Version 7.2.8

PVsyst - Simulation report

Grid-Connected System

Project: IT21CS - Castellaneta 1

Variant: Castelaneta 1_Fixed_525Wp_2P(7-14-28)

Ground system (tables) on a hill

System power: 75.78 MWp

Masseria Salesiani - Italy

MAURIZIO DE DONNO
07.09.2022 11:16:20
GMT+01:00

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Project summary

Geographical Site
Masseria Salesiani
Italy

Situation

Latitude	40.59 °N
Longitude	16.92 °E
Altitude	74 m
Time zone	UTC+1

Project settings

Albedo	0.20

Meteo data
Masseria Salesiani
Meteonorm 8.0, Sat=100% - 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 / 0 °

Near Shadings

According to strings	
Electrical effect	100 %

User's needs
Unlimited load (grid)

System information

PV Array

Nb. of modules	144340 units
Pnom total	75.78 MWp

Inverters

Nb. of units	66 units
Pnom total	65.868 MWac
Grid power limit	65.835 MWac
Grid lim. Pnom ratio	1.151

Results summary

Produced Energy	107357 MWh/year	Specific production	1417 kWh/kWp/year	Perf. Ratio PR	83.12 %

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General parameters

Grid-Connected System — **Ground system (tables) on a hill**

PV Field Orientation

Orientation		Sheds configuration		Models used	
Fixed plane		Nb. of sheds	3045 units	Transposition	Perez
Tilt/Azimuth	25 / 0 °	**Sizes**		Diffuse	Perez, Meteonorm
		Sheds spacing	7.10 m	Circumsolar	separate
		Collector width	4.48 m		
		Ground Cov. Ratio (GCR)	63.1 %		
		Shading limit angle			
		Limit profile angle	31.9 °		

Horizon		Near Shadings		User's needs
Average Height	1.2 °	According to strings		Unlimited load (grid)
		Electrical effect	100 %	

Bifacial system

Model: 2D Calculation, unlimited sheds

Bifacial model geometry		Bifacial model definitions	
Sheds spacing	7.10 m	Ground albedo	0.20
Sheds width	4.48 m	Bifaciality factor	70 %
Limit profile angle	31.9 °	Rear shading factor	5.0 %
GCR	63.1 %	Rear mismatch loss	10.0 %
Height above ground	1.50 m	Shed transparent fraction	0.0 %

Grid power limitation

Active Power	65.835 MWac
Pnom ratio	1.151

PV Array Characteristics

PV module

Manufacturer	Jinkosolar
Model	JKM525M-7TL4-TV
(Custom parameters definition)	
Unit Nom. Power	525 Wp
Number of PV modules	144340 units
Nominal (STC)	75.78 MWp
Modules	5155 Strings x 28 In series
At operating cond. (51°C)	
Pmpp	68.86 MWp
U mpp	1020 V
I mpp	67515 A

Inverter

Manufacturer	Santerno
Model	SUNWAY TG 900 1500V TE - 640 EV
(Custom parameters definition)	
Unit Nom. Power	998 kWac
Number of inverters	66 units
Total power	65868 kWac
Operating voltage	910-1300 V
Pnom ratio (DC:AC)	1.15

Total PV power

Nominal (STC)	75779 kWp
Total	144340 modules
Module area	365010 m²
Cell area	343160 m²

Total inverter power

Total power	65868 kWac
Nb. of inverters	66 units
Pnom ratio	1.15

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

DC wiring losses
Global array res. 0.11 mΩ
Loss Fraction 0.7 % at STC

Serie Diode Loss
Voltage drop 0.7 V
Loss Fraction 0.1 % at STC

LID - Light Induced Degradation
Loss Fraction 0.2 %

Module Quality Loss
Loss Fraction -0.8 %

Module mismatch losses
Loss Fraction 1.5 % at MPP

Strings Mismatch loss
Loss Fraction 0.1 %

Module average degradation
Year no 1
Loss factor 0.45 %/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

0°	30°	50°	60°	70°	75°	80°	85°	90°
1.000	1.000	1.000	0.999	0.989	0.964	0.922	0.729	0.000

AC wiring losses

Inv. output line up to MV transfo
Inverter voltage 640 Vac tri
Loss Fraction 0.09 % at STC
Inverter: SUNWAY TG 900 1500V TE - 640 EV
Wire section (66 Inv.) Alu 66 x 3 x 1000 mm²
Average wires length 10 m

MV line up to HV Transfo
MV Voltage 20 kV
Wires Alu 3 x 2000 mm²
Length 50 m
Loss Fraction 0.01 % at STC

HV line up to Injection
HV line voltage 150 kV
Wires Alu 3 x 240 mm²
Length 10500 m
Loss Fraction 0.46 % at STC

AC losses in transformers

MV transfo
Medium voltage 20 kV
Operating losses at STC
Nominal power at STC 74605 kVA
Iron loss (24/24 Connexion) 74.60 kW
Loss Fraction 0.10 % at STC
Coils equivalent resistance 3 x 0.05 mΩ
Loss Fraction 1.00 % at STC

HV transfo
Grid voltage 150 kV
Transformer from Datasheets
Nominal power 80000 kVA
Iron loss 440.00 kVA
Loss Fraction 0.55 % of PNom
Copper loss 304.00 kVA
Loss Fraction 0.38 % of PNom

Operating losses at STC
Nominal power at STC 74605 kVA
Iron loss (24/24 Connexion) 440.00 kW
Loss Fraction 0.59 % at STC
Coils equivalent resistance 3 x 19.00 mΩ
Loss Fraction 0.35 % at STC

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Horizon definition

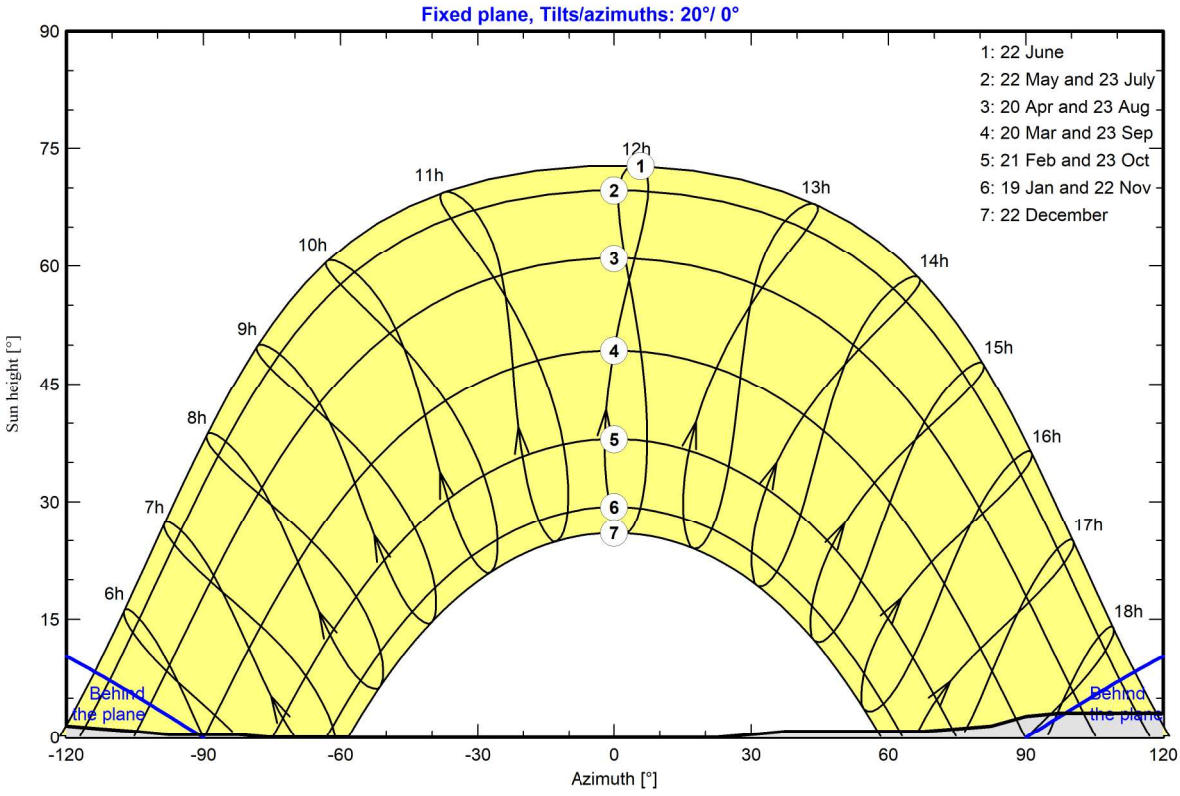
Horizon from PVGIS website API, Lat=40°35'29', Long=16°54'56', Alt=74m

Average Height	1.2 °	Albedo Factor	0.99
Diffuse Factor	1.00	Albedo Fraction	100 %

Horizon profile

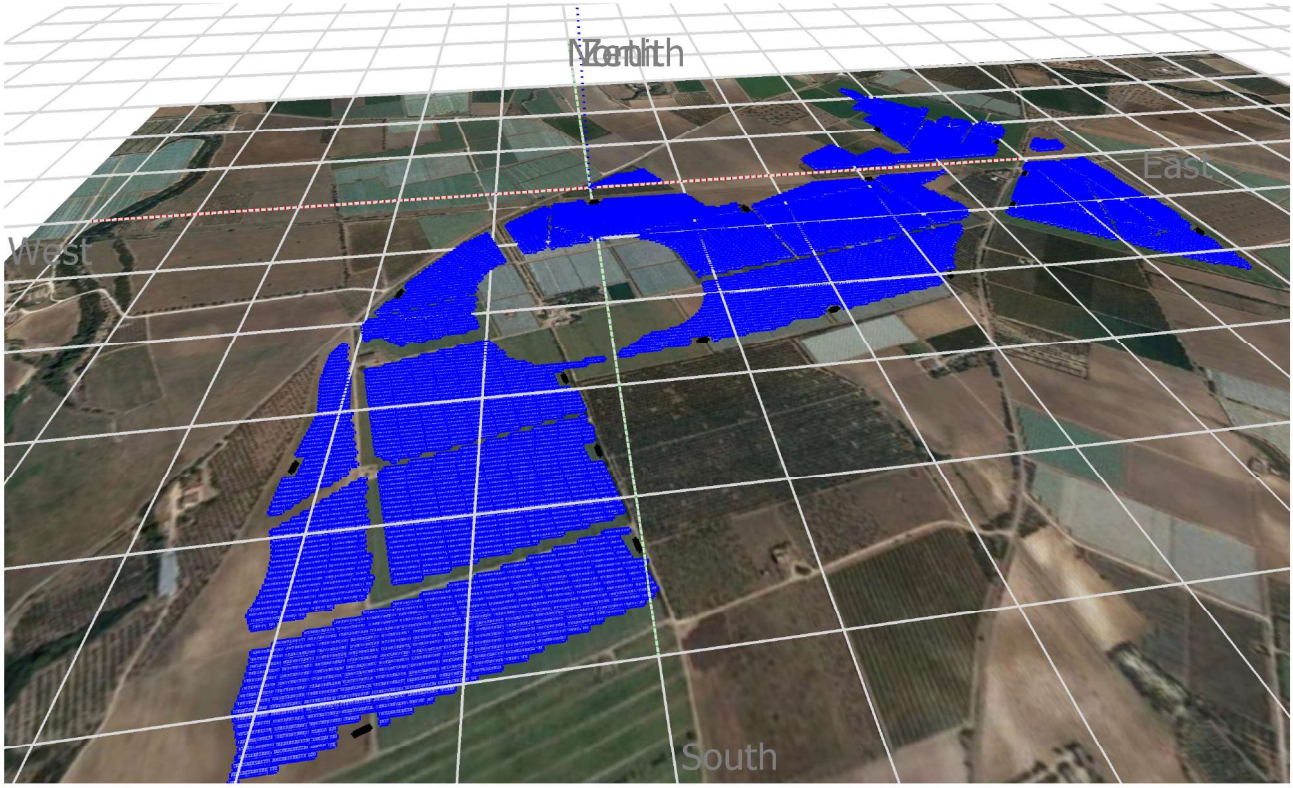
Azimuth [°]	-180	-173	-165	-143	-135	-120	-113	-105	-98	-83	-75	23	30	38
Height [°]	1.9	2.3	1.9	1.9	1.5	1.5	1.1	0.8	0.4	0.4	0.0	0.0	0.4	0.8
Azimuth [°]	68	75	83	90	98	128	135	143	150	158	165	173	180	
Height [°]	0.8	1.1	1.5	2.7	3.1	3.1	2.7	2.3	1.9	2.3	2.3	1.9	1.9	

Sun Paths (Height / Azimuth diagram)

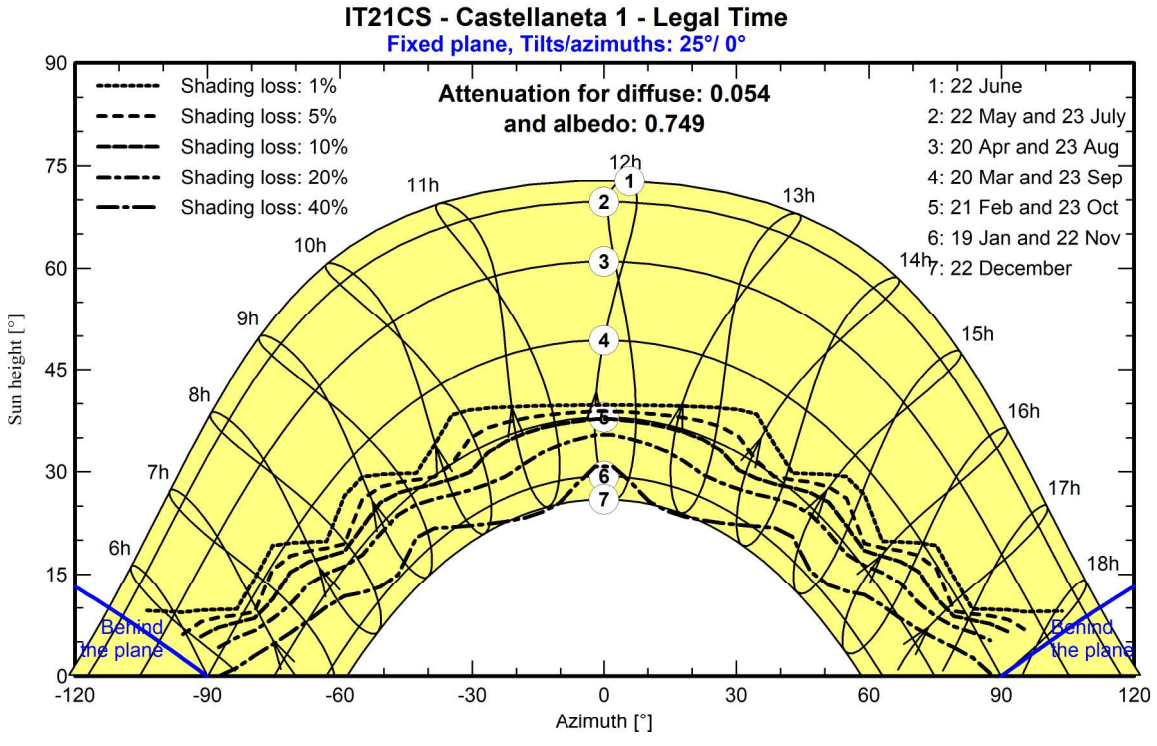


Near shadings parameter

Perspective of the PV-field and surrounding shading scene



Iso-shadings diagram



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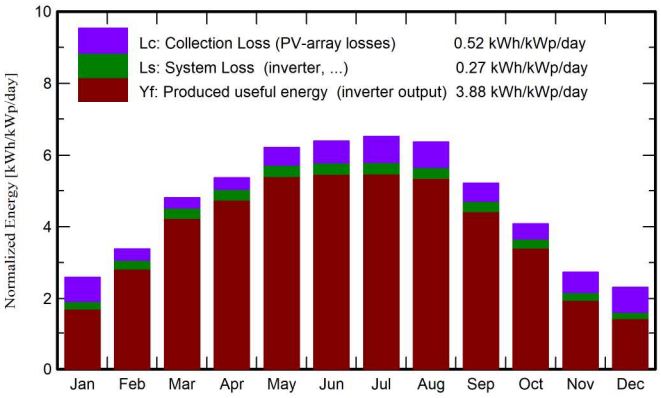
Main results

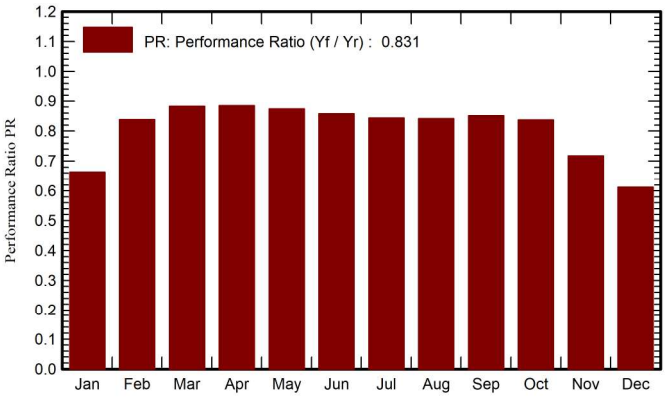
System Production

Produced Energy	107357 MWh/year	Specific production	1417 kWh/kWp/year
		Performance Ratio PR	83.12 %

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	54.3	27.89	9.18	80.2	71.0	4525	4031	0.664
February	71.2	37.76	9.84	94.5	88.4	6511	6004	0.838
March	122.0	52.54	12.39	148.9	141.9	10625	9954	0.882
April	148.3	77.58	15.29	161.2	153.1	11473	10805	0.884
May	190.0	86.42	19.98	192.5	183.2	13477	12734	0.873
June	197.0	86.08	24.99	191.8	182.6	13180	12467	0.858
July	205.0	76.12	28.65	202.0	192.9	13649	12906	0.843
August	185.2	76.00	28.27	197.3	188.5	13325	12582	0.842
September	134.6	57.22	22.79	156.1	148.9	10724	10072	0.851
October	98.1	49.04	18.75	126.3	119.3	8619	8016	0.837
November	58.2	32.43	14.14	81.9	74.0	4948	4457	0.718
December	46.1	23.36	10.49	71.7	61.2	3806	3328	0.613
Year	1509.9	682.45	17.95	1704.4	1605.1	114862	107357	0.831

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		

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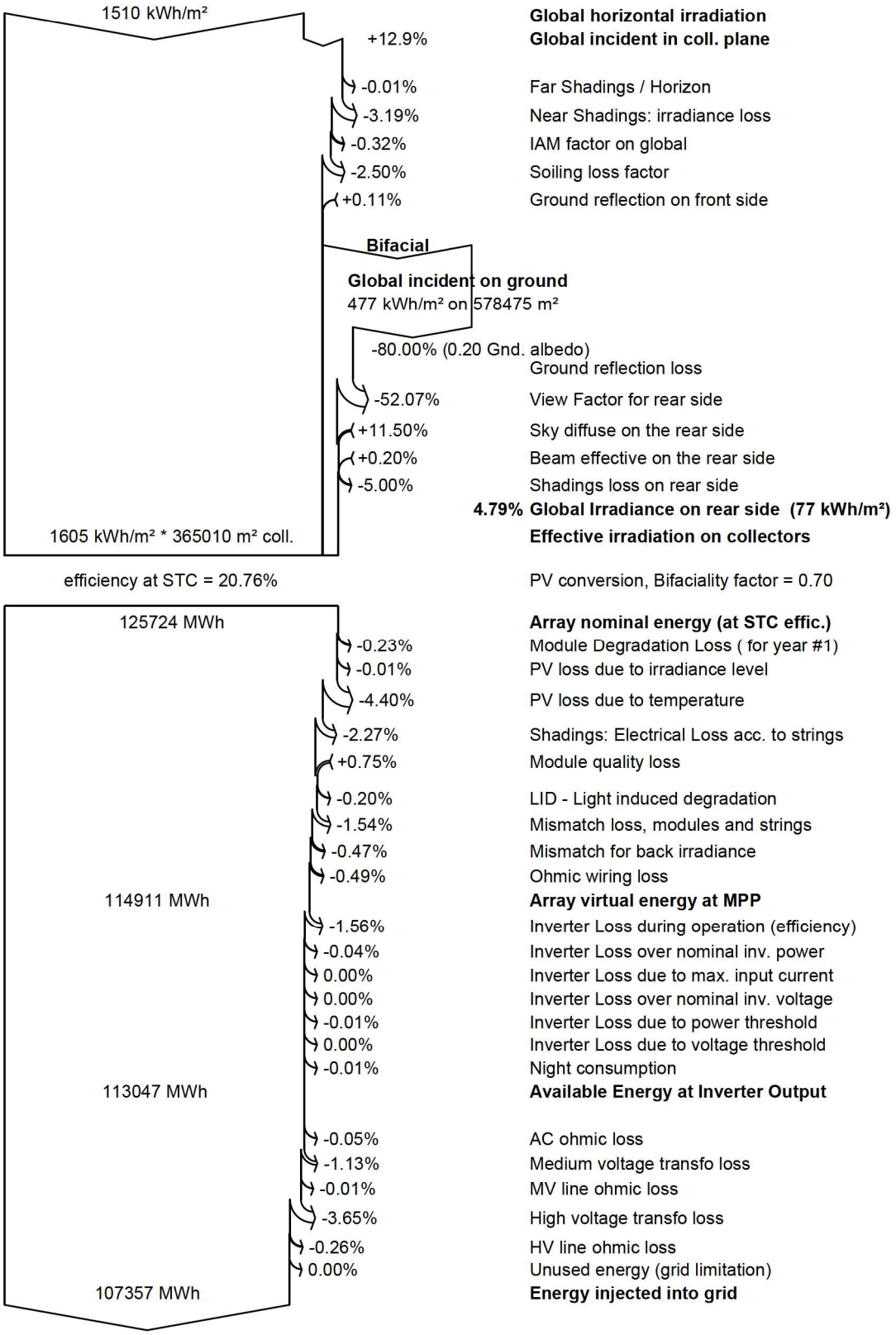
Loss diagram



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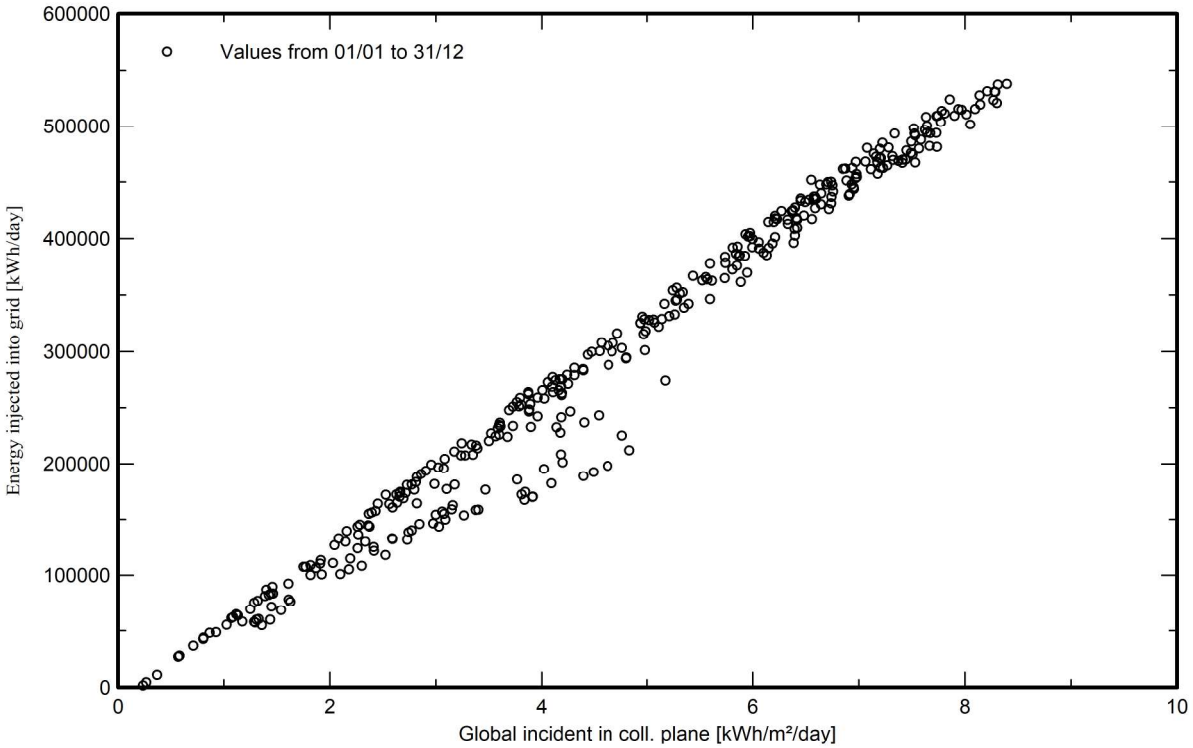
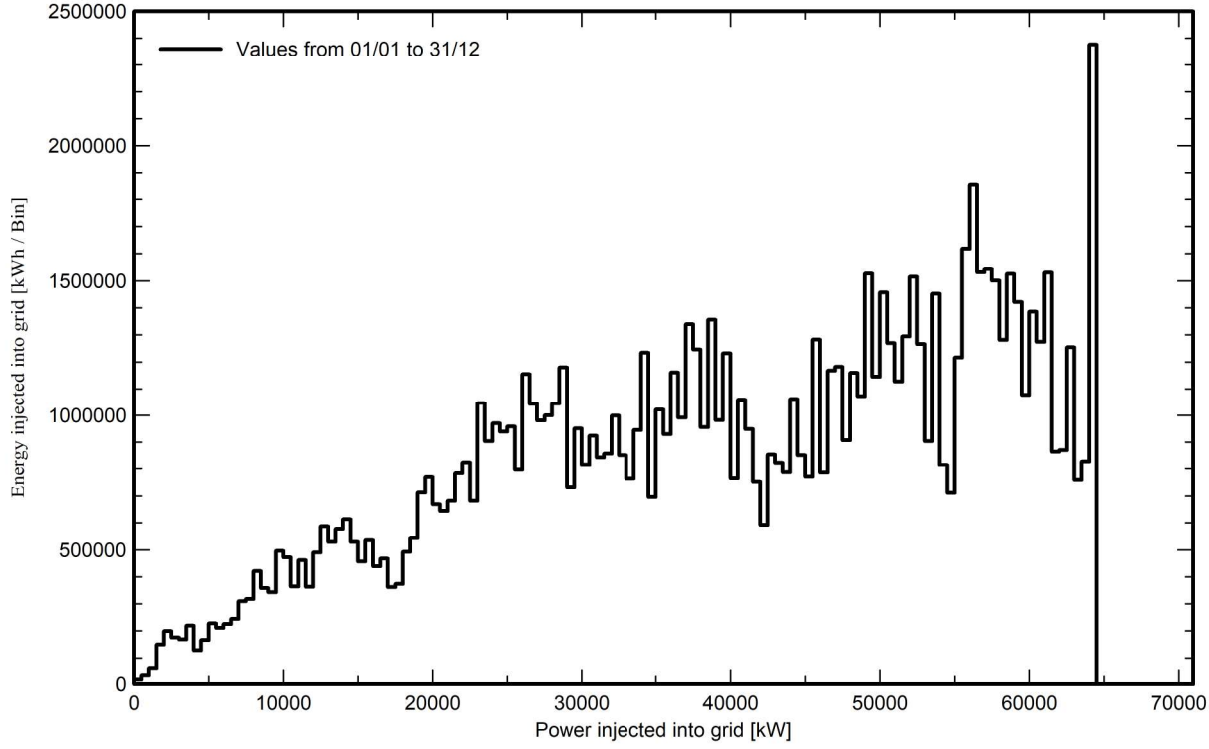
Special graphs

Diagrama entrada/salida diaria



Distribución de potencia de salida del sistema



Aging Tool

Aging Parameters

Time span of simulation 30 years

Module average degradation

Loss factor 0.45 %/year

Mismatch due to degradation

Imp RMS dispersion 0.4 %/year

Vmp RMS dispersion 0.4 %/year

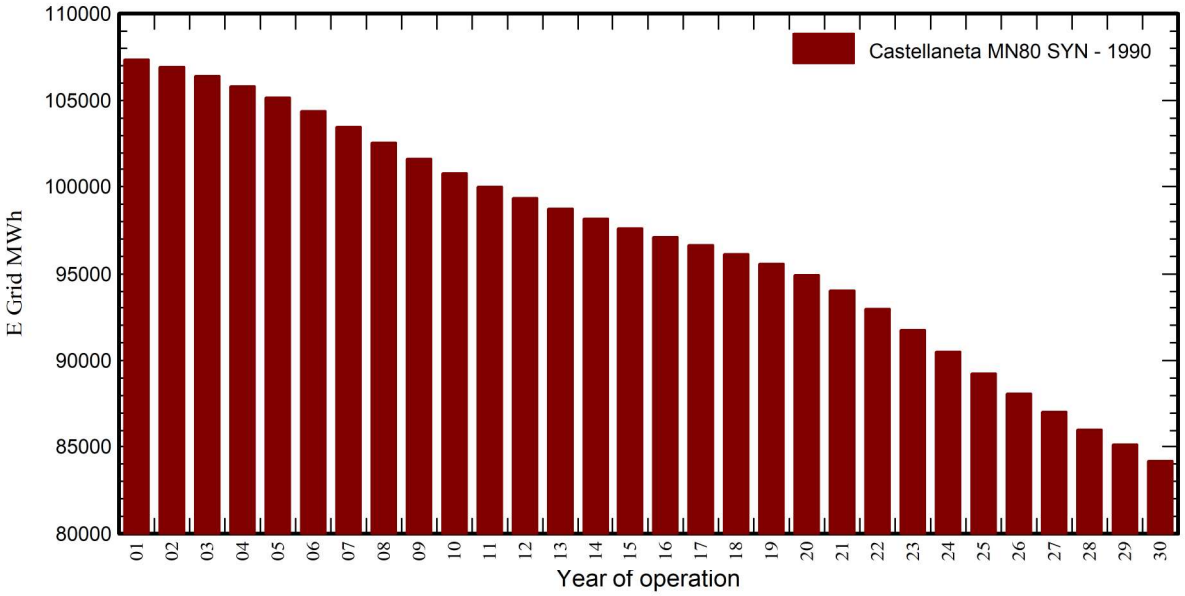
Meteo used in the simulation

#1 Castellaneta MN80 SYN

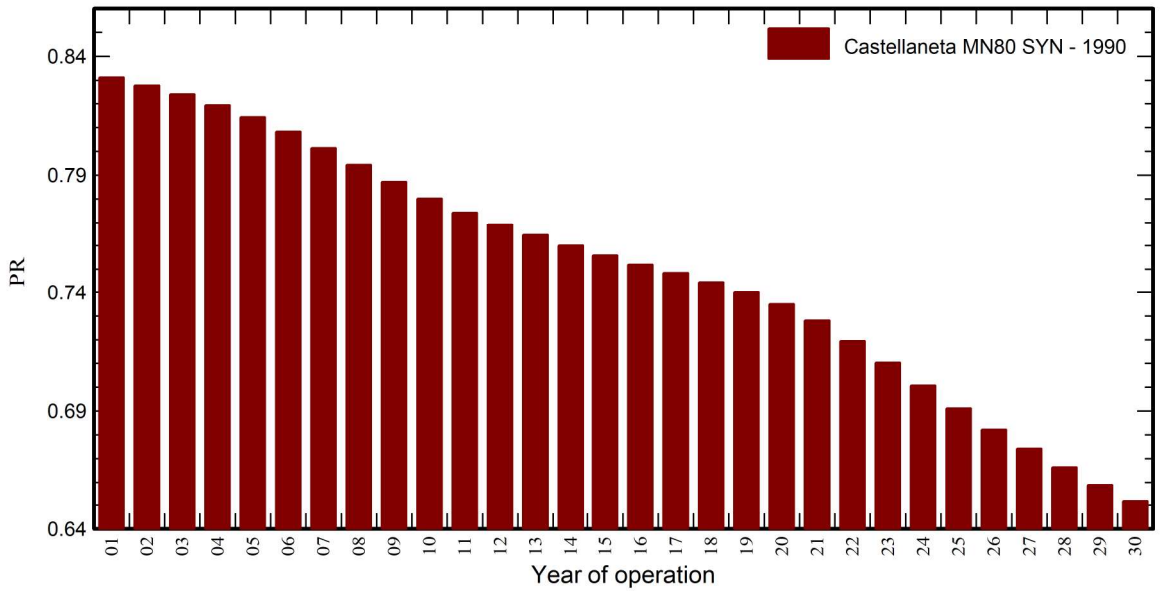
Years 1990 (reference year)

Years simulated 1-30

Energy injected into grid



Performance Ratio



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Meteo used in the simulation

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Years 1990 (reference year)
Years simulated 1-30

Castellaneta MN80 SYN

Year	E Grid	PR	PR loss
	MWh		%
1	107357	0.831	0%
2	106921	0.828	-0.4%
3	106410	0.824	-0.9%
4	105826	0.819	-1.4%
5	105170	0.814	-2%
6	104391	0.808	-2.8%
7	103501	0.801	-3.6%
8	102582	0.794	-4.4%
9	101660	0.787	-5.3%
10	100761	0.78	-6.1%
11	99984	0.774	-6.9%
12	99335	0.769	-7.5%
13	98730	0.764	-8%
14	98158	0.76	-8.6%
15	97610	0.756	-9.1%
16	97112	0.752	-9.5%
17	96644	0.748	-10%
18	96142	0.744	-10.4%
19	95580	0.74	-11%
20	94931	0.735	-11.6%
21	94043	0.728	-12.4%
22	92923	0.719	-13.4%
23	91731	0.71	-14.6%
24	90499	0.701	-15.7%
25	89259	0.691	-16.9%
26	88112	0.682	-17.9%
27	87070	0.674	-18.9%
28	86067	0.666	-19.8%
29	85099	0.659	-20.7%
30	84164	0.652	-21.6%

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P50 - P90 evaluation

Meteo data

Source	Meteonorm 8.0, Sat=100%
Kind	Monthly averages
Sintético - Multi-year average	
Year-to-year variability(Variance)	3.0 %
Specified Deviation	
Climate change	0.0 %

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 %

Global variability (meteo + system)

Variability (Quadratic sum)	3.5 %

Annual production probability

Variability	3.76 GWh
P50	107.36 GWh
P90	102.54 GWh
P95	101.18 GWh

Probability distribution