



REGIONE: SICILIA	PROVINCIA: PALERMO
COMUNI: POLIZZI GENEROSA	LOCALITA': C/da Platani

LIVELLO PROGETTO: PD	OGGETTO: Progetto per la realizzazione di un impianto agrovoltaico denominato "Agrovoltaico Polizzi Generosa" per la produzione di energia elettrica con una potenza installata di 43 MW, per la produzione agricola di beni e servizi oltre alle opere connesse e alle infrastrutture indispensabili nell'area identificata nel comune di Polizzi Generosa (PA).
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TAV.N.: 055	IMPIANTO: AGROVOLTAICO POLIZZI GENEROSA	FILE: RT	SCALA:
	ELABORATO: Report PVSYST	COD DOC: SP19GNRT055	VER: 01

PROPONENTE: 	RESPONSABILE:	VALIDATO DA:
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PROGETTISTI: 	RESPONSABILE: Direttore Tecnico ARCH. FRANCESCO LAUDICINA <i>Timbro e Firma</i>	APPROVATO DA: <i>Timbro e Firma</i>
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REV.:	DATA:	DISEGNATO:	DESCRIZIONE:
00	03/01/2023	Ing. Antonella M. Castronovo	
01			
02			

PVsyst - Simulation report

Grid-Connected System

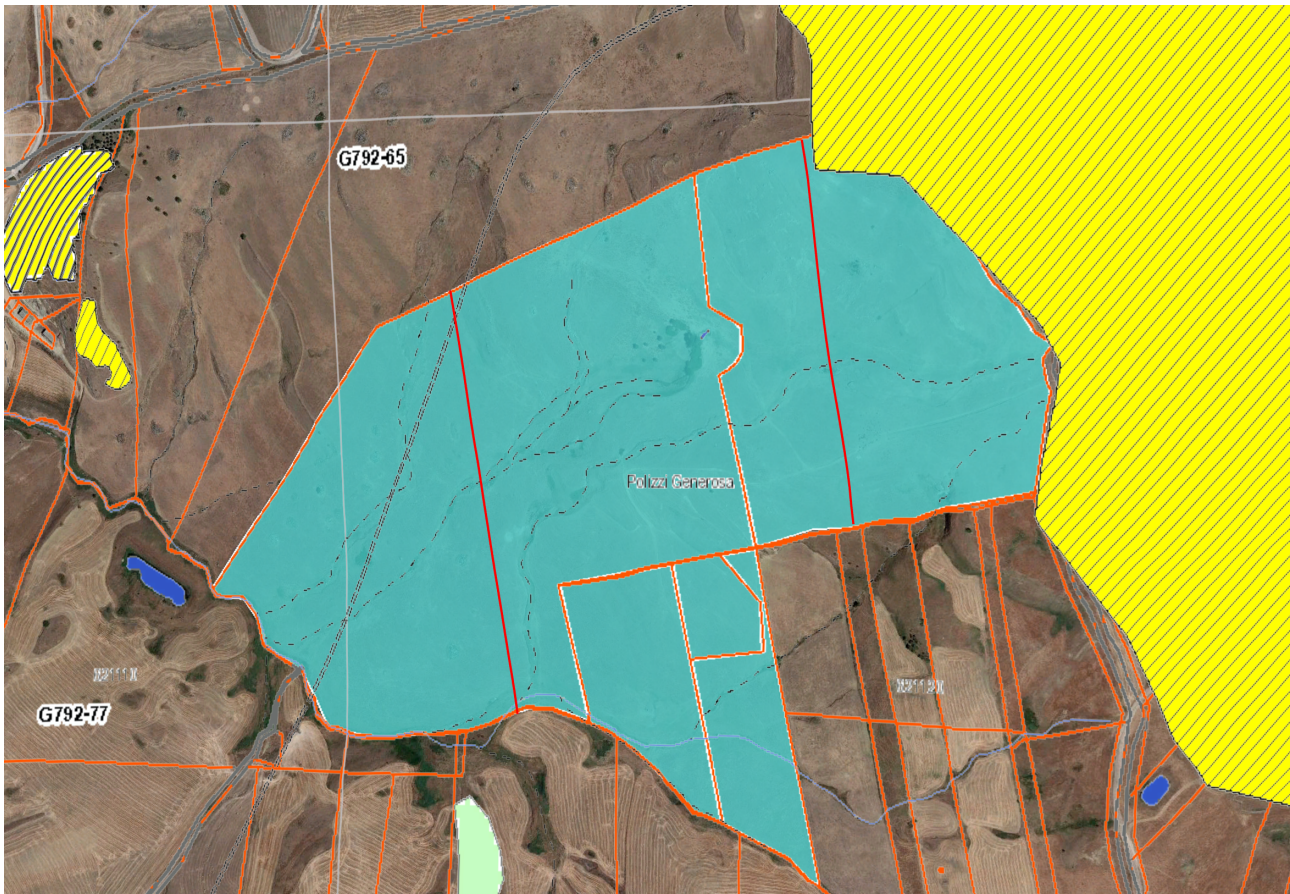
Project: Prj 19 Polizzi Generosa

Variant: Nuova variante di simulazione_STRING

Tracking system with backtracking

System power: 42.94 MWp

Landro - Italy



SuperCorp



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Project summary

Geographical Site	Situation	Project settings
Landro	Latitude 37.69 °N	Albedo 0.20
Italy	Longitude 13.92 °E	
	Altitude 589 m	
	Time zone UTC+1	
Meteo data		
Landro		
PVGIS api TMY		

System summary

Grid-Connected System	Tracking system with backtracking	
PV Field Orientation	Near Shadings	User's needs
Tracking plane, horizontal N-S axis	Linear shadings	Unlimited load (grid)
Axis azimuth 0 °		
System information		
PV Array	Inverters	
Nb. of modules 68160 units	Nb. of units 198 units	
Pnom total 42.94 MWp	Pnom total 42.57 MWac	
	Pnom ratio 1.009	

Results summary

Produced Energy 82427 MWh/year	Specific production 1920 kWh/kWp/year	Perf. Ratio PR 82.74 %
Apparent energy 82427 MVAh		

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General parameters

Grid-Connected System		Tracking system with backtracking	
PV Field Orientation		Backtracking strategy	
Orientation		Nb. of trackers	720 units
Tracking plane, horizontal N-S axis		Sizes	
Axis azimuth	0 °	Tracker Spacing	12.0 m
		Collector width	4.60 m
		Ground Cov. Ratio (GCR)	38.3 %
		Phi min / max.	-/+ 60.0 °
		Backtracking limit angle	
		Phi limits	+/- 67.4 °
Horizon		Near Shadings	
Average Height	7.3 °	Linear shadings	
Grid injection point		User's needs	
Power factor		Unlimited load (grid)	
Cos(phi) (leading)	1.000		
		Models used	
		Transposition	Perez
		Diffuse	Imported
		Circumsolar	separate

PV Array Characteristics

PV module		Inverter	
Manufacturer	Jinko Solar	Manufacturer	Huawei Technologies
Model	JKM630N-78HL4	Model	SUN2000-215KTL- H0
(Custom parameters definition)		(Custom parameters definition)	
Unit Nom. Power	630 Wp	Unit Nom. Power	215 kVA
Number of PV modules	68160 units	Number of inverters	198 units
Nominal (STC)	42.94 MWp	Total power	42570 kVA
Array #1 - Sottocampo A		Array #1 - Sottocampo A	
Number of PV modules	34080 units	Number of inverters	99 units
Nominal (STC)	21.47 MWp	Total power	21285 kVA
Modules	1420 Strings x 24 In series		
At operating cond. (50°C)		Operating voltage	550-1500 V
Pmpp	20.01 MWp	Pnom ratio (DC:AC)	1.01
U mpp	1029 V		
I mpp	19434 A		
Array #2 - Sottocampo B		Array #2 - Sottocampo B	
Number of PV modules	34080 units	Number of inverters	99 units
Nominal (STC)	21.47 MWp	Total power	21285 kVA
Modules	1420 Strings x 24 In series		
At operating cond. (50°C)		Operating voltage	550-1500 V
Pmpp	20.01 MWp	Pnom ratio (DC:AC)	1.01
U mpp	1029 V		
I mpp	19434 A		
Total PV power		Total inverter power	
Nominal (STC)	42941 kWp	Total power	42570 kVA
Total	68160 modules	Nb. of inverters	198 units
Module area	190528 m²	Pnom ratio	1.01



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Array losses

Array Soiling Losses

Loss Fraction 3.0 %

Thermal Loss factor

Module temperature according to irradiance
 U_c (const) 20.0 W/m²K
 U_v (wind) 0.0 W/m²K/m/s

DC wiring losses

Global array res. 0.86 mΩ
 Global wiring resistance 0.43 mΩ
 Loss Fraction 1.5 % at STC

Serie Diode Loss

Voltage drop 0.7 V
 Loss Fraction 0.1 % at STC

LID - Light Induced Degradation

Loss Fraction 2.0 %

Module Quality Loss

Loss Fraction -0.8 %

Module mismatch losses

Loss Fraction 1.0 % at MPP

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



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Horizon definition

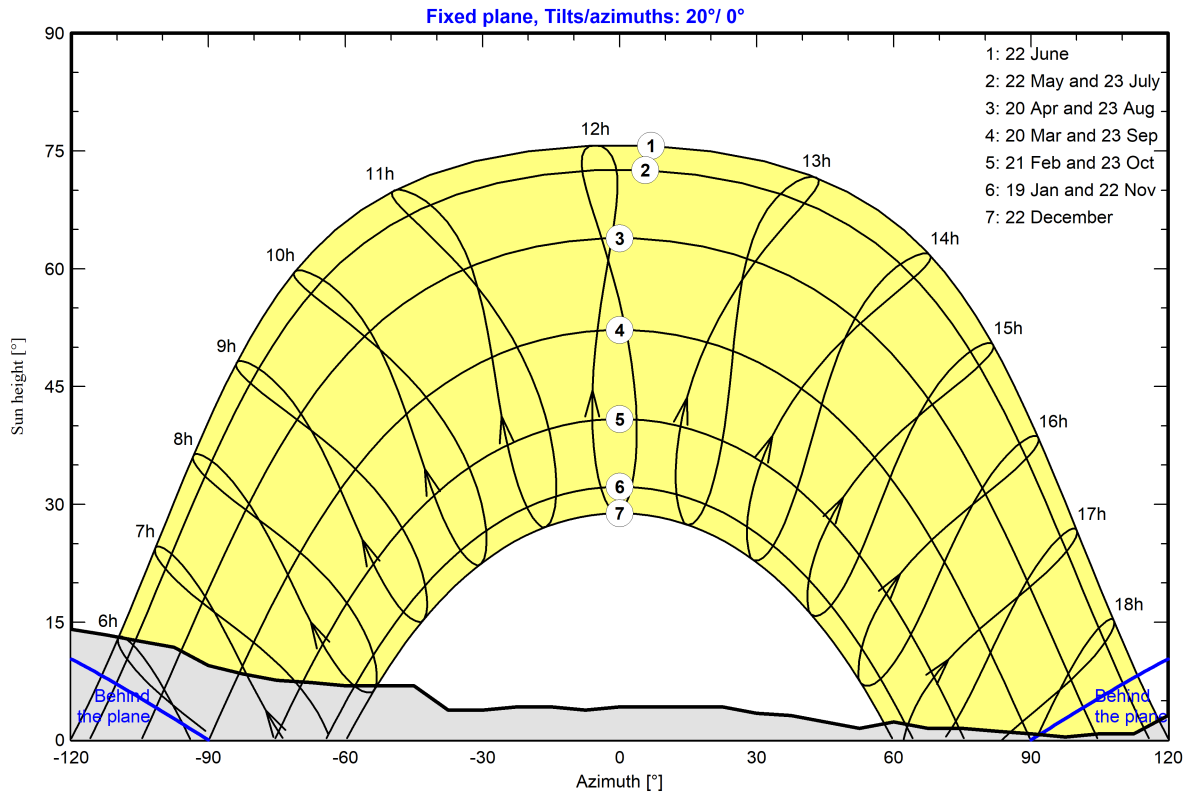
Horizon from PVGIS website API, Lat=37°41'37', Long=13°55'14', Alt=589m

Average Height 7.3 ° Albedo Factor 0.87
 Diffuse Factor 0.95 Albedo Fraction 100 %

Horizon profile

Azimuth [°]	-180	-173	-165	-158	-150	-135	-128	-120	-113	-105	-98	-90	-83	-75
Height [°]	12.6	12.6	15.3	15.3	16.8	16.8	15.7	14.1	13.4	12.6	11.8	9.5	8.4	7.6
Azimuth [°]	-68	-60	-45	-38	-30	-23	-15	-8	0	23	30	38	45	53
Height [°]	7.3	6.9	6.9	3.8	3.8	4.2	4.2	3.8	4.2	4.2	3.4	3.1	2.3	1.5
Azimuth [°]	60	68	75	83	90	98	105	113	120	135	143	165	173	180
Height [°]	2.3	1.5	1.5	1.1	0.8	0.4	0.8	0.8	3.1	3.1	11.5	11.5	12.6	12.6

Sun Paths (Height / Azimuth diagram)

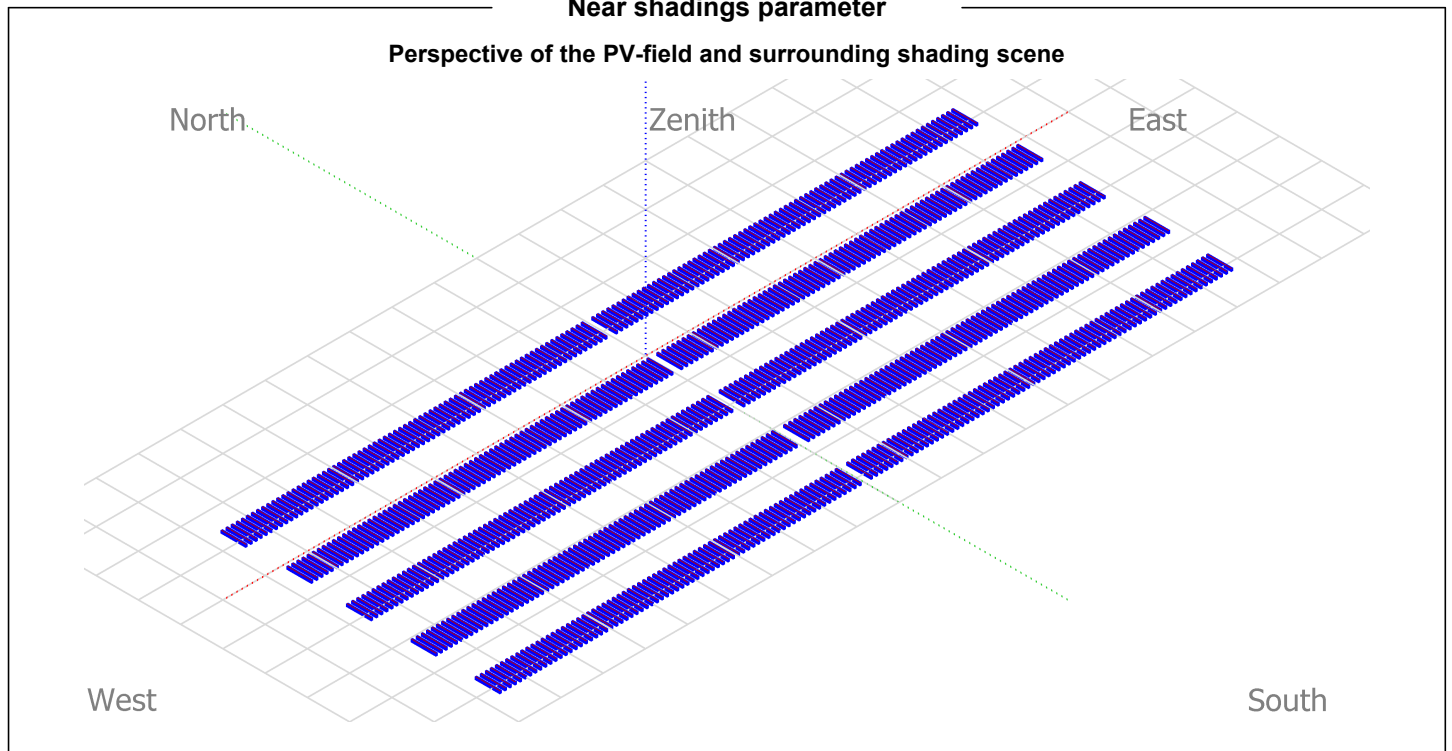




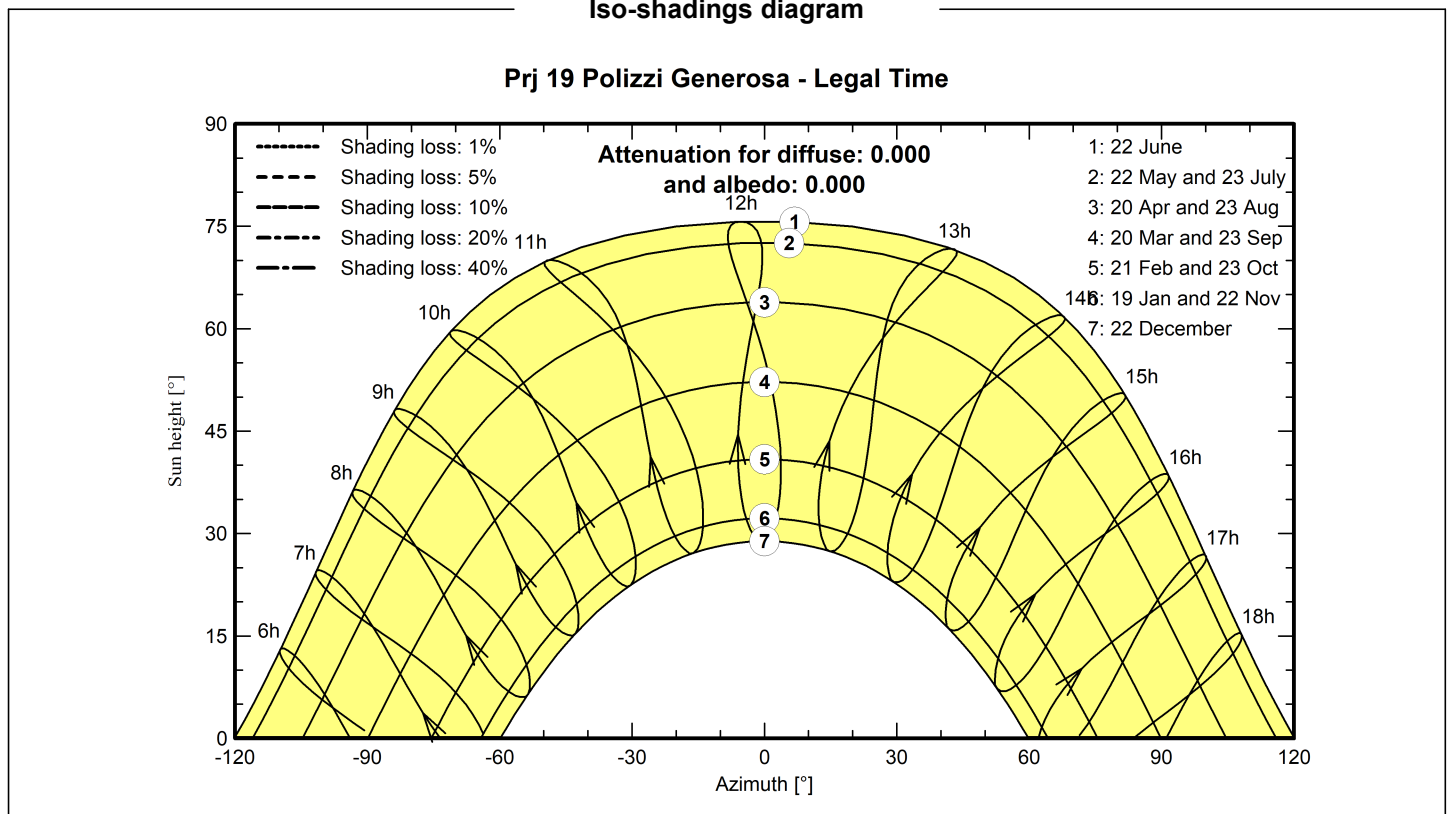
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Near shadings parameter



Iso-shadings diagram





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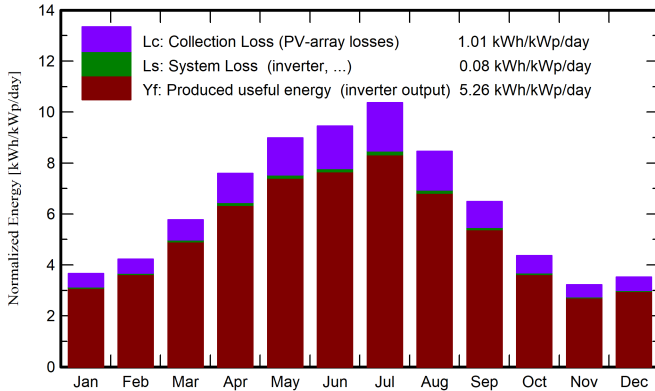
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Main results

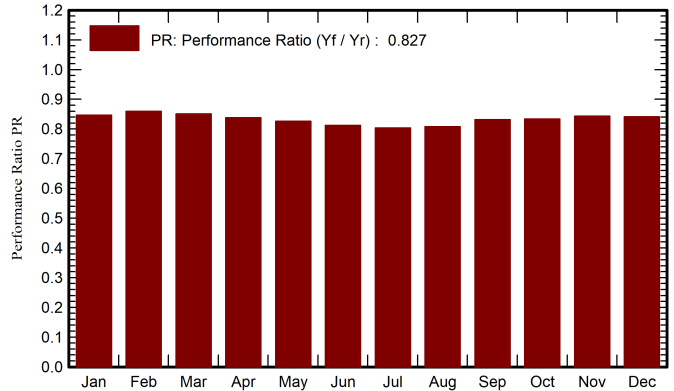
System Production

Produced Energy	82427 MWh/year	Specific production	1920 kWh/kWp/year
Apparent energy	82427 MVAh	Performance Ratio PR	82.74 %

Normalized productions (per installed kWp)



Performance Ratio PR



Balances and main results

	GlobHor	DiffHor	T_Amb	GlobInc	GlobEff	EArray	EArrMPP	EApGrid	PRTemp	EApGrid
	kWh/m ²	kWh/m ²	°C	kWh/m ²	kWh/m ²	MWh	MWh	MVAh	ratio	MVAh
January	81.4	31.80	8.19	113.4	102.0	4182	4182	4123	0.809	4123
February	87.4	37.35	6.40	118.2	108.1	4429	4429	4365	0.823	4365
March	136.4	59.30	8.90	179.0	165.2	6645	6645	6546	0.831	6546
April	177.1	66.95	12.57	227.6	211.6	8318	8318	8186	0.834	8186
May	213.6	74.02	16.21	278.6	259.4	10043	10043	9880	0.835	9880
June	218.4	76.78	20.25	283.4	263.0	10047	10047	9882	0.830	9882
July	241.0	59.16	24.28	321.4	300.5	11288	11288	11098	0.835	11098
August	198.9	68.75	23.76	262.2	243.8	9247	9247	9094	0.831	9094
September	147.8	55.69	19.84	194.8	181.7	7065	7065	6953	0.838	6953
October	105.9	49.83	16.63	135.3	124.2	4923	4923	4848	0.824	4848
November	72.9	35.61	11.03	96.8	87.7	3558	3558	3505	0.812	3505
December	78.4	29.80	8.43	109.2	97.3	4003	4003	3947	0.801	3947
Year	1759.1	645.04	14.76	2320.0	2144.4	83749	83749	82427	0.828	82427

Legends

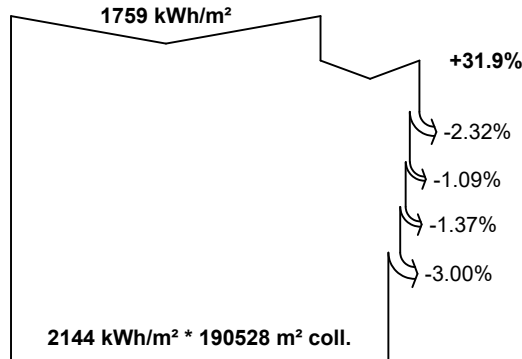
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|---------|--|---------|---|
| GlobHor | Global horizontal irradiation | EArray | Effective energy at the output of the array |
| DiffHor | Horizontal diffuse irradiation | EArrMPP | Array virtual energy at MPP |
| T_Amb | Ambient Temperature | EApGrid | Apparent energy to the grid |
| GlobInc | Global incident in coll. plane | PRTemp | Weather corrected PR |
| GlobEff | Effective Global, corr. for IAM and shadings | EApGrid | Apparent energy to the grid |



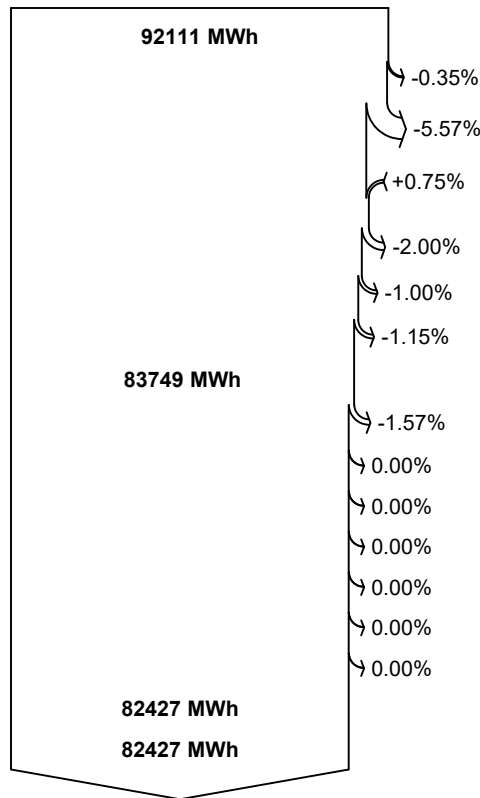
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Loss diagram



efficiency at STC = 22.54%



0 MVAR
82427 MVA

Global horizontal irradiation
Global incident in coll. plane

- Far Shadings / Horizon
- Near Shadings: irradiance loss
- IAM factor on global
- Soiling loss factor

Effective irradiation on collectors

PV conversion

Array nominal energy (at STC effic.)

- PV loss due to irradiance level
- PV loss due to temperature
- Module quality loss

LID - Light induced degradation

Module array mismatch loss

Ohmic wiring loss

Array virtual energy at MPP

- Inverter Loss during operation (efficiency)
- Inverter Loss over nominal inv. power
- Inverter Loss due to max. input current
- Inverter Loss over nominal inv. voltage
- Inverter Loss due to power threshold
- Inverter Loss due to voltage threshold
- Night consumption

Available Energy at Inverter Output

Active Energy injected into grid

Reactive energy to the grid: Aver. cos(phi) = 1.000

Apparent energy to the grid

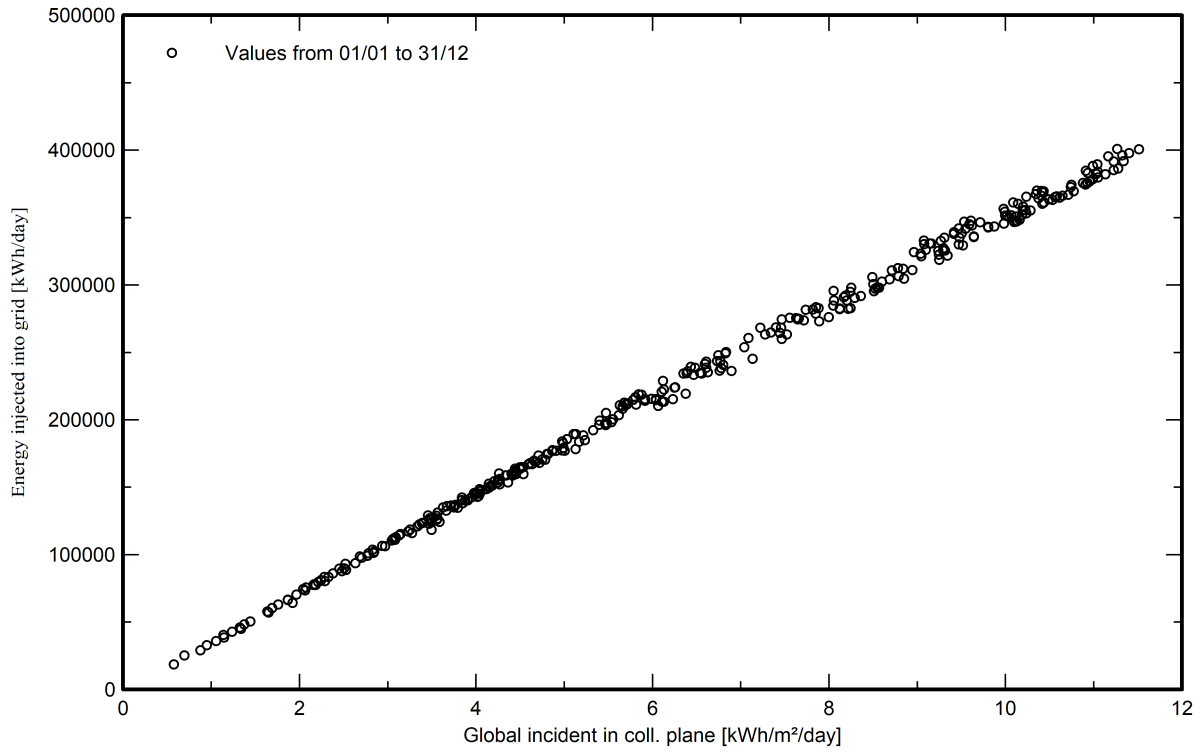


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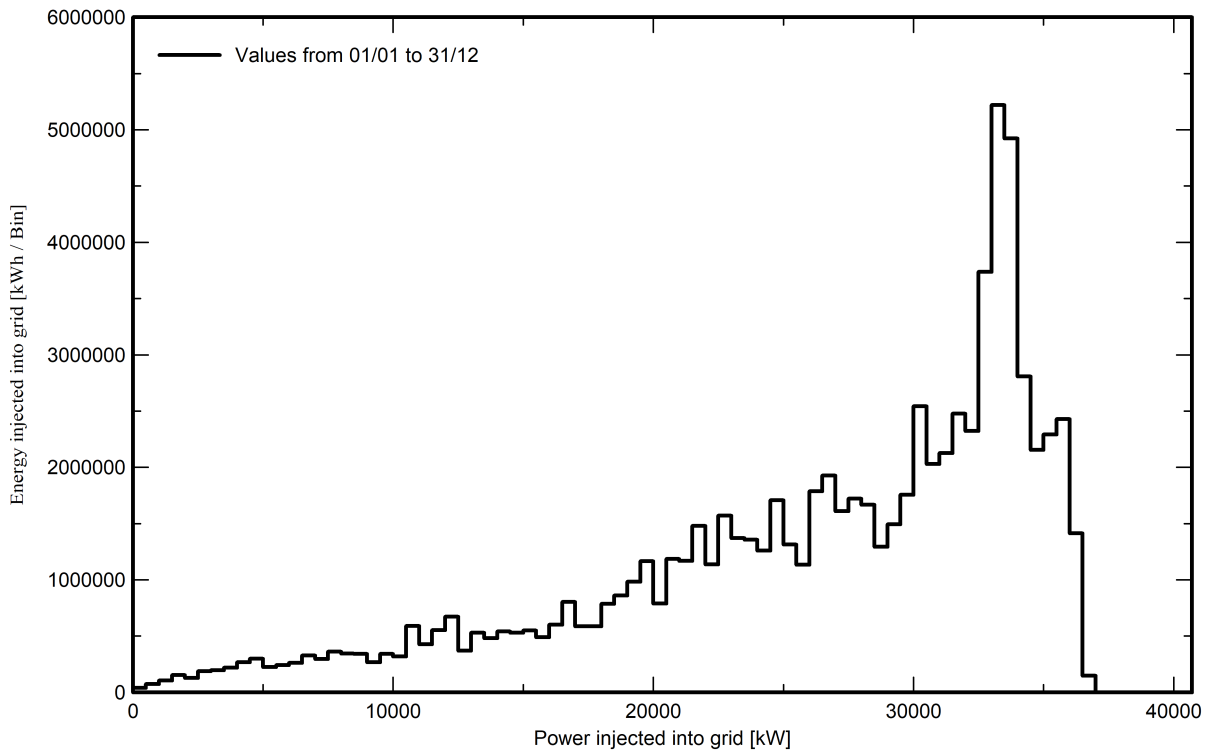
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Special graphs

Diagramma giornaliero entrata/uscita



Distribuzione potenza in uscita sistema





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P50 - P90 evaluation

Meteo data

Source	PVGIS api TMY
Kind	Own measured
Year	TMY
Year-to-year variability(Variance)	2.5 %

Specified Deviation

Year deviation from average	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	2.54 GWh
P50	82.43 GWh
P90	79.17 GWh
P95	78.25 GWh

Probability distribution

