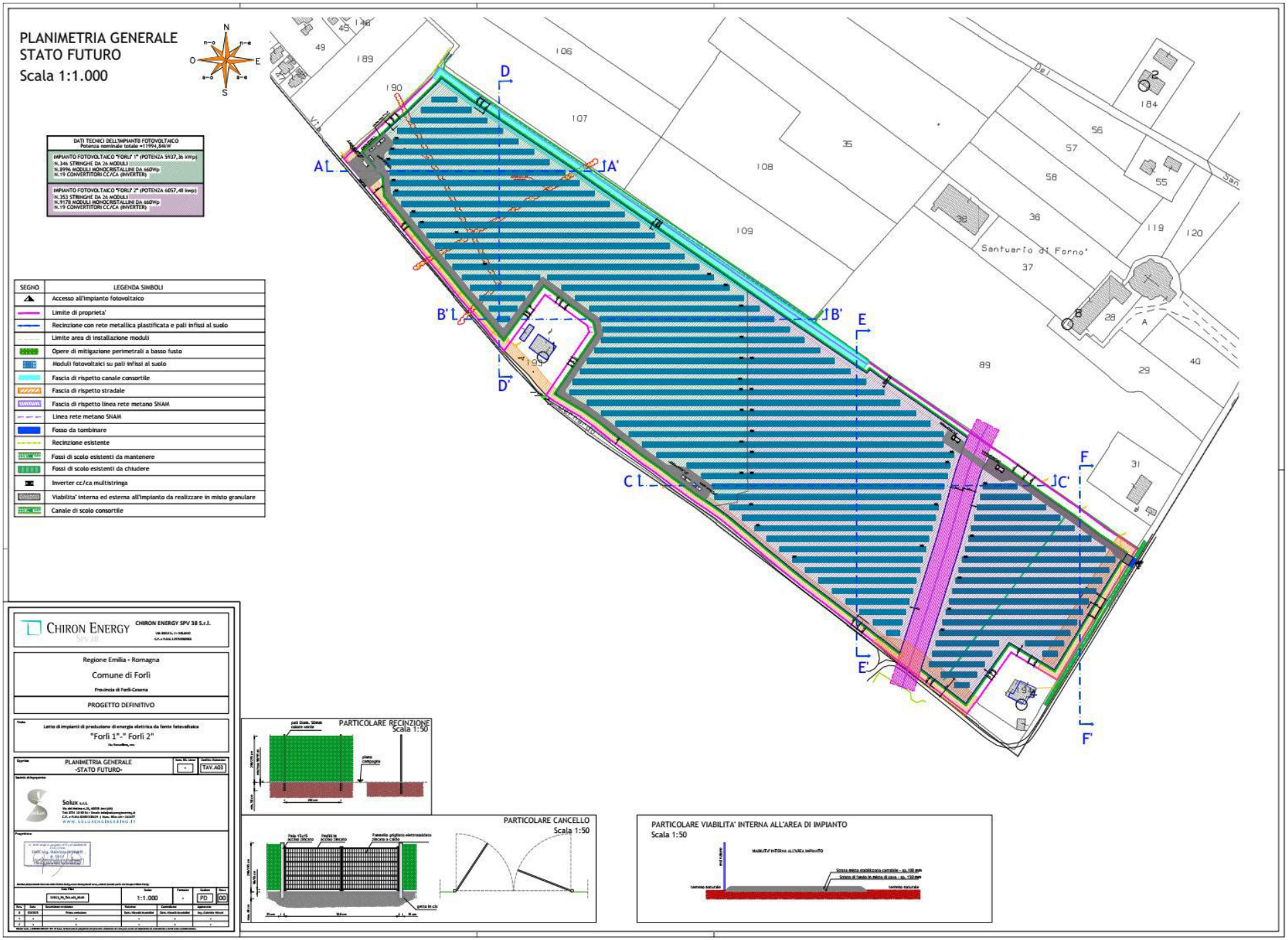
x Relazione tecnica di analisi del fenomeno dell'abbagliamento

Data _____

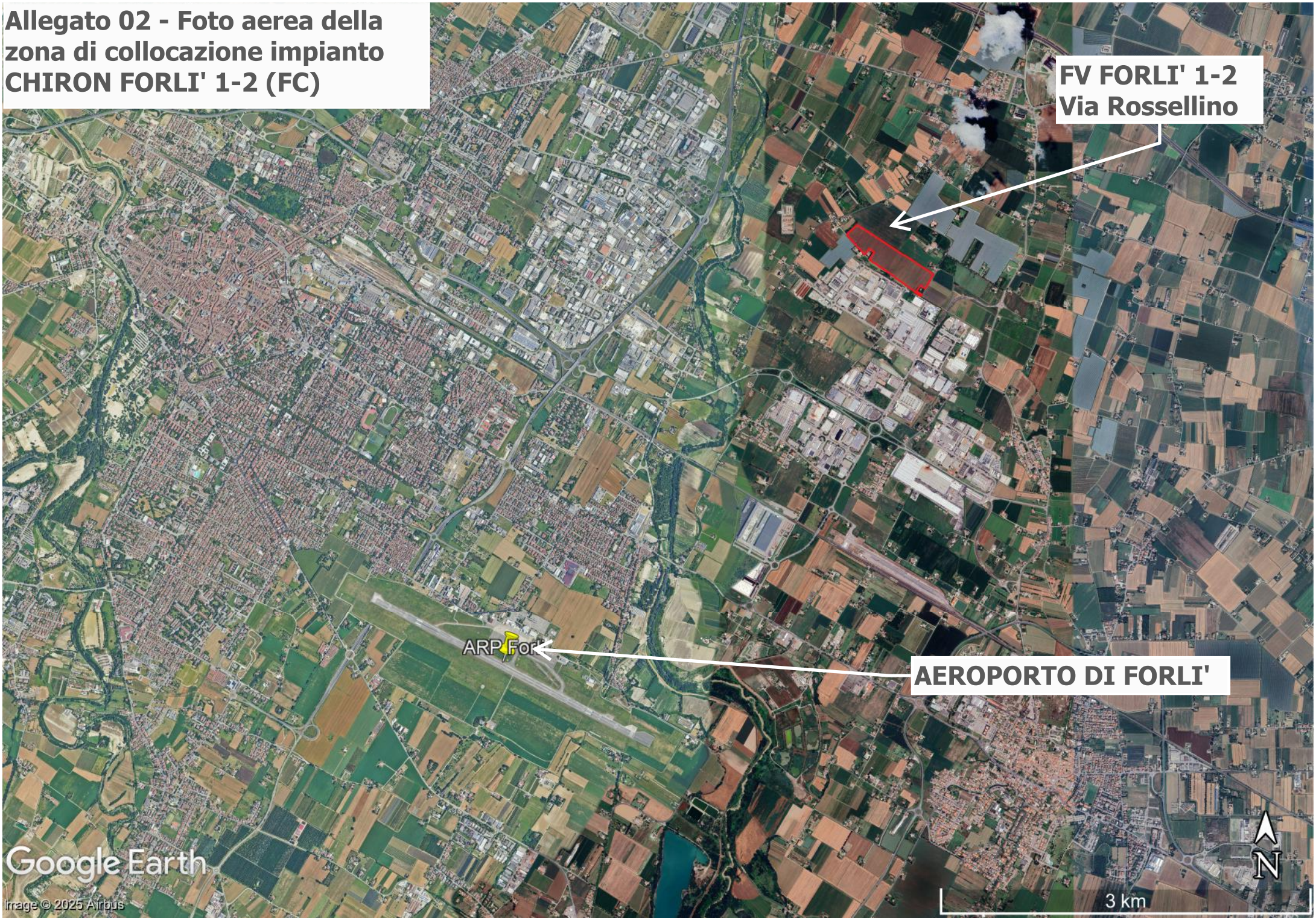
FIRMA

_____

Firmato digitalmente da: DEL CARLO IACOPO
Data: 09/04/2025 19:13:31


PLANIMETRIA GENERALE
STATO FUTURO
Scala 1:1.000
DATI TECNICI DELL'IMPIANTO FOTOVOLTAICO
Potenza nominale totale =11994,,84kW
IMPIANTO FOTOVOLTAICO "FORLI' 1" (POTENZA 5937,36 kWp)
N.346 STRINGHE DA 26 MODULI
N.8996 MODULI MONOCRISTALLINI DA 660Wp
N.19 CONVERTITORI CC/CA (INVERTER)
IMPIANTO FOTOVOLTAICO "FORLI' 2" (POTENZA 6057,48 kWp)
N.351 STRINGHE DA 26 MODULI
N.9178 MODULI MONOCRISTALLINI DA 660Wp
N.19 CONVERTITORI CC/CA (INVERTER)
SEGNO
LEGENDA SIMBOLI
Accesso all'impianto fotovoltaico
Limite di proprieta'
Recinzione con rete metallica plastificata e pali infissi al suolo
Limite area di installazione moduli
Opere di mitigazione perimetrali a basso fusto
Moduli fotovoltaici su pali infissi al suolo
Fascia di rispetto canale consortile
Fascia di rispetto stradale
Fascia di rispetto linea rete metano SNAM
Linea rete metano SNAM
Fosso da tombinare
Recinzione esistente
Fossi di scolo esistenti da mantenere
Fossi di scolo esistenti da chiudere
Inverter cc/ca multistringa
Viabilita' interna ed esterna all'impianto da realizzare in misto granulare
Canale di scolo consortile
A
A'
B
B'
C
C'
D
D'
E
E'
F
F'
Santuario di Forno
CHIRON ENERGY
CHIRON ENERGY SPV 38 S.r.l.
Regione Emilia - Romagna
Comune di Forlì
Provincia di Forlì-Cesena
PROGETTO DEFINITIVO
Lotto di impianti di produzione di energia elettrica da fonte fotovoltaica
"Forlì 1"-" Forlì 2"
PLANIMETRIA GENERALE
-STATO FUTURO-
TAV.A03
Solux s.r.l.
1:1.000
PD
00
PARTICOLARE RECINZIONE
Scala 1:50
PARTICOLARE CANCELLO
Scala 1:50
PARTICOLARE VIABILITA' INTERNA ALL'AREA DI IMPIANTO
Scala 1:50

Allegato 02 - Foto aerea della zona di collocazione impianto CHIRON FORLI' 1-2 (FC)



Hi-MO 9

LR7-72HYD

625~660M

- Products for utility with optimal power generation through the entire lifecycle
- Performance improvement leads to a more than 6.5% power generation gain
- TaiRay wafer & BC technology enhances high product reliability
- Smart manufacturing & LONGi product lifecycle standards deliver exceptional product quality

12 12-year Warranty for Materials and Processing

30 30-year Warranty for Extra Linear Power Output

Complete System and Product Certifications

IEC 61215, IEC 61730, UL 61730

ISO9001:2015: ISO Quality Management System

ISO14001: 2015: ISO Environment Management System

ISO45001: 2018: Occupational Health and Safety

IEC62941: Guideline for module design qualification and type approval

LONGi

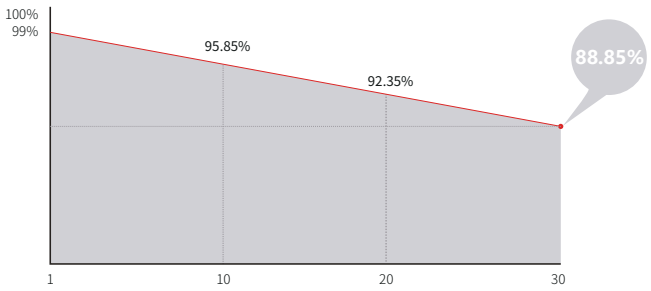
Hi-MO 9

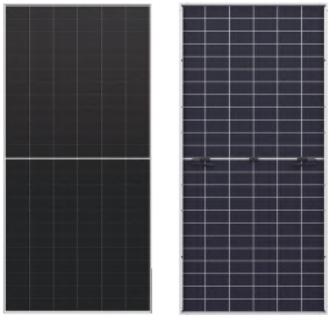
LR7-72HYD 625~660M

24.4%	0~3%	<1%	0.35%	BC-CELL
MAX MODULE EFFICIENCY	POWER TOLERANCE	FIRST YEAR POWER DEGRADATION	YEAR 2-30 POWER DEGRADATION	LOWER OPERATING TEMPERATURE

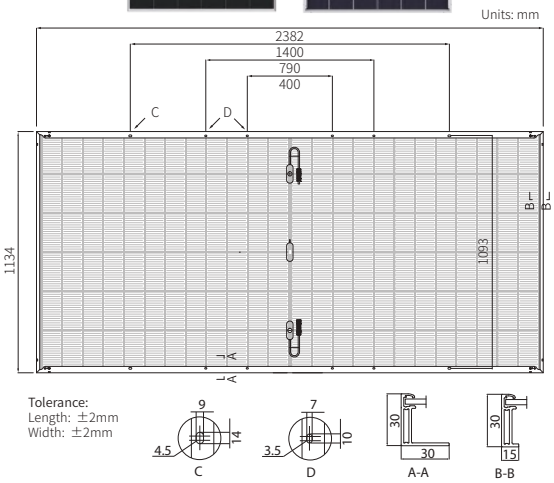
Additional Value

30-Year Power Warranty





Units: mm



Mechanical Parameters

Cell Orientation	144 (6×24)
Junction Box	IP68, three diodes
Output Cable	4mm², +400, -200mm/±1400mm length can be customized
Glass	Dual glass, 2.0+2.0mm heat strengthened glass
Frame	Anodized aluminum alloy frame
Weight	33.5kg
Dimension	2382×1134×30mm
Packaging	36pcs per pallet / 144pcs per 20' GP / 720pcs per 40' HC

Electrical Characteristics

STC : AM1.5 1000W/m² 25°C NOCT : AM1.5 800W/m² 20°C 1m/s

Test uncertainty for Pmax: ±3%

Module Type	LR7-72HYD-625M		LR7-72HYD-630M		LR7-72HYD-635M		LR7-72HYD-640M		LR7-72HYD-645M		LR7-72HYD-650M		LR7-72HYD-655M		LR7-72HYD-660M	
Testing Condition	STC	NOCT	STC	NOCT	STC	NOCT	STC	NOCT	STC	NOCT	STC	NOCT	STC	NOCT	STC	NOCT
Maximum Power (Pmax/W)	625	475.8	630	479.6	635	483.4	640	487.2	645	491.0	650	494.8	655	498.6	660	502.4
Open Circuit Voltage (Voc/V)	53.72	51.05	53.82	51.15	53.92	51.24	54.02	51.34	54.12	51.43	54.22	51.53	54.32	51.62	54.42	51.72
Short Circuit Current (Isc/A)	14.73	11.83	14.81	11.90	14.89	11.96	14.98	12.03	15.06	12.10	15.14	12.16	15.22	12.22	15.30	12.29
Voltage at Maximum Power (Vmp/V)	44.37	42.17	44.47	42.26	44.57	42.36	44.67	42.45	44.77	42.55	44.87	42.64	44.97	42.74	45.07	42.83
Current at Maximum Power (Imp/A)	14.09	11.29	14.17	11.36	14.25	11.42	14.33	11.49	14.41	11.55	14.49	11.61	14.57	11.68	14.65	11.75
Module Efficiency(%)	23.1		23.3		23.5		23.7		23.9		24.1		24.2		24.4	

Electrical characteristics with different rear side power gain (reference to 645W front)

Pmax /W	Voc/V	Isc /A	Vmp/V	Imp /A	Pmax gain
677	54.12	15.81	44.77	15.13	5%
710	54.12	16.57	44.77	15.85	10%
744	54.22	17.32	44.87	16.57	15%
776	54.22	18.07	44.87	17.29	20%
808	54.22	18.83	44.87	18.01	25%

Operating Parameters

Operational Temperature	-40°C ~ +85°C
Power Output Tolerance	0 ~ 3%
Maximum System Voltage	DC1500V (IEC/UL)
Maximum Series Fuse Rating	30A
Nominal Operating Cell Temperature	45±2°C
Protection Class	Class II
Bifaciality	70±5%
Fire Rating	UL type 29 IEC Class C

Mechanical Loading

Front Side Maximum Static Loading	5400Pa
Rear Side Maximum Static Loading	2400Pa
Hailstone Test	25mm Hailstone at the speed of 23m/s

Temperature Ratings (STC)

Temperature Coefficient of Isc	+0.050%/°C
Temperature Coefficient of Voc	-0.200%/°C
Temperature Coefficient of Pmax	-0.260%/°C

LONGi

Web: www.longi.com

FORGESOLAR GLARE ANALYSIS

Project: **Via Rossellino Forlì**
Campo Fotovoltaico fisso a terra nei pressi del centro abitato di Forlì

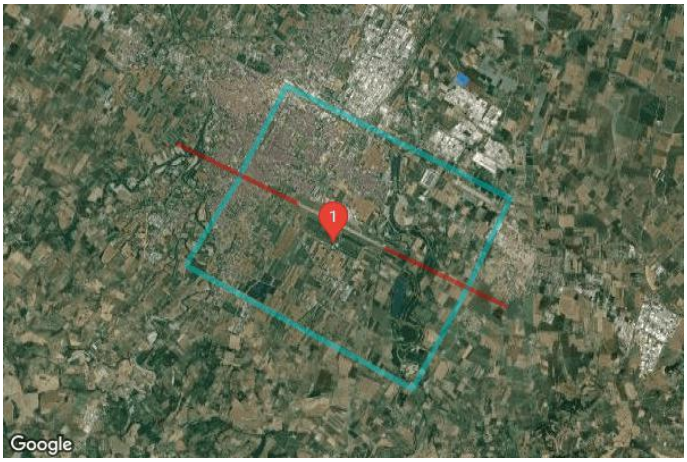
Site configuration: **Via Rossellino 1**

Firmato digitalmente da: DEL CARLO IACOPO
Data: 09/04/2025 19:13:35

Client: CHIRON SPV 38

Created 08 Apr, 2025
Updated 08 Apr, 2025
Time-step 1 minute
Timezone offset UTC1
Minimum sun altitude 0.0 deg
DNI peaks at 1,000.0 W/m^2
Category 500 kW to 1 MW
(1,000 kW / 32,400 m^2 limit)
Site ID 146220.23721

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
	°	°	min	hr	min	hr	kWh
PV array 1	25.0	180.0	11,729	195.5	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
Circuito Nord est	7,560	126.0	0	0.0
Circuito Sud ovest	1,468	24.5	0	0.0
Finale 12	2,701	45.0	0	0.0
Finale 30	0	0.0	0	0.0
1-ATCT	0	0.0	0	0.0

Component Data

PV Arrays

Name: PV array 1
Axis tracking: Fixed (no rotation)
Tilt: 25.0°
Orientation: 180.0°
Rated power: -
Panel material: Light textured glass with AR coating
Reflectivity: Vary with sun
Slope error: correlate with material

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
1	44.227319	12.104759	19.58	3.00	22.58
2	44.228049	12.105768	19.92	3.00	22.92
3	44.227080	12.107828	19.51	3.00	22.51
4	44.225865	12.106615	19.93	3.00	22.93

Route Receptors

Name: Circuito Nord est
Path type: Two-way
Observer view angle: 50.0°

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
1	44.206394	12.039129	32.17	150.00	182.17
2	44.225587	12.053205	26.78	333.00	359.78
3	44.201226	12.120840	25.75	333.00	358.75
4	44.181778	12.107880	30.41	150.00	180.41

Name: Circuito Sud ovest
Path type: Two-way
Observer view angle: 50.0°

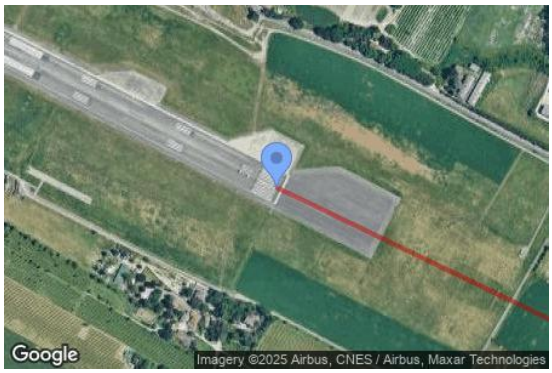
Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
1	44.205902	12.039129	32.74	150.00	182.74
2	44.186702	12.022650	50.10	333.00	383.10
3	44.159862	12.091314	31.26	333.00	364.26
4	44.181778	12.107837	30.38	150.00	180.38

Flight Path Receptors

Name: Finale 12
Description:
Threshold height: 15 m
Direction: 116.4°
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	44.200140	12.056294	29.57	15.24	44.81
Two-mile	44.212996	12.020128	35.02	178.47	213.50

Name: Finale 30
Description:
Threshold height: 15 m
Direction: 295.7°
Glide slope: 3.0°
Pilot view restricted? Yes
Vertical view: 30.0°
Azimuthal view: 50.0°

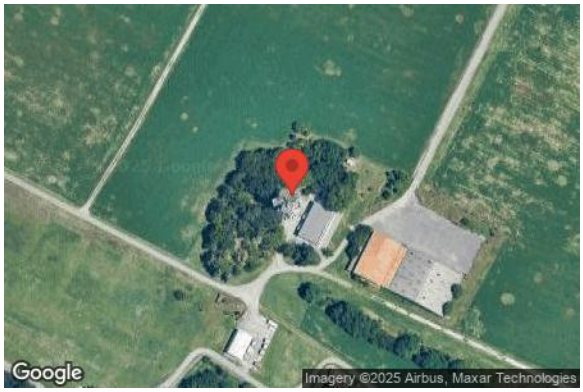


Point	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
Threshold	44.190354	12.083080	25.99	15.24	41.23
Two-mile	44.177798	12.119444	34.54	175.37	209.91

Discrete Observation Point Receptors

Name	ID	Latitude (°)	Longitude (°)	Elevation (m)	Height (m)
1-ATCT	1	44.191319	12.067526	31.00	22.00

Map image of 1-ATCT



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
PV array 1	25.0	180.0	11,729	195.5	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
Circuito Nord est	7,560	126.0	0	0.0
Circuito Sud ovest	1,468	24.5	0	0.0
Finale 12	2,701	45.0	0	0.0
Finale 30	0	0.0	0	0.0
1-ATCT	0	0.0	0	0.0

PV: PV array 1 low potential for temporary after-image

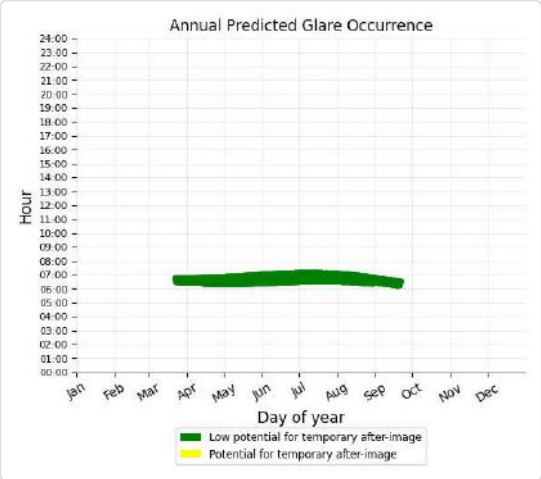
Receptor results ordered by category of glare

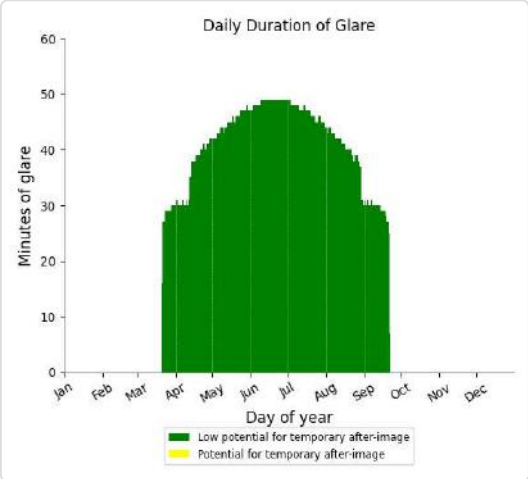
Receptor	Annual Green Glare		Annual Yellow Glare	
	min	hr	min	hr
Circuito Nord est	7,560	126.0	0	0.0
Circuito Sud ovest	1,468	24.5	0	0.0
Finale 12	2,701	45.0	0	0.0
Finale 30	0	0.0	0	0.0
1-ATCT	0	0.0	0	0.0

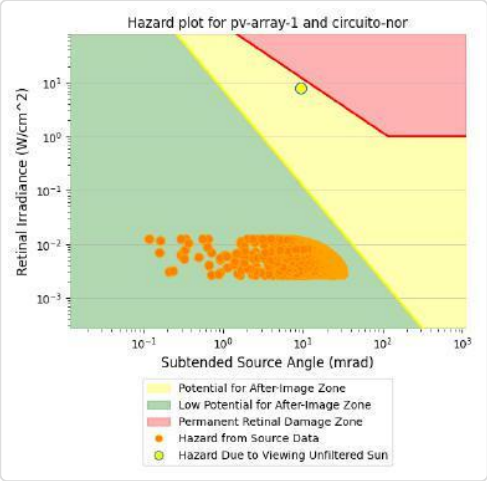
PV array 1 and Route: Circuito Nord est

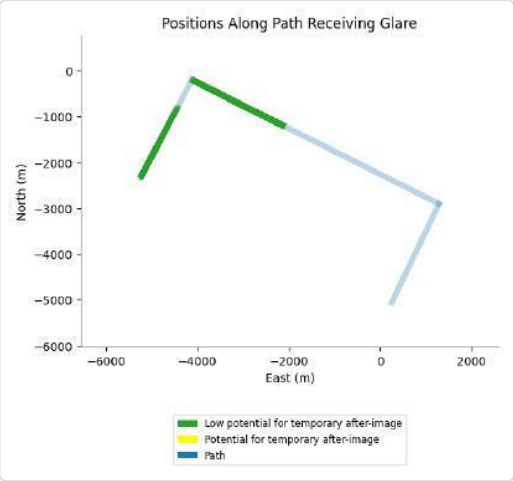
Yellow glare: none

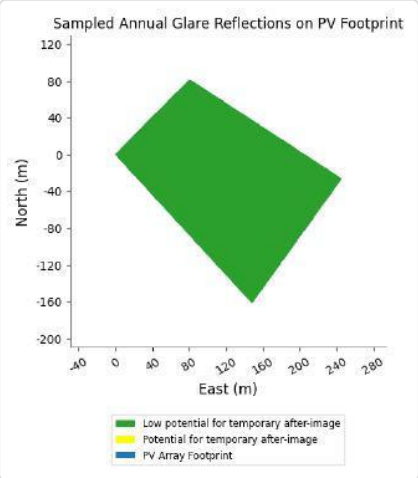
Green glare: 7,560 min.







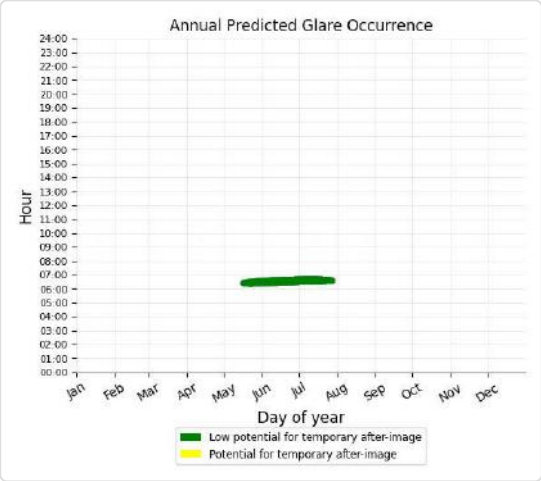


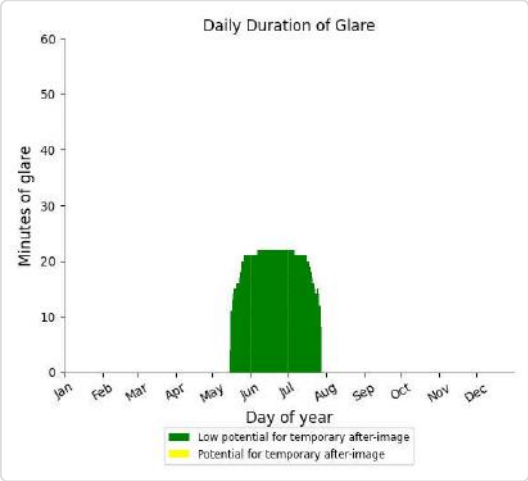


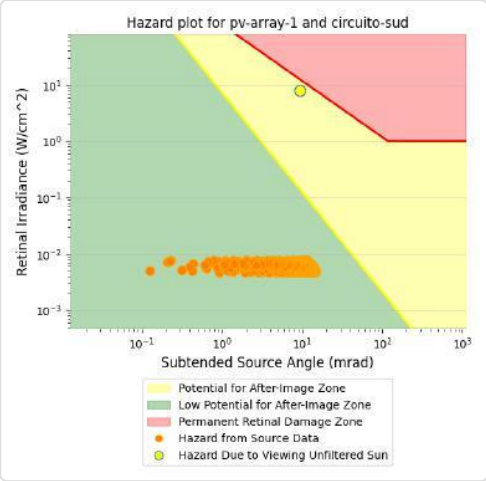
PV array 1 and Route: Circuito Sud ovest

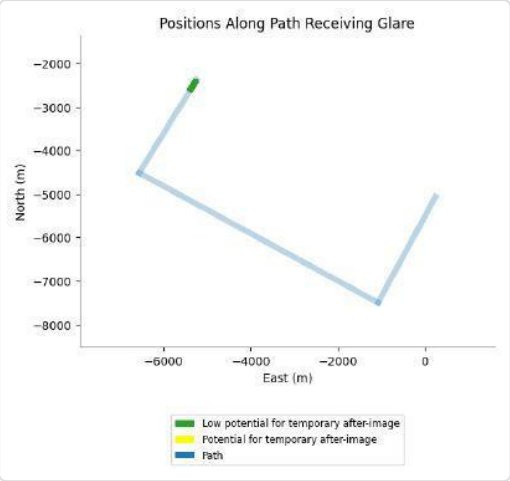
Yellow glare: none

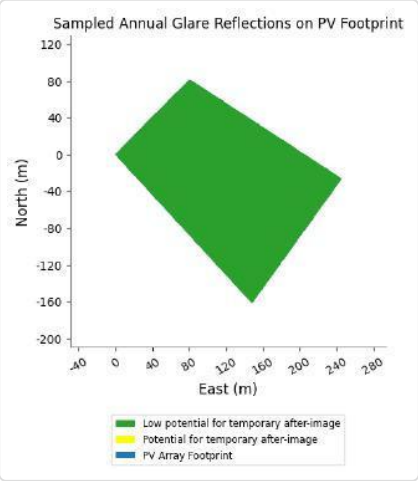
Green glare: 1,468 min.







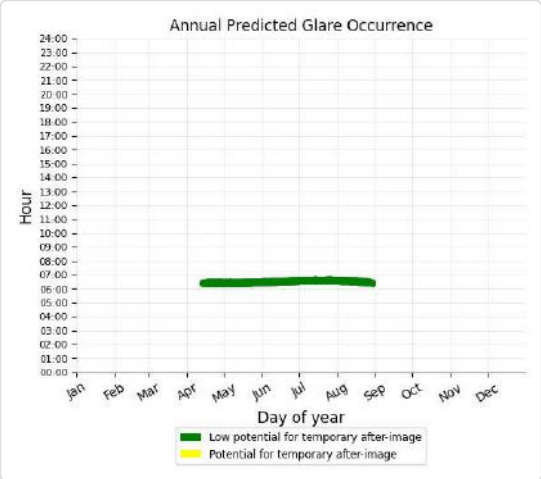


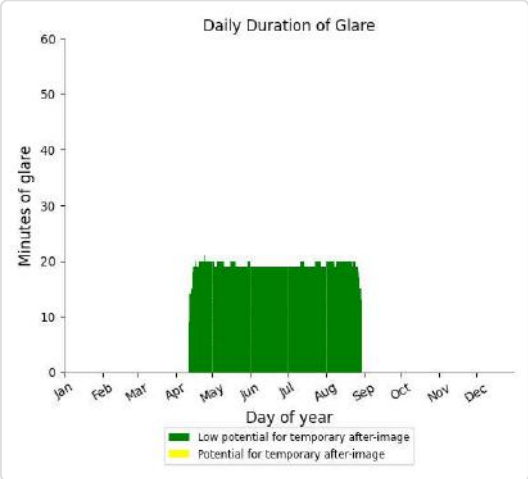


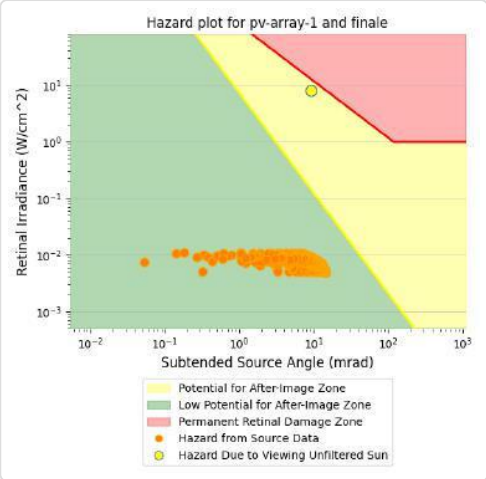
PV array 1 and FP: Finale 12

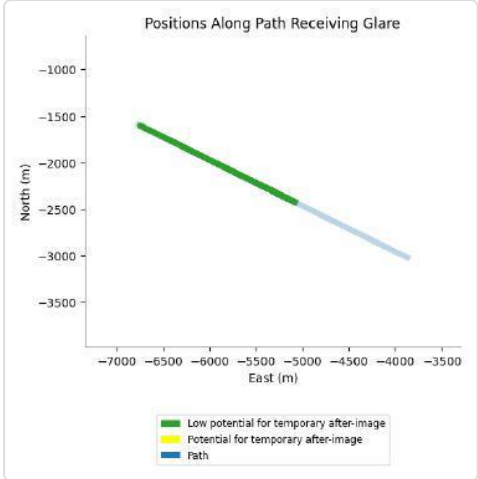
Yellow glare: none

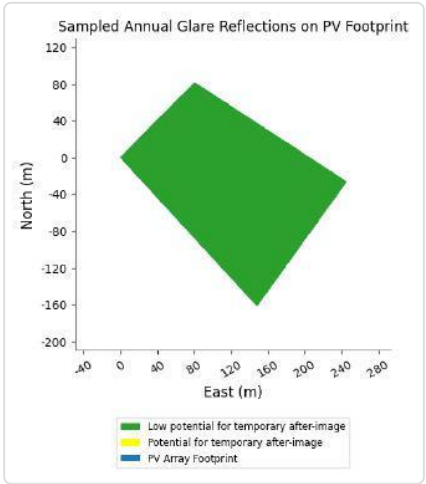
Green glare: 2,701 min.

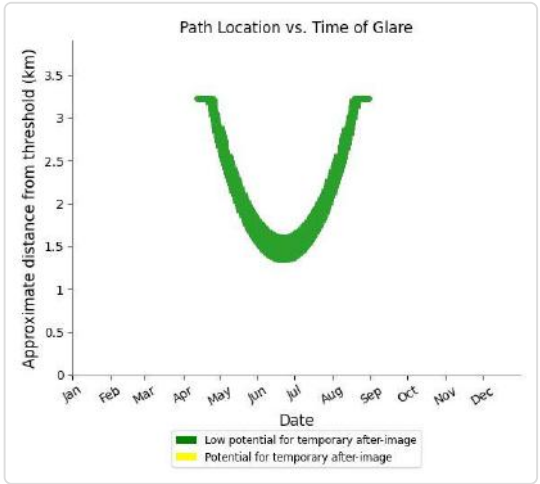












PV array 1 and FP: Finale 30

No glare found

PV array 1 and 1-ATCT

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

FORGESOLAR GLARE ANALYSIS

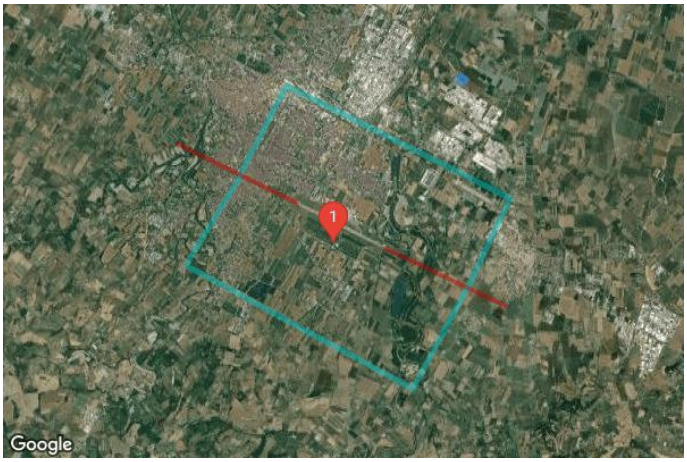
Project: **Via Rossellino Forlì**
Campo Fotovoltaico fisso a terra nei pressi del centro abitato di Forlì

Site configuration: **Via Rossellino1**

Client: CHIRON SPV 38

Created 08 Apr, 2025
Updated 08 Apr, 2025
Time-step 1 minute
Timezone offset UTC1
Minimum sun altitude 0.0 deg
DNI peaks at 1,000.0 W/m^2
Site ID 146220.23721

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



Glare Policy Adherence

The following table estimates the policy adherence of this glare analysis according to the **2021** U.S. Federal Aviation Administration Policy:

Review of Solar Energy System Projects on Federally-Obligated Airports

This policy may require the following criteria be met for solar energy systems on airport property:

- No glare of any kind for Air Traffic Control Tower(s) ("ATCT") at cab height.
- Default analysis and observer characteristics, including 1-minute time step.

ForgeSolar is not affiliated with the U.S. FAA and does not represent or speak officially for the U.S. FAA. ForgeSolar cannot approve or deny projects - results are informational only. Contact the relevant airport and FAA district office for information on policy and requirements.

COMPONENT	STATUS	DESCRIPTION
Analysis parameters	PASS	Analysis time interval and eye characteristics used are acceptable
ATCT(s)	PASS	Receptor(s) marked as ATCT do not receive glare

The referenced policy can be read at https://www.federalregister.gov/d/2021-09862

Component Data

This report includes results for PV arrays and Observation Point ("OP") receptors marked as ATCTs. Components that are not pertinent to the policy, such as routes, flight paths, and vertical surfaces, are excluded.

PV Arrays

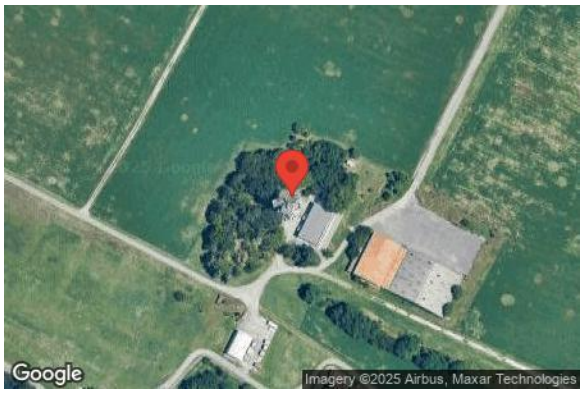
Name: PV array 1
Axis tracking: Fixed (no rotation)
Tilt: 25.0°
Orientation: 180.0°
Rated power: -
Panel material: Light textured glass with AR coating
Reflectivity: Vary with sun
Slope error: correlate with material

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
1	44.227319	12.104759	19.58	3.00	22.58
2	44.228049	12.105768	19.92	3.00	22.92
3	44.227080	12.107828	19.51	3.00	22.51
4	44.225865	12.106615	19.93	3.00	22.93

Observation Point ATCT Receptors

Name	ID	Latitude (°)	Longitude (°)	Elevation (m)	Height (m)
1-ATCT	1	44.191319	12.067526	31.00	22.00

Map image of 1-ATCT



Glare Analysis Results

Summary of Results No glare predicted

PV Array	Tilt	Orient	Annual Green Glare		Annual Yellow Glare		Energy
	°	°	min	hr	min	hr	kWh
PV array 1	25.0	180.0	0	0.0	0	0.0	-

Total annual 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
1-ATCT	0	0.0	0	0.0

PV: PV array 1

Receptor	Annual Green Glare		Annual Yellow Glare	
	min	hr	min	hr
1-ATCT	0	0.0	0	0.0

PV array 1 and 1-ATCT

Receptor type: ATCT Observation Point

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

FORGESOLAR GLARE ANALYSIS

Project: Via Rossellino Forlì
Campo Fotovoltaico fisso a terra nei pressi del centro abitato di Forlì

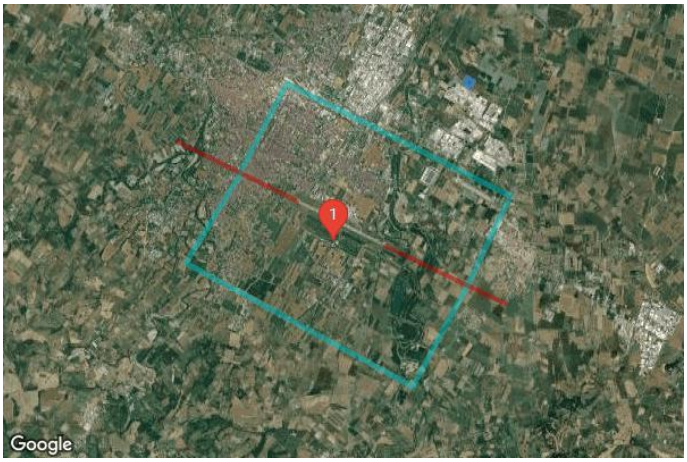
Site configuration: via Rossellino 2

Firmato digitalmente da: DEL CARLO IACOPO
Data: 09/04/2025 19:13:39

Client: CHIRON SPV 38

Created 08 Apr, 2025
Updated 08 Apr, 2025
Time-step 1 minute
Timezone offset UTC1
Minimum sun altitude 0.0 deg
DNI peaks at 1,000.0 W/m^2
Category 500 kW to 1 MW
(1,000 kW / 32,400 m^2 limit)
Site ID 146222.23721

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
	°	°	min	hr	min	hr	kWh
PV array 2	25.0	180.0	13,189	219.8	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
Circuito Nord est	8,274	137.9	0	0.0
Circuito Sud ovest	1,930	32.2	0	0.0
Finale 12	2,985	49.8	0	0.0
Finale 30	0	0.0	0	0.0
1-ATCT	0	0.0	0	0.0

Component Data

PV Arrays

Name: PV array 2
Axis tracking: Fixed (no rotation)
Tilt: 25.0°
Orientation: 180.0°
Rated power: -
Panel material: Light textured glass with AR coating
Reflectivity: Vary with sun
Slope error: correlate with material

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
1	44.227053	12.107826	19.55	3.00	22.55
2	44.226123	12.107097	19.91	3.00	22.91
3	44.225912	12.107505	20.97	3.00	23.97
4	44.225475	12.107097	20.42	3.00	23.42
5	44.224731	12.108620	20.01	3.00	23.01
6	44.226169	12.109908	20.38	3.00	23.38

Route Receptors

Name: Circuito Nord est
Path type: Two-way
Observer view angle: 50.0°

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
1	44.206394	12.039129	32.17	150.00	182.17
2	44.225587	12.053205	26.78	333.00	359.78
3	44.201226	12.120840	25.75	333.00	358.75
4	44.181778	12.107880	30.41	150.00	180.41

Name: Circuito Sud ovest
Path type: Two-way
Observer view angle: 50.0°

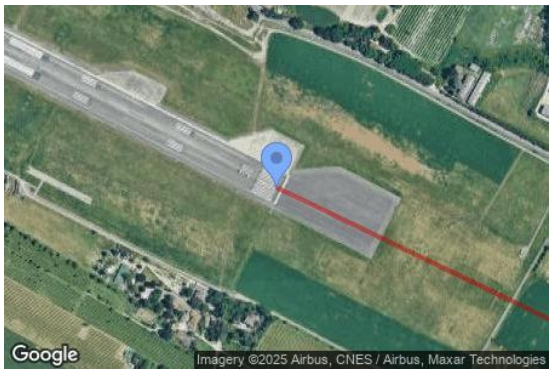
Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
1	44.205902	12.039129	32.74	150.00	182.74
2	44.186702	12.022650	50.10	333.00	383.10
3	44.159862	12.091314	31.26	333.00	364.26
4	44.181778	12.107837	30.38	150.00	180.38

Flight Path Receptors

Name: Finale 12
Description:
Threshold height: 15 m
Direction: 116.4°
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	44.200140	12.056294	29.57	15.24	44.81
Two-mile	44.212996	12.020128	35.02	178.47	213.50

Name: Finale 30
Description:
Threshold height: 15 m
Direction: 295.7°
Glide slope: 3.0°
Pilot view restricted? Yes
Vertical view: 30.0°
Azimuthal view: 50.0°

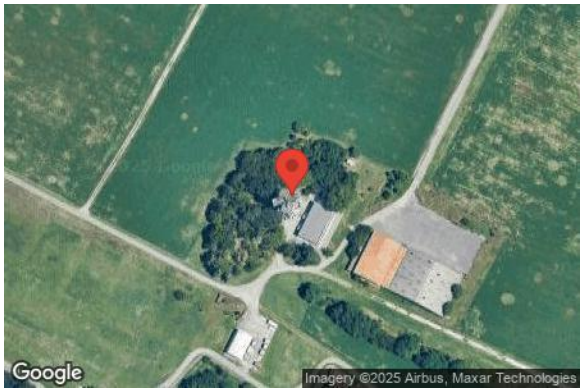


Point	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
Threshold	44.190354	12.083080	25.99	15.24	41.23
Two-mile	44.177798	12.119444	34.54	175.37	209.91

Discrete Observation Point Receptors

Name	ID	Latitude (°)	Longitude (°)	Elevation (m)	Height (m)
1-ATCT	1	44.191319	12.067526	31.00	22.00

Map image of 1-ATCT



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
PV array 2	25.0	180.0	13,189	219.8	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
Circuito Nord est	8,274	137.9	0	0.0
Circuito Sud ovest	1,930	32.2	0	0.0
Finale 12	2,985	49.8	0	0.0
Finale 30	0	0.0	0	0.0
1-ATCT	0	0.0	0	0.0

PV: PV array 2 low potential for temporary after-image

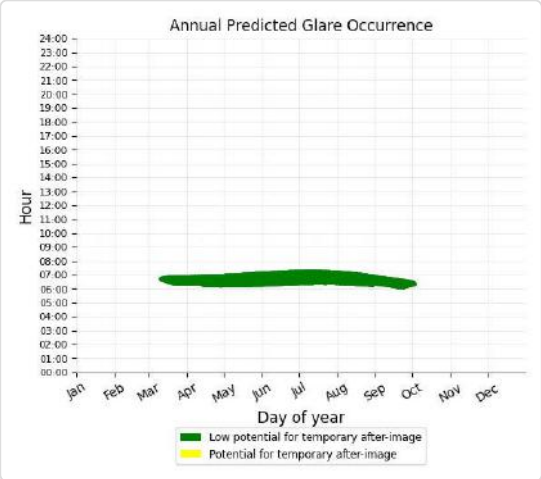
Receptor results ordered by category of glare

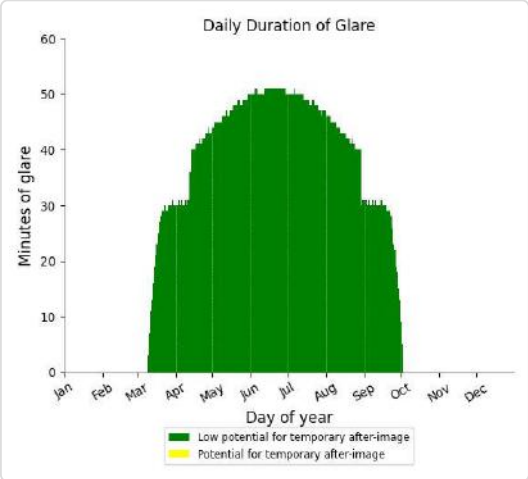
Receptor	Annual Green Glare		Annual Yellow Glare	
	min	hr	min	hr
Circuito Nord est	8,274	137.9	0	0.0
Circuito Sud ovest	1,930	32.2	0	0.0
Finale 12	2,985	49.8	0	0.0
Finale 30	0	0.0	0	0.0
1-ATCT	0	0.0	0	0.0

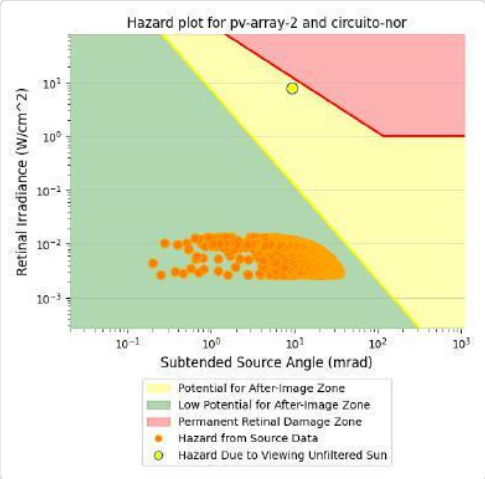
PV array 2 and Route: Circuito Nord est

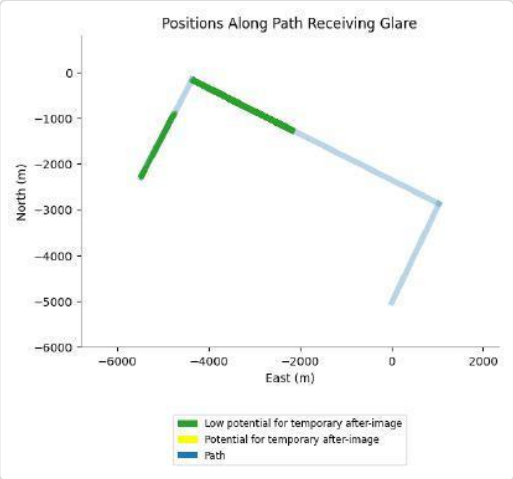
Yellow glare: none

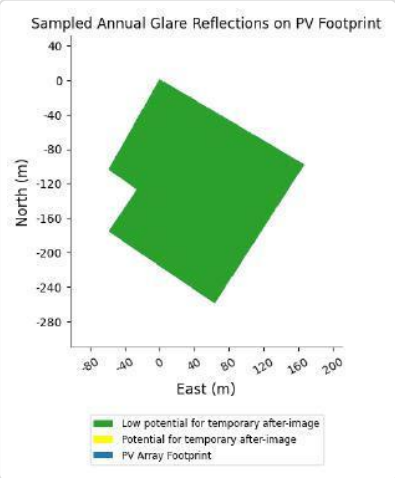
Green glare: 8,274 min.







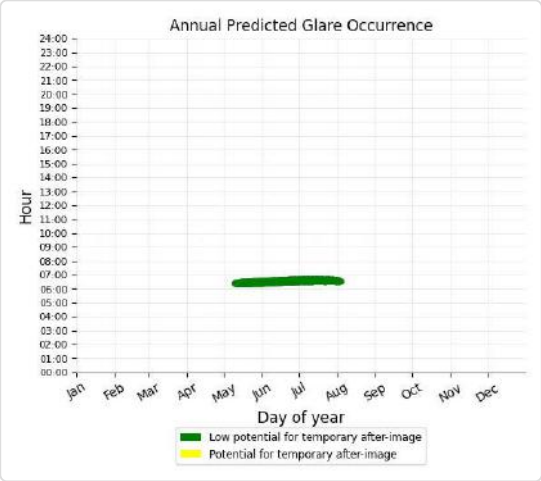


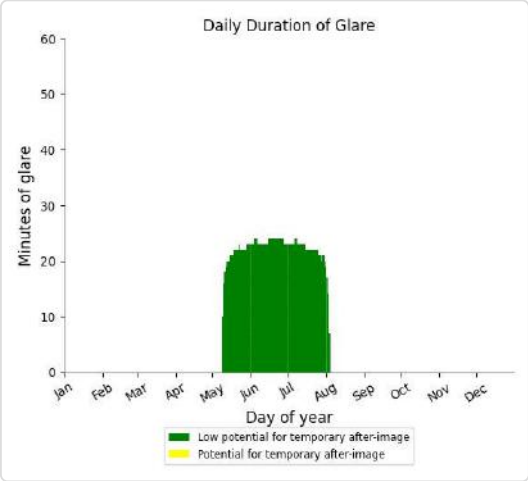


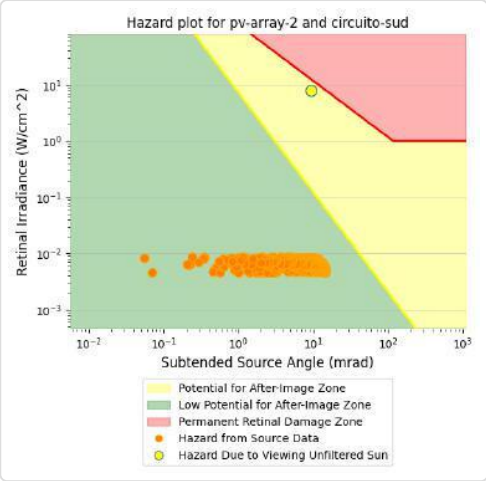
PV array 2 and Route: Circuito Sud ovest

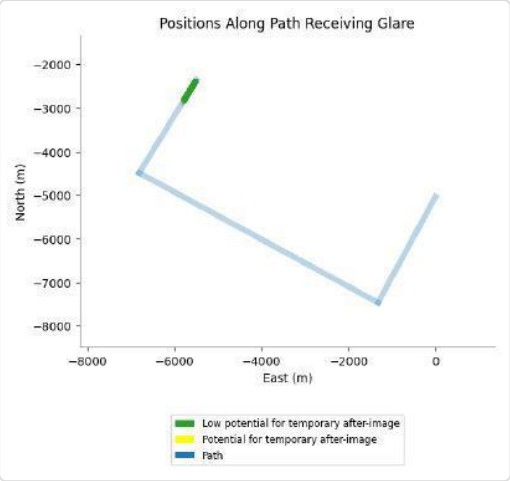
Yellow glare: none

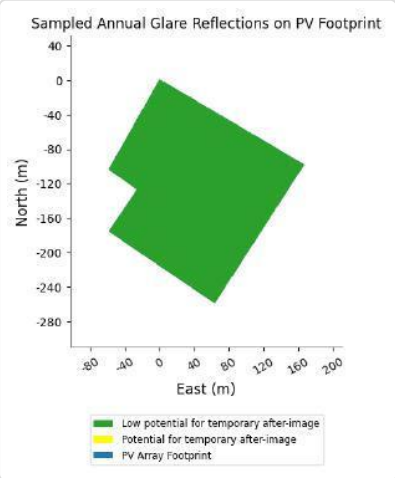
Green glare: 1,930 min.







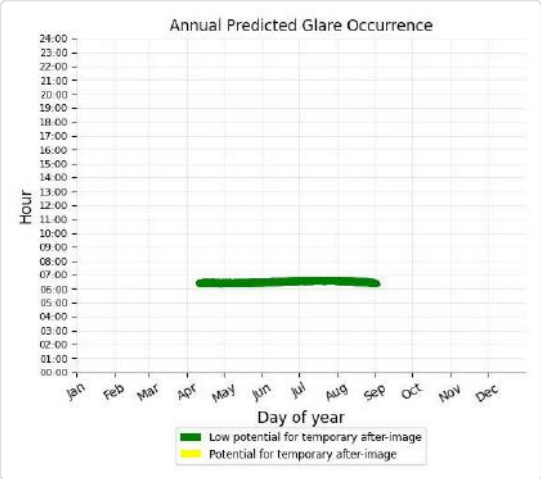


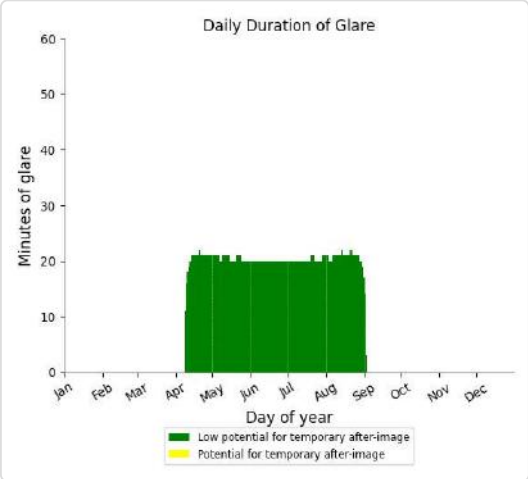


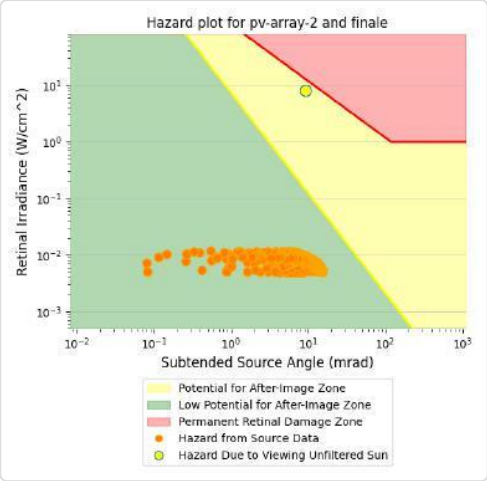
PV array 2 and FP: Finale 12

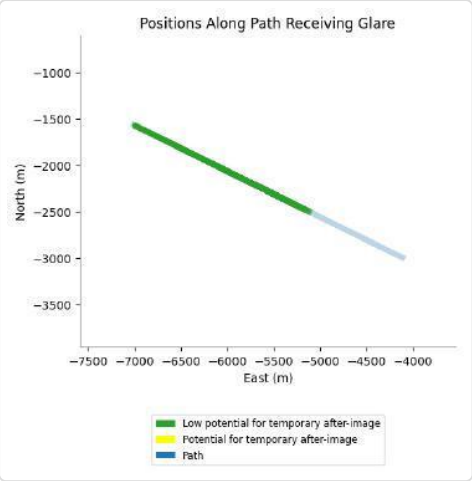
Yellow glare: none

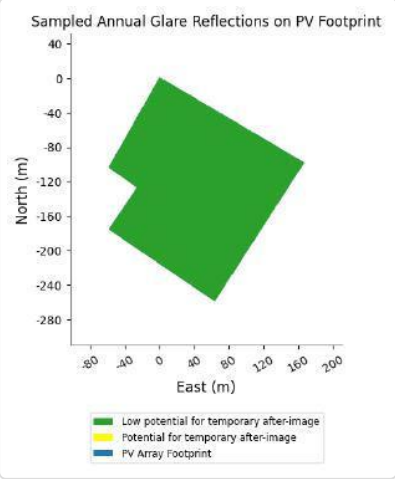
Green glare: 2,985 min.

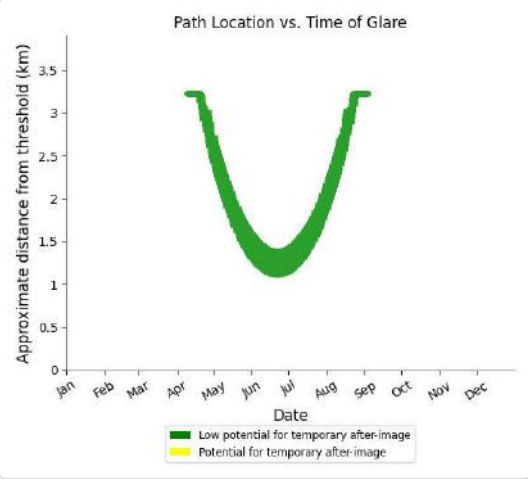












PV array 2 and FP: Finale 30

No glare found

PV array 2 and 1-ATCT

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

FORGESOLAR GLARE ANALYSIS

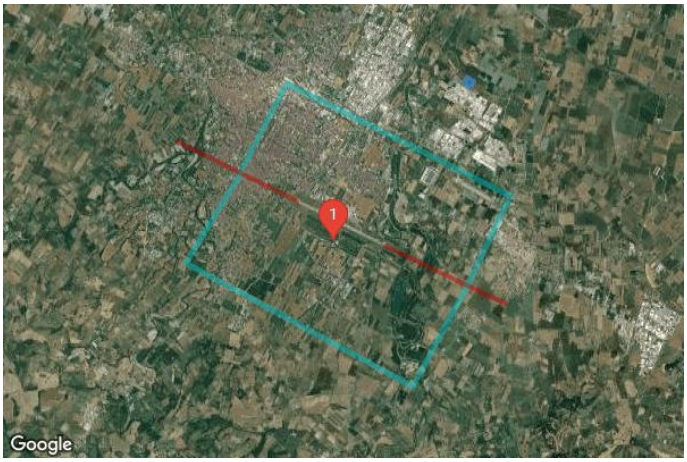
Project: **Via Rossellino Forlì**
Campo Fotovoltaico fisso a terra nei pressi del centro abitato di Forlì

Site configuration: **via Rossellino 2**

Client: CHIRON SPV 38

Created 08 Apr, 2025
Updated 08 Apr, 2025
Time-step 1 minute
Timezone offset UTC1
Minimum sun altitude 0.0 deg
DNI peaks at 1,000.0 W/m^2
Site ID 146222.23721

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



Glare Policy Adherence

The following table estimates the policy adherence of this glare analysis according to the **2021** U.S. Federal Aviation Administration Policy:

Review of Solar Energy System Projects on Federally-Obligated Airports

This policy may require the following criteria be met for solar energy systems on airport property:

- No glare of any kind for Air Traffic Control Tower(s) ("ATCT") at cab height.
- Default analysis and observer characteristics, including 1-minute time step.

ForgeSolar is not affiliated with the U.S. FAA and does not represent or speak officially for the U.S. FAA. ForgeSolar cannot approve or deny projects - results are informational only. Contact the relevant airport and FAA district office for information on policy and requirements.

COMPONENT	STATUS	DESCRIPTION
Analysis parameters	PASS	Analysis time interval and eye characteristics used are acceptable
ATCT(s)	PASS	Receptor(s) marked as ATCT do not receive glare

The referenced policy can be read at https://www.federalregister.gov/d/2021-09862

Component Data

This report includes results for PV arrays and Observation Point ("OP") receptors marked as ATCTs. Components that are not pertinent to the policy, such as routes, flight paths, and vertical surfaces, are excluded.

PV Arrays

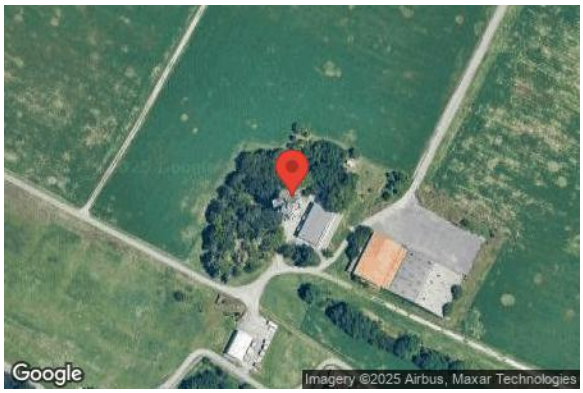
Name: PV array 2
Axis tracking: Fixed (no rotation)
Tilt: 25.0°
Orientation: 180.0°
Rated power: -
Panel material: Light textured glass with AR coating
Reflectivity: Vary with sun
Slope error: correlate with material

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
1	44.227053	12.107826	19.55	3.00	22.55
2	44.226123	12.107097	19.91	3.00	22.91
3	44.225912	12.107505	20.97	3.00	23.97
4	44.225475	12.107097	20.42	3.00	23.42
5	44.224731	12.108620	20.01	3.00	23.01
6	44.226169	12.109908	20.38	3.00	23.38

Observation Point ATCT Receptors

Name	ID	Latitude (°)	Longitude (°)	Elevation (m)	Height (m)
1-ATCT	1	44.191319	12.067526	31.00	22.00

Map image of 1-ATCT



Glare Analysis Results

Summary of Results No glare predicted

PV Array	Tilt	Orient	Annual Green Glare		Annual Yellow Glare		Energy
	°	°	min	hr	min	hr	kWh
PV array 2	25.0	180.0	0	0.0	0	0.0	-

Total annual 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
1-ATCT	0	0.0	0	0.0

PV: PV array 2

Receptor	Annual Green Glare		Annual Yellow Glare	
	min	hr	min	hr
1-ATCT	0	0.0	0	0.0

PV array 2 and 1-ATCT

Receptor type: ATCT Observation Point
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

FORGESOLAR GLARE ANALYSIS

Firmato digitalmente da: DEL CARLO IACOPO
Data: 09/04/2025 19:13:48

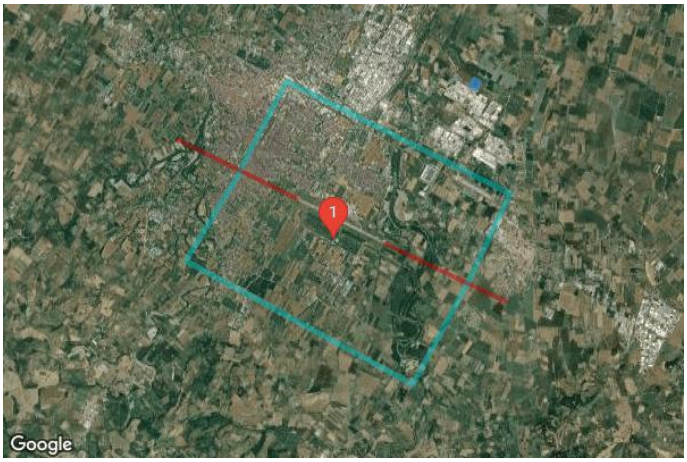
Project: **Via Rossellino Forlì**
Campo Fotovoltaico fisso a terra nei pressi del centro abitato di Forlì

Site configuration: **viaRossellino 3**

Client: CHIRON SPV 38

Created 08 Apr, 2025
Updated 08 Apr, 2025
Time-step 1 minute
Timezone offset UTC1
Minimum sun altitude 0.0 deg
DNI peaks at 1,000.0 W/m^2
Category 500 kW to 1 MW
(1,000 kW / 32,400 m^2 limit)
Site ID 146222.23721

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
	°	°	min	hr	min	hr	kWh
PV array 3	25.0	180.0	13,094	218.2	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
Circuito Nord est	8,192	136.5	0	0.0
Circuito Sud ovest	2,047	34.1	0	0.0
Finale 12	2,855	47.6	0	0.0
Finale 30	0	0.0	0	0.0
1-ATCT	0	0.0	0	0.0

Component Data

PV Arrays

Name: PV array 3
Axis tracking: Fixed (no rotation)
Tilt: 25.0°
Orientation: 180.0°
Rated power: -
Panel material: Light textured glass with AR coating
Reflectivity: Vary with sun
Slope error: correlate with material

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
1	44.226173	12.109971	20.53	3.00	23.53
2	44.224774	12.108662	20.14	3.00	23.14
3	44.223882	12.110443	21.10	3.00	24.10
4	44.225343	12.111709	20.58	3.00	23.58

Route Receptors

Name: Circuito Nord est
Path type: Two-way
Observer view angle: 50.0°

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
1	44.206394	12.039129	32.17	150.00	182.17
2	44.225587	12.053205	26.78	333.00	359.78
3	44.201226	12.120840	25.75	333.00	358.75
4	44.181778	12.107880	30.41	150.00	180.41

Name: Circuito Sud ovest
Path type: Two-way
Observer view angle: 50.0°

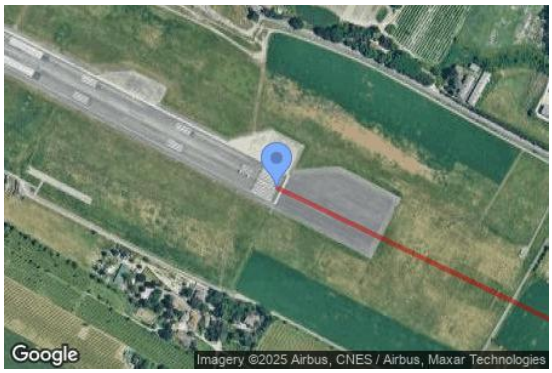
Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
1	44.205902	12.039129	32.74	150.00	182.74
2	44.186702	12.022650	50.10	333.00	383.10
3	44.159862	12.091314	31.26	333.00	364.26
4	44.181778	12.107837	30.38	150.00	180.38

Flight Path Receptors

Name: Finale 12
Description:
Threshold height: 15 m
Direction: 116.4°
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	44.200140	12.056294	29.57	15.24	44.81
Two-mile	44.212996	12.020128	35.02	178.47	213.50

Name: Finale 30
Description:
Threshold height: 15 m
Direction: 295.7°
Glide slope: 3.0°
Pilot view restricted? Yes
Vertical view: 30.0°
Azimuthal view: 50.0°

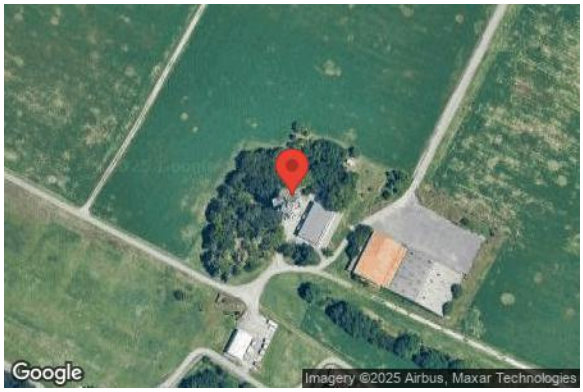


Point	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
Threshold	44.190354	12.083080	25.99	15.24	41.23
Two-mile	44.177798	12.119444	34.54	175.37	209.91

Discrete Observation Point Receptors

Name	ID	Latitude (°)	Longitude (°)	Elevation (m)	Height (m)
1-ATCT	1	44.191319	12.067526	31.00	22.00

Map image of 1-ATCT



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
PV array 3	25.0	180.0	13,094	218.2	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
Circuito Nord est	8,192	136.5	0	0.0
Circuito Sud ovest	2,047	34.1	0	0.0
Finale 12	2,855	47.6	0	0.0
Finale 30	0	0.0	0	0.0
1-ATCT	0	0.0	0	0.0

PV: PV array 3 low potential for temporary after-image

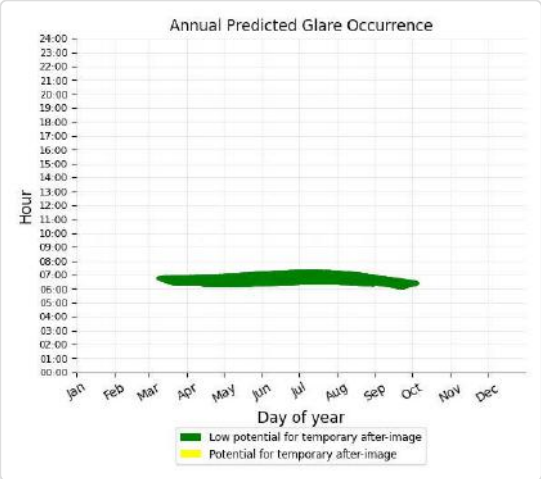
Receptor results ordered by category of glare

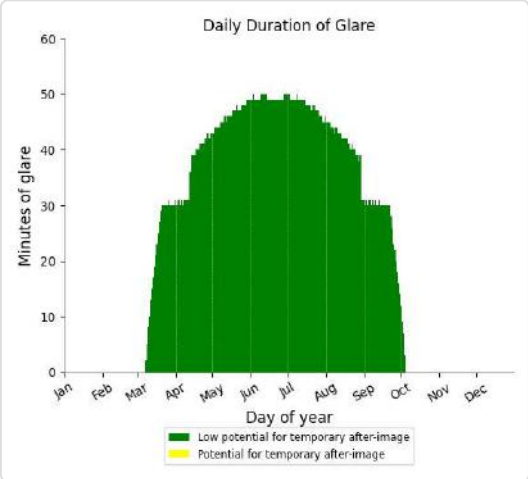
Receptor	Annual Green Glare		Annual Yellow Glare	
	min	hr	min	hr
Circuito Nord est	8,192	136.5	0	0.0
Circuito Sud ovest	2,047	34.1	0	0.0
Finale 12	2,855	47.6	0	0.0
Finale 30	0	0.0	0	0.0
1-ATCT	0	0.0	0	0.0

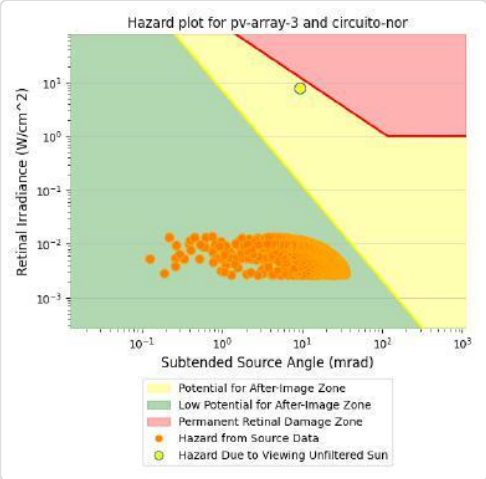
PV array 3 and Route: Circuito Nord est

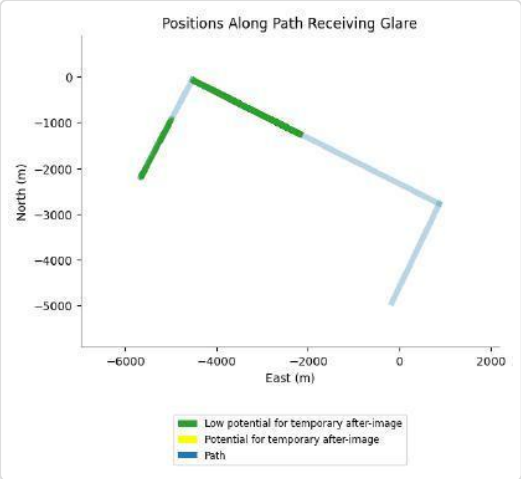
Yellow glare: none

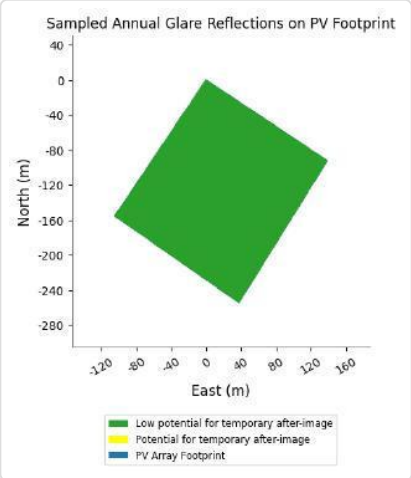
Green glare: 8,192 min.







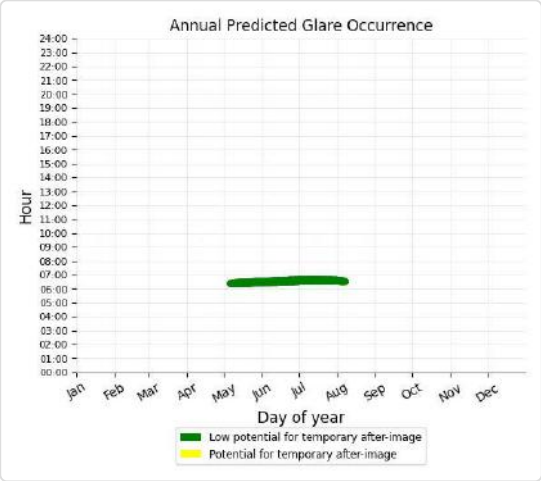


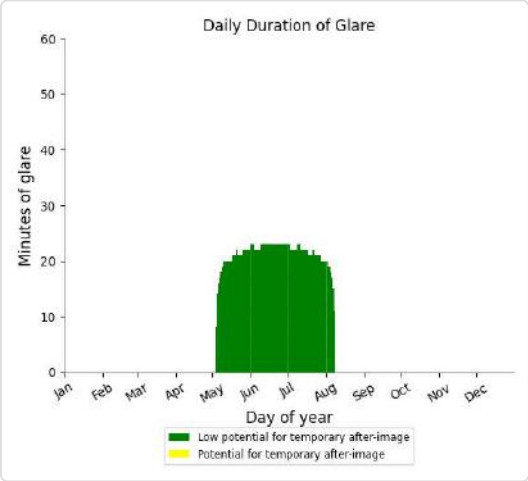


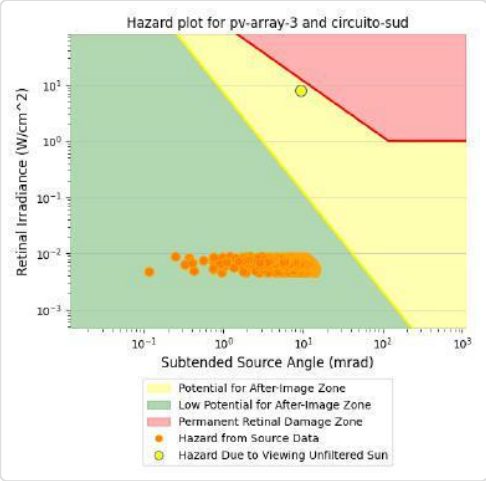
PV array 3 and Route: Circuito Sud ovest

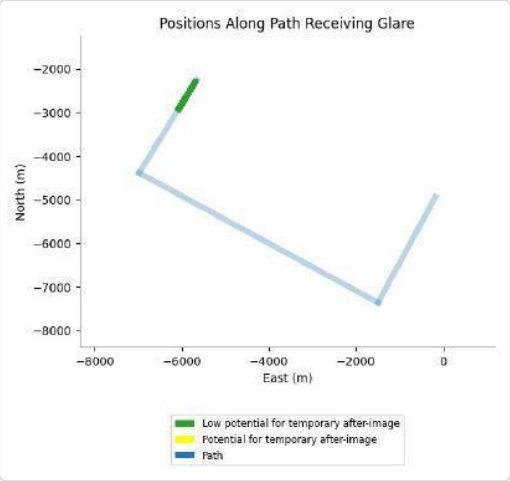
Yellow glare: none

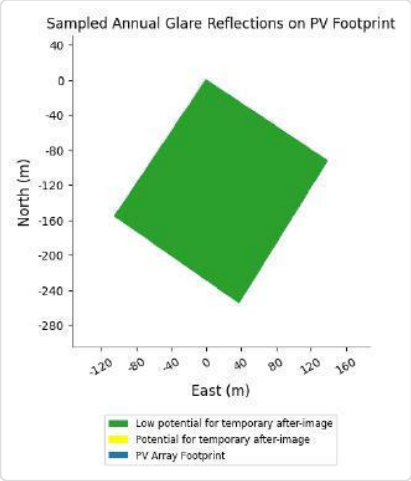
Green glare: 2,047 min.







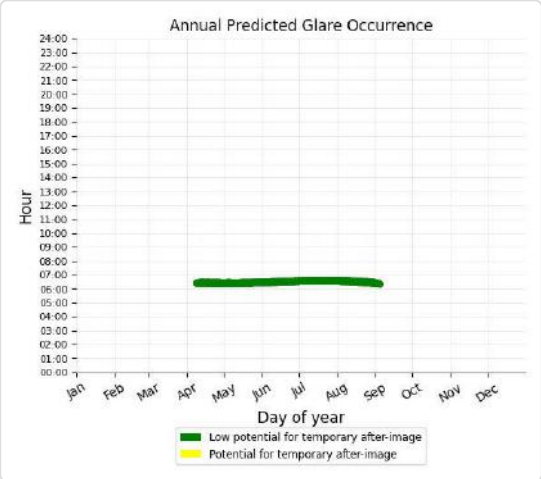


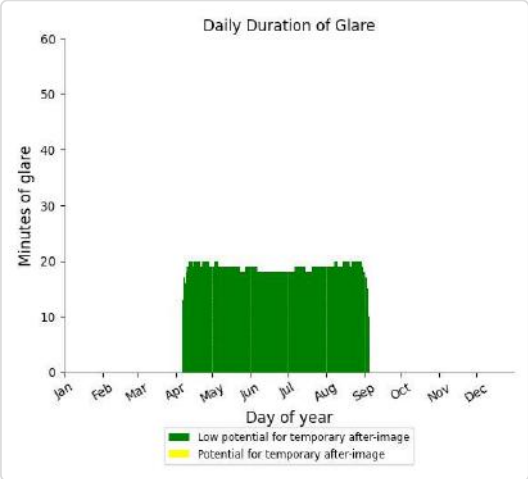


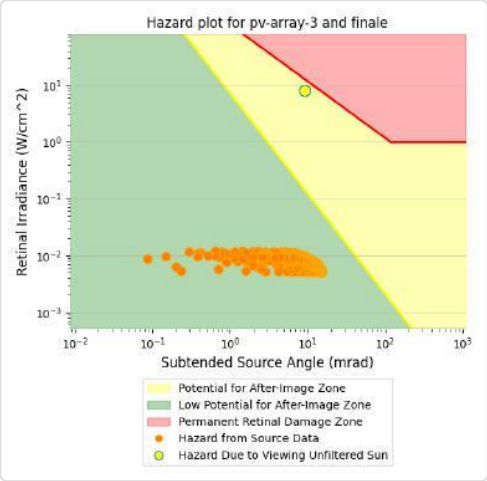
PV array 3 and FP: Finale 12

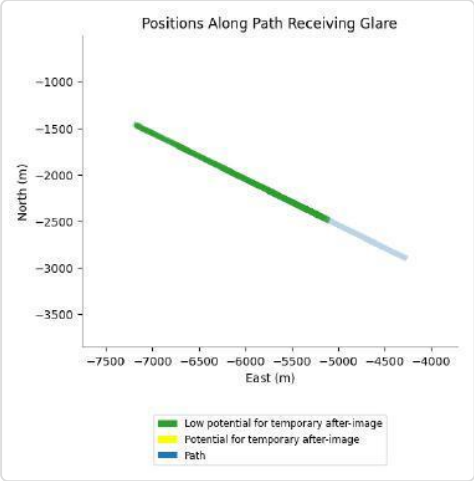
Yellow glare: none

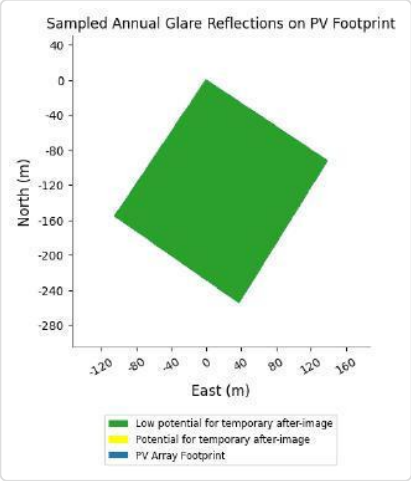
Green glare: 2,855 min.

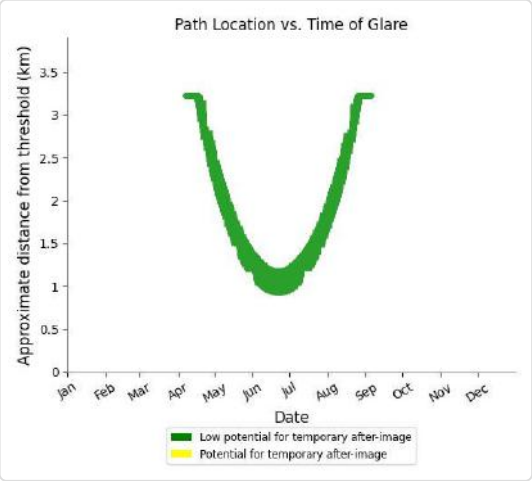












PV array 3 and FP: Finale 30

No glare found

PV array 3 and 1-ATCT

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

FORGESOLAR GLARE ANALYSIS

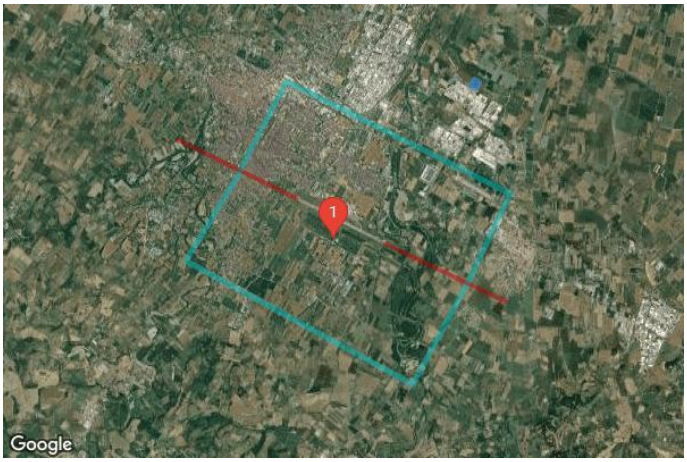
Project: **Via Rossellino Forlì**
Campo Fotovoltaico fisso a terra nei pressi del centro abitato di Forlì

Site configuration: **via Rossellino 3**

Client: CHIRON SPV 38

Created 08 Apr, 2025
Updated 08 Apr, 2025
Time-step 1 minute
Timezone offset UTC1
Minimum sun altitude 0.0 deg
DNI peaks at 1,000.0 W/m^2
Site ID 146222.23721

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



Glare Policy Adherence

The following table estimates the policy adherence of this glare analysis according to the **2021** U.S. Federal Aviation Administration Policy:

Review of Solar Energy System Projects on Federally-Obligated Airports

This policy may require the following criteria be met for solar energy systems on airport property:

- No glare of any kind for Air Traffic Control Tower(s) ("ATCT") at cab height.
- Default analysis and observer characteristics, including 1-minute time step.

ForgeSolar is not affiliated with the U.S. FAA and does not represent or speak officially for the U.S. FAA. ForgeSolar cannot approve or deny projects - results are informational only. Contact the relevant airport and FAA district office for information on policy and requirements.

COMPONENT	STATUS	DESCRIPTION
Analysis parameters	PASS	Analysis time interval and eye characteristics used are acceptable
ATCT(s)	PASS	Receptor(s) marked as ATCT do not receive glare

The referenced policy can be read at https://www.federalregister.gov/d/2021-09862

Component Data

This report includes results for PV arrays and Observation Point ("OP") receptors marked as ATCTs. Components that are not pertinent to the policy, such as routes, flight paths, and vertical surfaces, are excluded.

PV Arrays

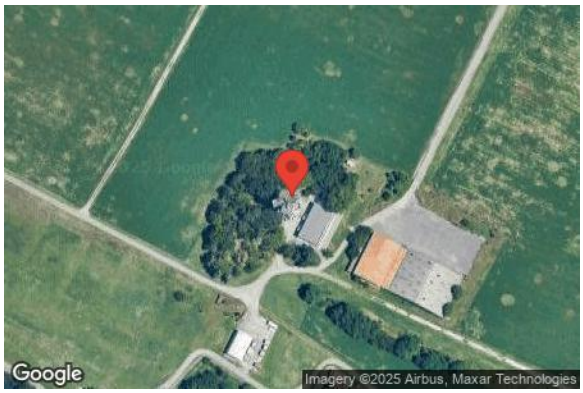
Name: PV array 3
Axis tracking: Fixed (no rotation)
Tilt: 25.0°
Orientation: 180.0°
Rated power: -
Panel material: Light textured glass with AR coating
Reflectivity: Vary with sun
Slope error: correlate with material

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
1	44.226173	12.109971	20.53	3.00	23.53
2	44.224774	12.108662	20.14	3.00	23.14
3	44.223882	12.110443	21.10	3.00	24.10
4	44.225343	12.111709	20.58	3.00	23.58

Observation Point ATCT Receptors

Name	ID	Latitude (°)	Longitude (°)	Elevation (m)	Height (m)
1-ATCT	1	44.191319	12.067526	31.00	22.00

Map image of 1-ATCT



Glare Analysis Results

Summary of Results No glare predicted

PV Array	Tilt	Orient	Annual Green Glare		Annual Yellow Glare		Energy
	°	°	min	hr	min	hr	kWh
PV array 3	25.0	180.0	0	0.0	0	0.0	-

Total annual 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
1-ATCT	0	0.0	0	0.0

PV: PV array 3

Receptor	Annual Green Glare		Annual Yellow Glare	
	min	hr	min	hr
1-ATCT	0	0.0	0	0.0

PV array 3 and 1-ATCT

Receptor type: ATCT Observation Point
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

FORGESOLAR GLARE ANALYSIS

Project: Via Rossellino Forlì
Campo Fotovoltaico fisso a terra nei pressi del centro abitato di Forlì

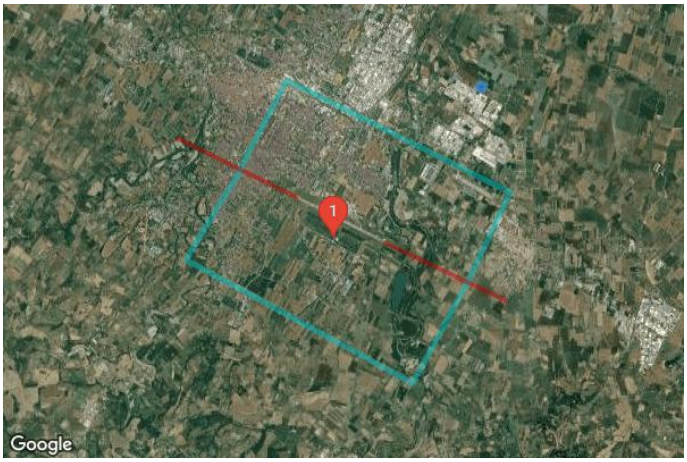
Site configuration: Via Rossellino 4

Firmato digitalmente da: DEL CARLO IACOPO
Data: 09/04/2025 19:13:43

Client: CHIRON SPV .38

Created 08 Apr, 2025
Updated 08 Apr, 2025
Time-step 1 minute
Timezone offset UTC1
Minimum sun altitude 0.0 deg
DNI peaks at 1,000.0 W/m^2
Category 500 kW to 1 MW
(1,000 kW / 32,400 m^2 limit)
Site ID 146225.23721

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
	°	°	min	hr	min	hr	kWh
PV array 4	25.0	180.0	12,998	216.6	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
Circuito Nord est	7,876	131.3	0	0.0
Circuito Sud ovest	2,253	37.5	0	0.0
Finale 12	2,869	47.8	0	0.0
Finale 30	0	0.0	0	0.0
1-ATCT	0	0.0	0	0.0

Component Data

PV Arrays

Name: PV array 4
Axis tracking: Fixed (no rotation)
Tilt: 25.0°
Orientation: 180.0°
Rated power: -
Panel material: Light textured glass with AR coating
Reflectivity: Vary with sun
Slope error: correlate with material

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
1	44.225298	12.111687	20.73	3.00	23.73
2	44.223853	12.110432	21.04	3.00	24.04
3	44.223153	12.111762	20.91	3.00	23.91
4	44.223607	12.112170	21.70	3.00	24.70
5	44.223361	12.112792	21.15	3.00	24.15
6	44.224383	12.113565	21.09	3.00	24.09

Route Receptors

Name: Circuito Nord est
Path type: Two-way
Observer view angle: 50.0°

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
1	44.206394	12.039129	32.17	150.00	182.17
2	44.225587	12.053205	26.78	333.00	359.78
3	44.201226	12.120840	25.75	333.00	358.75
4	44.181778	12.107880	30.41	150.00	180.41

Name: Circuito Sud ovest
Path type: Two-way
Observer view angle: 50.0°

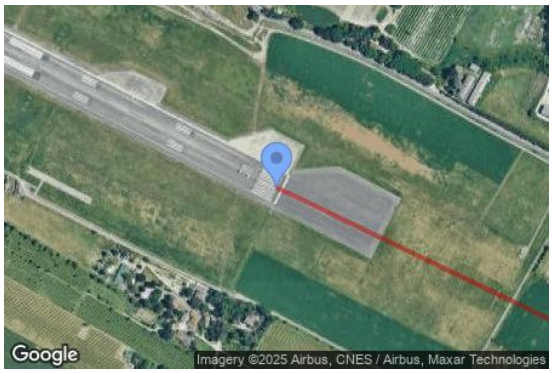
Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
1	44.205902	12.039129	32.74	150.00	182.74
2	44.186702	12.022650	50.10	333.00	383.10
3	44.159862	12.091314	31.26	333.00	364.26
4	44.181778	12.107837	30.38	150.00	180.38

Flight Path Receptors

Name: Finale 12
Description:
Threshold height: 15 m
Direction: 116.4°
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	44.200140	12.056294	29.57	15.24	44.81
Two-mile	44.212996	12.020128	35.02	178.47	213.50

Name: Finale 30
Description:
Threshold height: 15 m
Direction: 295.7°
Glide slope: 3.0°
Pilot view restricted? Yes
Vertical view: 30.0°
Azimuthal view: 50.0°

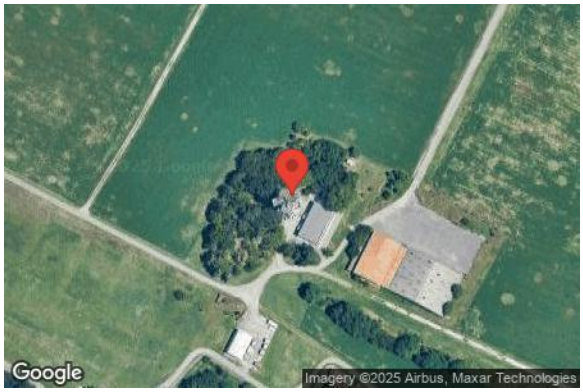


Point	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
Threshold	44.190354	12.083080	25.99	15.24	41.23
Two-mile	44.177798	12.119444	34.54	175.37	209.91

Discrete Observation Point Receptors

Name	ID	Latitude (°)	Longitude (°)	Elevation (m)	Height (m)
1-ATCT	1	44.191319	12.067526	31.00	22.00

Map image of 1-ATCT



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
PV array 4	25.0	180.0	12,998	216.6	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
Circuito Nord est	7,876	131.3	0	0.0
Circuito Sud ovest	2,253	37.5	0	0.0
Finale 12	2,869	47.8	0	0.0
Finale 30	0	0.0	0	0.0
1-ATCT	0	0.0	0	0.0

PV: PV array 4 low potential for temporary after-image

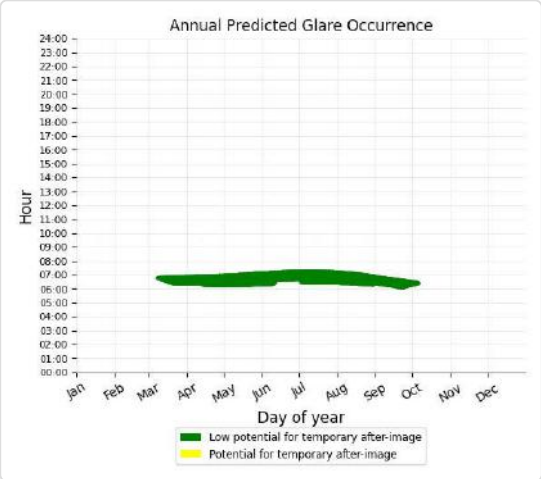
Receptor results ordered by category of glare

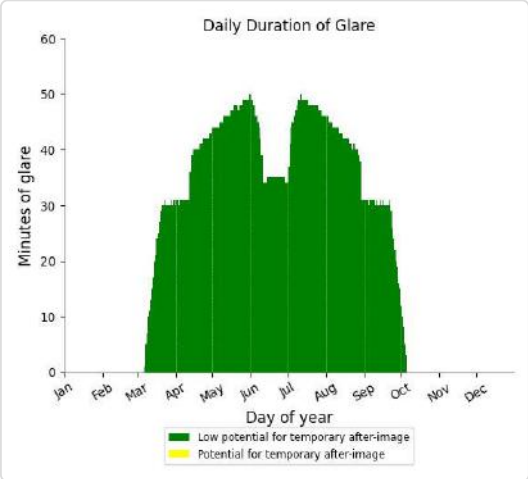
Receptor	Annual Green Glare		Annual Yellow Glare	
	min	hr	min	hr
Circuito Nord est	7,876	131.3	0	0.0
Circuito Sud ovest	2,253	37.5	0	0.0
Finale 12	2,869	47.8	0	0.0
Finale 30	0	0.0	0	0.0
1-ATCT	0	0.0	0	0.0

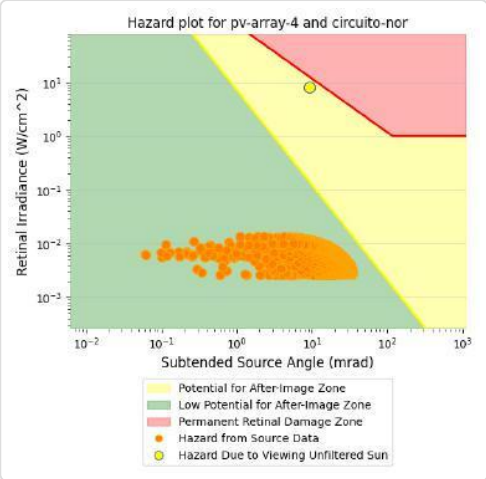
PV array 4 and Route: Circuito Nord est

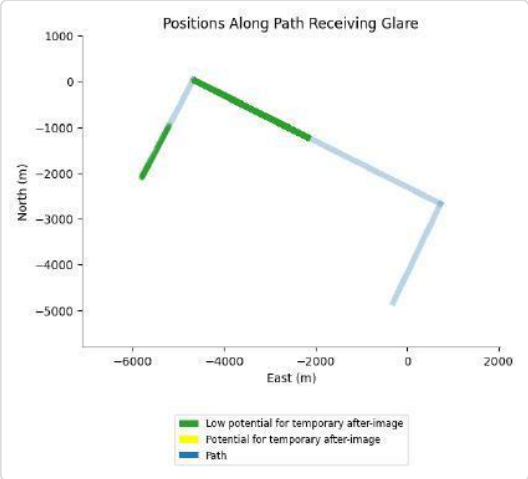
Yellow glare: none

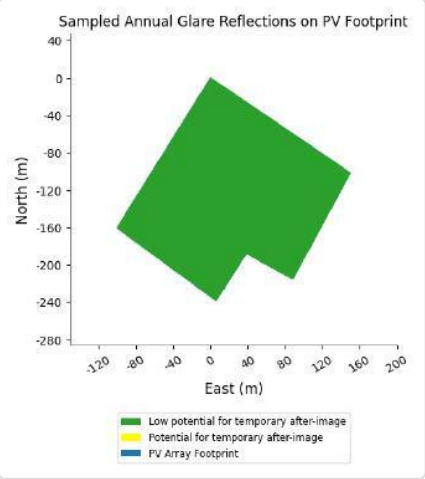
Green glare: 7,876 min.







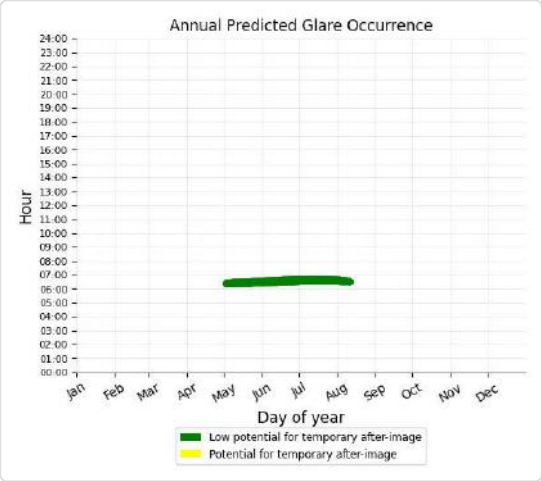


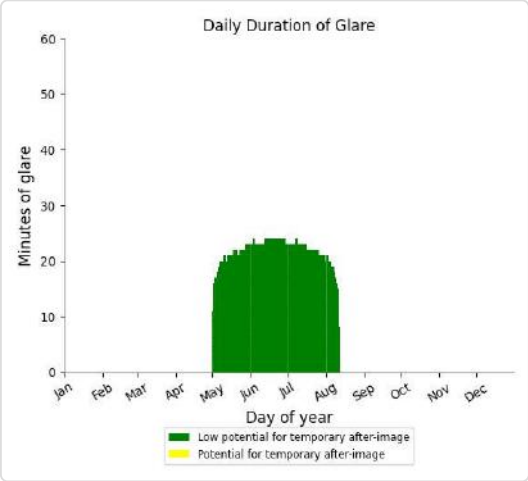


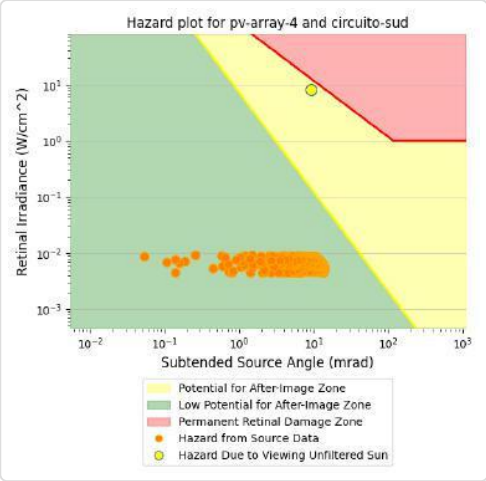
PV array 4 and Route: Circuito Sud ovest

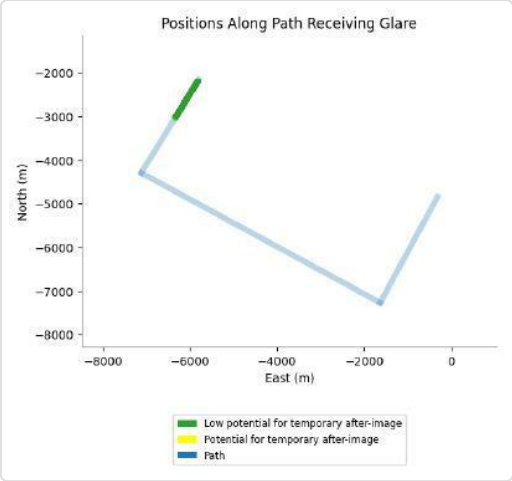
Yellow glare: none

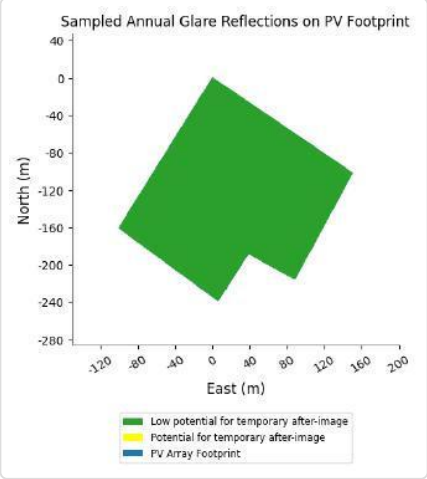
Green glare: 2,253 min.







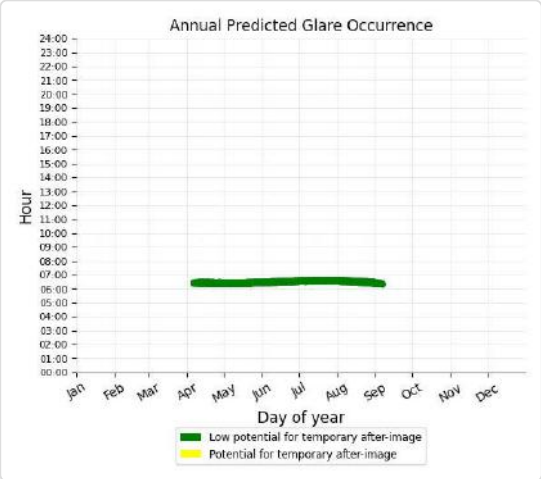


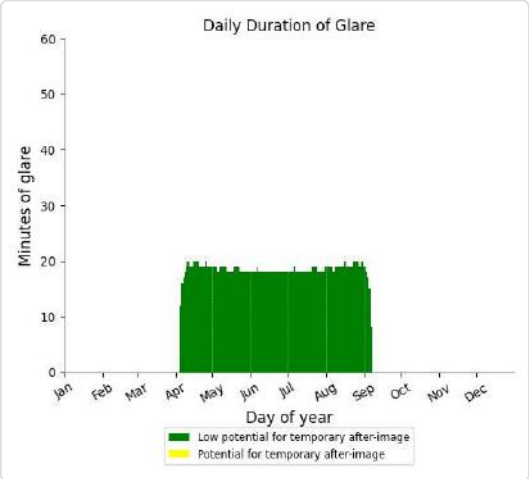


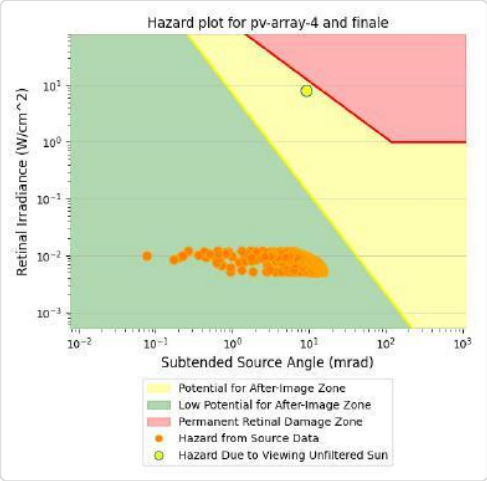
PV array 4 and FP: Finale 12

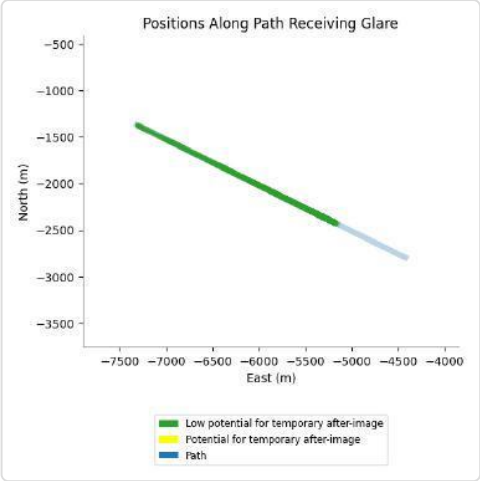
Yellow glare: none

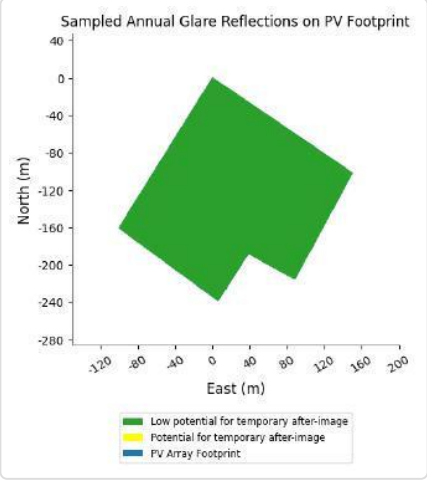
Green glare: 2,869 min.

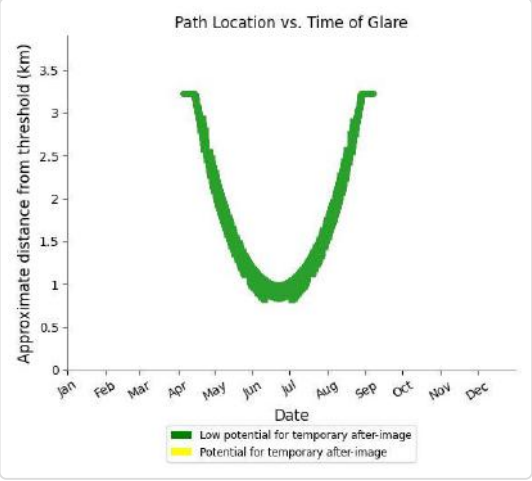












PV array 4 and FP: Finale 30

No glare found

PV array 4 and 1-ATCT

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

FORGESOLAR GLARE ANALYSIS

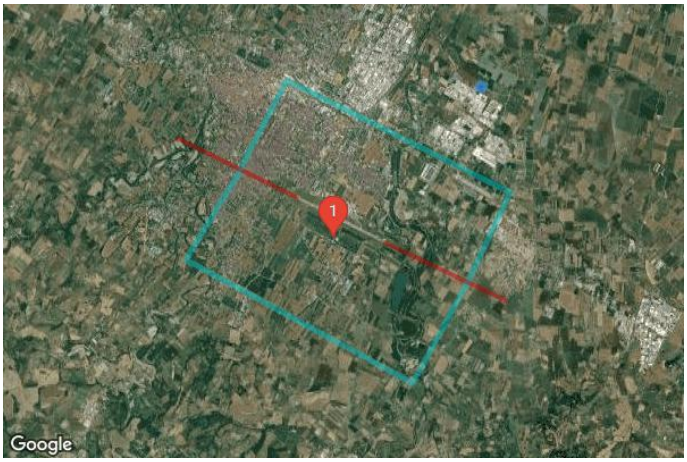
Project: **ViaRossellino Forlì**
Campo Fotovoltaico fisso a terra nei pressi del centro abitato di Forlì

Site configuration: **Via Rossellino 4**

Client: CHIRON SPV 38

Created 08 Apr, 2025
Updated 08 Apr, 2025
Time-step 1 minute
Timezone offset UTC1
Minimum sun altitude 0.0 deg
DNI peaks at 1,000.0 W/m^2
Site ID 146225.23721

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



Glare Policy Adherence

The following table estimates the policy adherence of this glare analysis according to the **2021** U.S. Federal Aviation Administration Policy:

Review of Solar Energy System Projects on Federally-Obligated Airports

This policy may require the following criteria be met for solar energy systems on airport property:

- No glare of any kind for Air Traffic Control Tower(s) ("ATCT") at cab height.
- Default analysis and observer characteristics, including 1-minute time step.

ForgeSolar is not affiliated with the U.S. FAA and does not represent or speak officially for the U.S. FAA. ForgeSolar cannot approve or deny projects - results are informational only. Contact the relevant airport and FAA district office for information on policy and requirements.

COMPONENT	STATUS	DESCRIPTION
Analysis parameters	PASS	Analysis time interval and eye characteristics used are acceptable
ATCT(s)	PASS	Receptor(s) marked as ATCT do not receive glare

The referenced policy can be read at https://www.federalregister.gov/d/2021-09862

Component Data

This report includes results for PV arrays and Observation Point ("OP") receptors marked as ATCTs. Components that are not pertinent to the policy, such as routes, flight paths, and vertical surfaces, are excluded.

PV Arrays

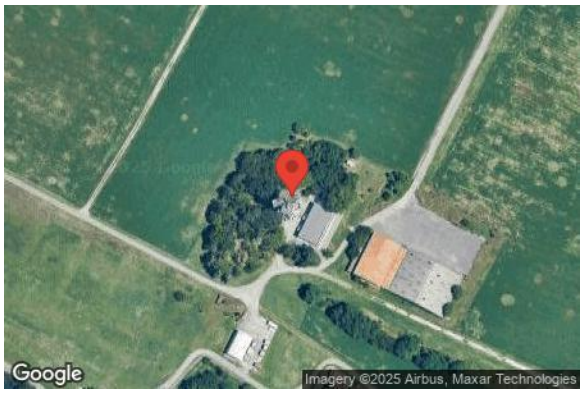
Name: PV array 4
Axis tracking: Fixed (no rotation)
Tilt: 25.0°
Orientation: 180.0°
Rated power: -
Panel material: Light textured glass with AR coating
Reflectivity: Vary with sun
Slope error: correlate with material

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
1	44.225298	12.111687	20.73	3.00	23.73
2	44.223853	12.110432	21.04	3.00	24.04
3	44.223153	12.111762	20.91	3.00	23.91
4	44.223607	12.112170	21.70	3.00	24.70
5	44.223361	12.112792	21.15	3.00	24.15
6	44.224383	12.113565	21.09	3.00	24.09

Observation Point ATCT Receptors

Name	ID	Latitude (°)	Longitude (°)	Elevation (m)	Height (m)
1-ATCT	1	44.191319	12.067526	31.00	22.00

Map image of 1-ATCT



Glare Analysis Results

Summary of Results No glare predicted

PV Array	Tilt	Orient	Annual Green Glare		Annual Yellow Glare		Energy
	°	°	min	hr	min	hr	kWh
PV array 4	25.0	180.0	0	0.0	0	0.0	-

Total annual 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
1-ATCT	0	0.0	0	0.0

PV: PV array 4

Receptor	Annual Green Glare		Annual Yellow Glare	
	min	hr	min	hr
1-ATCT	0	0.0	0	0.0

PV array 4 and 1-ATCT

Receptor type: ATCT Observation Point
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