

ISTANZA VIA
Presentata al
Ministero della Transizione Ecologica
e al Ministero della Cultura
(art. 23 del D. Lgs 152/2006 e ss. mm. ii)

PROGETTO

IMPIANTO FOTOVOLTAICO A TERRA (AGRIVOLTAICO)
COLLEGATO ALLA RTN
POTENZA NOMINALE (DC) 14,26 MWp
POTENZA IN IMMISSIONE (AC) 13,6 MW
Comune di Butera (CL)

CALCOLO DI PRODUCIBILITA'

22-00073-IT-BUTERA_PI-R02

PROPONENTE:

TEP RENEWABLES (BUTERA PV) S.R.L.
Viale Shakespeare, 71 00144 – Roma
P. IVA e C.F. 16627641000 – REA RM - 1666510

PROGETTISTA:

ING. VALENTINA CASALINI
Iscritta all' Ordine degli Ingegneri della Provincia di Pisa al n. 2940 B-91

Data	Rev.	Tipo revisione	Redatto	Verificato	Approvato
07/2022	0	Prima Emissione	P.Farenti	P.Farenti	G.Calzolari

PVsyst - Simulation report

Grid-Connected System

Project: Butera - Progeco - REV5

Variant: Nuova variante di simulazione

Tracking system with backtracking

System power: 14.26 MWp

Butera - Progeco - Italy

Author

Farenti Srl (Italy)

**PVsyst V7.2.17**

VC0, Simulation date:
05/08/22 16:39
with v7.2.17

Project summary

Geographical Site Butera - Progeco Italy	Situation Latitude 37.19 °N Longitude 14.22 °E Altitude 352 m Time zone UTC	Project settings Albedo 0.20
Meteo data Butera - Progeco PVGIS api TMY		

System summary

Grid-Connected System	Tracking system with backtracking		Near Shadings Linear shadings
PV Field Orientation Orientation Tracking plane, horizontal N-S axis Axis azimuth 0 °	Tracking algorithm Astronomic calculation Backtracking activated		
System information PV Array Nb. of modules 23568 units Pnom total 14.26 MWp	Inverters Nb. of units 4 units Pnom total 13.75 MWac Grid power limit 13.60 MWac Grid lim. Pnom ratio 1.048		
User's needs Unlimited load (grid)			

Results summary

Produced Energy	32 GWh/year	Specific production	2228 kWh/kWp/year	Perf. Ratio PR	93.60 %
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General parameters**Grid-Connected System****PV Field Orientation****Orientation**

Tracking plane, horizontal N-S axis
Axis azimuth 0 °

Models used

Transposition Perez
Diffuse Imported
Circumsolar separate

Horizon

Free Horizon

Bifacial system

Model 2D Calculation
unlimited trackers

Bifacial model geometry

Tracker Spacing 9.50 m
Tracker width 5.34 m
GCR 56.2 %
Axis height above ground 2.30 m

Grid power limitation

Active Power 13.60 MWac
Pnom ratio 1.048

Tracking system with backtracking**Tracking algorithm**

Astronomic calculation
Backtracking activated

Near Shadings

Linear shadings

Backtracking array

Nb. of trackers 982 units

Sizes

Tracker Spacing 9.50 m
Collector width 5.34 m
Ground Cov. Ratio (GCR) 56.2 %
Phi min / max. +/- 55.0 °

Backtracking strategy

Phi limits +/- 55.7 °
Backtracking pitch 9.50 m
Backtracking width 5.34 m

User's needs

Unlimited load (grid)

Bifacial model definitions

Ground albedo 0.25
Bifaciality factor 80 %
Rear shading factor 4.0 %
Rear mismatch loss 1.0 %
Shed transparent fraction 1.3 %

PV Array Characteristics**PV module**

Manufacturer JA Solar
Model JAM78-D30-605-MB
(Custom parameters definition)

Unit Nom. Power 605 Wp
Number of PV modules 23568 units
Nominal (STC) 14.26 MWp
Modules 982 Strings x 24 In series

At operating cond. (50°C)

Pmpp 13.93 MWp
U mpp 985 V
I mpp 14138 A

Total PV power

Nominal (STC) 14259 kWp
Total 23568 modules
Module area 66040 m²

Inverter

Manufacturer Sungrow
Model SG3400-HV-20
(Original PVsyst database)

Unit Nom. Power 3437 kWac
Number of inverters 4 units
Total power 13748 kWac
Operating voltage 875-1300 V
Max. power (=>25°C) 3593 kWac
Pnom ratio (DC:AC) 1.04

Total inverter power

Total power 13748 kWac
Number of inverters 4 units
Pnom ratio 1.04



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Array losses

Array Soiling Losses

Loss Fraction 2.0 %

Thermal Loss factor

Module temperature according to irradiance

Uc (const) 31.3 W/m²K

Uv (wind) 2.3 W/m²K/m/s

DC wiring losses

Global array res. 0.40 mΩ

Loss Fraction 0.5 % at STC

LID - Light Induced Degradation

Loss Fraction 2.0 %

Module Quality Loss

Loss Fraction -0.8 %

Module mismatch losses

Loss Fraction 2.0 % at MPP

Strings Mismatch loss

Loss Fraction 0.1 %

IAM loss factor

Incidence effect (IAM): Fresnel smooth glass, n = 1.526

0°	30°	50°	60°	70°	75°	80°	85°	90°
1.000	0.998	0.981	0.948	0.862	0.776	0.636	0.403	0.000

System losses

Unavailability of the system

Time fraction 2.0 %
7.3 days,
3 periods

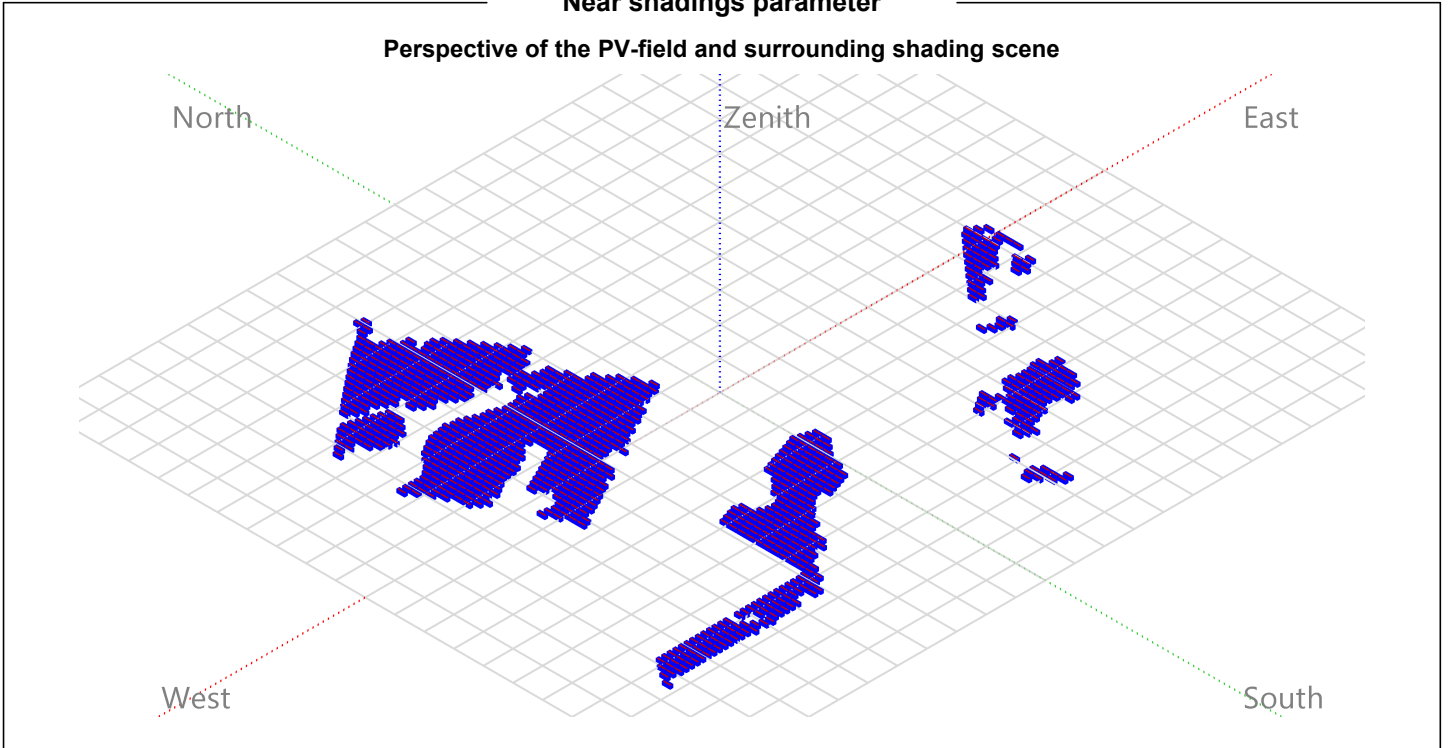


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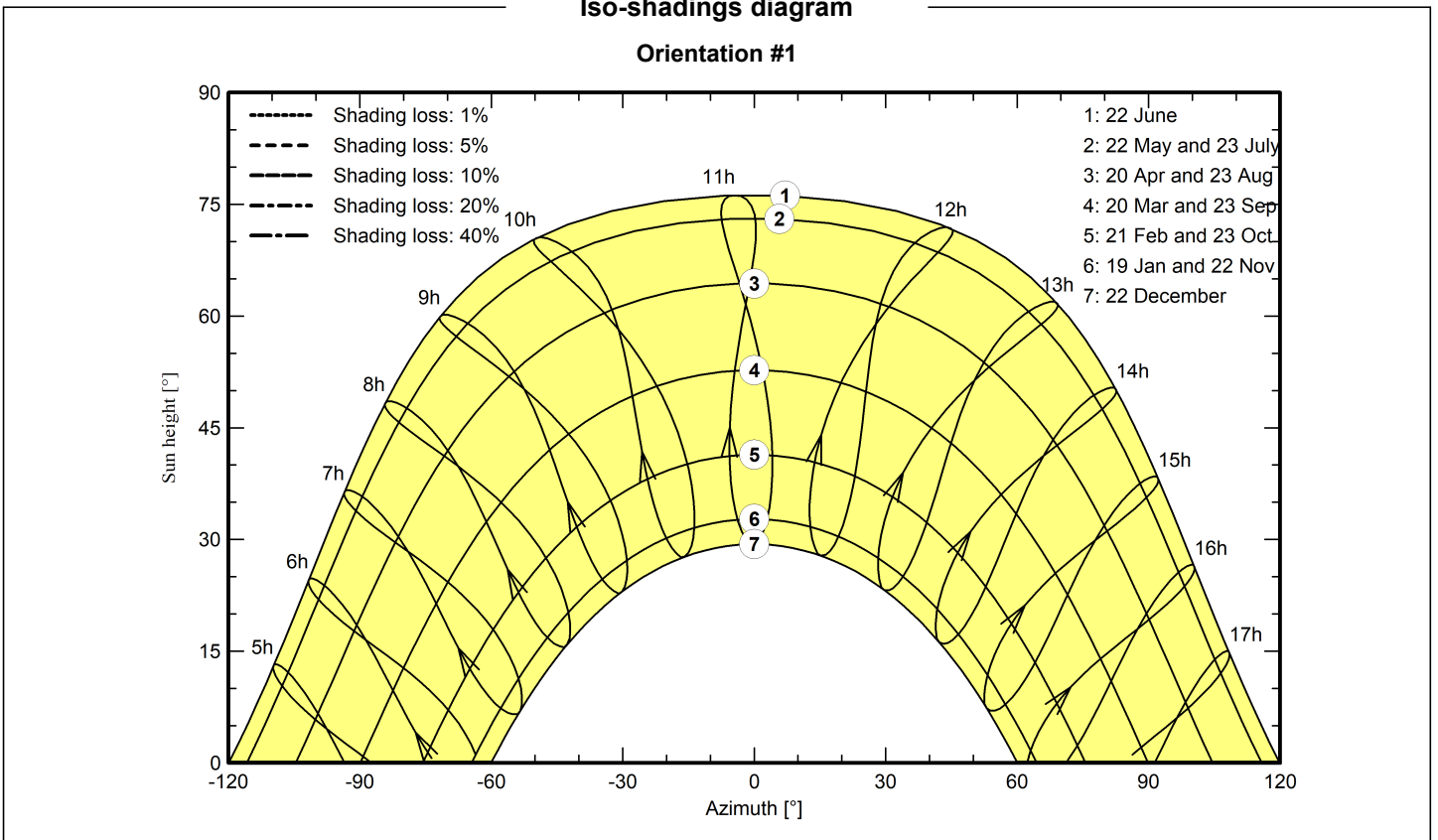
Near shadings parameter

Perspective of the PV-field and surrounding shading scene



Iso-shadings diagram

Orientation #1



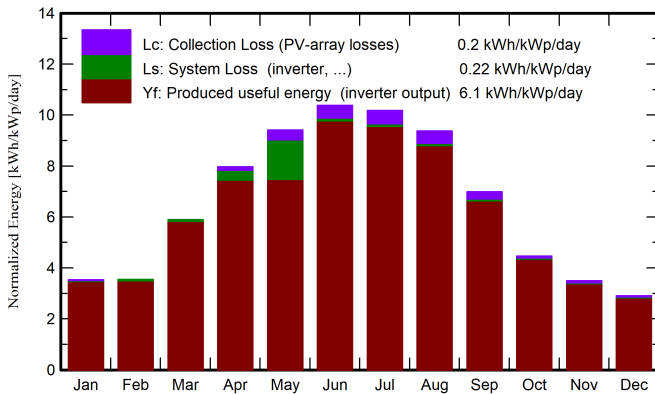


Main results

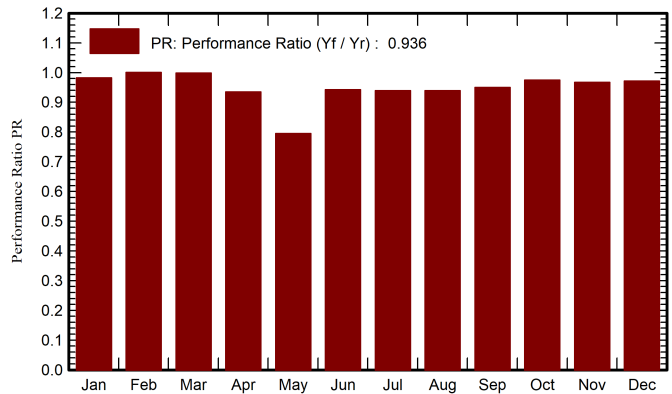
System Production

Produced Energy 32 GWh/year Specific production 2228 kWh/kWp/year
Performance Ratio PR 93.60 %

Normalized productions (per installed kWp)



Performance Ratio PR



Balances and main results

	GlobHor kWh/m ²	DiffHor kWh/m ²	T_Amb °C	GlobInc kWh/m ²	GlobEff kWh/m ²	EArray GWh	E_Grid GWh	PR ratio
January	85.6	31.15	10.63	109.5	101.4	1.553	1.535	0.983
February	80.3	38.81	11.02	97.9	91.6	1.415	1.397	1.001
March	144.4	58.18	12.16	181.2	171.8	2.608	2.579	0.998
April	191.6	61.06	17.14	239.2	229.2	3.358	3.188	0.935
May	233.1	62.13	19.63	291.7	280.5	3.996	3.307	0.795
June	246.6	60.15	22.55	311.5	299.8	4.229	4.185	0.942
July	249.2	56.74	25.73	315.6	303.8	4.272	4.227	0.940
August	228.6	54.14	25.90	290.8	279.5	3.933	3.892	0.939
September	166.4	49.60	24.08	209.8	200.7	2.873	2.842	0.950
October	112.8	48.29	18.70	138.3	130.5	1.944	1.922	0.974
November	83.1	33.57	17.01	104.9	97.4	1.463	1.446	0.967
December	72.4	32.28	13.50	90.2	82.7	1.266	1.250	0.972
Year	1894.0	586.10	18.21	2380.7	2269.0	32.910	31.771	0.936

Legends

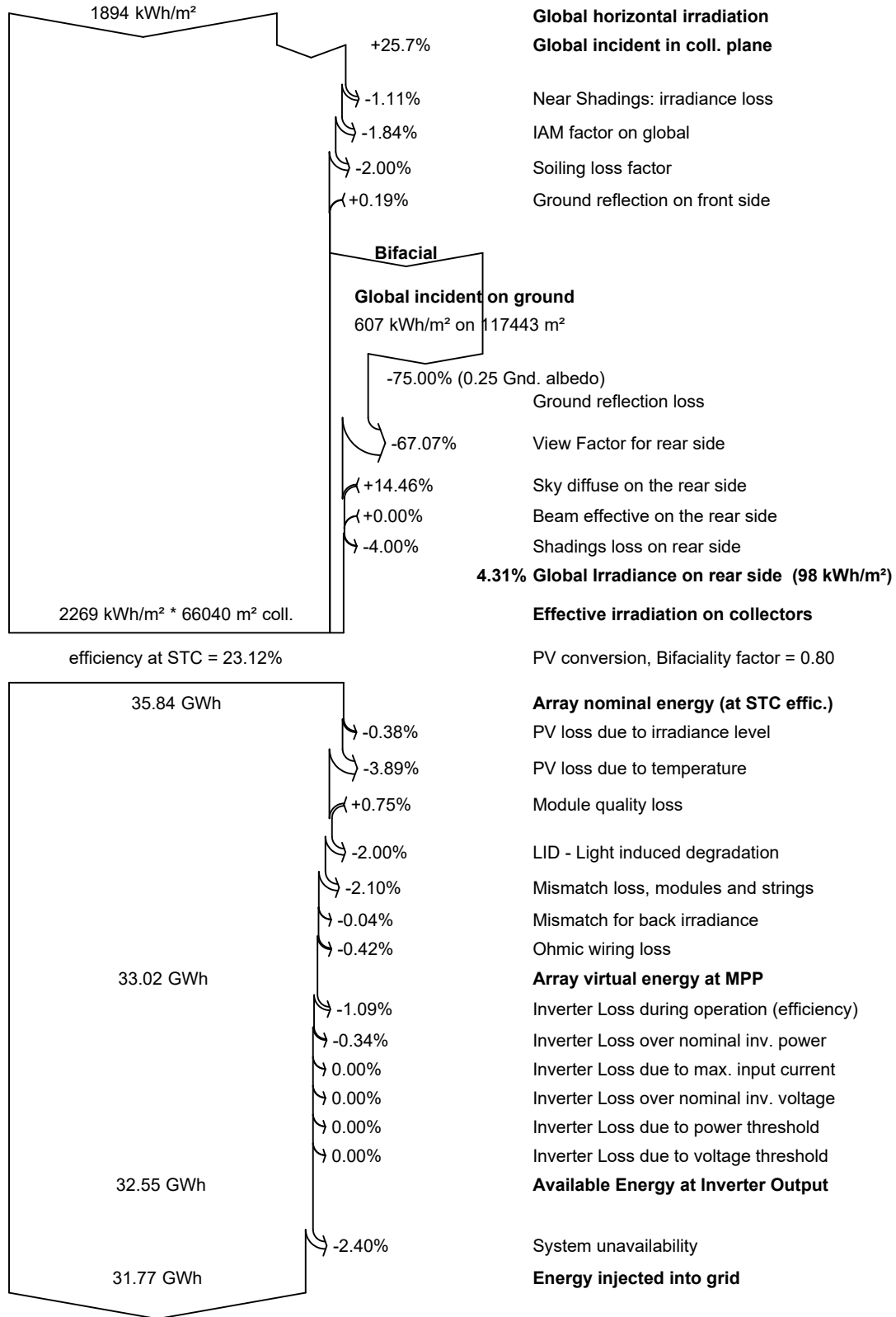
- GlobHor Global horizontal irradiation
- DiffHor Horizontal diffuse irradiation
- T_Amb Ambient Temperature
- GlobInc Global incident in coll. plane
- GlobEff Effective Global, corr. for IAM and shadings
- EArray Effective energy at the output of the array
- E_Grid Energy injected into grid
- PR Performance Ratio



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Loss diagram



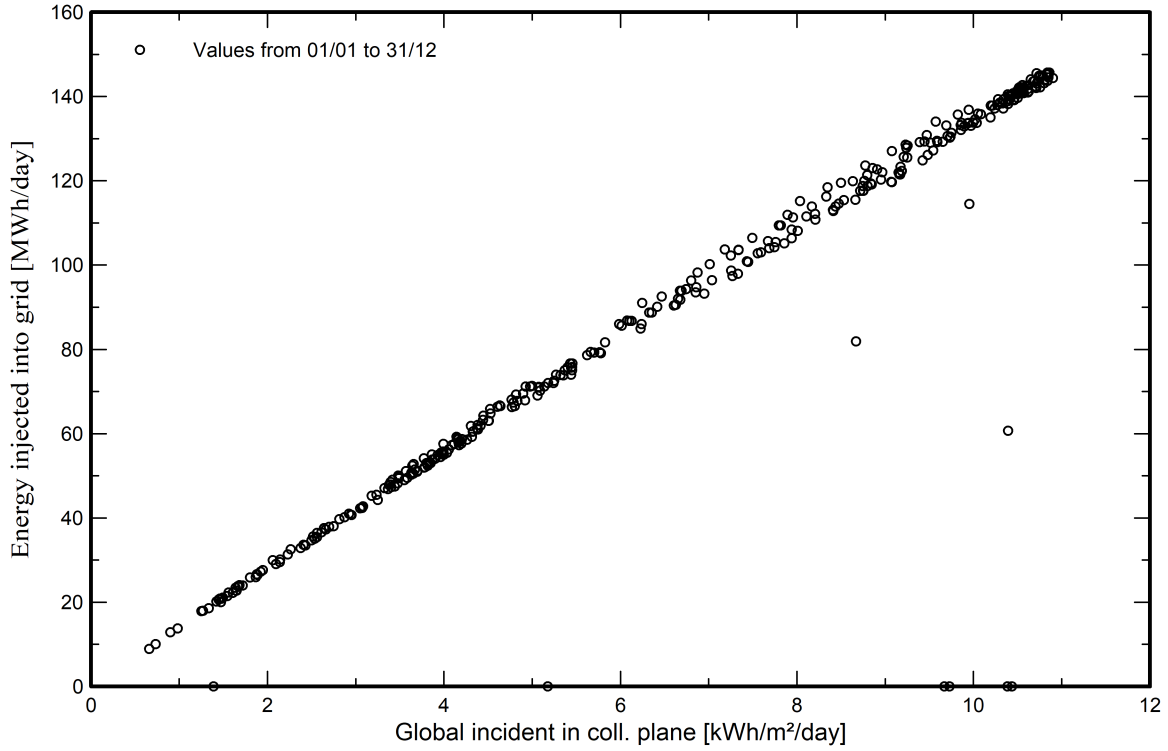


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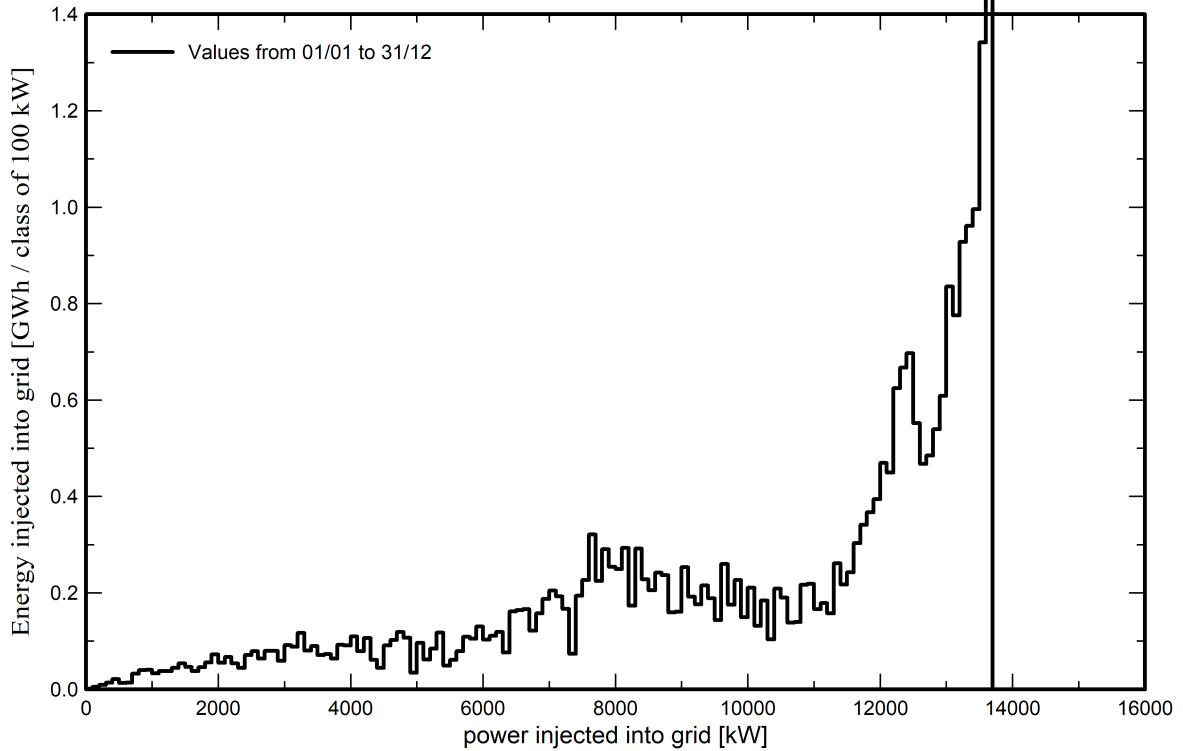
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Special graphs

Daily Input/Output diagram



Distribuzione potenza in uscita sistema





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P50 - P90 evaluation

Meteo data

Source	PVGIS api TMY
Kind	TMY, multi-year
Year-to-year variability(Variance)	2.5 %

Specified Deviation

Climate change	0.0 %
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Global variability (meteo + system)

Variability (Quadratic sum)	3.1 %
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Simulation and parameters uncertainties

PV module modelling/parameters	1.0 %
Inverter efficiency uncertainty	0.5 %
Soiling and mismatch uncertainties	1.0 %
Degradation uncertainty	1.0 %

Annual production probability

Variability	0.98 GWh
P50	31.77 GWh
P90	30.52 GWh
P95	30.16 GWh

Probability distribution

