



REGIONE: MOLISE
PROVINCIA: CAMPOBASSO
COMUNE: CAMPOMARINO,
SAN MARTINO IN PENSILIS,
PORTOCANNONE

Greenvolt

Impianto agrivoltaico "CAMPOMARINO 40.92"

PD01_21 – SIMULAZIONE ENERGETICA (PVSYST)

PROGETTISTI	IL PROPONENTE
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AGOSTO 2023

PVsyst - Simulation report

Grid-Connected System

Project: ITS2CM - Campomarino

Variant: Campomarino_Fixed 3L(4-5-9-18-27)_680Wp_Pitch5.8m

Ground system (tables) on a hill

System power: 48.01 MWp

Campomarino_Solcast - Italy

Autor(a)



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Project summary

Geographical Site Campomarino_Solcast Italy	Situation Latitude 41.91 °N Longitude 15.05 °E Altitude 56 m Time zone UTC+1	Project settings Albedo 0.20
Meteo data Campomarino_Solcast Campomarino_Solcast_SYN.MET - Sintético		

System summary

Grid-Connected System Simulation for year no 1	Ground system (tables) on a hill	
PV Field Orientation Fixed plane Tilt/Azimuth 25.3 / -0.7 °	Near Shadings According to strings Electrical effect 100 %	User's needs Unlimited load (grid)
System information		
PV Array Nb. of modules 70605 units Pnom total 48.01 MWp	Inverters Nb. of units 161 units Pnom total 53.13 MWac Grid power limit 40.92 MWac Grid lim. Pnom ratio 1.173	

Results summary

Produced Energy 72475 MWh/year	Specific production 1510 kWh/kWp/year	Perf. Ratio PR 83.04 %
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General parameters

Grid-Connected System		Ground system (tables) on a hill		
PV Field Orientation		Sheds configuration		Models used
Orientation		Nb. of sheds	1101 units	Transposition Perez
Fixed plane		Identical arrays		Diffuse Perez, Meteonorm
Tilt/Azimuth	25.3 / -0.7 °	Sizes		Circumsolar separate
		Sheds spacing	5.80 m	
		Collector width	3.95 m	
		Ground Cov. Ratio (GCR)	68.1 %	
		Shading limit angle		
		Limit profile angle	37.1 °	
Horizon		Near Shadings		User's needs
Average Height	2.2 °	According to strings		Unlimited load (grid)
		Electrical effect	100 %	
Bifacial system				
Model	2D Calculation unlimited sheds			
Bifacial model geometry		Bifacial model definitions		
Sheds spacing	5.80 m	Ground albedo	0.20	
Sheds width	3.95 m	Bifaciality factor	90 %	
Limit profile angle	37.1 °	Rear shading factor	5.0 %	
GCR	68.1 %	Rear mismatch loss	10.0 %	
Height above ground	1.50 m	Shed transparent fraction	0.0 %	
Grid power limitation				
Active Power	40.92 MWac			
Pnom ratio	1.173			

PV Array Characteristics

PV module		Inverter	
Manufacturer	3SUN-EGP	Manufacturer	Huawei Technologies
Model	3SHB680G+-GGF_2P (Custom parameters definition)	Model	SUN2000-330KTL-H1-Preliminary V0.1 (Custom parameters definition)
Unit Nom. Power	680 Wp	Unit Nom. Power	330 kWac
Number of PV modules	70605 units	Number of inverters	161 units
Nominal (STC)	48.01 MWp	Total power	53130 kWac
Modules	2615 Strings x 27 In series	Operating voltage	500-1500 V
At operating cond. (49°C)		Pnom ratio (DC:AC)	0.90
Pmpp	46.17 MWp	Power sharing within this inverter	
U mpp	942 V		
I mpp	49019 A		
Total PV power		Total inverter power	
Nominal (STC)	48011 kWp	Total power	53130 kWac
Total	70605 modules	Number of inverters	161 units
Module area	199820 m²	Pnom ratio	0.90
Cell area	186821 m²		



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Array losses

Array Soiling Losses

Loss Fraction 3.0 %

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. 0.30 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 0.7 %

Module Quality Loss

Loss Fraction -1.3 %

Module mismatch losses

Loss Fraction 2.0 % at MPP

Strings Mismatch loss

Loss Fraction 0.1 %

Module average degradation

Year no 1
Loss factor 0.25 %/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°	20°	30°	40°	50°	60°	70°	80°	90°
1.000	1.000	1.000	1.000	1.000	0.995	0.958	0.832	0.000

AC wiring losses

Inv. output line up to MV transfo

Inverter voltage 800 Vac tri
Loss Fraction 1.20 % at STC

Inverter: SUN2000-330KTL-H1-Preliminary V0.1

Wire section (161 Inv.) Alu 161 x 3 x 240 mm²
Average wires length 200 m

MV line up to Injection

MV Voltage 30 kV
Wires Alu 3 x 2000 mm²
Length 13989 m
Loss Fraction 1.16 % at STC

AC losses in transformers

MV transfo

Medium voltage 30 kV

Transformer parameters

Nominal power at STC 47.19 MVA
Iron Loss (24/24 Connexion) 53.32 kVA
Iron loss fraction 0.11 % at STC
Copper loss 419.02 kVA
Copper loss fraction 0.89 % at STC
Coils equivalent resistance 3 x 0.12 mΩ



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Horizon definition

Horizon from PVGIS website API, Lat=41°54'36", Long=15°3'0", Alt=56m

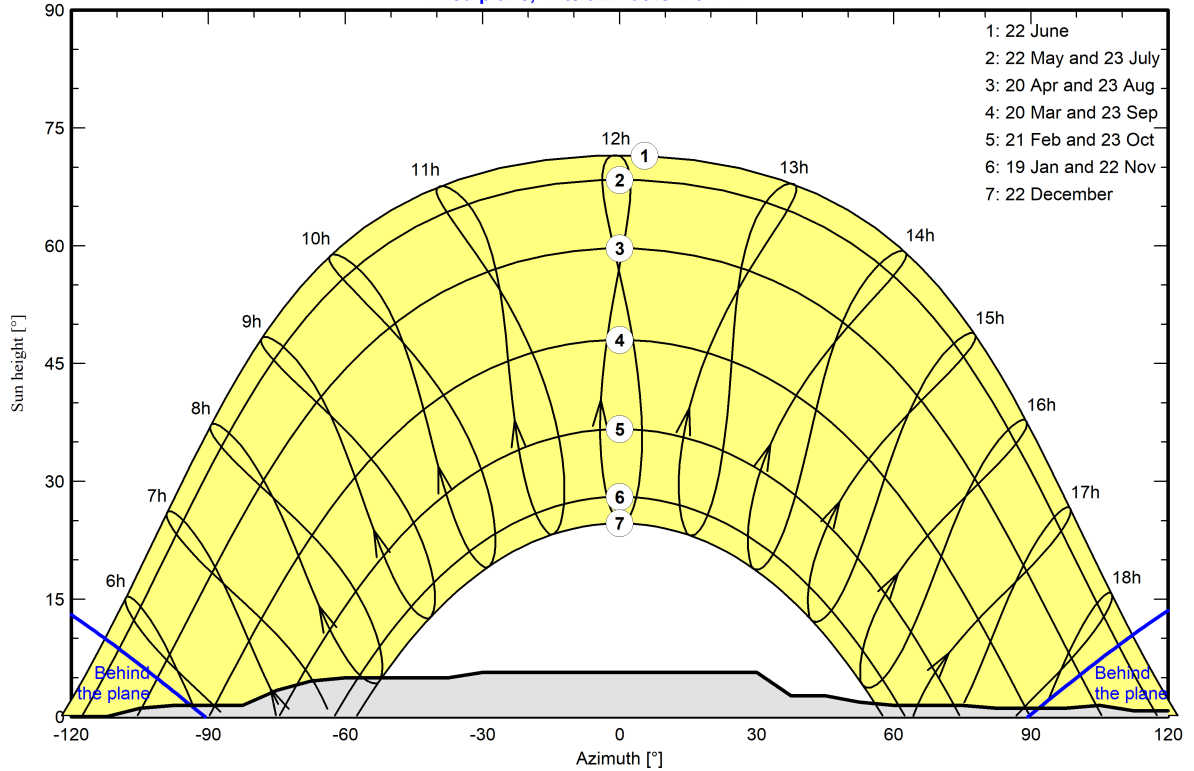
Average Height 2.2 ° Albedo Factor 0.75
Diffuse Factor 0.97 Albedo Fraction 100 %

Horizon profile

Azimuth [°]	-180	-113	-105	-98	-83	-75	-68	-60	-38	-30	30	38	45
Height [°]	0.0	0.0	1.1	1.5	1.5	3.4	4.6	5.0	5.0	5.7	5.7	2.7	2.7
Azimuth [°]	53	60	75	83	98	105	113	120	128	135	143	180	
Height [°]	1.9	1.5	1.5	1.1	1.1	1.5	0.8	0.8	0.4	0.4	0.0	0.0	

Sun Paths (Height / Azimuth diagram)

Fixed plane, Tilts/azimuths: 25°/ -1°

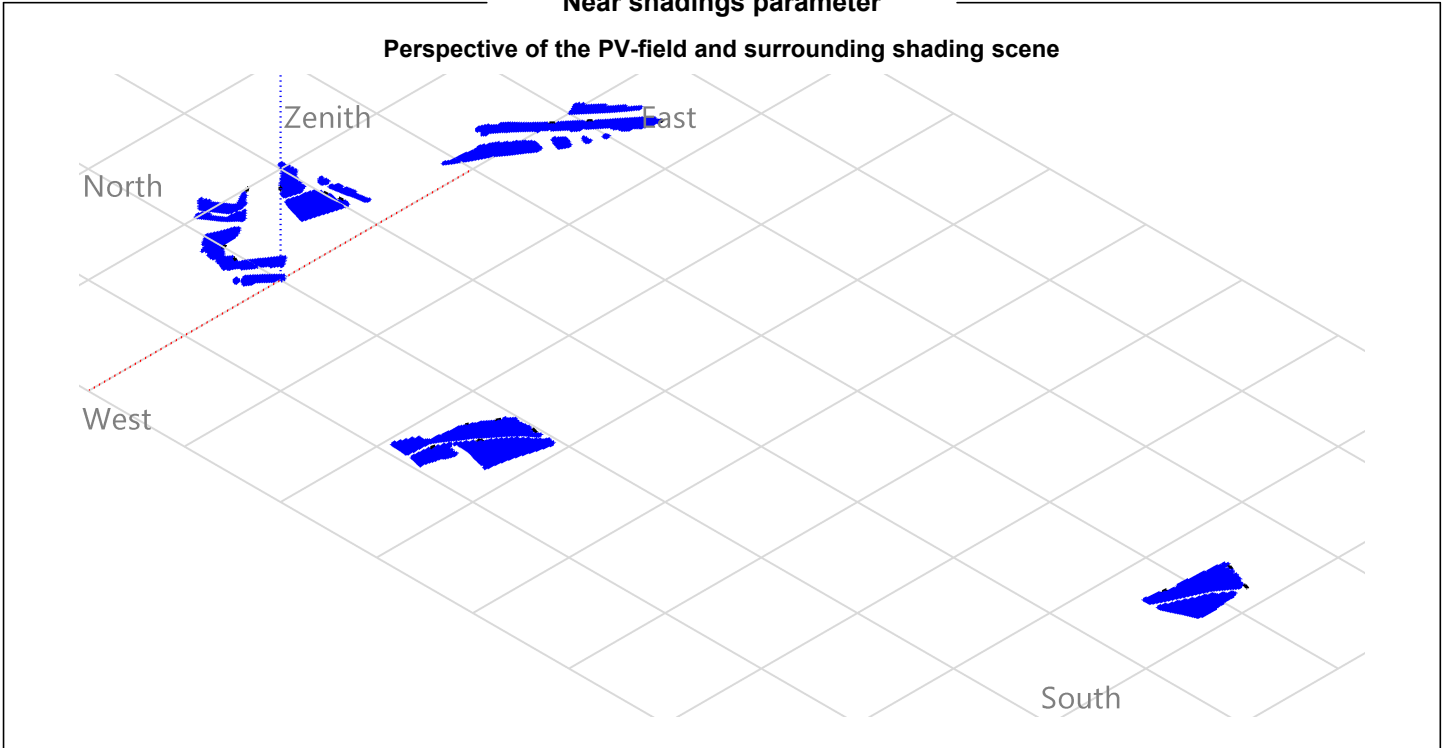




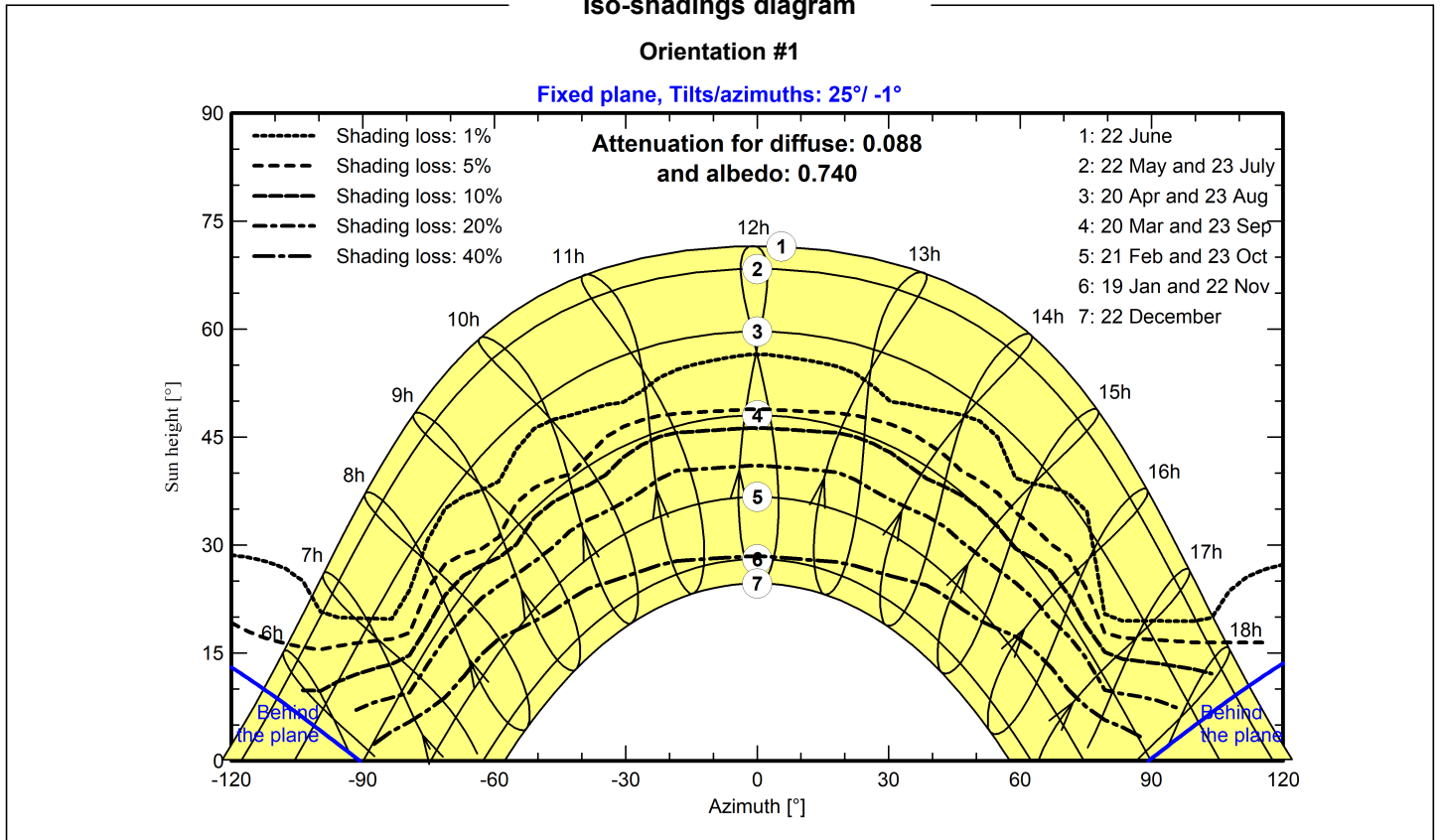
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Near shadings parameter



Iso-shadings diagram





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Main results

System Production

Produced Energy 72475 MWh/year

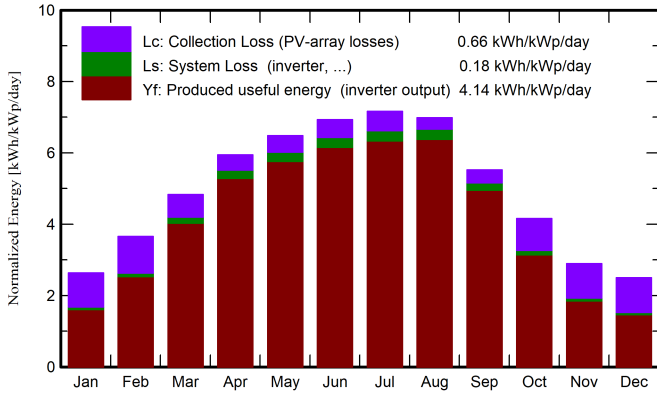
Specific production

1510 kWh/kWp/year

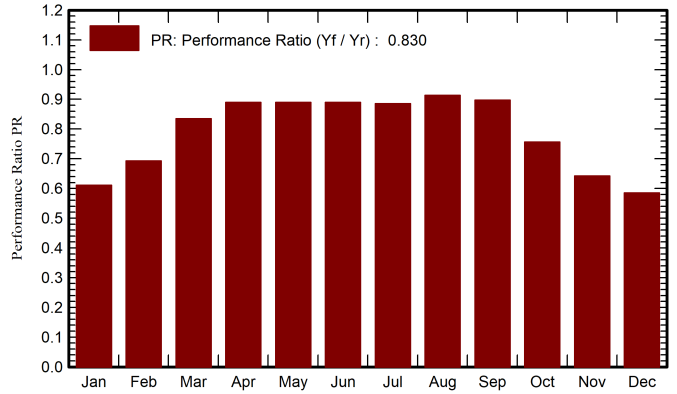
Performance Ratio PR

83.04 %

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 MWh	E_Grid MWh	PR ratio
January	53.9	27.30	9.01	81.6	60.8	2504	2395	0.611
February	72.4	32.50	9.52	102.4	85.4	3544	3404	0.692
March	119.2	45.90	11.20	149.6	137.4	6253	6000	0.835
April	158.5	56.20	14.30	178.3	167.4	7953	7619	0.890
May	196.4	68.00	18.43	200.8	188.6	8961	8581	0.890
June	211.3	67.60	23.19	207.9	195.7	9271	8876	0.889
July	221.9	62.10	23.91	222.0	209.4	9860	9435	0.885
August	199.0	55.20	0.00	216.6	204.5	9927	9502	0.914
September	137.7	50.40	0.00	165.6	154.3	7441	7136	0.897
October	95.7	40.70	0.00	128.8	112.6	4867	4677	0.757
November	58.3	28.80	0.00	86.7	66.5	2788	2672	0.642
December	48.7	24.40	0.00	77.5	54.8	2279	2179	0.585
Year	1573.0	559.10	9.12	1817.8	1637.4	75648	72475	0.830

Legends

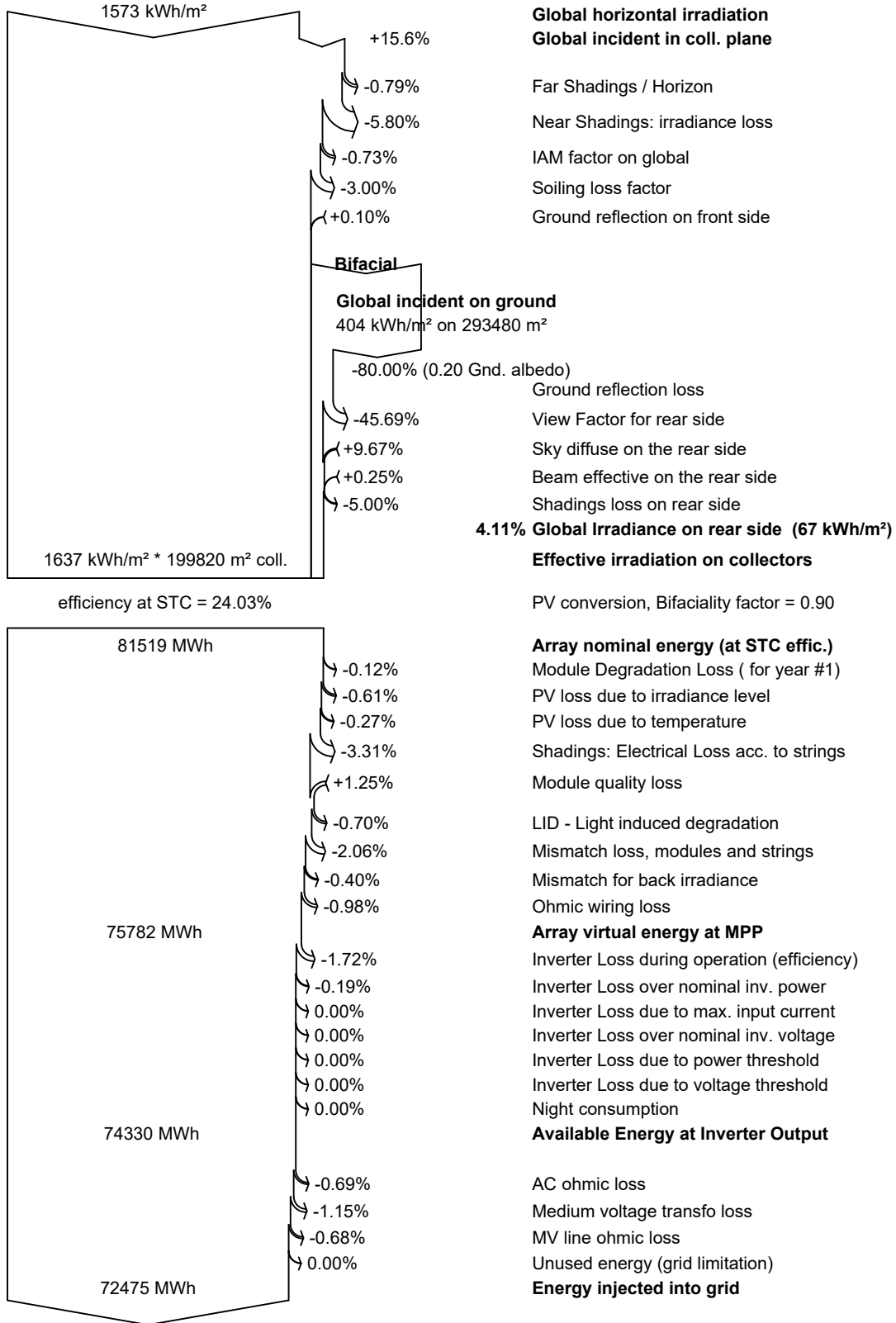
- GlobHor Global horizontal irradiation
- DiffHor Horizontal diffuse irradiation
- T_Amb Ambient Temperature
- GlobInc Global incident in coll. plane
- GlobEff Effective Global, corr. for IAM and shadings
- EArray Effective energy at the output of the array
- E_Grid Energy injected into grid
- PR Performance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



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Loss diagram



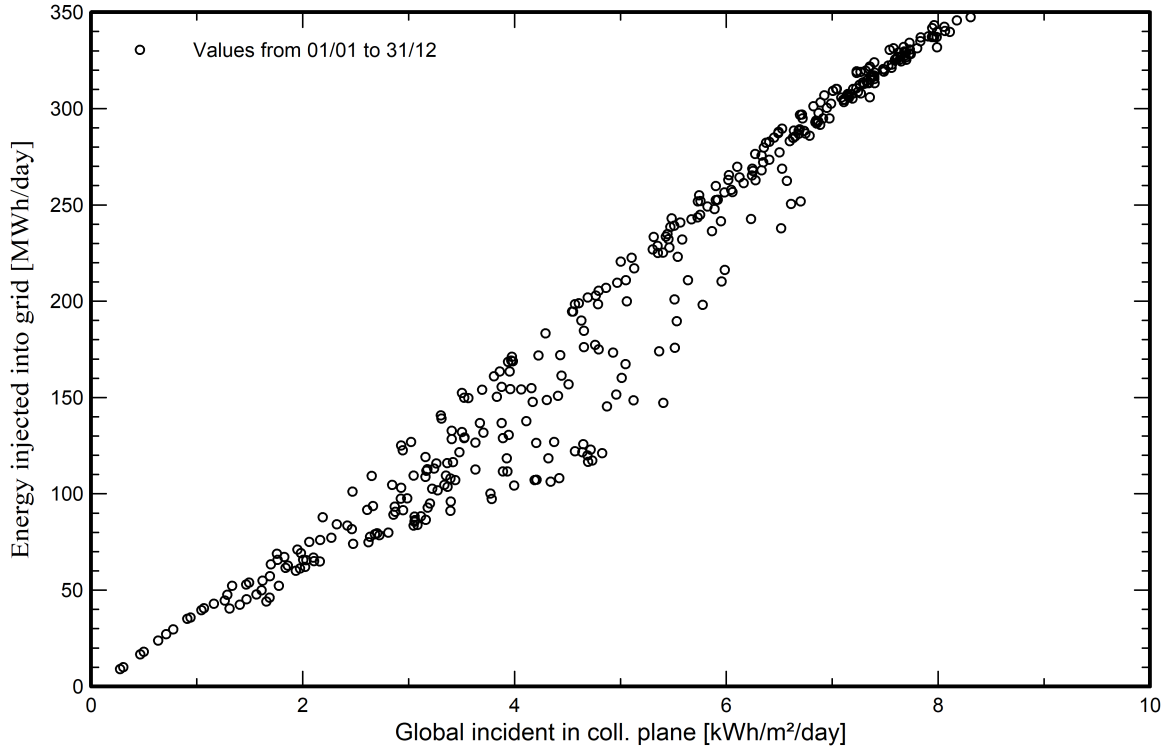


PVsyst V7.3.1

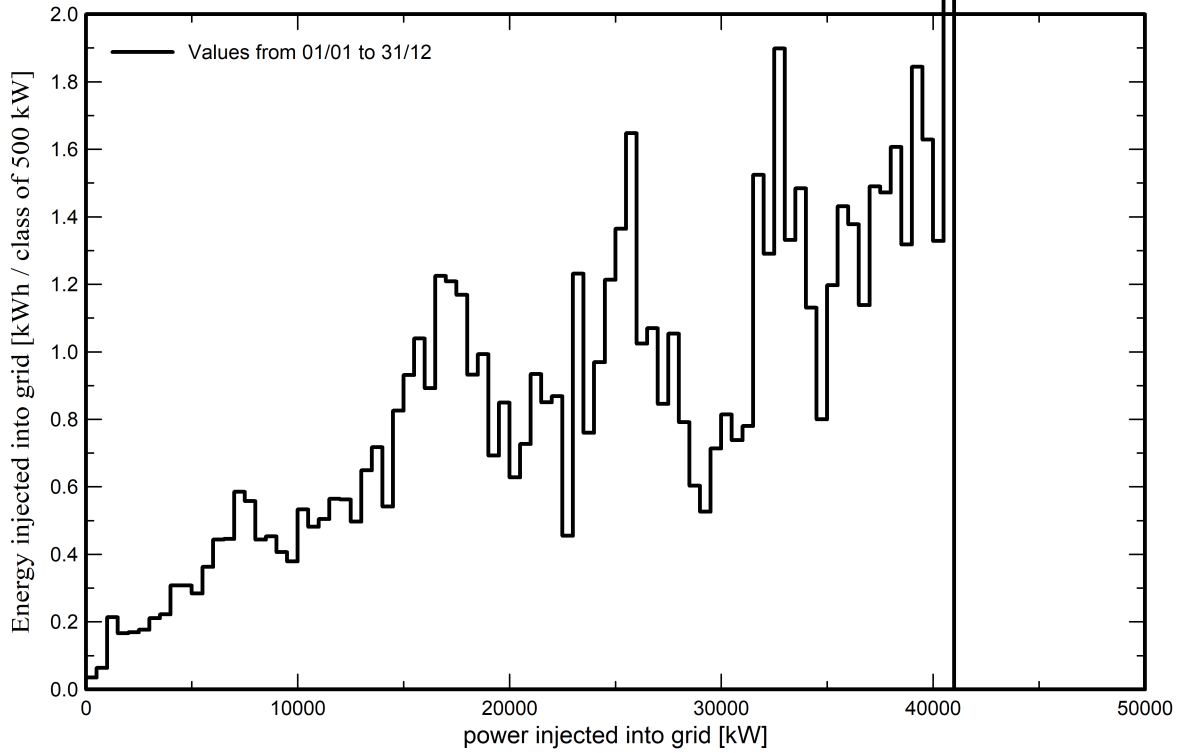
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Predef. graphs

Diagrama entrada/salida diaria



Distribución de potencia de salida del sistema





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Aging Tool

Aging Parameters

Time span of simulation 30 years

Module average degradation

Loss factor 0.25 %/year

Mismatch due to degradation

Imp RMS dispersion 0.4 %/year
Vmp RMS dispersion 0.4 %/year

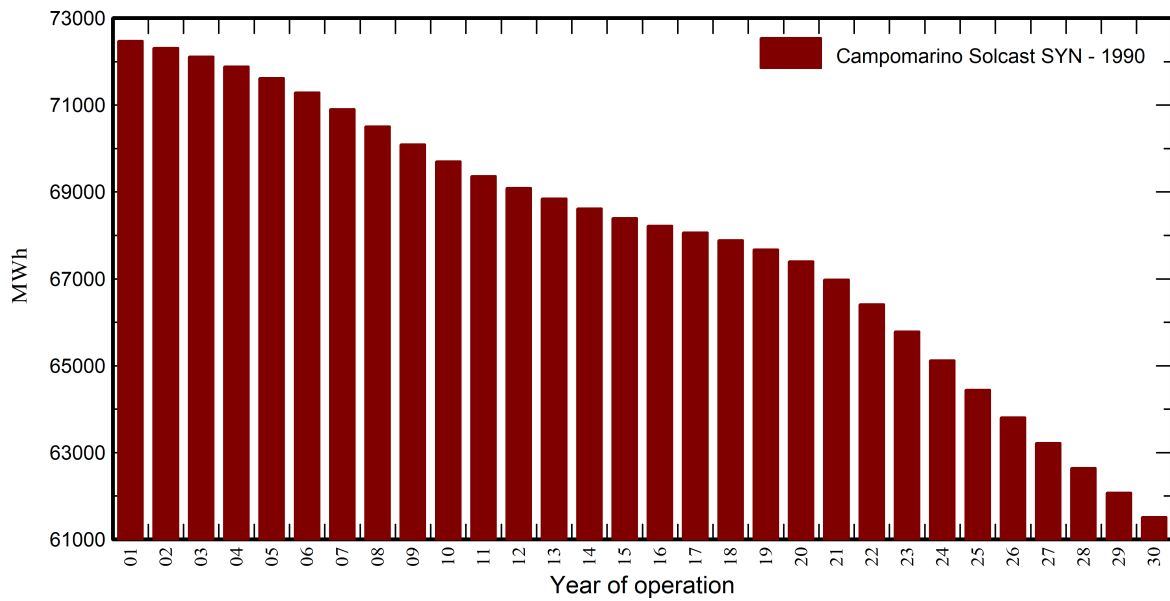
Meteo used in the simulation

#1 Campomarino Solcast SYN

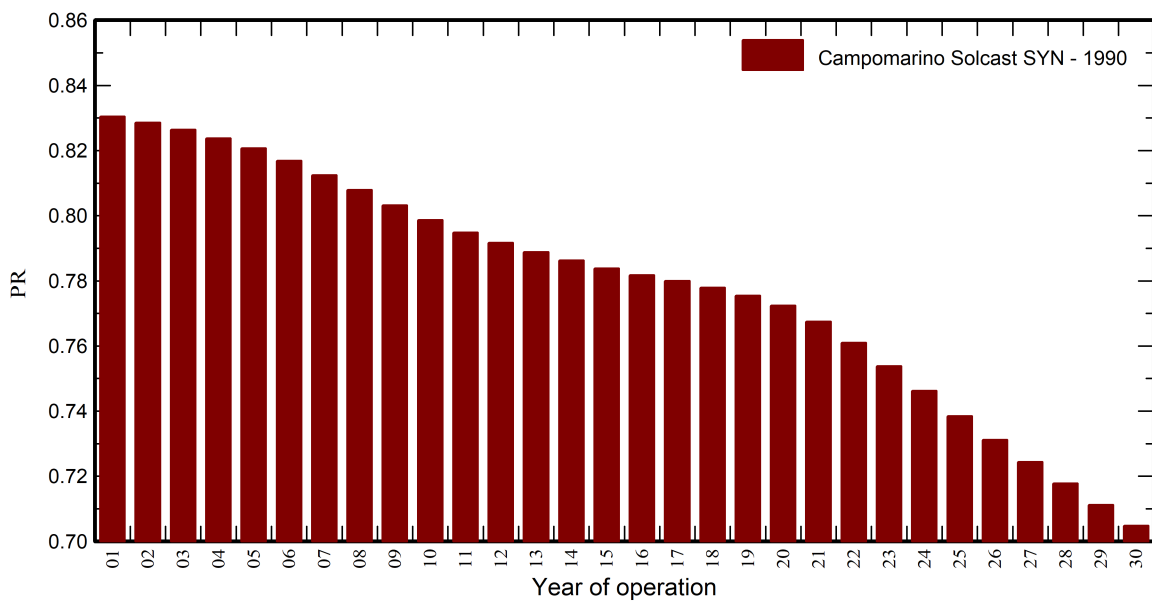
Years 1990 (reference year)

Years simulated 1-30

System output energy



Performance Ratio





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Meteo used in the simulation

#1 Campomarino Solcast SYN

Years 1990 (reference year)
Years simulated 1-30

Campomarino Solcast SYN

Year	System output	PR	PR loss
	MWh		%
1	72475	0.83	0%
2	72315	0.829	-0.2%
3	72120	0.826	-0.5%
4	71889	0.824	-0.8%
5	71622	0.821	-1.2%
6	71293	0.817	-1.6%
7	70907	0.812	-2.2%
8	70505	0.808	-2.7%
9	70098	0.803	-3.3%
10	69701	0.799	-3.8%
11	69365	0.795	-4.3%
12	69094	0.792	-4.7%
13	68846	0.789	-5%
14	68617	0.786	-5.3%
15	68401	0.784	-5.6%
16	68222	0.782	-5.9%
17	68068	0.78	-6.1%
18	67892	0.778	-6.3%
19	67677	0.775	-6.6%
20	67405	0.772	-7%
21	66983	0.767	-7.6%
22	66411	0.761	-8.4%
23	65785	0.754	-9.2%
24	65124	0.746	-10.1%
25	64447	0.738	-11.1%
26	63809	0.731	-12%
27	63220	0.724	-12.8%
28	62641	0.718	-13.6%
29	62072	0.711	-14.4%
30	61513	0.705	-15.1%



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P50 - P90 evaluation

Meteo data

Source Campomarino_Solcast_SYN.MET
Kind Monthly averages
Sintético - Multi-year average
Year-to-year variability(Variance) 3.0 %

Specified Deviation

Climate change 0.0 %

Global variability (meteo + system)

Variability (Quadratic sum) 3.5 %

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 72.48 GWh
P90 69.22 GWh
P95 68.31 GWh

Probability distribution

