

# PVsyst - Simulation report

## Grid-Connected System

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Project: Macchiareddu - CACIP 25

Variant: Impianto FV Cacip 25

Unlimited Trackers with backtracking

System power: 25.29 MWp

Macchiareddu - Italy

**Author**

Stantec S.p.A. (Italy)



**PVsyst V7.1.3**

VC1, Simulation date:  
05/10/21 12:42  
with v7.1.3

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**Project summary**

<b>Geographical Site</b> Macchiareddu Italy	<b>Situation</b> Latitude 39.24 °N Longitude 8.96 °E Altitude 16 m Time zone UTC+1	<b>Project settings</b> Albedo 0.20
<b>Meteo data</b> Macchiareddu Meteonorm 7.3 (1991-2010) - Synthetic		

**System summary**

<b>Grid-Connected System</b>	<b>Unlimited Trackers with backtracking</b>	
<b>PV Field Orientation</b> <b>Orientation</b> Tracking horizontal axis	<b>Tracking algorithm</b> Astronomic calculation Backtracking activated	<b>Near Shadings</b> No Shadings
<b>System information</b> <b>PV Array</b>	<b>Inverters</b>	
Nb. of modules 38910 units Pnom total 25.29 MWp	Nb. of units 138 units Pnom total 24.15 MWac Pnom ratio 1.047	
<b>User's needs</b> Unlimited load (grid)		

**Results summary**

Produced Energy 45066 MWh/year	Specific production 1782 kWh/kWp/year	Perf. Ratio PR 86.87 %
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**General parameters**

<b>Grid-Connected System</b>		<b>Unlimited Trackers with backtracking</b>	
<b>PV Field Orientation</b>		<b>Tracking algorithm</b>	
<b>Orientation</b>	Tracking horizontal axis	Astronomic calculation	<b>Backtracking strategy</b>
		Backtracking activated	Nb. of trackers 10 units
			Unlimited trackers
			<b>Sizes</b>
			Tracker Spacing 9.00 m
			Collector width 4.79 m
			Ground Cov. Ratio (GCR) 53.2 %
			Left inactive band 0.02 m
			Right inactive band 0.02 m
			<b>Backtracking limit angle</b>
			Phi limits +/- 57.4 °
<b>Models used</b>		<b>Horizon</b>	
Transposition	Perez	Average Height	1.5 °
Diffuse	Perez, Meteonorm	<b>Near Shadings</b>	
Circumsolar	separate	No Shadings	
		<b>User's needs</b>	
		Unlimited load (grid)	
<b>Bifacial system</b>		<b>Bifacial model geometry</b>	
Model	2D Calculation	Tracker Spacing	9.00 m
	unlimited trackers	Tracker width	4.83 m
		Tracking limit angle	55 °
		GCR	53.6 %
		Axis height above ground	2.10 m
		<b>Bifacial model definitions</b>	
		Ground albedo	0.10
		Bifaciality factor	70 %
		Rear shading factor	5.0 %
		Rear mismatch loss	10.0 %
		Module transparency	0.0 %

**PV Array Characteristics**

<b>PV module</b>		<b>Inverter</b>	
Manufacturer	Canadian Solar Inc.	Manufacturer	Huawei Technologies
Model	CS7N-650MB-AG 1500V	Model	SUN2000-185KTL-H1
	(Custom parameters definition)		(Custom parameters definition)
Unit Nom. Power	650 Wp	Unit Nom. Power	175 kWac
Number of PV modules	38910 units	Number of inverters	138 units
Nominal (STC)	25.29 MWp	Total power	24150 kWac
Modules	1297 Strings x 30 In series	Operating voltage	500-1500 V
<b>At operating cond. (50°C)</b>		Max. power (=>30°C)	185 kWac
Pmpp	23.23 MWp	Pnom ratio (DC:AC)	1.05
U mpp	1017 V		
I mpp	22845 A		
<b>Total PV power</b>		<b>Total inverter power</b>	
Nominal (STC)	25292 kWp	Total power	24150 kWac
Total	38910 modules	Nb. of inverters	138 units
Module area	120868 m²	Pnom ratio	1.05

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**Array losses****Array Soiling Losses**

Loss Fraction 1.0 %

**Thermal Loss factor**

Module temperature according to irradiance

Uc (const) 29.0 W/m<sup>2</sup>KUv (wind) 0.0 W/m<sup>2</sup>K/m/s**DC wiring losses**

Global array res. 0.24 mΩ

Loss Fraction 0.5 % at STC

**LID - Light Induced Degradation**

Loss Fraction 2.0 %

**Module Quality Loss**

Loss Fraction -0.2 %

**Module mismatch losses**

Loss Fraction 1.0 % at MPP

**Strings Mismatch loss**

Loss Fraction 0.1 %

**IAM loss factor**

Incidence effect (IAM): User defined profile

20°	40°	60°	65°	70°	75°	80°	85°	90°
1.000	1.000	1.000	0.990	0.960	0.920	0.840	0.720	0.000

**System losses****Auxiliaries loss**

Proportionnal to Power 5.0 W/kW

0.0 kW from Power thresh.

**AC wiring losses****Inv. output line up to MV transfo**

Inverter voltage 800 Vac tri

Loss Fraction 1.5 % at STC

**Inverter: SUN2000-185KTL-H1**Wire section (138 Inv.) Copper 138 x 3 x 185 mm<sup>2</sup>

Average wires length 536 m

**MV line up to Injection**

MV Voltage 30 kV

Wires Copper 3 x 500 mm<sup>2</sup>

Length 4800 m

Loss Fraction 0.5 % at STC

**AC losses in transformers****MV transfo**

Grid Voltage 30 kV

**Operating losses at STC**

Nominal power at STC (PNomac) 25016 kVA

Iron loss (24/24 Connexion) 25.02 kW

Loss Fraction 0.1 % at STC

Coils equivalent resistance 3 x 0.26 mΩ

Loss Fraction 1.0 % at STC



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Horizon definition

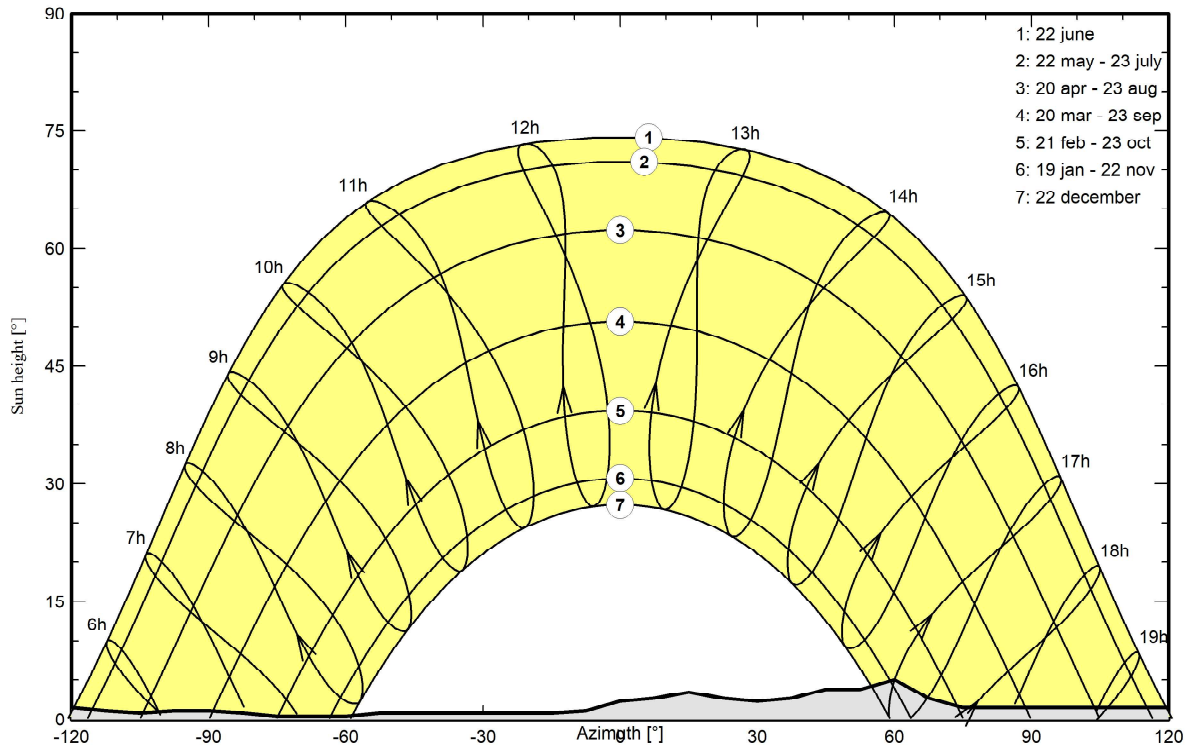
Average Height	1.5 °	Albedo Factor	0.90
Diffuse Factor	0.97	Albedo Fraction	100 %

Horizon profile

Azimuth [°]	-180	-143	-128	-120	-113	-105	-98	-90	-83	-75
Height [°]	0.8	0.8	1.5	1.5	1.1	0.8	1.1	1.1	0.8	0.4
Azimuth [°]	-60	-53	-15	-8	0	8	15	23	30	38
Height [°]	0.4	0.8	0.8	1.1	2.3	2.7	3.4	2.7	2.3	2.7
Azimuth [°]	45	53	60	68	75	135	143	158	165	180
Height [°]	3.8	3.8	5.0	2.7	1.5	1.5	1.1	1.1	0.8	0.8

Sun Paths (Height / Azimuth diagram)

Horizon from PVGIS website API, Lat=39°14'33', Long=8°57'41', Alt=16m





**Main results**

**System Production**

Produced Energy 45066 MWh/year

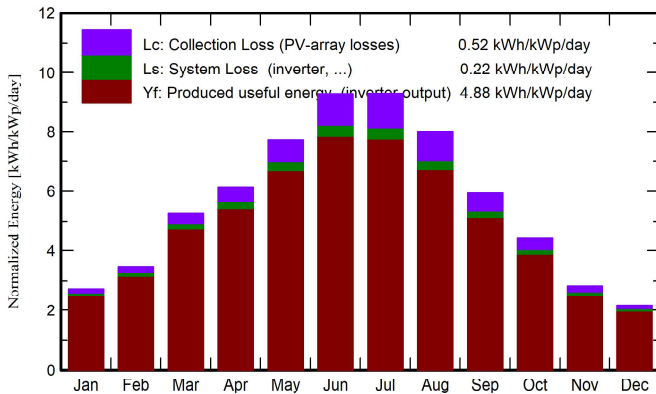
Specific production

1782 kWh/kWp/year

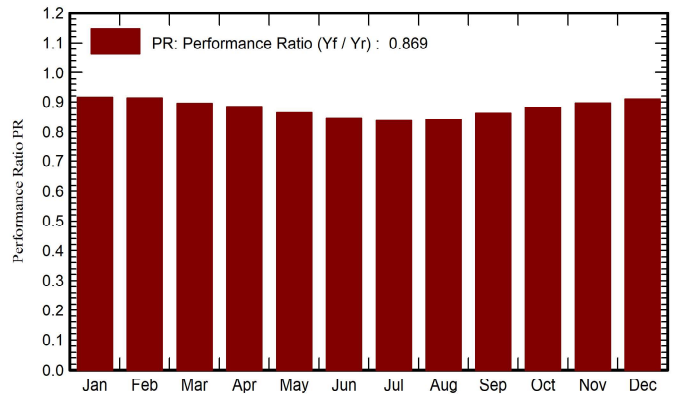
Performance Ratio PR

86.87 %

**Normalized productions (per installed kWp)**



**Performance Ratio PR**



**Balances and main results**

	GlobHor	DiffHor	T_Amb	GlobInc	GlobEff	EArray	E_Grid	PR
	kWh/m <sup>2</sup>	kWh/m <sup>2</sup>	°C	kWh/m <sup>2</sup>	kWh/m <sup>2</sup>	MWh	MWh	ratio
January	66.9	28.92	9.29	84.4	80.9	2035	1956	0.916
February	79.1	39.22	9.96	96.9	93.1	2330	2239	0.914
March	131.8	53.75	12.53	163.8	158.1	3875	3715	0.897
April	152.3	72.88	14.84	184.1	177.6	4307	4126	0.886
May	195.6	86.59	19.60	240.0	231.9	5491	5255	0.866
June	222.8	76.37	23.78	278.7	270.7	6254	5976	0.848
July	228.9	77.06	26.82	288.3	280.1	6392	6108	0.838
August	195.8	73.45	26.79	248.0	240.3	5516	5277	0.841
September	143.0	59.62	22.26	178.6	172.6	4071	3902	0.864
October	109.4	47.01	19.53	136.6	131.7	3173	3047	0.882
November	68.3	34.10	14.25	84.5	80.8	1999	1920	0.898
December	54.5	27.18	10.87	67.2	64.1	1611	1546	0.910
Year	1648.3	676.15	17.59	2051.2	1982.0	47053	45066	0.869

**Legends**

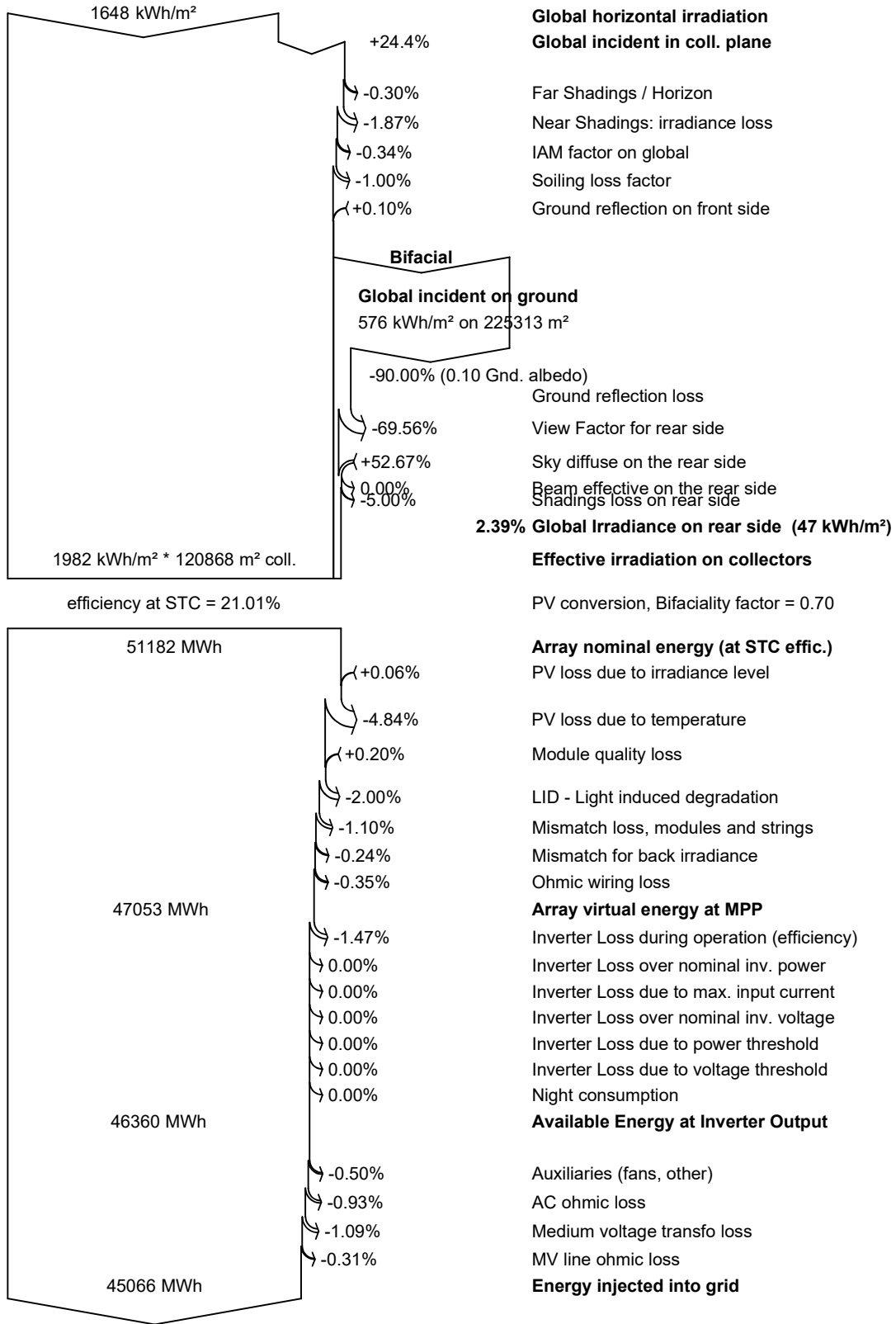
- |         |  |        |   |
|---------|--|--------|---|
| GlobHor | Global horizontal irradiation                | EArray | Effective energy at the output of the array |
| DiffHor | Horizontal diffuse irradiation               | E_Grid | Energy injected into grid                   |
| T_Amb   | Ambient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



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**Loss diagram**



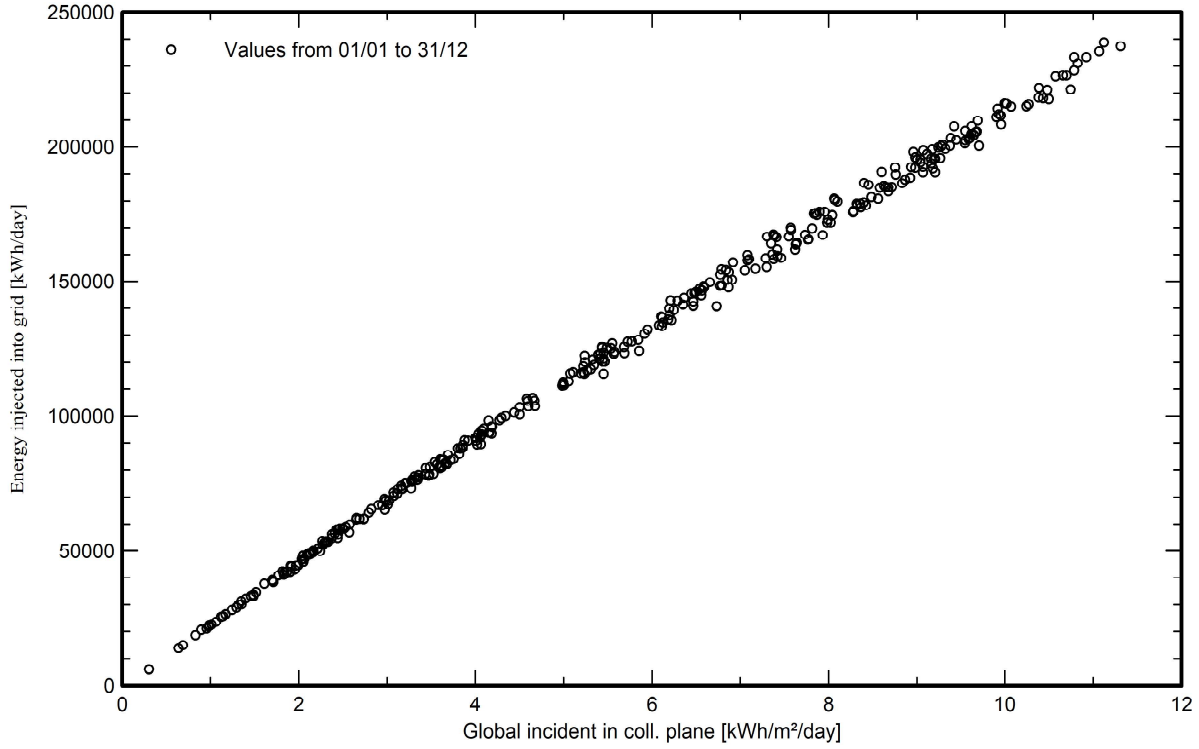


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**Special graphs**

**Daily Input/Output diagram**



**System Output Power Distribution**

