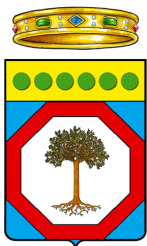


REGIONE
PUGLIA



COMUNE DI
FOGGIA



COMUNE DI
MANFREDONIA



Provincia
FOGGIA



**PROGETTO PER LA REALIZZAZIONE DI UN IMPIANTO AGROVOLTAICO,
DENOMINATO "CSPV MANFREDONIA" DELLA POTENZA COMPLESSIVA PARI
A 53,84 MW_p E DELLE RELATIVE OPERE DI CONNESSIONE ALLA RTN, DA
REALIZZARSI NEI COMUNI DI FOGGIA (FG) E MANFREDONIA (FG)**

STUDIO DEL POTENZIALE SOLARE

ELABORATO

PR_12

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Paesaggio
Dott. Arch. Vincenzo BONASORTA

EM./REV.	DATA	REDATTO	VERIFICATO	APPROVATO	DESCRIZIONE
0	GIUGNO 2022	V.D.P.	A.A. - O.T.	A.A. - O.T.	Progetto Definitivo



Project: CSPV MANFREDONIA

Variant: CSPV MANFREDONIA_tracker_53,84MWp_50MWn

PVsyst V7.2.14

VC1, Simulation date:
27/05/22 14:14
with v7.2.14

Abei Energy & Infraestructures (Spain)

Project summary

Geographical Site

Tamaricciola
Italy

Situation

Latitude 41.44 °N
Longitude 15.76 °E
Altitude 14 m
Time zone UTC+1

Project settings

Albedo 0.20

Meteo data

Tamaricciola
Meteonorm 8.0 (1986-2005), Sat=7% - Sintético

System summary

Grid-Connected System

Simulation for year no 1

Trackers single array, with backtracking

PV Field Orientation

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

Tracking algorithm

Irradiance optimization
Backtracking activated

Near Shadings

Linear shadings

System information

PV Array

Nb. of modules 99708 units
Pnom total 53.84 MWp

Inverters

Nb. of units 18 units
Pnom total 46.80 MWac
Grid power limit 50.00 MWac
Grid lim. Pnom ratio 1.077

User's needs

Unlimited load (grid)

Results summary

Produced Energy 98 GWh/year Specific production 1817 kWh/kWp/year Perf. Ratio PR 87.65 %

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General parameters

Grid-Connected System		Trackers single array, with backtracking	
PV Field Orientation		Tracking algorithm	
Orientation		Irradiance optimization	
Tracking plane, horizontal N-S axis		Backtracking activated	
Axis azimuth	0 °		
			Backtracking strategy
			Nb. of trackers
			219 units
			Single array
			Sizes
			Tracker Spacing
			6.00 m
			Collector width
			2.26 m
			Ground Cov. Ratio (GCR)
			37.6 %
			Phi min / max.
			-/+ 55.0 °
			Backtracking limit angle
			Phi limits
			+/- 67.7 °
Models used		Near Shadings	
Transposition	Perez	Linear shadings	
Diffuse	Perez, Meteonorm		
Circumsolar	separate		
Horizon		User's needs	
Free Horizon		Unlimited load (grid)	
Bifacial system			
Model	2D Calculation		
	unlimited trackers		
Bifacial model geometry		Bifacial model definitions	
Tracker Spacing	6.00 m	Ground albedo	0.20
Tracker width	2.26 m	Bifaciality factor	70 %
GCR	37.6 %	Rear shading factor	10.0 %
Axis height above ground	1.50 m	Rear mismatch loss	10.0 %
		Shed transparent fraction	0.0 %
Grid power limitation			
Active Power	50.00 MWac		
Pnom ratio	1.077		

PV Array Characteristics

PV module		Inverter	
Manufacturer	Seraphim	Manufacturer	Gamesa Electric
Model	SRP-540-BMA-BG-182-V1.1	Model	Gamesa E-2.5MVA-SB-I
(Custom parameters definition)		(Custom parameters definition)	
Unit Nom. Power	540 Wp	Unit Nom. Power	2600 kWac
Number of PV modules	99708 units	Number of inverters	18 units
Nominal (STC)	53.84 MWp	Total power	46800 kWac
Modules	3561 Strings x 28 In series	Operating voltage	900-1300 V
At operating cond. (50°C)		Pnom ratio (DC:AC)	1.15
Pmpp	49.32 MWp		
U mpp	1050 V		
I mpp	46968 A		
Total PV power		Total inverter power	
Nominal (STC)	53842 kWp	Total power	46800 kWac
Total	99708 modules	Number of inverters	18 units
Module area	254858 m²	Pnom ratio	1.15



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Array losses

Array Soiling Losses

Loss Fraction 2.0 %

Thermal Loss factor

Module temperature according to irradiance

Uc (const) 29.0 W/m²K

Uv (wind) 0.0 W/m²K/m/s

DC wiring losses

Global array res. 0.32 mΩ

Loss Fraction 1.3 % at STC

Serie Diode Loss

Voltage drop 0.7 V

Loss Fraction 0.1 % at STC

LID - Light Induced Degradation

Loss Fraction 1.5 %

Module Quality Loss

Loss Fraction -0.5 %

Module mismatch losses

Loss Fraction 1.1 % at MPP

Strings Mismatch loss

Loss Fraction 0.1 %

Module average degradation

Year no 1

Loss factor 0.5 %/year

Mismatch due to degradation

Imp RMS dispersion 0.4 %/year

Vmp RMS dispersion 0.4 %/year

IAM loss factor

Incidence effect (IAM): User defined profile

10°	30°	40°	50°	60°	70°	80°	85°	90°
1.000	1.000	1.000	1.000	1.000	0.990	0.903	0.750	0.000

System losses

Unavailability of the system

Time fraction 1.0 %
3.7 days,
3 periods

Auxiliaries loss

Proportionnal to Power 4.0 W/kW
0.0 kW from Power thresh.

AC wiring losses

Inv. output line up to MV transfo

Inverter voltage 660 Vac tri

Loss Fraction 0.00 % at STC

Inverter: Gamesa E-2.5MVA-SB-I

Wire section (18 Inv.) Copper 18 x 3 x 2000 mm²

Average wires length 0 m

MV line up to Injection

MV Voltage 30 kV

Wires Copper 3 x 1000 mm²

Length 14150 m

Loss Fraction 1.57 % at STC

AC losses in transformers

MV transfo

Grid voltage 30 kV

Operating losses at STC

Nominal power at STC 53228 kVA

Iron loss (night disconnect) 159.68 kW

Loss Fraction 0.30 % at STC

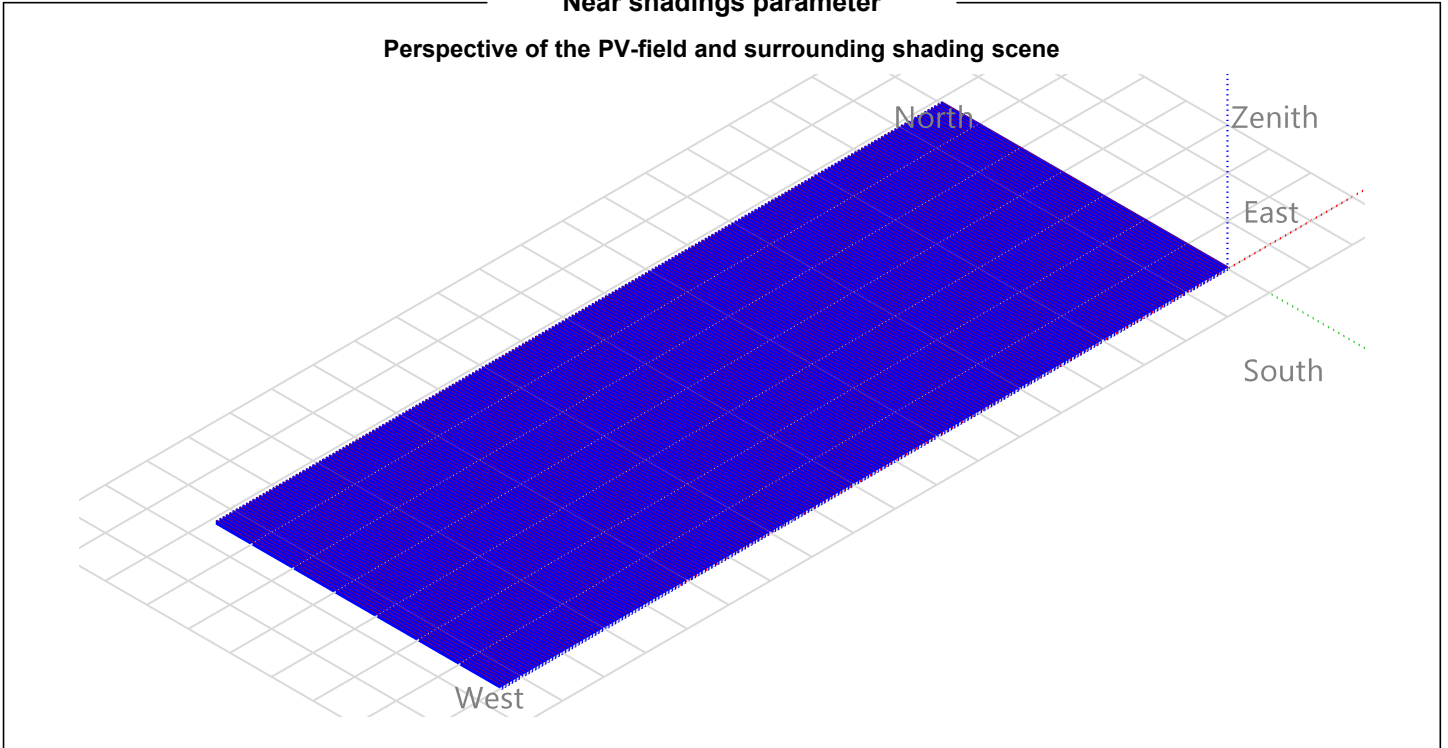
Coils equivalent resistance 3 x 0.10 mΩ

Loss Fraction 1.20 % at STC



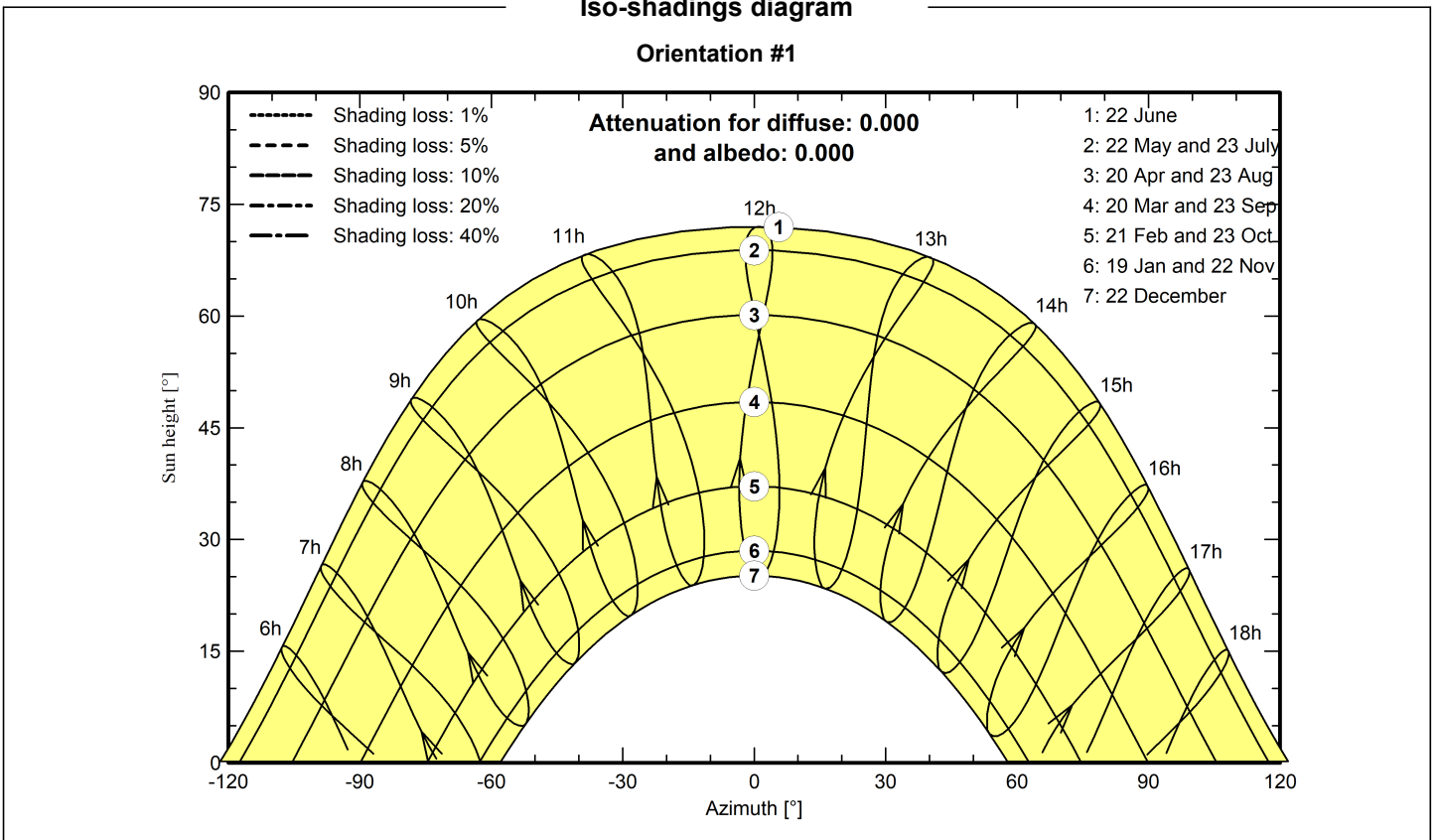
Near shadings parameter

Perspective of the PV-field and surrounding shading scene



Iso-shadings diagram

Orientation #1





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Main results

System Production

Produced Energy

98 GWh/year

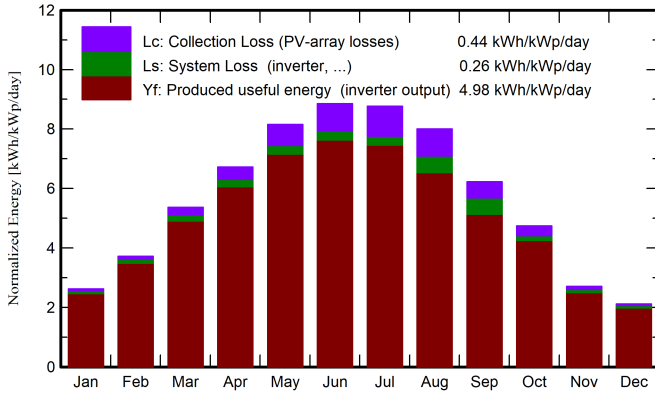
Specific production

1817 kWh/kWp/year

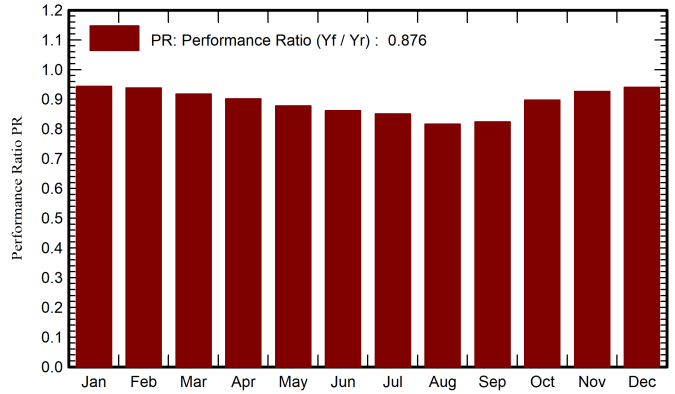
Performance Ratio PR

87.65 %

Normalized productions (per installed kWp)



Performance Ratio PR



Balances and main results

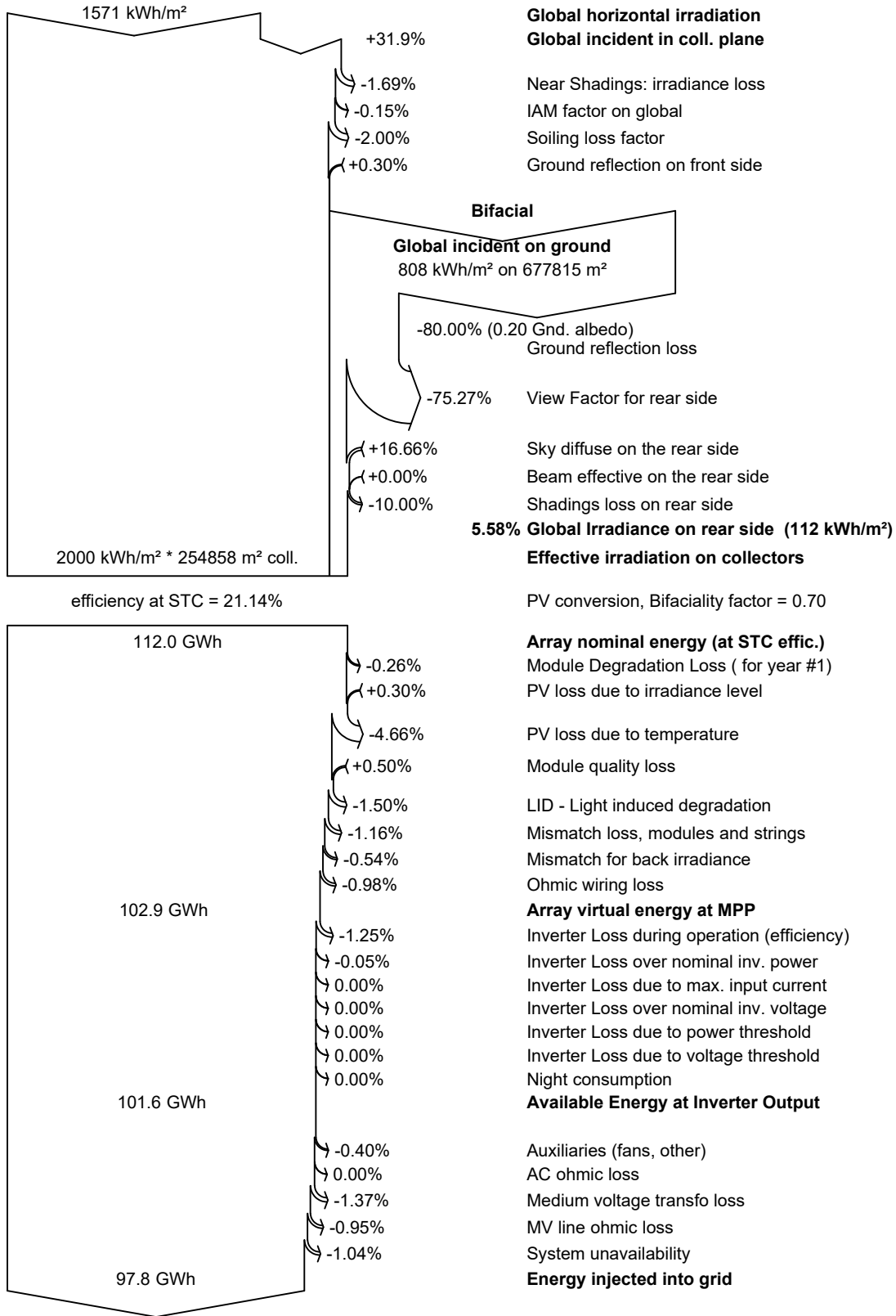
	GlobHor kWh/m ²	DiffHor kWh/m ²	T_Amb °C	GlobInc kWh/m ²	GlobEff kWh/m ²	EArray GWh	E_Grid GWh	PR ratio
January	59.4	27.16	7.50	81.3	78.3	4.31	4.13	0.944
February	76.9	35.29	7.95	104.2	100.3	5.48	5.26	0.938
March	125.7	52.80	11.30	166.2	160.4	8.55	8.21	0.917
April	156.5	67.87	14.53	201.8	194.8	10.20	9.79	0.901
May	195.2	83.41	19.98	252.7	243.9	12.45	11.95	0.878
June	205.9	82.85	24.83	265.8	256.6	12.83	12.33	0.862
July	209.0	83.29	27.76	271.9	262.6	12.96	12.46	0.851
August	187.5	67.14	27.43	248.3	239.8	11.85	10.92	0.817
September	139.1	57.09	22.03	187.0	180.5	9.19	8.29	0.824
October	106.9	37.03	18.07	147.0	141.8	7.38	7.10	0.897
November	60.6	30.97	12.75	81.1	78.1	4.22	4.05	0.927
December	48.8	24.12	8.82	65.6	63.2	3.47	3.32	0.940
Year	1571.5	649.01	16.97	2073.0	2000.2	102.89	97.83	0.876

Legends

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



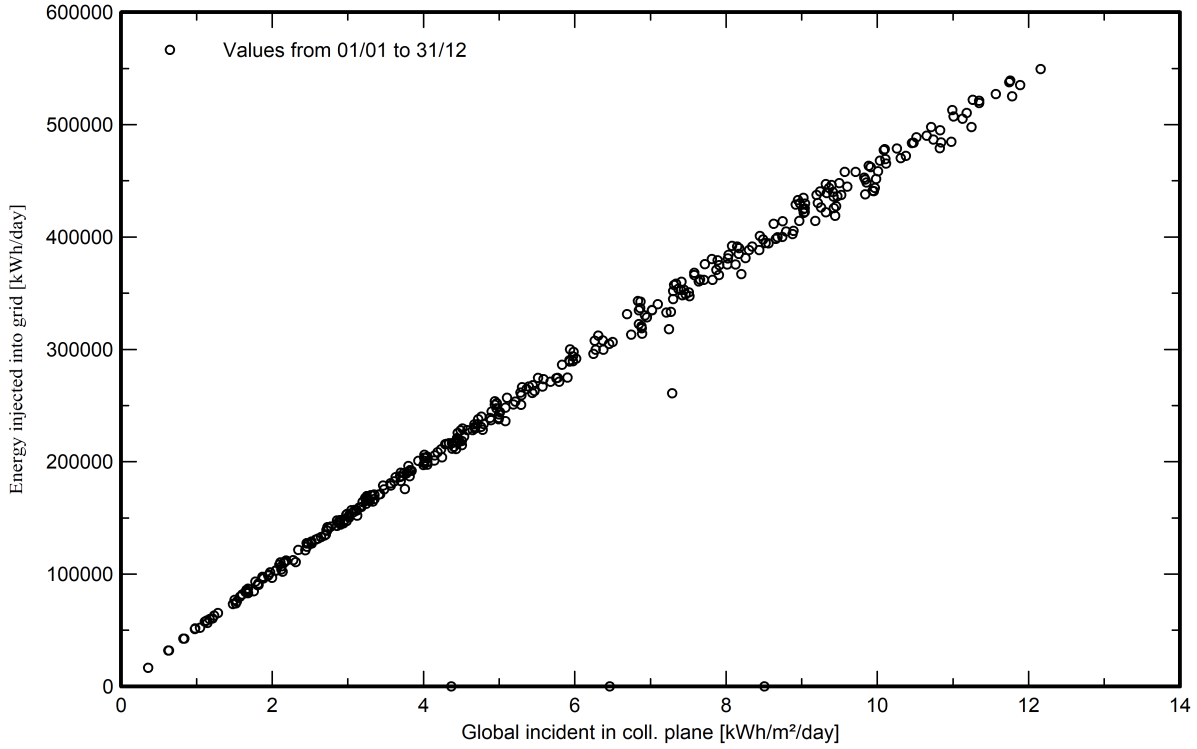
Loss diagram



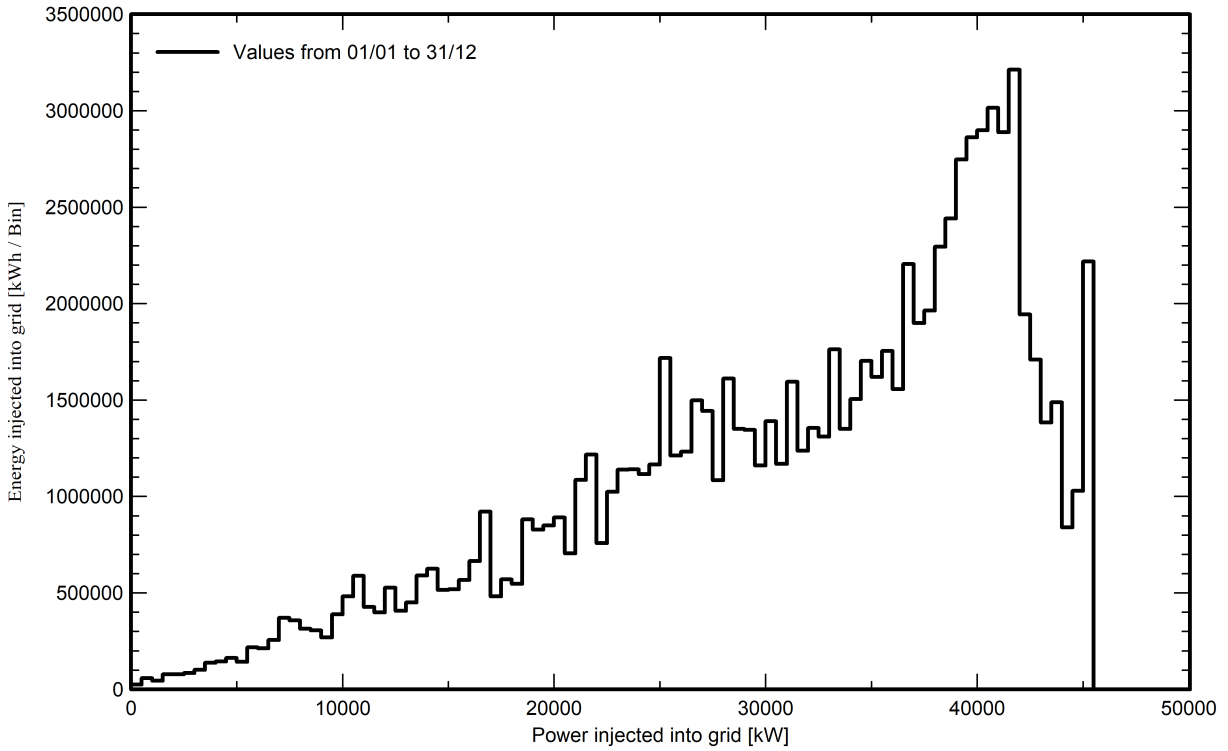


Special graphs

Daily Input/Output diagram



Distribución de potencia de salida del sistema





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P50 - P90 evaluation

Meteo data

Source Meteonorm 8.0 (1986-2005), Sat=7%
Kind Monthly averages
Sintético - Multi-year average
Year-to-year variability(Variance) 5.9 %

Specified Deviation

Climate change 0.0 %

Global variability (meteo + system)

Variability (Quadratic sum) 6.1 %

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 6.01 GWh
P50 97.83 GWh
P90 90.12 GWh
P95 87.95 GWh

Probability distribution

