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NOME COMMESSA:

**COSTRUZIONE ED ESERCIZIO IMPIANTO
AGROVOLTAICO AVENTE POTENZA NOMINALE PARI A
11.000 kW E POTENZA MODULI PARI A 14.271,4 kWp,
CON RELATIVO COLLEGAMENTO ALLA RETE
ELETTRICA, SITO NEI COMUNI DI BRINDISI E SAN
DONACI (BR) - IMPIANTO SV94**

STATO DI AVANZAMENTO COMMESSA:

PROGETTO DEFINITIVO PER AUTORIZZAZIONE UNICA

CODICE COMMESSA:

HE.21.0041

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OGGETTO:

**Analisi della risorsa solare e stima di produzione
energia**

SCALA:

-

DATA:

FEBBRAIO 2022

NOME FILE:

EJ3G292 _AnalisiRisorsaSolare.pdf

TAVOLA:

DPE.RE01

N. REV.	DATA	REVISIONE	ELABORATO	VERIFICATO	VALIDATO
0	01.2022	Emissione	M.Girardi	responsabile commessa A.Albuzzi	direttore tecnico N.Zuech

PVsyst - Simulation report

Grid-Connected System

Project: HE.19.0024 HEPV12 SV94

Variant: HEPV12 SV94 14.271 KWp - Inverter singoli

Trackers single array, with backtracking

System power: 14.27 MWp

HE190024_68-94 - Italy

Author

Heliopolis spa (Italy)



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Project summary

Geographical Site HE190024_68-94 Italy	Situation Latitude 40.51 °N Longitude 17.92 °E Altitude 63 m Time zone UTC+1	Project settings Albedo 0.20
Meteo data HE190024_68-94 PVGIS TMY: SARA, COSMO or NSRDB - Synthetic		

System summary

Grid-Connected System Simulation for year no 1	Trackers single array, with backtracking		
PV Field Orientation Tracking plane, horizontal N-S axis Axis azimuth 0 °	Near Shadings Linear shadings	User's needs Unlimited load (grid)	
System information			
PV Array		Inverters	
Nb. of modules	25948 units	Nb. of units	34 units
Pnom total	14.27 MWp	Pnom total	10.03 MWac
		Pnom ratio	1.424

Results summary

Produced Energy	26 GWh/year	Specific production	1849 kWh/kWp/year	Perf. Ratio PR	84.28 %
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**PVsyst V7.2.11**

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General parameters**Grid-Connected System****PV Field Orientation****Orientation**

Tracking plane, horizontal N-S axis
Axis azimuth 0 °

Horizon

Free Horizon

Trackers single array, with backtracking**Backtracking strategy**

Nb. of trackers 50 units
Single array

Sizes

Tracker Spacing 5.50 m
Collector width 2.28 m
Ground Cov. Ratio (GCR) 41.4 %
Phi min / max. +/- 60.0 °

Backtracking limit angle

Phi limits +/- 65.4 °

Near Shadings

Linear shadings

Models used

Transposition Perez
Diffuse Perez, Meteonorm
Circumsolar separate

User's needs

Unlimited load (grid)

PV Array Characteristics**Array #1 - 94 OVEST 1****PV module**

Manufacturer Phono Solar
Model PS550M6H-24/TH

(Custom parameters definition)

Unit Nom. Power 550 Wp
Number of PV modules 5148 units
Nominal (STC) 2831 kWp
Modules 198 Strings x 26 In series

At operating cond. (50°C)

Pmpp 2562 kWp
U mpp 973 V
I mpp 2633 A

PV module

Manufacturer Phono Solar
Model PS550M6H-24/TH

(Custom parameters definition)

Unit Nom. Power 550 Wp
Number of PV modules 20800 units
Nominal (STC) 11.44 MWp

Array #2 - 94 OVEST 2

Number of PV modules 5824 units
Nominal (STC) 3203 kWp
Modules 224 Strings x 26 In series

At operating cond. (50°C)

Pmpp 2898 kWp
U mpp 973 V
I mpp 2979 A

Array #3 - 94 EST 1

Number of PV modules 4992 units
Nominal (STC) 2746 kWp
Modules 192 Strings x 26 In series

Inverter

Manufacturer Sungrow
Model SG250HX

(Custom parameters definition)

Unit Nom. Power 225 kWac
Number of inverters 9 units
Total power 2025 kWac
Operating voltage 600-1500 V
Max. power (=>30°C) 250 kWac
Pnom ratio (DC:AC) 1.40

Inverter

Manufacturer Sungrow
Model SG350HX-20A-Preliminary

(Custom parameters definition)

Unit Nom. Power 320 kWac
Number of inverters 25 units
Total power 8000 kWac

Number of inverters 7 units
Total power 2240 kWac

Operating voltage 500-1500 V
Max. power (=>30°C) 352 kWac
Pnom ratio (DC:AC) 1.43

Number of inverters 6 units
Total power 1920 kWac



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PV Array Characteristics

Array #3 - 94 EST 1			
At operating cond. (50°C)			
Pmpp	2484 kWp	Operating voltage	500-1500 V
U mpp	973 V	Max. power (=>30°C)	352 kWac
I mpp	2553 A	Pnom ratio (DC:AC)	1.43
Array #4 - 94 EST 2			
Number of PV modules	4992 units	Number of inverters	6 units
Nominal (STC)	2746 kWp	Total power	1920 kWac
Modules	192 Strings x 26 In series		
At operating cond. (50°C)			
Pmpp	2484 kWp	Operating voltage	500-1500 V
U mpp	973 V	Max. power (=>30°C)	352 kWac
I mpp	2553 A	Pnom ratio (DC:AC)	1.43
Array #5 - 94 EST 3			
Number of PV modules	4992 units	Number of inverters	6 units
Nominal (STC)	2746 kWp	Total power	1920 kWac
Modules	192 Strings x 26 In series		
At operating cond. (50°C)			
Pmpp	2484 kWp	Operating voltage	500-1500 V
U mpp	973 V	Max. power (=>30°C)	352 kWac
I mpp	2553 A	Pnom ratio (DC:AC)	1.43
Total PV power		Total inverter power	
Nominal (STC)	14271 kWp	Total power	10025 kWac
Total	25948 modules	Number of inverters	34 units
Module area	67060 m ²	Pnom ratio	1.42
Cell area	61652 m ²		

Array losses

Array Soiling Losses		Thermal Loss factor		LID - Light Induced Degradation				
Loss Fraction	1.0 %	Module temperature according to irradiance		Loss Fraction	1.0 %			
		Uc (const)	29.0 W/m ² K					
		Uv (wind)	0.0 W/m ² K/m/s					
Module Quality Loss		Module mismatch losses		Strings Mismatch loss				
Loss Fraction	-0.6 %	Loss Fraction	0.7 % at MPP	Loss Fraction	0.1 %			
Module average degradation								
Year no	1							
Loss factor	0.5 %/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°	20°	40°	60°	70°	75°	80°	85°	90°
1.000	1.000	1.000	0.970	0.910	0.850	0.740	0.440	0.000



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DC wiring losses

Global wiring resistance 0.33 mΩ
Loss Fraction 0.4 % at STC

Array #1 - 94 OVEST 1

Global array res. 1.7 mΩ
Loss Fraction 0.4 % at STC

Array #3 - 94 EST 1

Global array res. 1.7 mΩ
Loss Fraction 0.4 % at STC

Array #5 - 94 EST 3

Global array res. 1.7 mΩ
Loss Fraction 0.4 % at STC

Array #2 - 94 OVEST 2

Global array res. 1.5 mΩ
Loss Fraction 0.4 % at STC

Array #4 - 94 EST 2

Global array res. 1.7 mΩ
Loss Fraction 0.4 % at STC

System losses

Auxiliaries loss

Proportionnal to Power 4.0 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 1.40 % at STC

Inverters: SG250HX, SG350HX-20A-Preliminary

Wire section (34 Inv.) Alu 34 x 3 x 150 mm²
Average wires length 106 m

AC losses in transformers

MV transfo

Grid voltage 20 kV

Operating losses at STC

Nominal power at STC 14057 kVA
Iron loss (24/24 Connexion) 14.06 kW
Loss Fraction 0.10 % at STC
Coils equivalent resistance 3 x 0.46 mΩ
Loss Fraction 1.00 % at STC

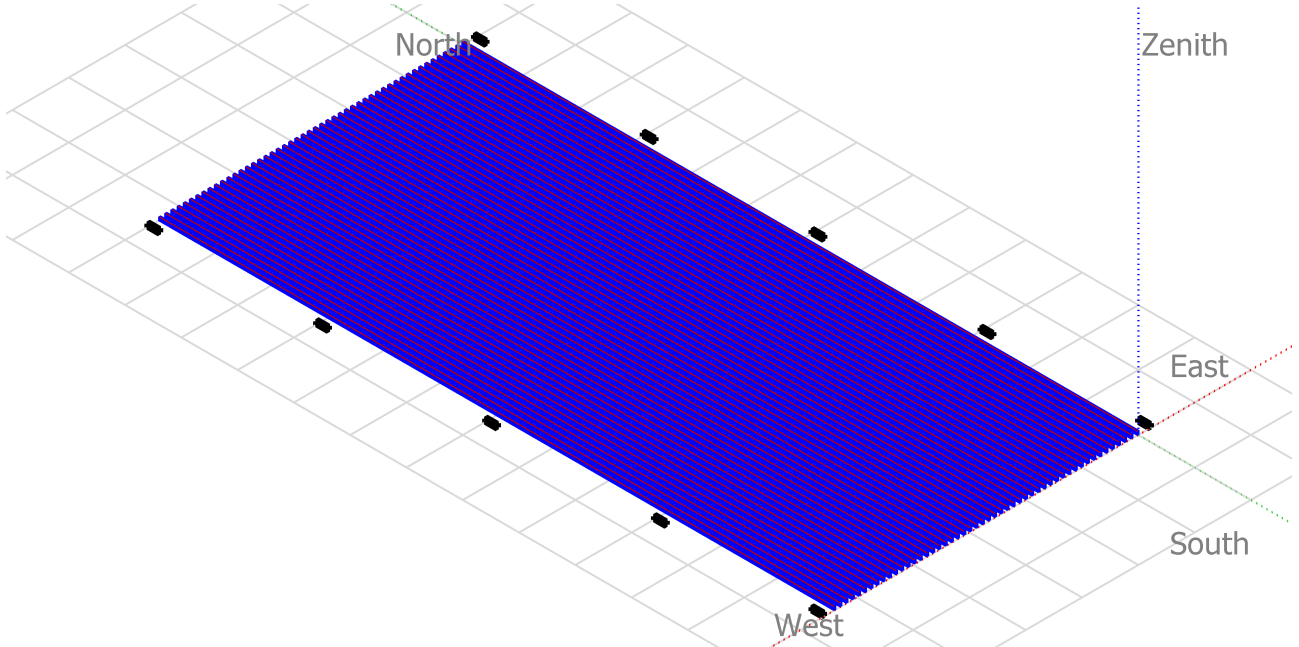


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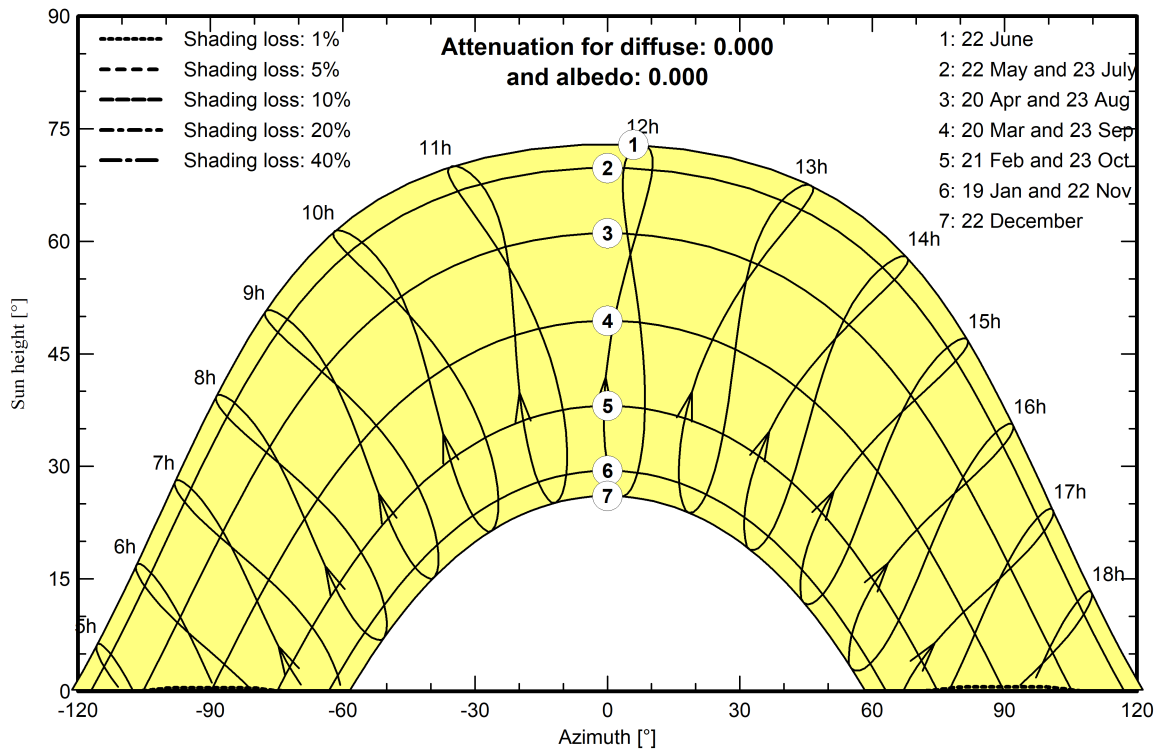
Near shadings parameter

Perspective of the PV-field and surrounding shading scene



Iso-shadings diagram

Orientation #1





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Main results

System Production

Produced Energy

26 GWh/year

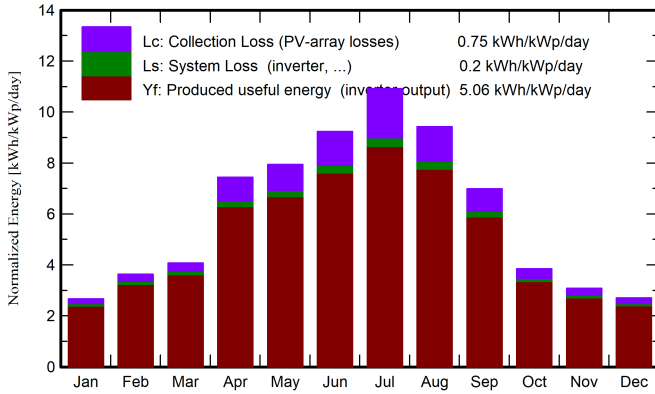
Specific production

1849 kWh/kWp/year

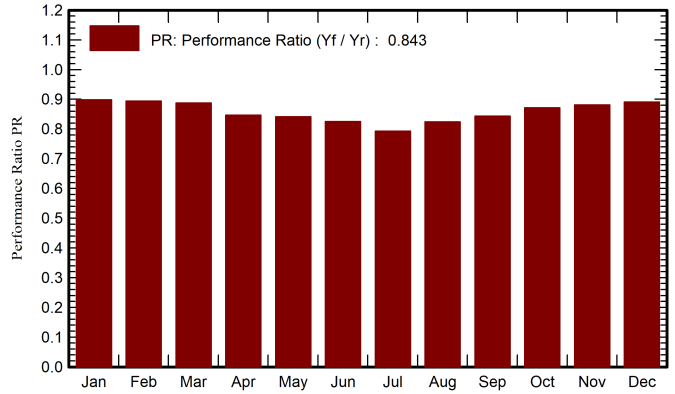
Performance Ratio PR

84.28 %

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 GWh	E_Grid GWh	PR ratio
January	62.5	30.60	7.43	82.7	77.7	1.101	1.061	0.898
February	78.7	37.60	9.70	101.8	96.6	1.347	1.299	0.894
March	100.4	52.50	11.17	126.5	120.5	1.663	1.601	0.887
April	170.3	63.30	14.44	223.1	214.9	2.800	2.697	0.847
May	189.9	69.60	17.83	246.3	237.6	3.072	2.958	0.842
June	211.1	70.10	23.27	277.0	267.9	3.389	3.263	0.825
July	251.9	59.60	27.12	338.5	328.5	3.982	3.830	0.793
August	216.4	59.50	25.72	292.3	283.2	3.578	3.439	0.824
September	157.0	52.90	23.45	209.5	202.0	2.621	2.522	0.843
October	92.8	44.70	15.76	119.5	113.5	1.543	1.486	0.872
November	69.3	29.50	13.09	92.5	87.1	1.206	1.162	0.881
December	62.4	26.80	9.19	83.8	78.4	1.104	1.065	0.891
Year	1662.7	596.70	16.55	2193.5	2107.8	27.404	26.384	0.843

Legends

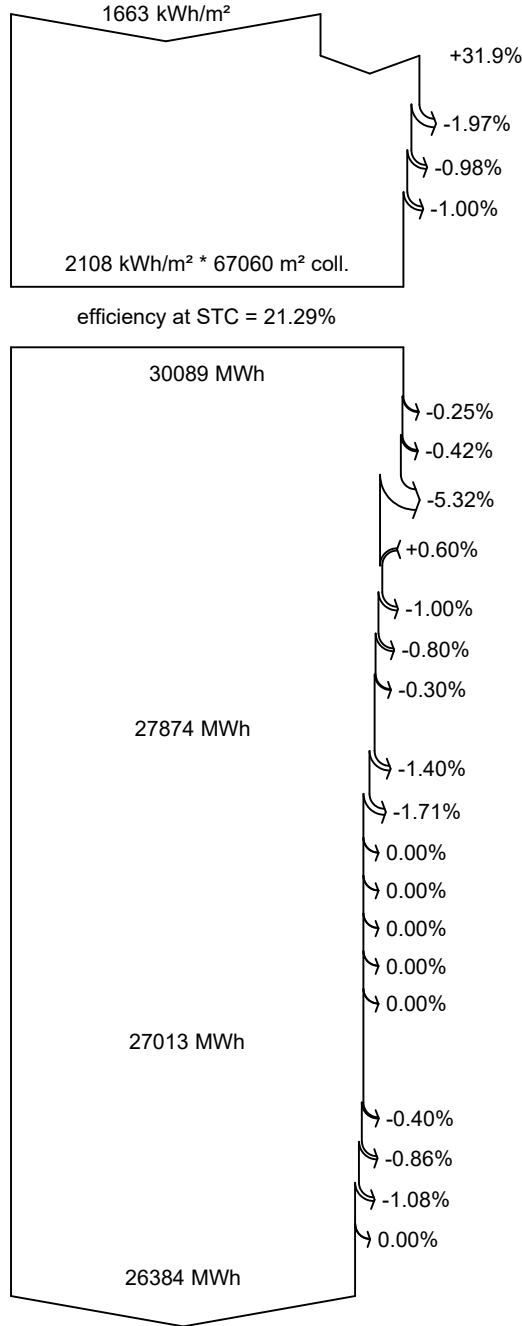
GlobHor	Global horizontal irradiation	EArray	Effective energy at the output of the array
DiffHor	Horizontal diffuse irradiation	E_Grid	Energy injected into grid
T_Amb	Ambient Temperature	PR	Performance Ratio
GlobInc	Global incident in coll. plane		
GlobEff	Effective Global, corr. for IAM and shadings		



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Loss diagram



- Global horizontal irradiation**
- Global incident in coll. plane**
- Near Shadings: irradiance loss
- IAM factor on global
- Soiling loss factor
- Effective irradiation on collectors**
- PV conversion
- Array nominal energy (at STC effic.)**
- Module Degradation Loss (for year #1)
- PV loss due to irradiance level
- PV loss due to temperature
- Module quality loss
- LID - Light induced degradation
- Mismatch loss, modules and strings
- Ohmic wiring loss
- Array virtual energy at MPP**
- Inverter Loss during operation (efficiency)
- Inverter Loss over nominal inv. power
- Inverter Loss due to max. input current
- Inverter Loss over nominal inv. voltage
- Inverter Loss due to power threshold
- Inverter Loss due to voltage threshold
- Night consumption
- Available Energy at Inverter Output**
- Auxiliaries (fans, other)
- AC ohmic loss
- Medium voltage transfo loss
- MV line ohmic loss
- Energy injected into grid**



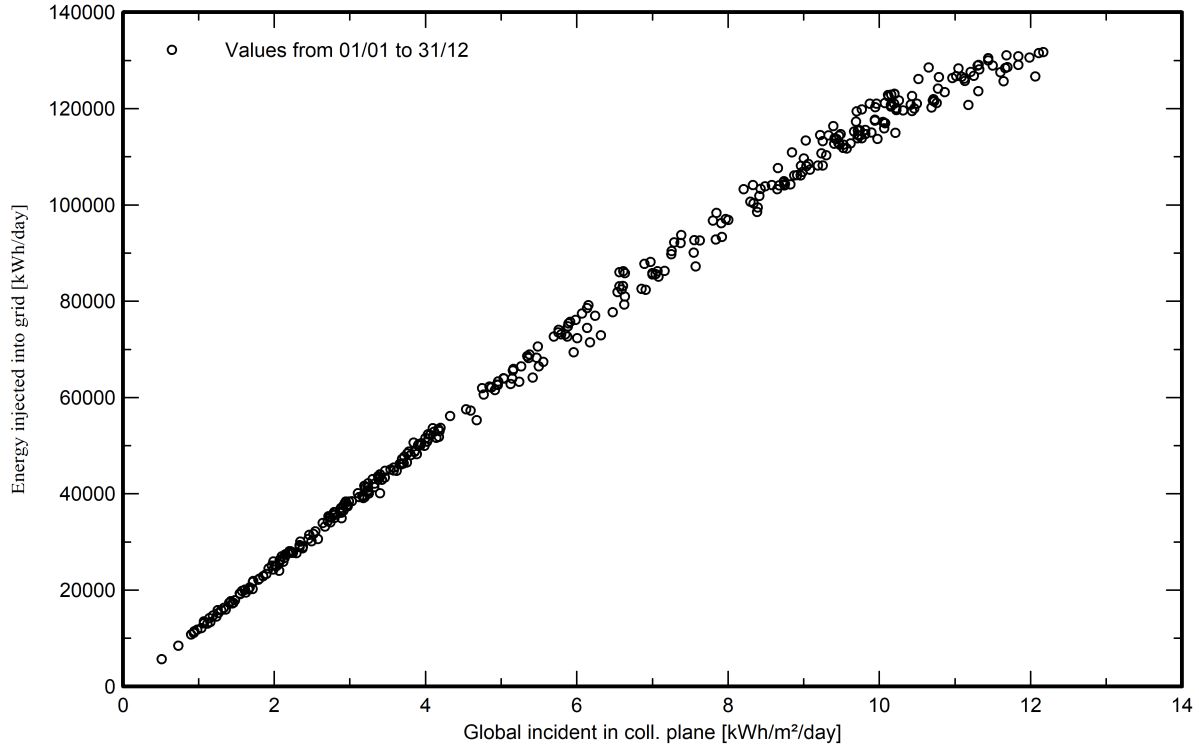
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Special graphs

Daily Input/Output diagram



System Output Power Distribution

