



REGIONE PUGLIA



COMUNE DI POGGIO  
IMPERIALE



COMUNE DI LESINA



COMUNE DI SAN PAOLO  
CIVITATE



COMUNE DI APRICENA

Nome Progetto / Project Name

**IMPIANTO AGRIVOLTAICO,  
DENOMINATO POGGIO 5  
POTENZA INSTALLATA 73,050 MW  
CON PANNELLI SU SUPPORTO TRACKER  
AD ASSE ORIZZONTALE IN AGRO DI  
POGGIO IMPERIALE, LESINA, SAN PAOLO CIVITATE,  
E RELATIVE OPERE DI CONNESSIONE**

committente

ITALIA ENERGIA SOLARE 1

Titolo documento /Document title

RELAZIONE TECNICA PRODUCIBILITÀ

Tavola /Pannel

Codice elaborato /Code processed

PG5\_REL\_FV\_PRD\_005

00	12/2022	PROGETTO DEFINITIVO			
N.	Data Revisione	Descrizione revisione	Preparato	Vagliato	Approvato

Specialista / Specialist

Ing. Pasquale De Bonis

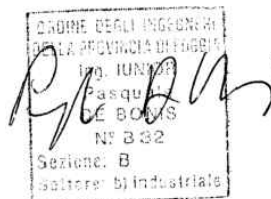


Sviluppatore / Developer

RENEWABLE CONSULTING

Progettisti / Planner

RENEWABLE CONSULTING S.R.L.



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### ALLEGATI:

- REPORT PVSYST



**PROGETTO RELATIVO ALLA COSTRUZIONE ED ESERCIZIO DI UN IMPIANTO AGRIVOLTAICO, DENOMINATO POGGIO 5, POTENZA INSTALLATA 73.05 MW, CON PANNELLI SU SUPPORTO TRACKER AD ASSE ORIZZONTALE IN AGRO DI POGGIO IMPERIALE, LESINA, SAN PAOLO DI CIVITATE**

**COMUNE DI POGGIO IMPERIALE,  
COMUNE DI LESINA, COMUNE DI SAN  
PAOLO CIVITATE**

**PG5\_REL\_FV\_PRD\_005\_Relazione tecnica producibilità**

## **1. PREMESSA**

Il presente documento è parte integrante del progetto definitivo redatto per la realizzazione della connessione elettrica alla rete di Terna SpA, in riferimento all'impianto di produzione di energia elettrica da fonte fotovoltaica denominato **POGGIO 5**, da realizzarsi in agro dei comuni di San Paolo di Civitate, Lesina e Poggio Imperiale (FG), caratterizzato da una potenza di 73,05 MWp.

## **2. CALCOLO PRODUCIBILITÀ IMPIANTO**

La valutazione della producibilità è stata eseguita tramite simulazione software con l'inserimento dei dati geometrici ed elettrici dell'impianto, geolocalizzando il sito per i dati meteorologici annuali calcolando quindi puntualmente i diversi orientamenti ottenuti dal movimento delle strutture ad inseguimento durante la giornata.

Da tale report si evince che la producibilità attesa media annua dell'impianto è pari a **117857 MWh/anno** con una produzione specifica pari a **1613 kWh/kWp/a**.

# PVsyst - Simulation report

## Grid-Connected System

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Project: STMG 5

Variant: interasse 5m

Tracking system

System power: 73.05 MWp

Poggio Imperiale - Italy

**Autore**

ING. PASQUALE DE BONIS (Italy)



# Project: STMG 5

Variant: interasse 5m

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### Project summary

<b>Geographical Site</b> Poggio Imperiale Italy	<b>Situation</b> Latitude 41.83 °N Longitude 15.37 °E Altitude 68 m Time zone UTC+1	<b>Project settings</b> Albedo 0.20
<b>Meteo data</b> Poggio Imperiale Meteonorm 7.3 (1991-2010), Sat=74% - Sintetico		

### System summary

<b>Grid-Connected System</b>	<b>Tracking system</b>	<b>Near Shadings</b>
<b>PV Field Orientation</b> Orientation Tracking plane, horizontal N-S axis Axis azimuth 0 °	<b>Tracking algorithm</b> Astronomic calculation	Linear shadings
<b>System information</b> <b>PV Array</b> Nb. of modules 120744 units Pnom total 73.05 MWp	<b>Inverters</b> Nb. of units 190 units Pnom total 60.80 MWac Pnom ratio 1.201	
<b>User's needs</b> Unlimited load (grid)		

### Results summary

Produced Energy 117857437 kWh/year	Specific production 1613 kWh/kWp/year	Perf. Ratio PR 79.15 %
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## PVsyst V7.3.1

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## General parameters

Grid-Connected System		Tracking system	
<b>PV Field Orientation</b>		<b>Tracking algorithm</b>	
<b>Orientation</b>		Astronomic calculation	
Tracking plane, horizontal N-S axis			
Axis azimuth	0 °		
<b>Models used</b>		<b>Trackers configuration</b>	
Transposition	Perez	Nb. of trackers	1830 units
Diffuse	Perez, Meteonorm	<b>Sizes</b>	
Circumsolar	separate	Tracker Spacing	5.00 m
		Collector width	2.26 m
		Ground Cov. Ratio (GCR)	45.1 %
		Phi min / max.	-/+ 60.0 °
		<b>Shading limit angles</b>	
		Phi limits for BT	-/+ 63.0 °
<b>Horizon</b>		<b>User's needs</b>	
Free Horizon		Unlimited load (grid)	
		<b>Near Shadings</b>	
		Linear shadings	

## PV Array Characteristics

PV module		Inverter	
Manufacturer	Risen Energy Co., Ltd	Manufacturer	Sungrow
Model	RSM120-8-605M	Model	SG350HX-20A-Preliminary
(Custom parameters definition)		(Custom parameters definition)	
Unit Nom. Power	605 Wp	Unit Nom. Power	320 kWac
Number of PV modules	120744 units	Number of inverters	190 units
Nominal (STC)	73.05 MWp	Total power	60800 kWac
<b>Array #1 - Sottocampo #1</b>		<b>Array #1 - Sottocampo #1</b>	
Number of PV modules	5564 units	Number of inverters	9 units
Nominal (STC)	3366 kWp	Total power	2880 kWac
Modules	214 Strings x 26 In series		
<b>At operating cond. (50°C)</b>		<b>At operating cond. (50°C)</b>	
Pmpp	3082 kWp	Operating voltage	500-1500 V
U mpp	821 V	Max. power (=>30°C)	352 kWac
I mpp	3756 A	Pnom ratio (DC:AC)	1.17
		Power sharing within this inverter	
<b>Array #2 - Sottocampo #2</b>		<b>Array #2 - Sottocampo #2</b>	
Number of PV modules	3848 units	Number of inverters	6 units
Nominal (STC)	2328 kWp	Total power	1920 kWac
Modules	148 Strings x 26 In series		
<b>At operating cond. (50°C)</b>		<b>At operating cond. (50°C)</b>	
Pmpp	2131 kWp	Operating voltage	500-1500 V
U mpp	821 V	Max. power (=>30°C)	352 kWac
I mpp	2597 A	Pnom ratio (DC:AC)	1.21
		Power sharing within this inverter	
<b>Array #3 - Sottocampo #3</b>		<b>Array #3 - Sottocampo #3</b>	
Number of PV modules	7150 units	Number of inverters	11 units
Nominal (STC)	4326 kWp	Total power	3520 kWac
Modules	275 Strings x 26 In series		
<b>At operating cond. (50°C)</b>		<b>At operating cond. (50°C)</b>	
Pmpp	3961 kWp	Operating voltage	500-1500 V
U mpp	821 V	Max. power (=>30°C)	352 kWac
I mpp	4826 A	Pnom ratio (DC:AC)	1.23
		Power sharing within this inverter	



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## PV Array Characteristics

**Array #4 - Sottocampo #4**

Number of PV modules	5226 units	Number of inverters	8 units
Nominal (STC)	3162 kWp	Total power	2560 kWac
Modules	201 Strings x 26 In series		
<b>At operating cond. (50°C)</b>			
Pmpp	2895 kWp	Operating voltage	500-1500 V
U mpp	821 V	Max. power (=>30°C)	352 kWac
I mpp	3528 A	Pnom ratio (DC:AC)	1.24
		Power sharing within this inverter	

**Array #5 - Sottocampo #5**

Number of PV modules	8554 units	Number of inverters	13 units
Nominal (STC)	5175 kWp	Total power	4160 kWac
Modules	329 Strings x 26 In series		
<b>At operating cond. (50°C)</b>			
Pmpp	4738 kWp	Operating voltage	500-1500 V
U mpp	821 V	Max. power (=>30°C)	352 kWac
I mpp	5774 A	Pnom ratio (DC:AC)	1.24
		Power sharing within this inverter	

**Array #6 - Sottocampo #6**

Number of PV modules	7176 units	Number of inverters	11 units
Nominal (STC)	4341 kWp	Total power	3520 kWac
Modules	276 Strings x 26 In series		
<b>At operating cond. (50°C)</b>			
Pmpp	3975 kWp	Operating voltage	500-1500 V
U mpp	821 V	Max. power (=>30°C)	352 kWac
I mpp	4844 A	Pnom ratio (DC:AC)	1.23
		Power sharing within this inverter	

**Array #7 - Sottocampo #7**

Number of PV modules	8086 units	Number of inverters	12 units
Nominal (STC)	4892 kWp	Total power	3840 kWac
Modules	311 Strings x 26 In series		
<b>At operating cond. (50°C)</b>			
Pmpp	4479 kWp	Operating voltage	500-1500 V
U mpp	821 V	Max. power (=>30°C)	352 kWac
I mpp	5458 A	Pnom ratio (DC:AC)	1.27
		Power sharing within this inverter	

**Array #8 - Sottocampo #8**

Number of PV modules	6370 units	Number of inverters	10 units
Nominal (STC)	3854 kWp	Total power	3200 kWac
Modules	245 Strings x 26 In series		
<b>At operating cond. (50°C)</b>			
Pmpp	3528 kWp	Operating voltage	500-1500 V
U mpp	821 V	Max. power (=>30°C)	352 kWac
I mpp	4300 A	Pnom ratio (DC:AC)	1.20
		Power sharing within this inverter	

**Array #9 - Sottocampo #9**

Number of PV modules	9516 units	Number of inverters	15 units
Nominal (STC)	5757 kWp	Total power	4800 kWac
Modules	366 Strings x 26 In series		
<b>At operating cond. (50°C)</b>			
Pmpp	5271 kWp	Operating voltage	500-1500 V
U mpp	821 V	Max. power (=>30°C)	352 kWac
I mpp	6423 A	Pnom ratio (DC:AC)	1.20
		Power sharing within this inverter	



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## PV Array Characteristics

**Array #10 - Sottocampo #10**

Number of PV modules	7020 units	Number of inverters	11 units
Nominal (STC)	4247 kWp	Total power	3520 kWac
Modules	270 Strings x 26 In series		
<b>At operating cond. (50°C)</b>		Operating voltage	500-1500 V
Pmpp	3888 kWp	Max. power (=>30°C)	352 kWac
U mpp	821 V	Pnom ratio (DC:AC)	1.21
I mpp	4739 A	Power sharing within this inverter	

**Array #11 - Sottocampo #11**

Number of PV modules	6812 units	Number of inverters	11 units
Nominal (STC)	4121 kWp	Total power	3520 kWac
Modules	262 Strings x 26 In series		
<b>At operating cond. (50°C)</b>		Operating voltage	500-1500 V
Pmpp	3773 kWp	Max. power (=>30°C)	352 kWac
U mpp	821 V	Pnom ratio (DC:AC)	1.17
I mpp	4598 A	Power sharing within this inverter	

**Array #12 - Sottocampo #12**

Number of PV modules	6812 units	Number of inverters	11 units
Nominal (STC)	4121 kWp	Total power	3520 kWac
Modules	262 Strings x 26 In series		
<b>At operating cond. (50°C)</b>		Operating voltage	500-1500 V
Pmpp	3773 kWp	Max. power (=>30°C)	352 kWac
U mpp	821 V	Pnom ratio (DC:AC)	1.17
I mpp	4598 A	Power sharing within this inverter	

**Array #13 - Sottocampo #13**

Number of PV modules	10296 units	Number of inverters	16 units
Nominal (STC)	6229 kWp	Total power	5120 kWac
Modules	396 Strings x 26 In series		
<b>At operating cond. (50°C)</b>		Operating voltage	500-1500 V
Pmpp	5703 kWp	Max. power (=>30°C)	352 kWac
U mpp	821 V	Pnom ratio (DC:AC)	1.22
I mpp	6950 A	Power sharing within this inverter	

**Array #14 - Sottocampo #14**

Number of PV modules	6214 units	Number of inverters	10 units
Nominal (STC)	3759 kWp	Total power	3200 kWac
Modules	239 Strings x 26 In series		
<b>At operating cond. (50°C)</b>		Operating voltage	500-1500 V
Pmpp	3442 kWp	Max. power (=>30°C)	352 kWac
U mpp	821 V	Pnom ratio (DC:AC)	1.17
I mpp	4195 A	Power sharing within this inverter	

**Array #15 - Sottocampo #15**

Number of PV modules	6786 units	Number of inverters	11 units
Nominal (STC)	4106 kWp	Total power	3520 kWac
Modules	261 Strings x 26 In series		
<b>At operating cond. (50°C)</b>		Operating voltage	500-1500 V
Pmpp	3759 kWp	Max. power (=>30°C)	352 kWac
U mpp	821 V	Pnom ratio (DC:AC)	1.17
I mpp	4581 A	Power sharing within this inverter	





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**PV Array Characteristics**

<b>Array #16 - Sottocampo #16</b>			
Number of PV modules	6786 units	Number of inverters	11 units
Nominal (STC)	4106 kWp	Total power	3520 kWac
Modules	261 Strings x 26 In series		
<b>At operating cond. (50°C)</b>			
Pmpp	3759 kWp	Operating voltage	500-1500 V
U mpp	821 V	Max. power (=>30°C)	352 kWac
I mpp	4581 A	Pnom ratio (DC:AC)	1.17
		Power sharing within this inverter	
<b>Array #17 - Sottocampo #17</b>			
Number of PV modules	5044 units	Number of inverters	8 units
Nominal (STC)	3052 kWp	Total power	2560 kWac
Modules	194 Strings x 26 In series		
<b>At operating cond. (50°C)</b>			
Pmpp	2794 kWp	Operating voltage	500-1500 V
U mpp	821 V	Max. power (=>30°C)	352 kWac
I mpp	3405 A	Pnom ratio (DC:AC)	1.19
		Power sharing within this inverter	
<b>Array #18 - Sottocampo #18</b>			
Number of PV modules	3484 units	Number of inverters	6 units
Nominal (STC)	2108 kWp	Total power	1920 kWac
Modules	134 Strings x 26 In series		
<b>At operating cond. (50°C)</b>			
Pmpp	1930 kWp	Operating voltage	500-1500 V
U mpp	821 V	Max. power (=>30°C)	352 kWac
I mpp	2352 A	Pnom ratio (DC:AC)	1.10
		Power sharing within this inverter	
<b>Total PV power</b>		<b>Total inverter power</b>	
Nominal (STC)	73050 kWp	Total power	60800 kWac
Total	120744 modules	Number of inverters	190 units
Module area	341720 m <sup>2</sup>	Pnom ratio	1.20
Cell area	320213 m <sup>2</sup>		

**Array losses**

<b>Thermal Loss factor</b>		<b>LID - Light Induced Degradation</b>		<b>Module Quality Loss</b>				
Module temperature according to irradiance		Loss Fraction	1.5 %	Loss Fraction	-0.8 %			
Uc (const)	20.0 W/m <sup>2</sup> K							
Uv (wind)	0.0 W/m <sup>2</sup> K/m/s							
<b>Module mismatch losses</b>		<b>Strings Mismatch loss</b>						
Loss Fraction	2.0 % at MPP	Loss Fraction	0.1 %					
<b>IAM loss factor</b>								
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



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DC wiring losses

Global wiring resistance 0.17 mΩ  
Loss Fraction 1.5 % at STC

**Array #1 - Sottocampo #1**

Global array res. 3.6 mΩ  
Loss Fraction 1.5 % at STC

**Array #3 - Sottocampo #3**

Global array res. 2.8 mΩ  
Loss Fraction 1.5 % at STC

**Array #5 - Sottocampo #5**

Global array res. 2.3 mΩ  
Loss Fraction 1.5 % at STC

**Array #7 - Sottocampo #7**

Global array res. 2.5 mΩ  
Loss Fraction 1.5 % at STC

**Array #9 - Sottocampo #9**

Global array res. 2.1 mΩ  
Loss Fraction 1.5 % at STC

**Array #11 - Sottocampo #11**

Global array res. 2.9 mΩ  
Loss Fraction 1.5 % at STC

**Array #13 - Sottocampo #13**

Global array res. 1.9 mΩ  
Loss Fraction 1.5 % at STC

**Array #15 - Sottocampo #15**

Global array res. 2.9 mΩ  
Loss Fraction 1.5 % at STC

**Array #17 - Sottocampo #17**

Global array res. 4.0 mΩ  
Loss Fraction 1.5 % at STC

**Array #2 - Sottocampo #2**

Global array res. 5.2 mΩ  
Loss Fraction 1.5 % at STC

**Array #4 - Sottocampo #4**

Global array res. 3.8 mΩ  
Loss Fraction 1.5 % at STC

**Array #6 - Sottocampo #6**

Global array res. 2.8 mΩ  
Loss Fraction 1.5 % at STC

**Array #8 - Sottocampo #8**

Global array res. 3.1 mΩ  
Loss Fraction 1.5 % at STC

**Array #10 - Sottocampo #10**

Global array res. 2.8 mΩ  
Loss Fraction 1.5 % at STC

**Array #12 - Sottocampo #12**

Global array res. 2.9 mΩ  
Loss Fraction 1.5 % at STC

**Array #14 - Sottocampo #14**

Global array res. 3.2 mΩ  
Loss Fraction 1.5 % at STC

**Array #16 - Sottocampo #16**

Global array res. 2.9 mΩ  
Loss Fraction 1.5 % at STC

**Array #18 - Sottocampo #18**

Global array res. 5.7 mΩ  
Loss Fraction 1.5 % at STC

System losses

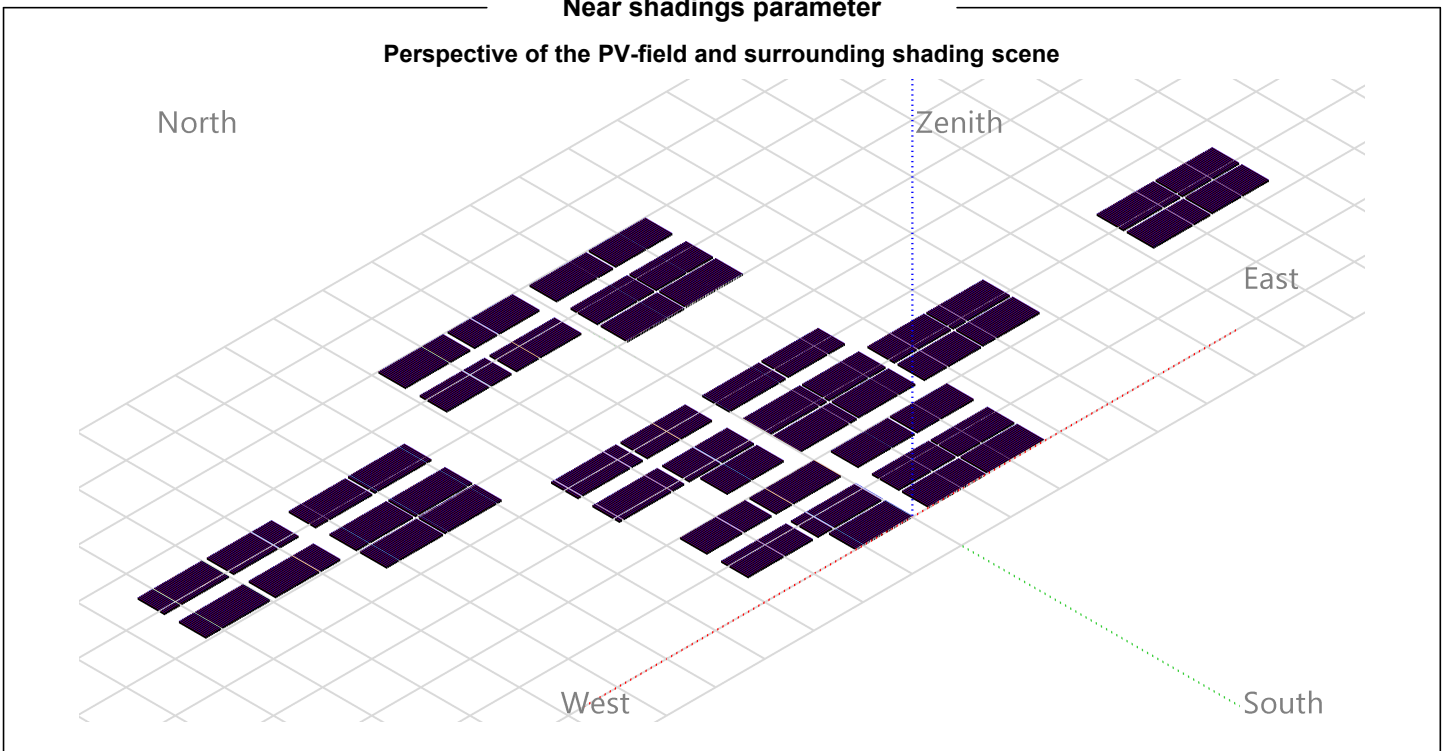
**Auxiliaries loss**

constant (fans) 20.0 kW  
0.0 kW from Power thresh.  
Night aux. cons. 10.0 kW



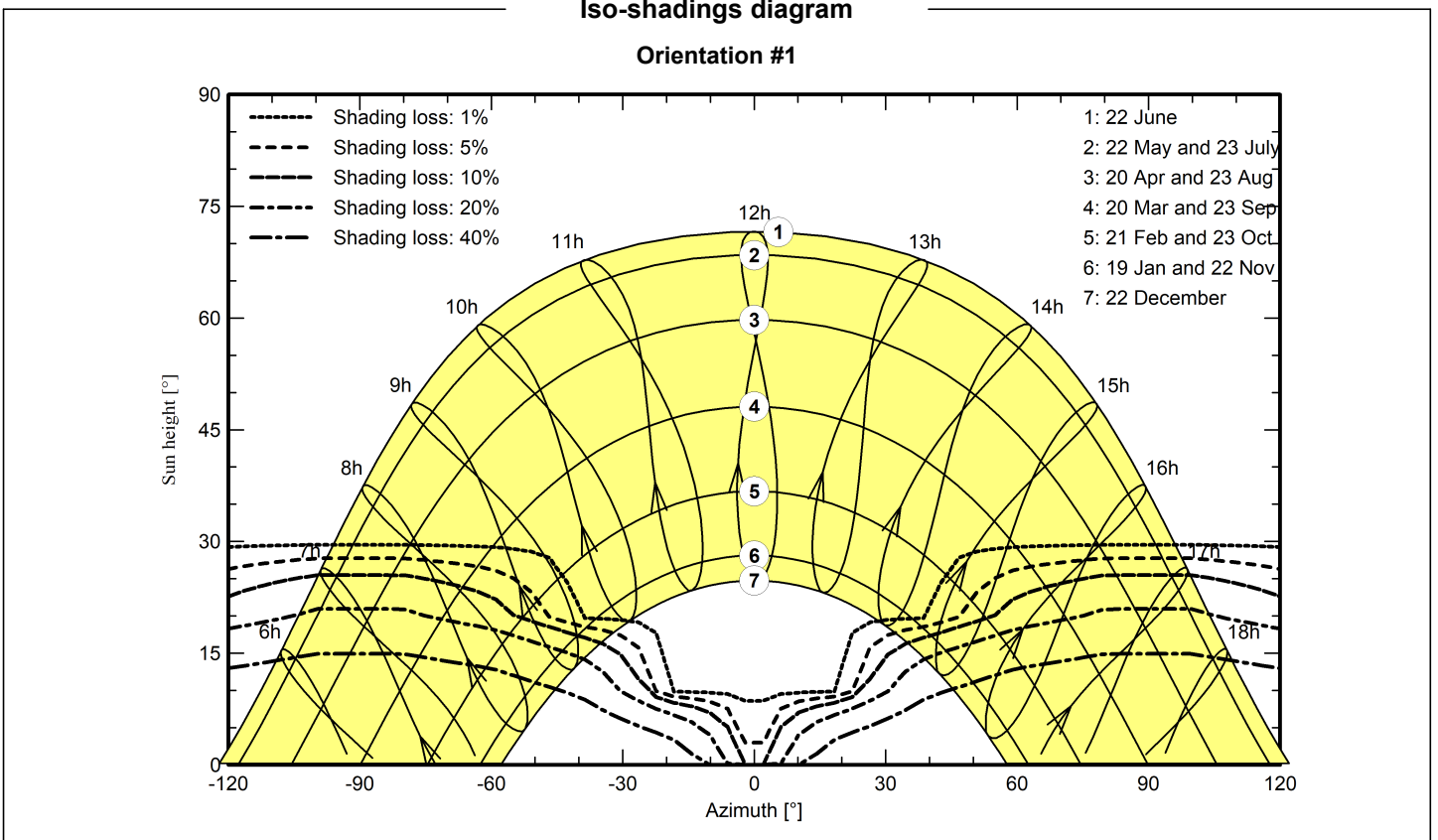
### Near shadings parameter

Perspective of the PV-field and surrounding shading scene



### Iso-shadings diagram

Orientation #1





**Main results**

**System Production**

Produced Energy 117857437 kWh/year

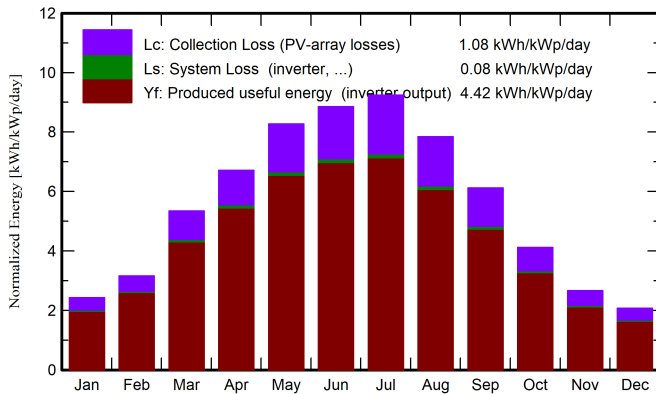
Specific production

1613 kWh/kWp/year

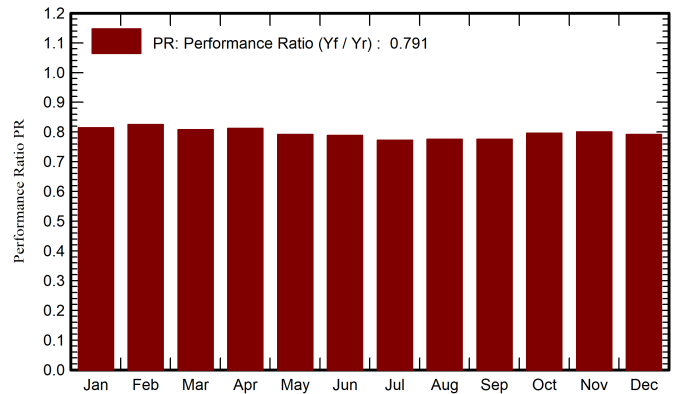
Performance Ratio PR

79.15 %

**Normalized productions (per installed kWp)**



**Performance Ratio PR**



**Balances and main results**

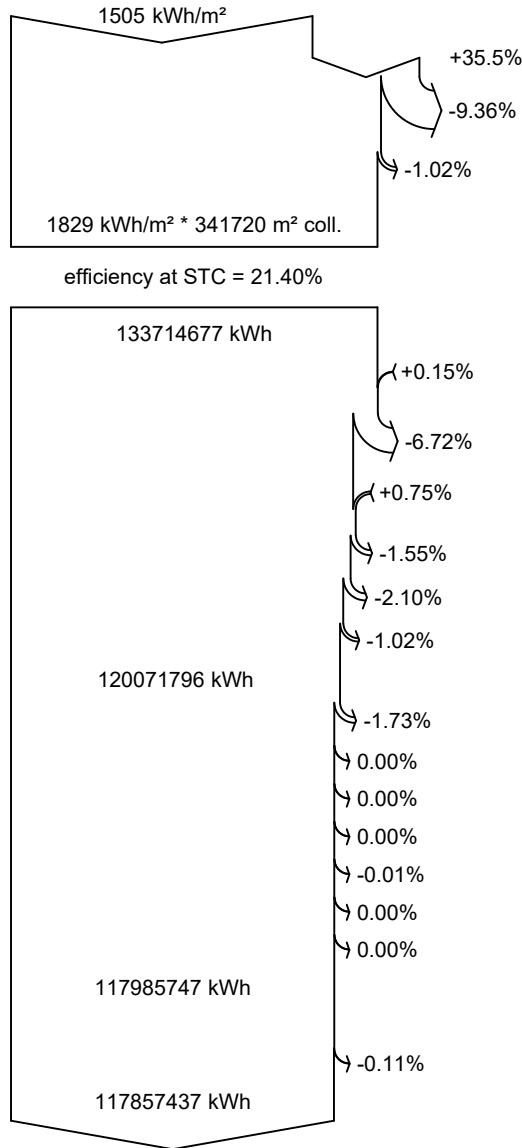
	GlobHor	DiffHor	T_Amb	GlobInc	GlobEff	EArray	E_Grid	PR
	kWh/m <sup>2</sup>	kWh/m <sup>2</sup>	°C	kWh/m <sup>2</sup>	kWh/m <sup>2</sup>	kWh	kWh	ratio
<b>January</b>	53.3	24.19	7.70	75.2	64.4	4572619	4476782	0.815
<b>February</b>	67.4	39.13	8.01	88.4	77.1	5437885	5331298	0.826
<b>March</b>	118.5	50.86	11.13	165.7	146.3	9959163	9774319	0.808
<b>April</b>	151.2	68.61	13.83	201.4	182.0	12180345	11960423	0.813
<b>May</b>	191.3	81.29	19.83	256.4	233.6	15104925	14833180	0.792
<b>June</b>	202.1	86.08	23.99	265.8	245.3	15582922	15306813	0.788
<b>July</b>	212.8	86.25	27.14	286.7	262.4	16468527	16179929	0.773
<b>August</b>	180.1	77.57	26.64	243.1	221.3	14019472	13768148	0.775
<b>September</b>	132.4	58.39	20.93	183.7	162.0	10595445	10402932	0.775
<b>October</b>	92.8	45.36	17.58	127.8	112.0	7571453	7427824	0.796
<b>November</b>	57.3	29.44	12.34	79.8	68.6	4769587	4669980	0.801
<b>December</b>	45.5	24.19	9.02	64.4	53.7	3809453	3725809	0.792
<b>Year</b>	1504.7	671.36	16.57	2038.4	1828.7	120071796	117857437	0.791

**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		



Loss diagram



**Global horizontal irradiation**

**Global incident in coll. plane**

Near Shadings: irradiance loss

IAM factor on global

**Effective irradiation on collectors**

PV conversion

**Array nominal energy (at STC effic.)**

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**

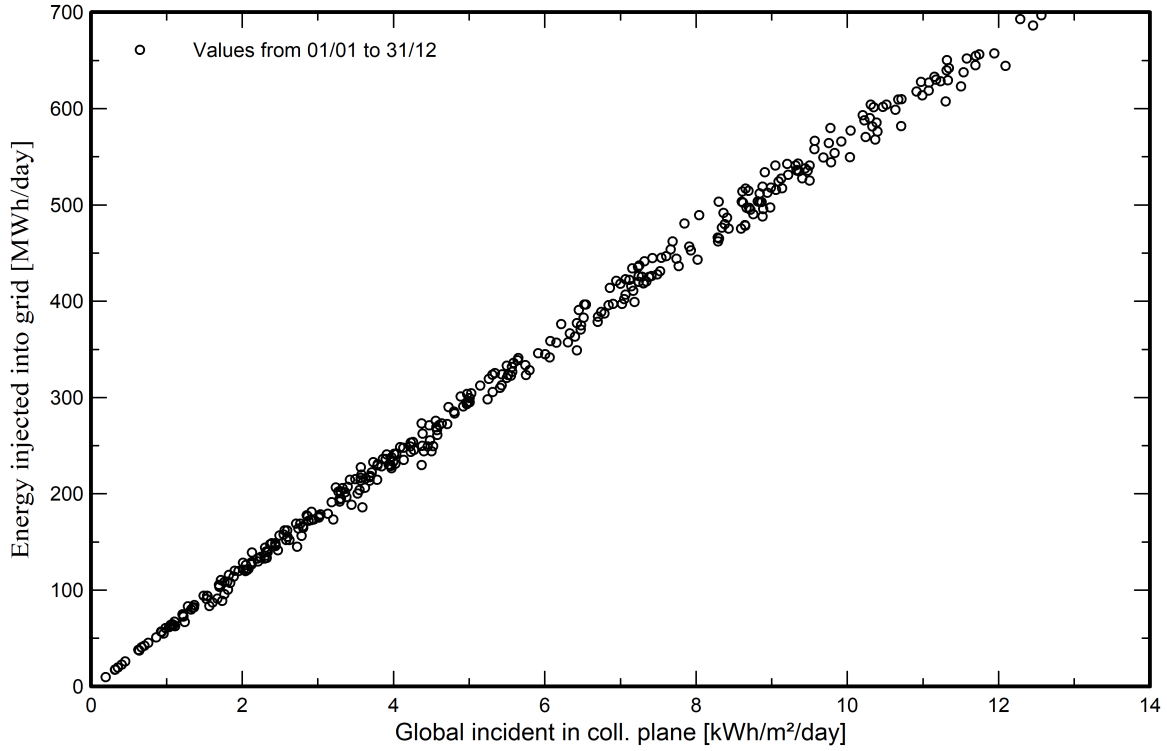
Auxiliaries (fans, other)

**Energy injected into grid**

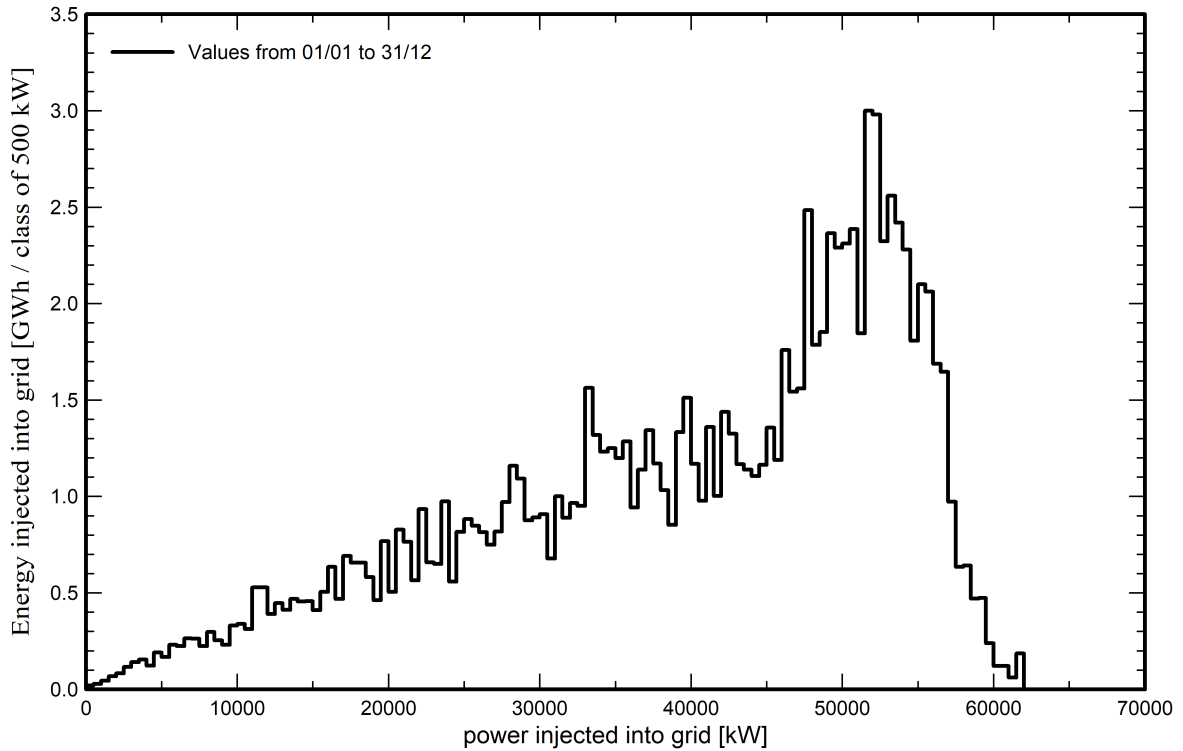


Predef. graphs

Diagramma giornaliero entrata/uscita



Distribuzione potenza in uscita sistema





**P50 - P90 evaluation**

**Meteo data**

Source      Meteonorm 7.3 (1991-2010), Sat=74%  
Kind            Not defined  
Year-to-year variability(Variance)      0.5 %

**Specified Deviation**

**Global variability (meteo + system)**

Variability (Quadratic sum)      1.9 %

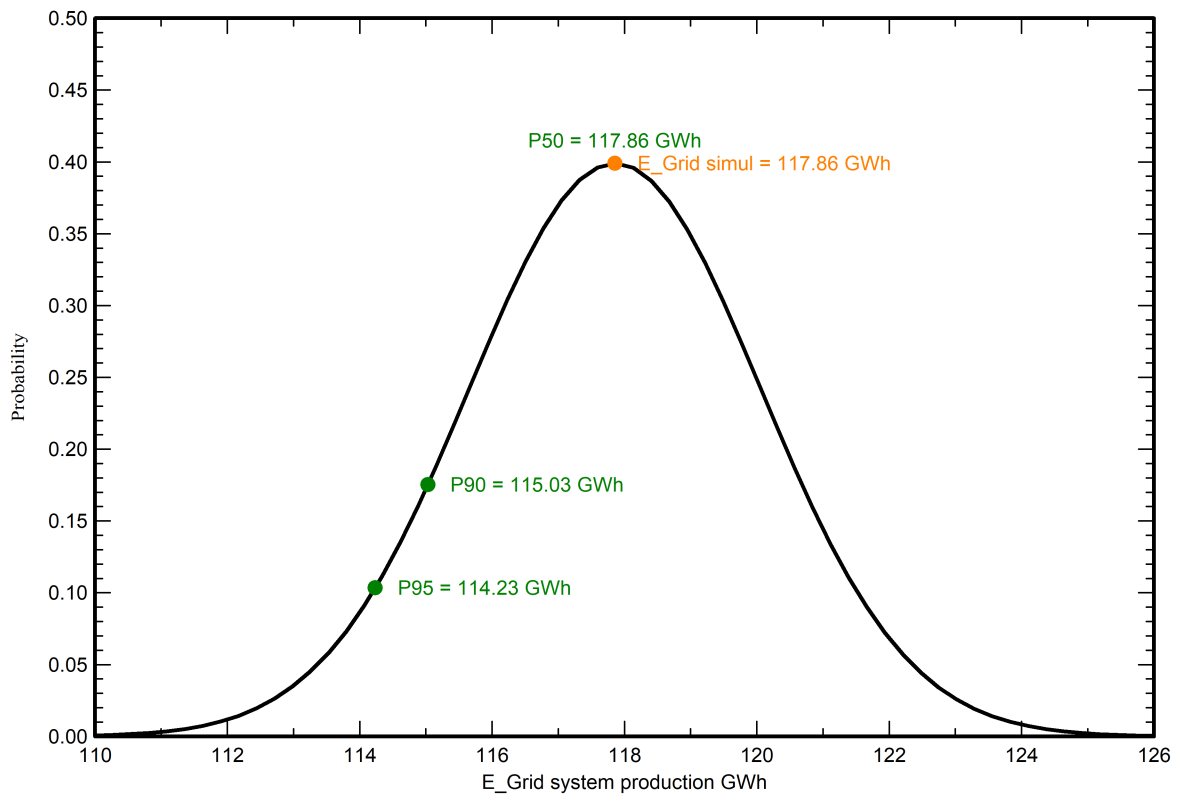
**Simulation and parameters uncertainties**

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      2.20 GWh  
P50      117.86 GWh  
P90      115.03 GWh  
P95      114.23 GWh

**Probability distribution**

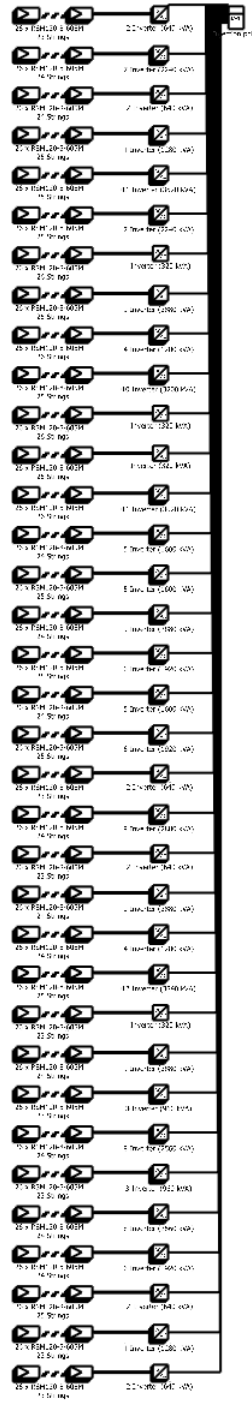




PVsyst V7.3.1

VC2, Simulation date:  
14/01/23 10:58  
with v7.3.1

# Single-line diagram



PV module	RSM120-8-605M
Inverter	SG350HX-20A-Preliminary
String	26 x RSM120-8-605M

STMG 5

ING. PASQUALE D

VC2 : interasse 5m

14/01/23