IL TECNICO	IL PROPONENTE
Coordinamento tecnico di progetto	
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	FEBBRAIO 2024

Version 7.4.0

PVsyst - Simulation report

Grid-Connected System

Project: ITS3SE - Serracapriola 2

Variant: Revisione A - Serracapriola 51.5

Tracking system with backtracking

System power: 64.53 MWp

Solcast_site_151229_417572 - Italy

Autor(a)

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with v7.4.0

Project summary

Geographical Site
Solcast_site_151229_417572
Italy

Situation

Latitude	41.76 °N
Longitude	15.12 °E
Altitude	180 m
Time zone	UTC+1

Project settings
Albedo 0.20

Meteo data
Serracapriola
SolarGISv2.2.38 - TMY

System summary

Grid-Connected System
Simulation for year no 1

Tracking system with backtracking

PV Field Orientation

Orientation	
Tracking plane, tilted axis	
Avg axis tilt	0.2 °
Avg axis azim.	0 °

Tracking algorithm
Irradiance optimization
Backtracking activated

Near Shadings
According to strings
Electrical effect 100 %
Diffuse shading Automatic

System information

PV Array		Inverters	
Nb. of modules	89628 units	Nb. of units	203 units
Pnom total	64.53 MWp	Pnom total	66.99 MWac
		Grid power limit	51.50 MWac
		Grid lim. Pnom ratio	1.253

User's needs
Unlimited load (grid)

Results summary

Produced Energy	104987.80 MWh/year	Specific production	1627 kWh/kWp/year	Perf. Ratio PR	80.45 %

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General parameters

Grid-Connected System

Tracking system with backtracking

PV Field Orientation

Orientation

Tracking plane, tilted axis	
Avg axis tilt	0.2 °
Avg axis azim.	0 °

Tracking algorithm

Irradiance optimization	
Backtracking activated	

Backtracking array

Nb. of trackers	2081 units

Sizes

Tracker Spacing	5.00 m
Collector width	2.38 m
Ground Cov. Ratio (GCR)	47.7 %
Phi min / max.	-/+ 60.0 °

Backtracking strategy

Phi limits for BT	-/+ 61.3 °
Backtracking pitch	5.00 m
Backtracking width	2.38 m

Models used

Transposition	Perez
Diffuse	Imported
Circumsolar	separate

Horizon

Average Height	2.6 °

Near Shadings

According to strings	
Electrical effect	100 %
Diffuse shading	Automatic

User's needs

Unlimited load (grid)

Bifacial system

Model: 2D Calculation
unlimited trackers

Bifacial model geometry

Tracker Spacing	5.00 m
Tracker width	2.38 m
GCR	47.7 %
Axis height above ground	3.13 m

Bifacial model definitions

Ground albedo	0.20
Bifaciality factor	80 %
Rear shading factor	5.0 %
Rear mismatch loss	10.0 %
Shed transparent fraction	0.0 %

Grid power limitation

Active power	51.50 MWac
Pnom ratio	1.253

PV Array Characteristics

PV module

Manufacturer	CSI Solar
Model	CS7N-720TB-AG 1500V
(Custom parameters definition)	
Unit Nom. Power	720 Wp
Number of PV modules	89628 units
Nominal (STC)	64.53 MWp

Inverter

Manufacturer	Huawei Technologies
Model	SUN2000-330KTL-H1-Preliminary V0.1
(Custom parameters definition)	
Unit Nom. Power	330 kWac
Number of inverters	203 units
Total power	66990 kWac

Array #1 - Area NORD

Number of PV modules	27552 units
Nominal (STC)	19.84 MWp
Modules	984 Strings x 28 In series
At operating cond. (47°C)	
Pmpp	18.60 MWp
U mpp	1057 V
I mpp	17587 A

Number of inverters	66 units
Total power	21780 kWac
Operating voltage	500-1500 V
Pnom ratio (DC:AC)	0.91
Power sharing within this inverter	

PV Array Characteristics

Array #2 - Area SUD

Number of PV modules	62076 units	Number of inverters	137 units
Nominal (STC)	44.69 MWp	Total power	45210 kWac
Modules	2217 Strings x 28 In series		
At operating cond. (47°C)		Operating voltage	500-1500 V
Pmpp	41.90 MWp	Pnom ratio (DC:AC)	0.99
U mpp	1057 V	Power sharing within this inverter	
I mpp	39624 A		

Total PV power

Nominal (STC)	64532 kWp	Total power	66990 kWac
Total	89628 modules	Number of inverters	203 units
Module area	278416 m²	Pnom ratio	0.96

Array losses

Array Soiling Losses
Loss Fraction 2.5 %

Thermal Loss factor
Module temperature according to irradiance
Uc (const) 29.0 W/m²K
Uv (wind) 0.0 W/m²K/m/s

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 -0.4 %

Module mismatch losses
Loss Fraction 1.0 % at MPP

Strings Mismatch loss
Loss Fraction 0.1 %

Module average degradation
Year no 1
Loss factor 0.4 %/year

Mismatch due to degradation
Imp RMS dispersion 0.4 %/year
Vmp RMS dispersion 0.4 %/year

IAM loss factor
Incidence effect (IAM): Fresnel, AR coating, n(glass)=1.526, n(AR)=1.290

0°	30°	50°	60°	70°	75°	80°	85°	90°
1.000	0.999	0.987	0.962	0.892	0.816	0.681	0.440	0.000

DC wiring losses

Global wiring resistance 0.30 mΩ
Loss Fraction 1.5 % at STC

Array #1 - Area NORD
Global array res. 0.97 mΩ
Loss Fraction 1.5 % at STC

Array #2 - Area SUD
Global array res. 0.43 mΩ
Loss Fraction 1.5 % at STC

System losses

Auxiliaries loss
constant (fans) 17.00 kW
0.0 kW from Power thresh.
Night aux. cons. 10.00 kW

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AC wiring losses

Inv. output line up to MV transfo

Inverter voltage	800	Vac tri
Loss Fraction	1.13	% at STC

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

Wire section (203 Inv.)	Alu 203 x 3 x 300	mm²
Average wires length	220	m

MV line up to Injection

MV Voltage	36	kV
Wires	Alu 3 x 2000	mm²
Length	16500	m
Loss Fraction	1.27	% at STC

AC losses in transformers

MV transfo

Medium voltage	36	kV

Transformer parameters

Nominal power at STC	63.41	MVA
Iron Loss (24/24 Connexion)	66.58	kVA
Iron loss fraction	0.10	% at STC
Copper loss	599.84	kVA
Copper loss fraction	0.95	% at STC
Coils equivalent resistance	3 x 0.10	mΩ

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Horizon definition

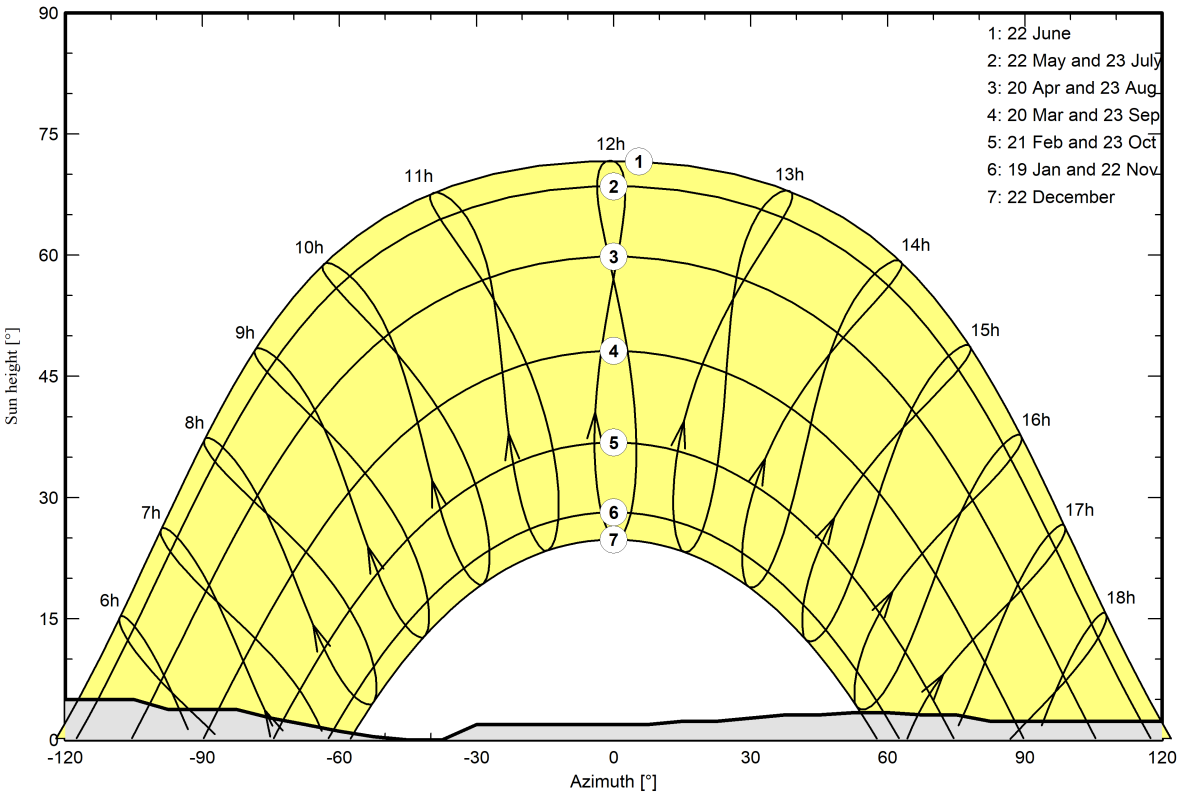
Horizon from PVGIS website API, Lat=41°45'25", Long=15°7'22", Alt=180m

Average Height	2.6 °	Albedo Factor	0.87
Diffuse Factor	0.96	Albedo Fraction	100 %

Horizon profile

Azimuth [°]	-180	-173	-165	-158	-150	-143	-128	-120	-105	-98	-83	-75	-68
Height [°]	2.3	2.7	3.1	3.1	3.8	4.2	4.2	5.0	5.0	3.8	3.8	2.7	1.9
Azimuth [°]	-60	-53	-45	-38	-30	8	15	23	30	38	45	53	60
Height [°]	1.1	0.4	0.0	0.0	1.9	1.9	2.3	2.3	2.7	3.1	3.1	3.4	3.4
Azimuth [°]	68	75	83	120	128	135	143	150	165	173	180		
Height [°]	3.1	3.1	2.3	2.3	1.9	1.5	1.5	1.9	1.9	2.3	2.3		

Sun Paths (Height / Azimuth diagram)

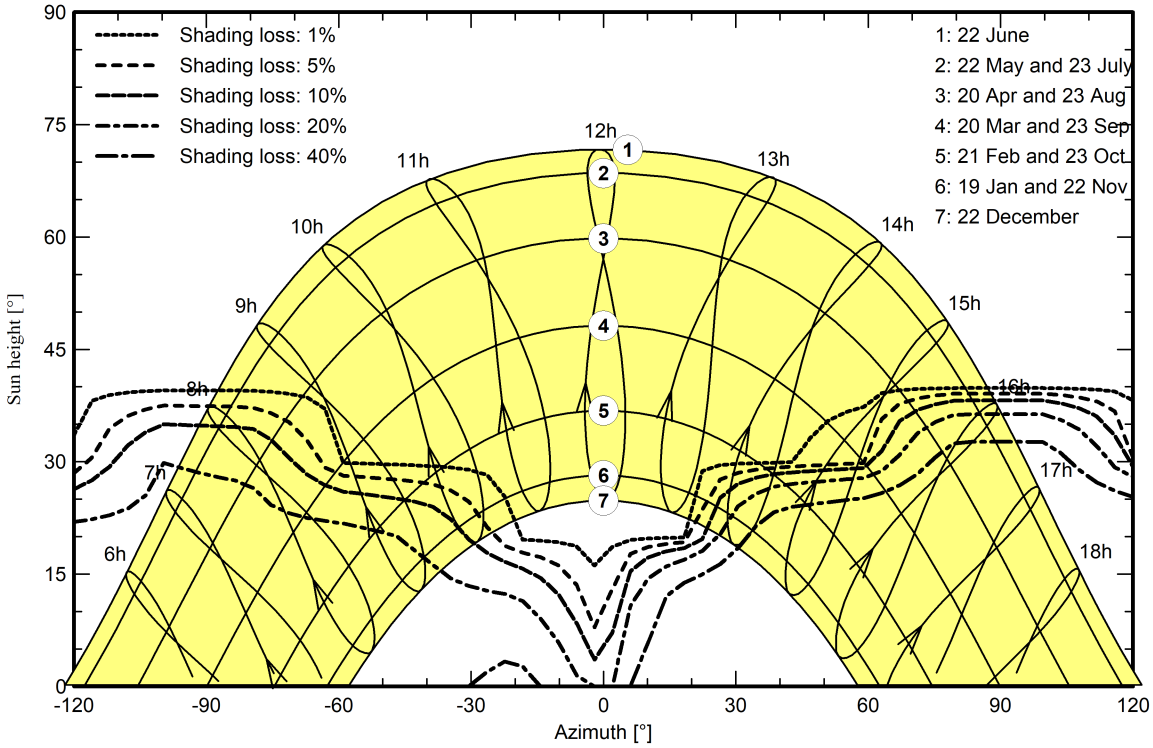


Near shadings parameter

Perspective of the PV-field and surrounding shading scene

Iso-shadings diagram

Orientation #1



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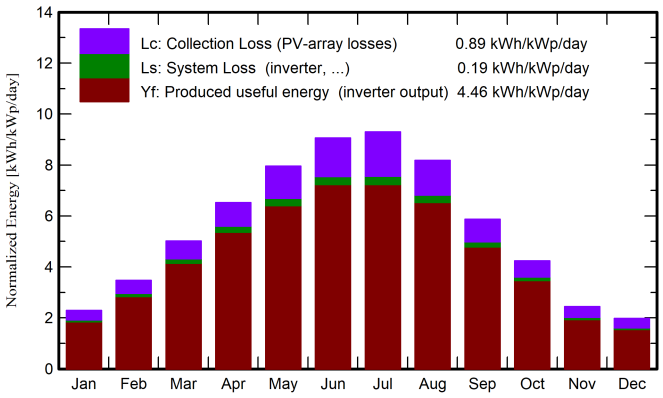
Main results

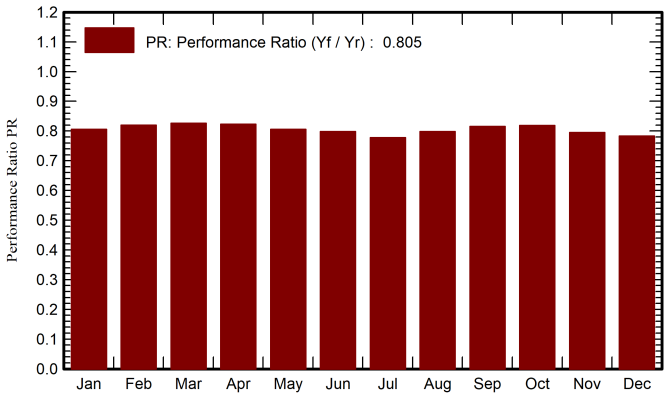
System Production

Produced Energy	104987.80 MWh/year	Specific production	1627 kWh/kWp/year
		Perf. Ratio PR	80.45 %

Normalized productions (per installed kWp)



Performance Ratio PR



Balances and main results

	GlobHor kWh/m²	DiffHor kWh/m²	T_Amb °C	GlobInc kWh/m²	GlobEff kWh/m²	EArray MWh	E_Grid MWh	PR ratio
January	54.7	25.37	9.53	71.2	65.1	3862	3706	0.806
February	75.7	33.90	8.71	97.4	90.0	5357	5152	0.820
March	119.3	49.43	11.59	155.6	145.3	8650	8301	0.827
April	156.3	64.74	14.76	195.7	185.1	10847	10389	0.822
May	196.5	79.13	18.88	246.5	233.4	13393	12828	0.806
June	218.0	82.14	24.54	271.8	258.2	14637	14005	0.799
July	223.9	67.64	26.49	288.3	273.7	15144	14478	0.778
August	198.3	65.54	26.41	253.8	240.8	13654	13071	0.798
September	137.3	58.28	22.62	176.1	165.4	9656	9270	0.816
October	102.5	46.84	19.53	131.2	122.4	7215	6936	0.819
November	57.7	28.94	14.00	73.3	67.1	3916	3756	0.795
December	46.2	22.33	9.04	61.2	55.2	3234	3095	0.783
Year	1586.3	624.29	17.22	2022.2	1901.8	109565	104988	0.805

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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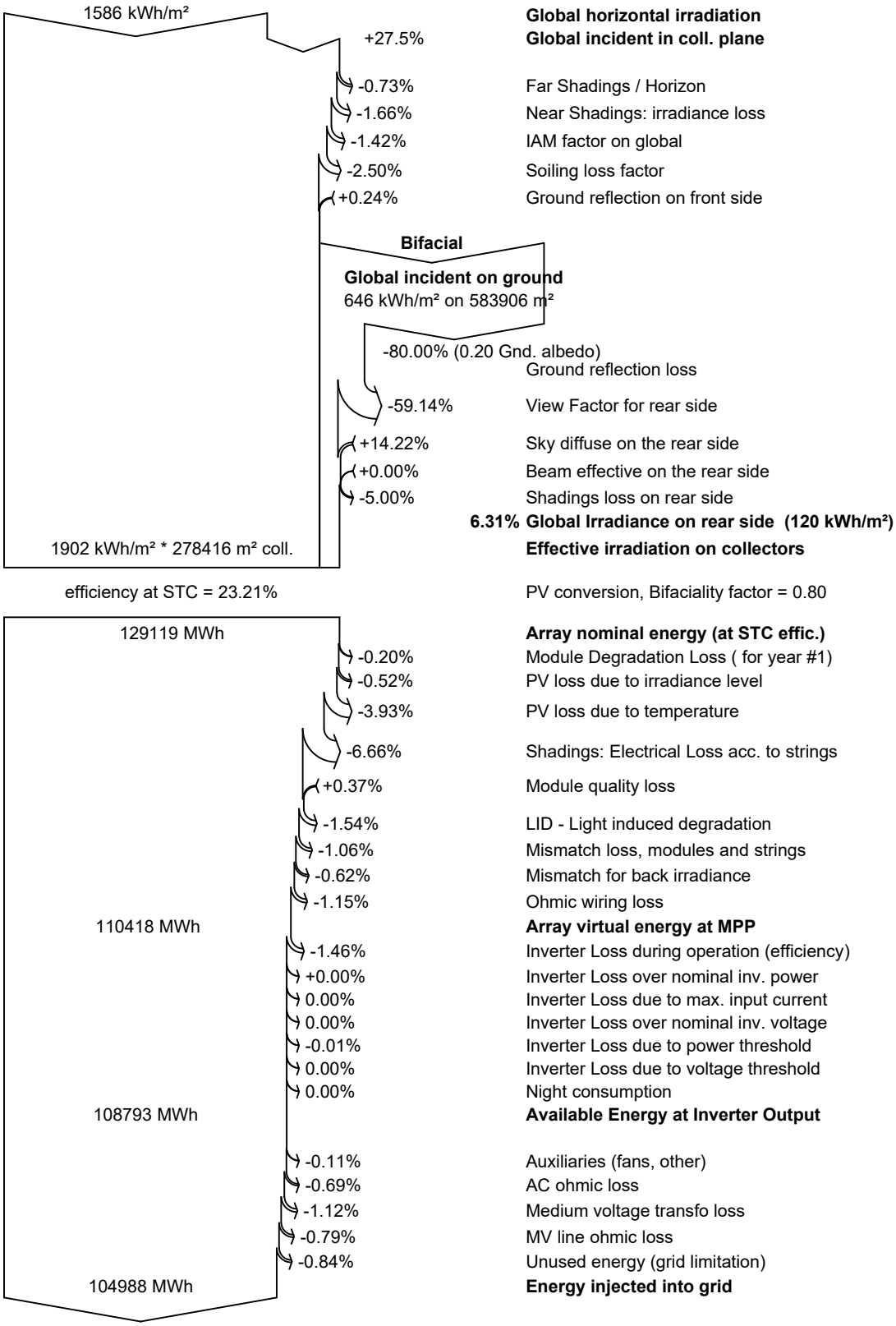
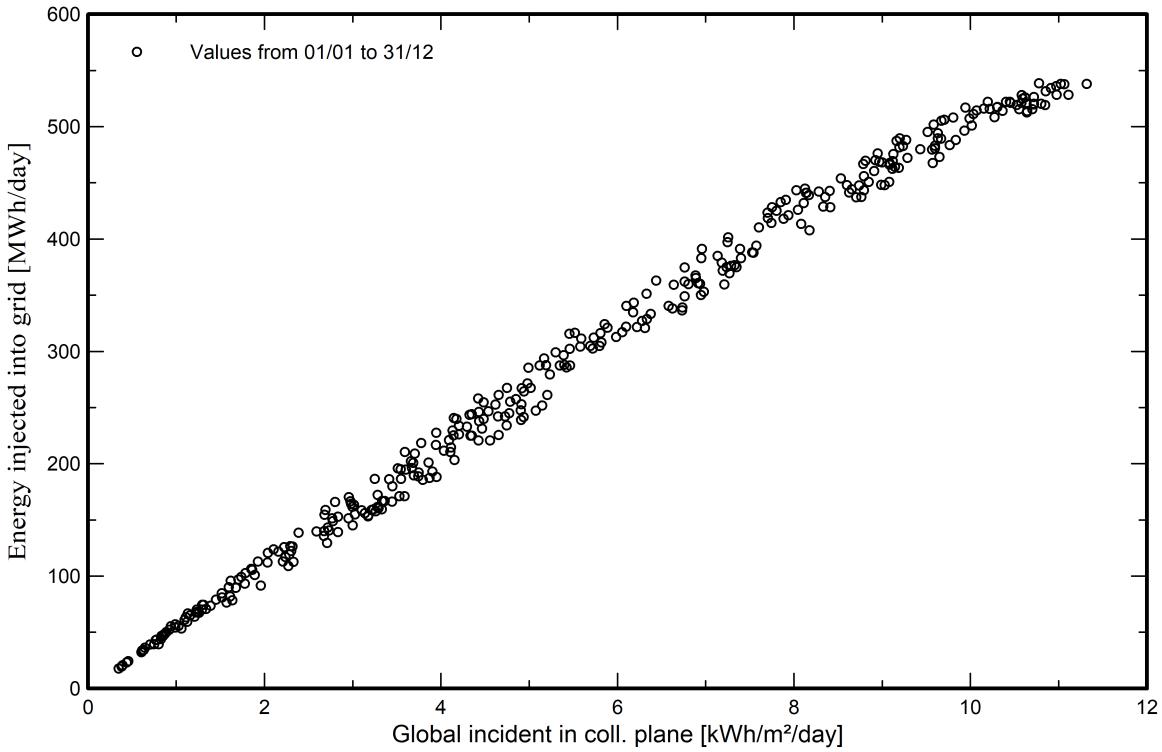
Loss diagram

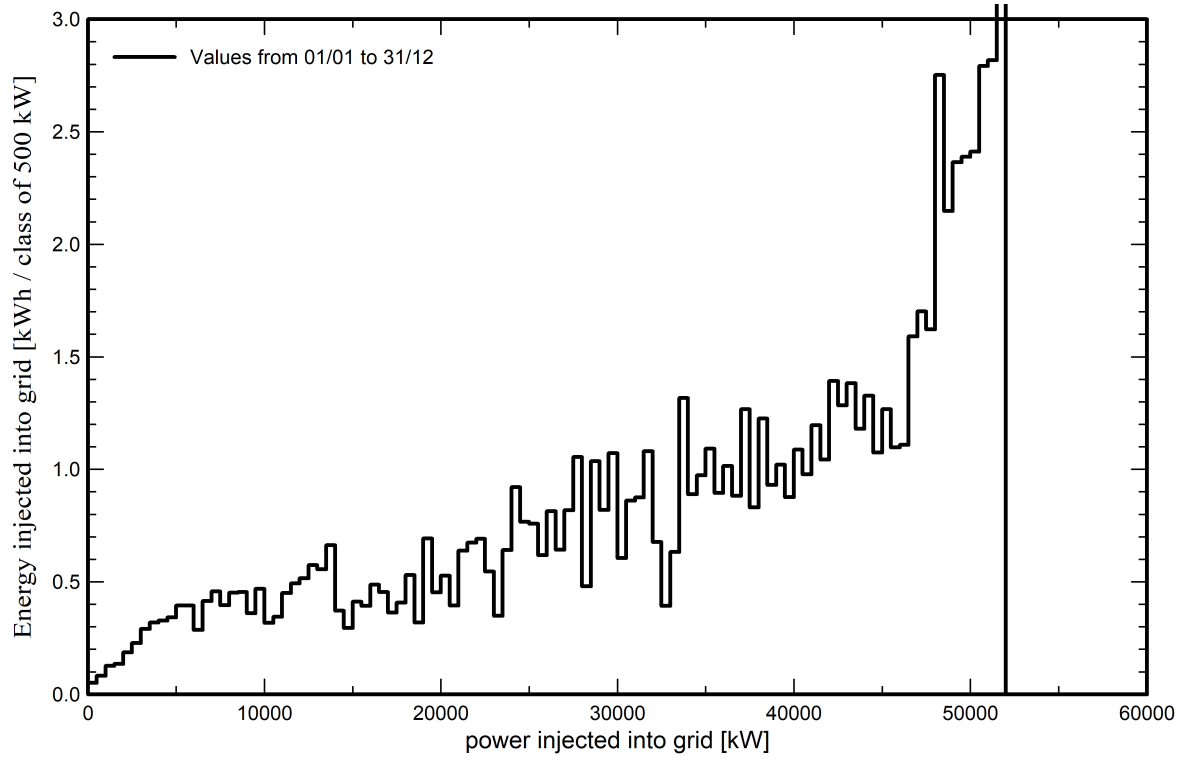


Predef. graphs

Diagramma giornaliero entrata/uscita



Distribución de potencia de salida del sistema



Aging Tool

Aging Parameters

Time span of simulation 30 years

Module average degradation

Loss factor 0.4 %/year

Mismatch due to degradation

Imp RMS dispersion 0.4 %/year

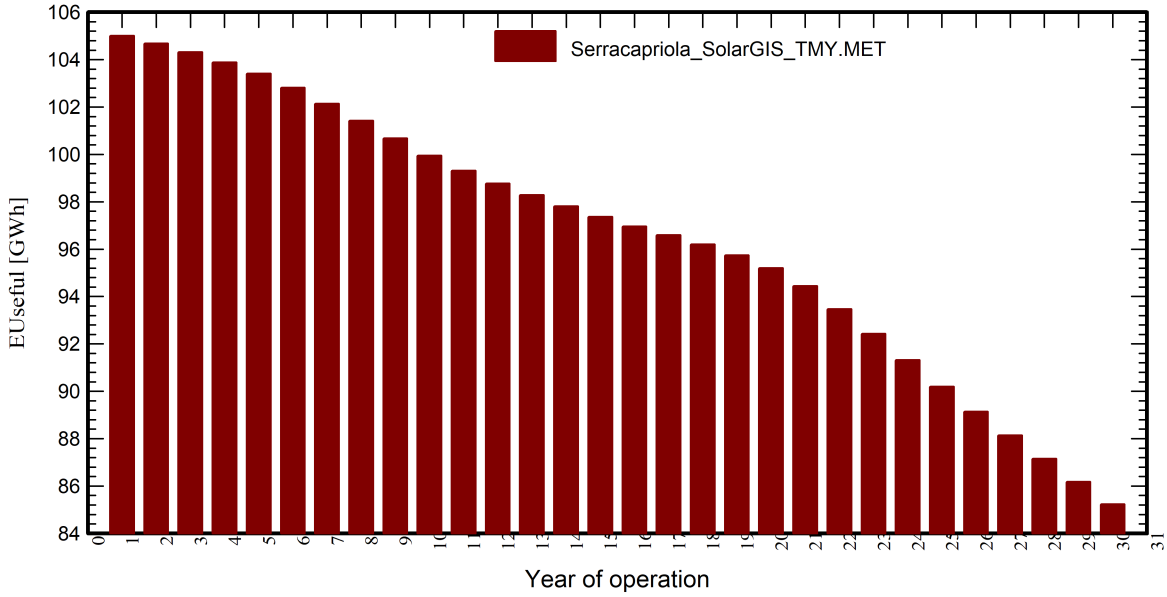
Vmp RMS dispersion 0.4 %/year

Meteo used in the simulation

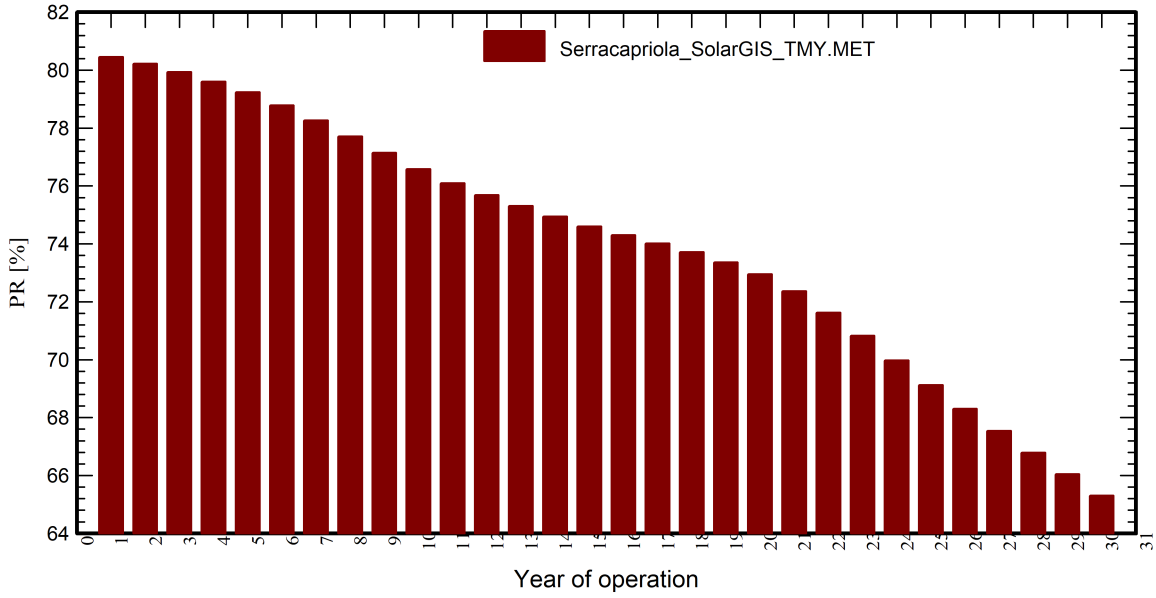
Serracapriola SolarGIS TMY

Years reference year

Useful out system energy



Performance Ratio



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Aging Tool

Aging Parameters

Time span of simulation 30 years

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Imp RMS dispersion 0.4 %/year

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Meteo used in the simulation

Serracapriola SolarGIS TMY

Years reference year

	EUseful	PR	PR loss
Year	GWh	%	%
1	105.00	80.46	-0.15
2	104.68	80.22	-0.45
3	104.31	79.93	-0.80
4	103.88	79.61	-1.21
5	103.40	79.24	-1.67
6	102.82	78.79	-2.22
7	102.13	78.26	-2.87
8	101.41	77.71	-3.56
9	100.67	77.15	-4.26
10	99.94	76.58	-4.96
11	99.30	76.09	-5.57
12	98.77	75.69	-6.07
13	98.27	75.31	-6.54
14	97.80	74.95	-6.99
15	97.36	74.60	-7.42
16	96.96	74.30	-7.80
17	96.59	74.02	-8.14
18	96.19	73.71	-8.52
19	95.74	73.36	-8.96
20	95.20	72.95	-9.47
21	94.44	72.37	-10.19
22	93.47	71.62	-11.11
23	92.42	70.82	-12.11
24	91.32	69.98	-13.16
25	90.20	69.12	-14.22
26	89.13	68.30	-15.24
27	88.13	67.54	-16.19
28	87.15	66.78	-17.12
29	86.18	66.04	-18.04
30	85.23	65.31	-18.95

P50 - P90 evaluation

Meteo data

Source	SolarGISv2.2.38
Kind	Monthly averages
TMY - 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	3.67 GWh
P50	104.99 GWh
P90	100.28 GWh
P95	98.95 GWh

Probability distribution