



Comune di Corigliano D'Otranto, Cutrofiano, Sogliano Cavour, Aradeo, Seclì, Galatone, Galatina  
Provincia di Lecce, Regione Puglia

## ARNG SOLAR XI S.R.L

Corso Europa 13  
20122 Milano (MI)  
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### Impianto Agrivoltaico "CORIGLIANO 43.8" PD01\_21 – SIMULAZIONE ENERGETICA (PVSYST)

IL TECNICO	IL PROPONENTE
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DICEMBRE 2023

# PVsyst - Simulation report

## Grid-Connected System

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Project: ITS2RO - Corigliano

Variant: REV\_B\_standard\_Corigliano\_Tracker.2P(7-14-28-56)\_670Wp.Bif\_Pitch=9.85m\_

Tracking system with backtracking

System power: 54.40 MWp

Solcast\_site\_18243\_40135 - Italy

Autor(a)



**PVsyst V7.4.0**

VCK, Simulation date:  
02/01/24 15:02  
with v7.4.0

**Project summary**

<b>Geographical Site</b>		<b>Situation</b>		<b>Project settings</b>	
Solcast_site_18243_40135		Latitude	40.14 °N	Albedo	0.20
Italy		Longitude	18.24 °E		
		Altitude	75 m		
		Time zone	UTC+1		
<b>Meteo data</b>					
Solcast_site_18243_40135					
Solcast <a href="https://solcast.com">https://solcast.com</a> - 2022					

**System summary**

<b>Grid-Connected System</b>		<b>Tracking system with backtracking</b>			
Simulation for year no 1					
<b>PV Field Orientation</b>		<b>Tracking algorithm</b>		<b>Near Shadings</b>	
<b>Orientation</b>		Irradiance optimization		According to strings	
Tracking plane, horizontal N-S axis		Backtracking activated		Electrical effect	100 %
Avg axis azim. 0 °				Diffuse shading	Automatic
<b>System information</b>					
<b>PV Array</b>					
Nb. of modules	81200 units	<b>Inverters</b>		Nb. of units 172 units	
Pnom total	54.40 MWp			Pnom total 56.76 MWac	
				Grid power limit 43.80 MWac	
				Grid lim. Pnom ratio 1.242	
<b>User's needs</b>					
Unlimited load (grid)					

**Results summary**

Produced Energy	96205.18 MWh/year	Specific production	1768 kWh/kWp/year	Perf. Ratio PR	81.57 %
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**General parameters****Grid-Connected System****PV Field Orientation****Orientation**

Tracking plane, horizontal N-S axis  
Avg axis azim. 0 °

**Models used**

Transposition Perez  
Diffuse Imported  
Circumsolar separate

**Horizon**

Free Horizon

**Bifacial system**

Model 2D Calculation  
unlimited trackers

**Bifacial model geometry**

Tracker Spacing 9.85 m  
Tracker width 4.91 m  
GCR 49.8 %  
Axis height above ground 2.73 m

**Grid power limitation**

Active power 43.80 MWac  
Pnom ratio 1.242

**Tracking system with backtracking****Tracking algorithm**

Irradiance optimization  
Backtracking activated

**Near Shadings**

According to strings  
Electrical effect 100 %  
Diffuse shading Automatic

**Backtracking array**

Nb. of trackers 1126 units

**Sizes**

Tracker Spacing 9.85 m  
Collector width 4.91 m  
Ground Cov. Ratio (GCR) 49.8 %  
Phi min / max. +/- 60.0 °

**Backtracking strategy**

Phi limits for BT +/- 60.0 °  
Backtracking pitch 9.85 m  
Backtracking width 4.91 m

**User's needs**

Unlimited load (grid)

**Bifacial model definitions**

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

**PV Array Characteristics****PV module**

Manufacturer Trina Solar  
Model TSM-670NEG21C.20  
(Custom parameters definition)

Unit Nom. Power 670 Wp  
Number of PV modules 81200 units  
Nominal (STC) 54.40 MWp  
Modules 2900 Strings x 28 In series

**At operating cond. (49°C)**

Pmpp 50.36 MWp  
U mpp 1006 V  
I mpp 50075 A

**Inverter**

Manufacturer Huawei Technologies  
Model SUN2000-330KTL-H1-Preliminary V0.1  
(Custom parameters definition)

Unit Nom. Power 330 kWac  
Number of inverters 172 units  
Total power 56760 kWac  
Operating voltage 500-1500 V  
Pnom ratio (DC:AC) 0.96

Power sharing within this inverter



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**PV Array Characteristics**

<b>Total PV power</b>		<b>Total inverter power</b>	
Nominal (STC)	54404 kWp	Total power	56760 kWac
Total	81200 modules	Number of inverters	172 units
Module area	252236 m <sup>2</sup>	Pnom ratio	0.96
Cell area	236341 m <sup>2</sup>		

**Array losses**

<b>Array Soiling Losses</b>		<b>Thermal Loss factor</b>		<b>DC wiring losses</b>				
Loss Fraction	2.5 %	Module temperature according to irradiance		Global array res.	0.33 mΩ			
		Uc (const)	29.0 W/m <sup>2</sup> K	Loss Fraction	1.5 % at STC			
		Uv (wind)	0.0 W/m <sup>2</sup> K/m/s					
<b>Serie Diode Loss</b>		<b>LID - Light Induced Degradation</b>		<b>Module Quality Loss</b>				
Voltage drop	0.7 V	Loss Fraction	0.5 %	Loss Fraction	-0.8 %			
Loss Fraction	0.1 % at STC							
<b>Module mismatch losses</b>		<b>Strings Mismatch loss</b>		<b>Module average degradation</b>				
Loss Fraction	2.0 % at MPP	Loss Fraction	0.1 %	Year no	1			
				Loss factor	0.4 %/year			
				<b>Mismatch due to degradation</b>				
				Imp RMS dispersion	0.4 %/year			
				Vmp RMS dispersion	0.4 %/year			
<b>IAM loss factor</b>								
Incidence effect (IAM): User defined profile								
0°	30°	50°	60°	70°	75°	80°	85°	90°
1.000	1.000	1.000	1.000	0.987	0.963	0.891	0.672	0.000

**System losses**

<b>Auxiliaries loss</b>	
Proportionnal to Power	10.0 W/kW
0.0 kW from Power thresh.	
Night aux. cons.	5.00 kW

**AC wiring losses**

<b>Inv. output line up to MV transfo</b>	
Inverter voltage	800 Vac tri
Loss Fraction	1.27 % at STC
<b>Inverter: SUN2000-330KTL-H1-Preliminary V0.1</b>	
Wire section (172 Inv.)	Alu 172 x 3 x 300 mm <sup>2</sup>
Average wires length	250 m
<b>MV line up to Injection</b>	
MV Voltage	36 kV
Wires	Alu 3 x 1500 mm <sup>2</sup>
Length	21656 m
Loss Fraction	1.88 % at STC



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**AC losses in transformers**

**MV transfo**

Medium voltage 36 kV

**Transformer parameters**

Nominal power at STC 53.46 MVA

Iron Loss (24/24 Connexion) 57.20 kVA

Iron loss fraction 0.11 % at STC

Copper loss 504.11 kVA

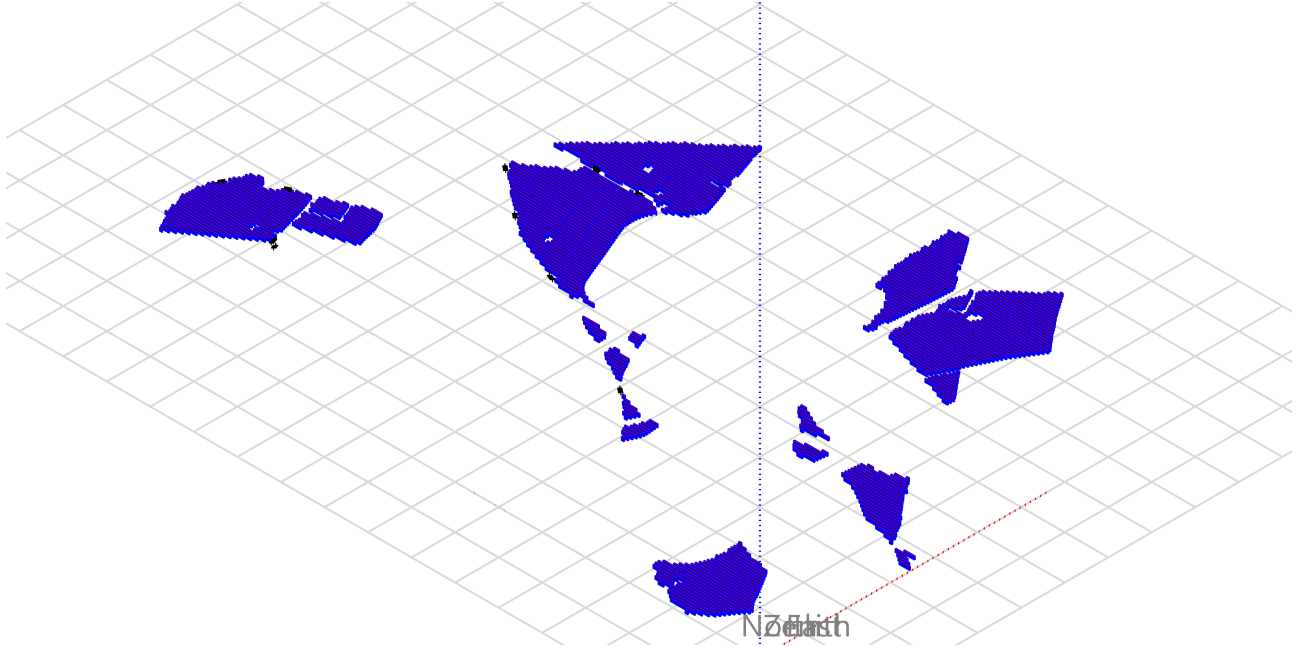
Copper loss fraction 0.94 % at STC

Coils equivalent resistance 3 x 0.11 mΩ



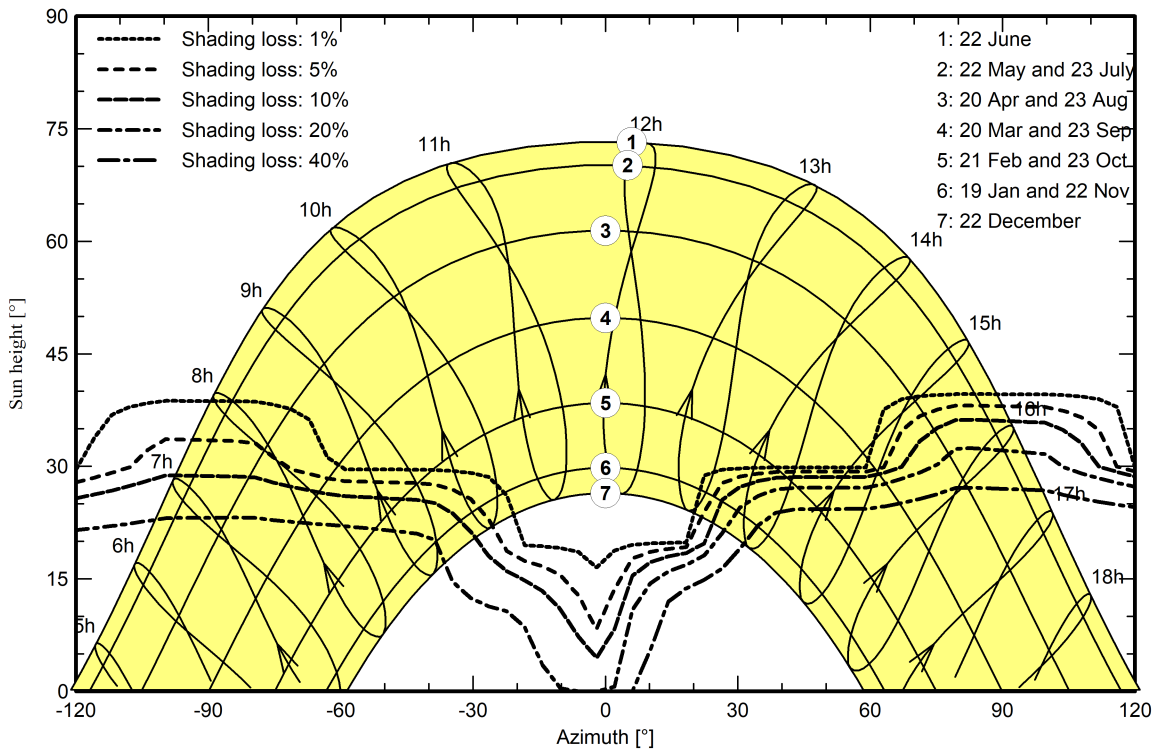
### Near shadings parameter

Perspective of the PV-field and surrounding shading scene



### Iso-shadings diagram

Orientation #1



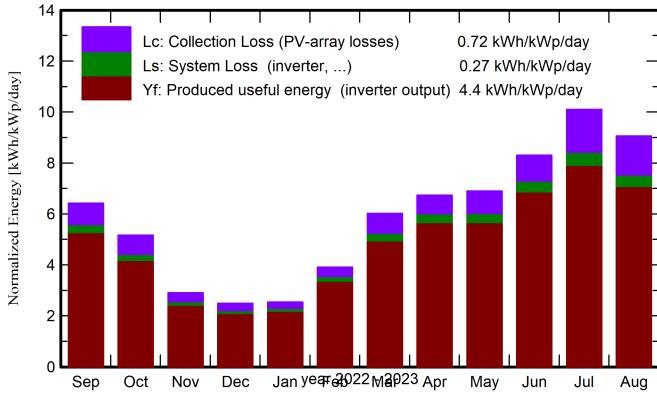


**Main results**

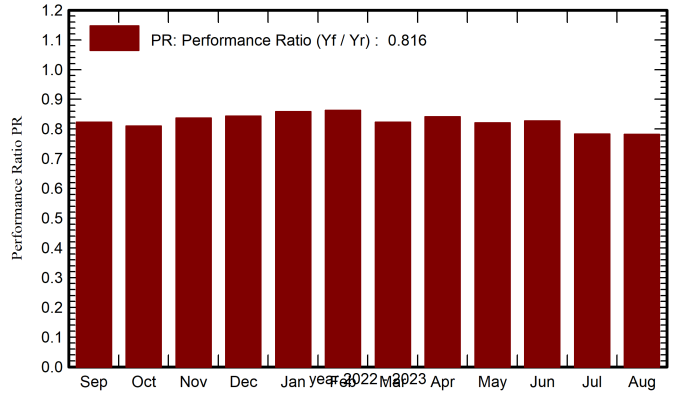
**System Production**

Produced Energy (P50) 96205.18 MWh/year      Specific production (P50) 1768 kWh/kWp/year      Perf. Ratio PR      81.57 %  
 Produced Energy (P90) 91887.48 MWh/year      Specific production (P90) 1689 kWh/kWp/year  
 Produced Energy (P95) 90672.65 MWh/year      Specific production (P95) 1667 kWh/kWp/year

**Normalized productions (per installed kWp)**



**Performance Ratio PR**



**Balances and main results**

	GlobHor kWh/m <sup>2</sup>	DiffHor kWh/m <sup>2</sup>	T_Amb °C	GlobInc kWh/m <sup>2</sup>	GlobEff kWh/m <sup>2</sup>	EArray MWh	PR ratio
Sep. 22	4.8	1.45	23.81	6.4	6.2	304	0.823
Oct. 22	120.8	35.28	19.77	160.2	154.6	7463	0.810
Nov. 22	68.7	30.08	16.48	87.2	84.1	4192	0.837
Dec. 22	60.0	26.12	14.40	77.3	74.3	3738	0.843
Jan. 23	62.5	30.51	11.97	79.0	76.0	3893	0.859
Feb. 23	85.4	37.20	10.87	109.5	105.7	5423	0.863
Mar. 23	143.9	45.89	13.49	186.8	180.4	8859	0.823
Apr. 23	159.6	62.94	14.49	202.0	195.2	9832	0.841
May 23	173.4	69.36	18.92	214.1	206.9	10179	0.821
June 23	200.6	77.37	23.98	249.2	240.9	11927	0.827
July 23	240.4	55.82	28.93	313.3	303.2	14222	0.784
Aug. 23	214.4	50.99	27.53	281.1	271.9	12709	0.782
Sep. 23	155.7	45.86	25.29	201.8	195.1	9356	0.804
<b>Period</b>	<b>1690.2</b>	<b>568.89</b>	<b>18.89</b>	<b>2167.8</b>	<b>2094.5</b>	<b>102096</b>	<b>0.816</b>

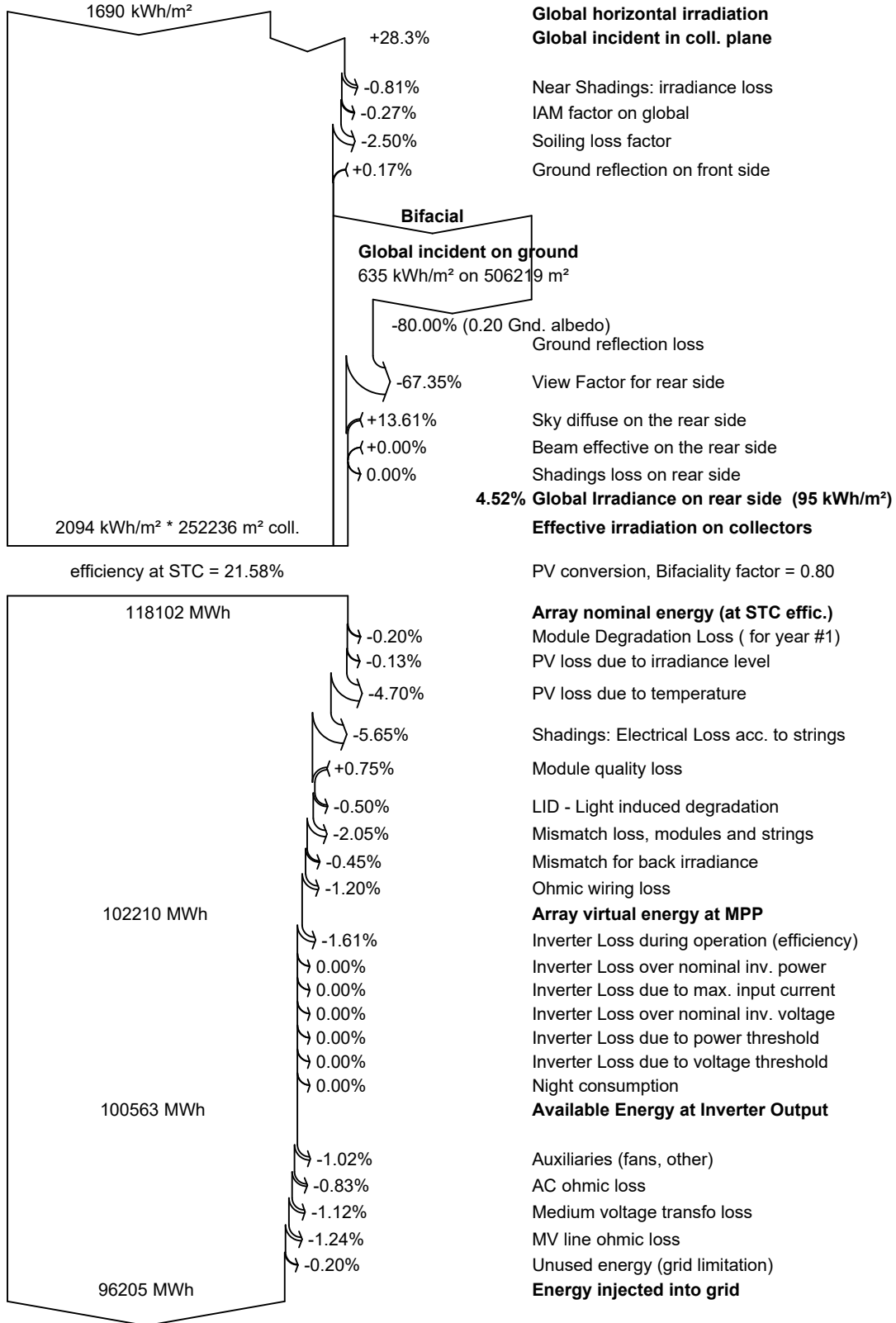
**Legends**

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  
 PR      Performance Ratio





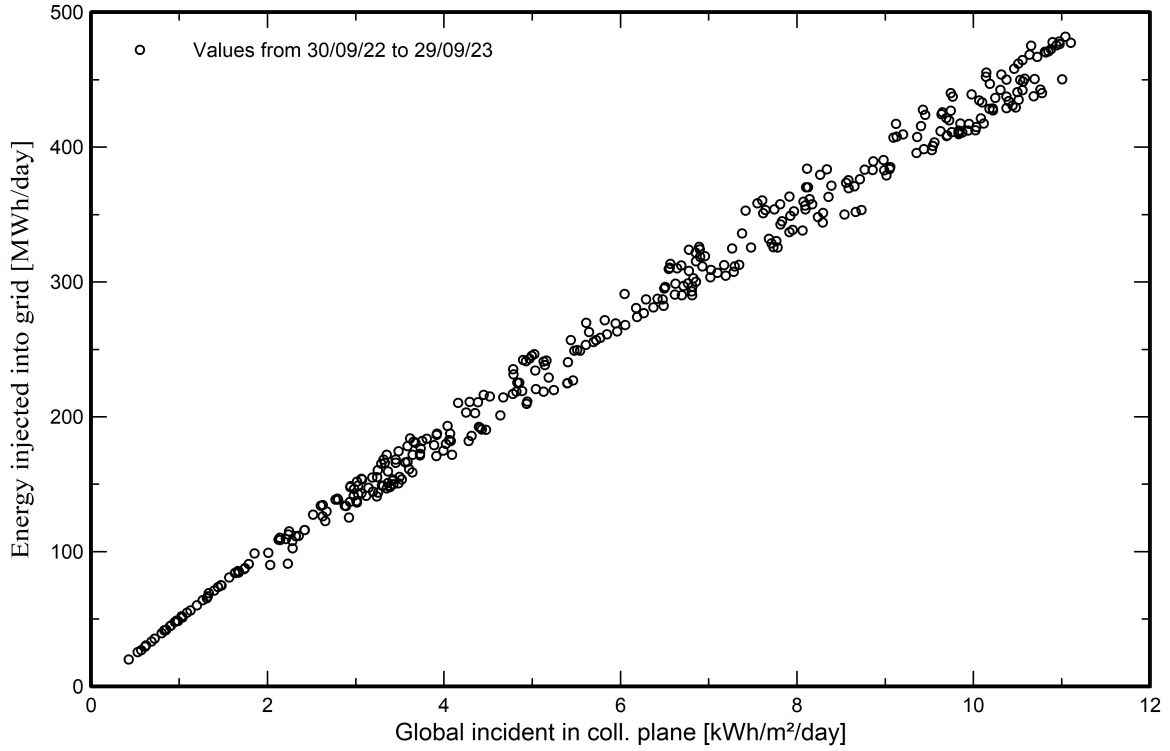
Loss diagram



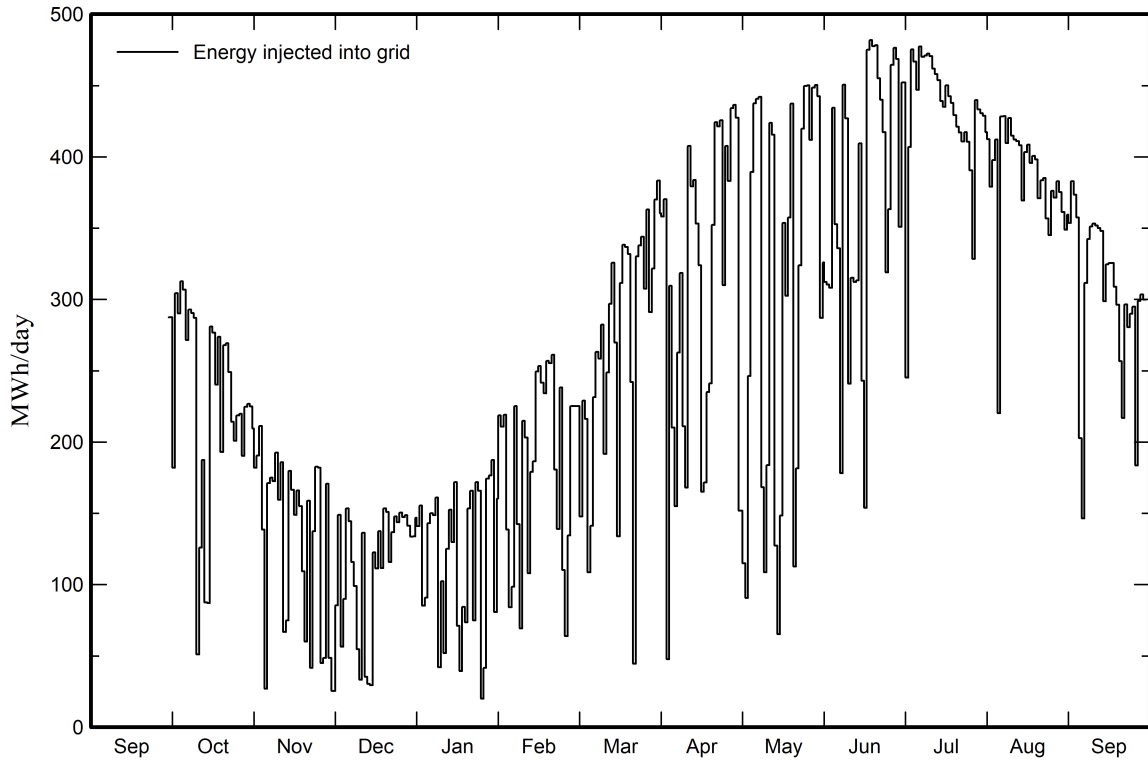


Predef. graphs

Diagramma giornaliero entrata/uscita



Energía diaria a la salida del sistema





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**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

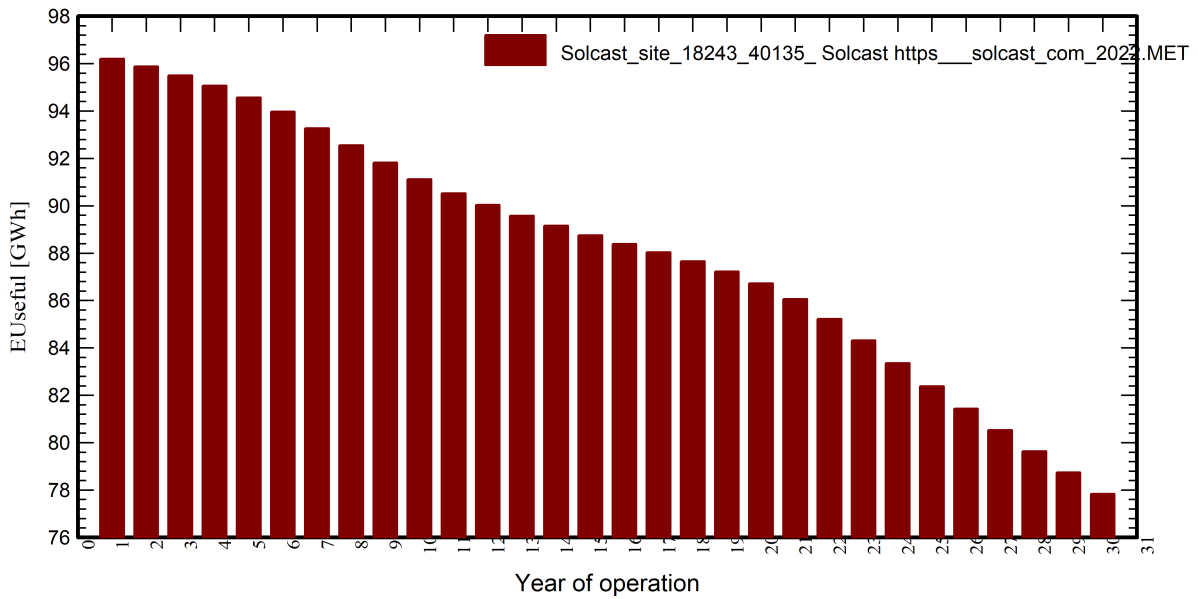
Vmp RMS dispersion 0.4 %/year

**Meteo used in the simulation**

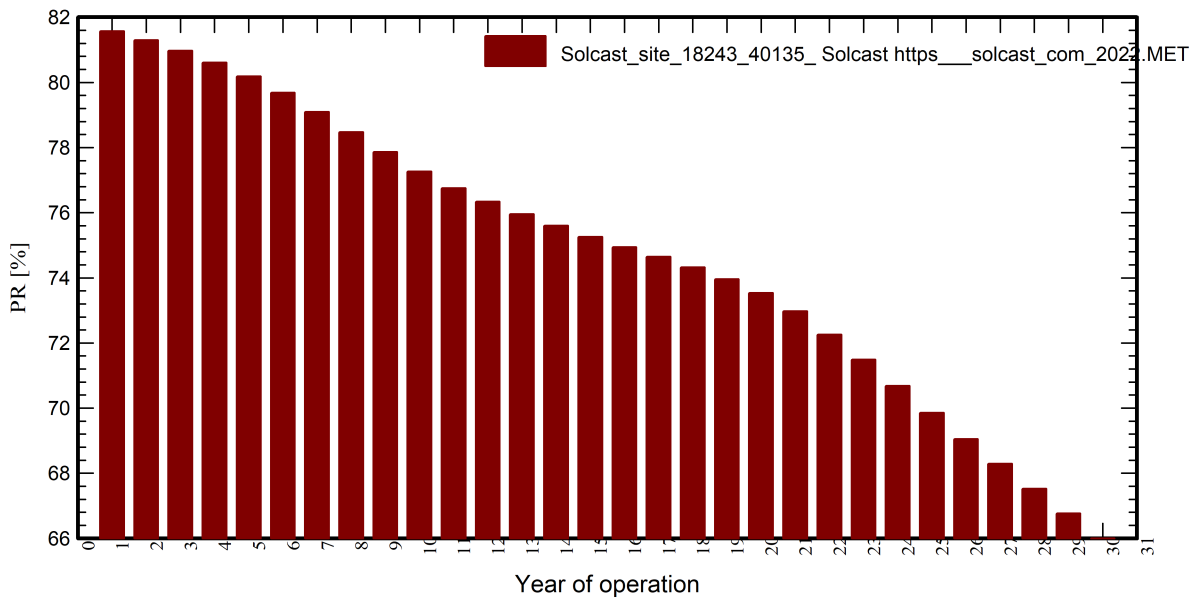
Solcast site 18243 40135 Solcast https solcast com

Years 2022

**Useful out system energy**



**Performance Ratio**





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**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**

Solcast site 18243 40135 Solcast https solcast com

Years 2022

	<b>EUseful</b>	<b>PR</b>	<b>PR loss</b>
<b>Year</b>	<b>GWh</b>	<b>%</b>	<b>%</b>
1	96.20	81.57	-0.17
2	95.88	81.29	-0.50
3	95.50	80.97	-0.89
4	95.06	80.60	-1.35
5	94.57	80.18	-1.86
6	93.97	79.68	-2.48
7	93.28	79.09	-3.20
8	92.55	78.47	-3.95
9	91.83	77.86	-4.71
10	91.12	77.26	-5.44
11	90.52	76.75	-6.06
12	90.03	76.34	-6.57
13	89.58	75.96	-7.03
14	89.16	75.60	-7.47
15	88.76	75.26	-7.89
16	88.39	74.94	-8.27
17	88.03	74.64	-8.64
18	87.65	74.32	-9.04
19	87.22	73.96	-9.48
20	86.73	73.54	-10.00
21	86.06	72.97	-10.69
22	85.22	72.26	-11.56
23	84.31	71.49	-12.50
24	83.36	70.68	-13.49
25	82.38	69.85	-14.51
26	81.44	69.05	-15.49
27	80.53	68.29	-16.42
28	79.63	67.52	-17.36
29	78.74	66.76	-18.29
30	77.84	66.00	-19.22



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**P50 - P90 evaluation**

**Meteo data**

Source Solcast <https://solcast.com>  
Kind Monthly averages  
2022 - 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 3.37 GWh  
P50 96.21 GWh  
P90 91.89 GWh  
P95 90.67 GWh

**Probability distribution**

