

**IMPIANTO AGRIVOLTAICO DELLA POTENZA NOMINALE
DI 40.683,52 kWp
"SALICE SANCHIRICO"**

UBICATO NEL COMUNE DI SALICE SALENTINO (LE)

CODICE IDENTIFICATIVO PRATICA AU REGIONALE: T141QE2

Titolo Elaborato:

**ANALISI DELLA RISORSA SOLARE E STIMA DI
PRODUZIONE ENERGIA**

IDENTIFICAZIONE ELABORATO (MITE)

LIVELLO PROGETTAZIONE	TIPO DOCUMENTO	CODICE IDENTIFICATIVO	DATA	SCALA
PD	R	T141QE2_REL_12	LUGLIO 2022	-

REVISIONI

REV.	DATA	DESCRIZIONE	ESEGUITO	VERIFICATO	APPROVATO
00	07/22	Prima emissione	Ing. Cosimo Totaro	Ing. Cosimo Totaro	Ing. Cosimo Totaro

PROGETTAZIONE:



TECNICO:

Ing. Cosimo Totaro
Ordine degli Ingegneri
Provincia di Brindisi n.1718



PROPONENTE:

TRINA SOLAR PAPIRO S.R.L.
Piazza Borromeo, 14
20123, Milano (MI) - Italy



PVsyst - Simulation report

Grid-Connected System

Project: Salice San Chirico

Variant: Nuova variante di simulazione

Tracking system with backtracking

System power: 40.68 MWp

Salice Salentino - Italy

Author

Trina Solar Italy Systems S.r.l. (Italy)



Project: Salice San Chirico

Variant: Nuova variante di simulazione

PVsyst V7.2.13

VCO, Simulation date:
14/07/22 13:12
with v7.2.13

Trina Solar Italy Systems S.r.l. (Italy)

Project summary

Geographical Site

Salice Salentino
Italy

Situation

Latitude 40.37 °N
Longitude 17.94 °E
Altitude 51 m
Time zone UTC+1

Meteo data

Salice Salentino
Meteonorm 8.0, Sat=100% - Sintetico

Monthly albedo values

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.
Albedo	0.14	0.15	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.14	0.14	0.14

System summary

Grid-Connected System

PV Field Orientation

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

Tracking system with backtracking

Tracking algorithm

Irradiance optimization
Backtracking activated

Near Shadings

Linear shadings

System information

PV Array

Nb. of modules 59392 units
Pnom total 40.68 MWp

Inverters

Nb. of units 176 units
Pnom total 44.00 MWac
Pnom ratio 0.925

User's needs

Unlimited load (grid)

Results summary

Produced Energy 74 GWh/year Specific production 1822 kWh/kWp/year Perf. Ratio PR 88.58 %

Table of contents

Project and results summary	2
General parameters, PV Array Characteristics, System losses	3
Near shading definition - Iso-shadings diagram	5
Main results	6
Loss diagram	7
Special graphs	8
P50 - P90 evaluation	9
CO ₂ Emission Balance	10



Project: Salice San Chirico

Variant: Nuova variante di simulazione

PVsyst V7.2.13

VCO, Simulation date:
14/07/22 13:12
with v7.2.13

Trina Solar Italy Systems S.r.l. (Italy)

General parameters

Grid-Connected System

PV Field Orientation

Orientation

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

Models used

Transposition Perez
Diffuse Perez, Meteonorm
Circumsolar separate

Horizon

Free Horizon

Bifacial system

Model 2D Calculation
unlimited trackers

Bifacial model geometry

Tracker Spacing 9.00 m
Tracker width 2.63 m
GCR 29.2 %
Axis height above ground 2.10 m

Tracking system with backtracking

Tracking algorithm

Irradiance optimization
Backtracking activated

Near Shadings

Linear shadings

Backtracking strategy

Nb. of trackers 928 units

Sizes

Tracker Spacing 9.00 m
Collector width 2.63 m
Ground Cov. Ratio (GCR) 29.2 %
Phi min / max. +/- 55.0 °

Backtracking limit angle

Phi limits +/- 73.0 °

User's needs

Unlimited load (grid)

Bifacial model definitions

Ground albedo average 0.15
Bifaciality factor 80 %
Rear shading factor 5.0 %
Rear mismatch loss 2.0 %
Shed transparent fraction 0.0 %

Monthly ground albedo values

Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.	Year
0.14	0.15	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.14	0.14	0.14	0.15

PV Array Characteristics

PV module

Manufacturer Trina Solar
Model TSM-685NEG21C.20
(Custom parameters definition)

Unit Nom. Power 685 Wp
Number of PV modules 59392 units
Nominal (STC) 40.68 MWp
Modules 1856 Strings x 32 In series

At operating cond. (50°C)

Pmpp 37.58 MWp
U mpp 1168 V
I mpp 32177 A

Total PV power

Nominal (STC) 40684 kWp
Total 59392 modules
Module area 184492 m²
Cell area 172866 m²

Inverter

Manufacturer Sungrow
Model SG250HX-IN
(Custom parameters definition)

Unit Nom. Power 250 kWac
Number of inverters 176 units
Total power 44000 kWac
Operating voltage 600-1500 V
Max. power (=>30°C) 250 kWac
Pnom ratio (DC:AC) 0.92

Total inverter power

Total power 44000 kWac
Number of inverters 176 units
Pnom ratio 0.92



PVsyst V7.2.13

VC0, Simulation date:
14/07/22 13:12
with v7.2.13

Trina Solar Italy Systems S.r.l. (Italy)

Array losses

Array Soiling Losses

Loss Fraction 2.0 %

Thermal Loss factor

Module temperature according to irradiance

Uc (const) 29.0 W/m²KUv (wind) 0.0 W/m²K/m/s**DC wiring losses**

Global array res. 0.20 mΩ

Loss Fraction 0.5 % at STC

Serie Diode Loss

Voltage drop 0.5 V

Loss Fraction 0.0 % at STC

LID - Light Induced Degradation

Loss Fraction 2.0 %

Module Quality Loss

Loss Fraction -1.0 %

Module mismatch losses

Loss Fraction 2.0 % at MPP

Strings Mismatch loss

Loss Fraction 0.1 %

IAM loss factor

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

Auxiliaries loss

Proportionnal to Power 2.0 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 1.50 % at STC

Inverter: SG250HX-INWire section (176 Inv.) Copper 176 x 3 x 70 mm²

Average wires length 157 m

MV line up to Injection

MV Voltage 36 kV

Average each inverter

Wires Alu 3 x 50 mm²

Length 12100 m

Loss Fraction 1.18 % at STC

AC losses in transformers

MV transfo

Grid voltage 36 kV

Operating losses at STC

Nominal power at STC 40097 kVA

Iron loss (24/24 Connexion) 4.01 kW/Inv.

Loss Fraction 0.20 % at STC

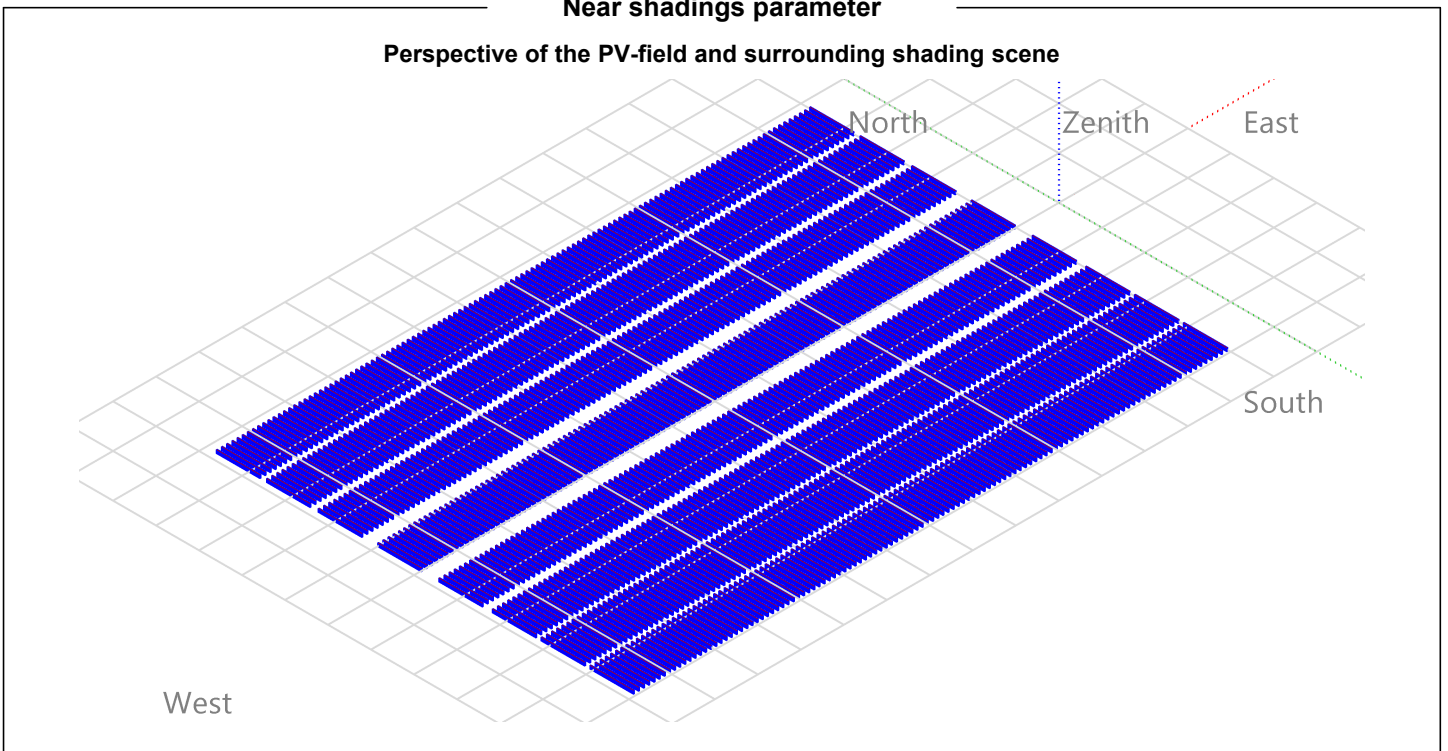
Coils equivalent resistance 3 x 2.87 mΩ/inv.

Loss Fraction 0.90 % at STC



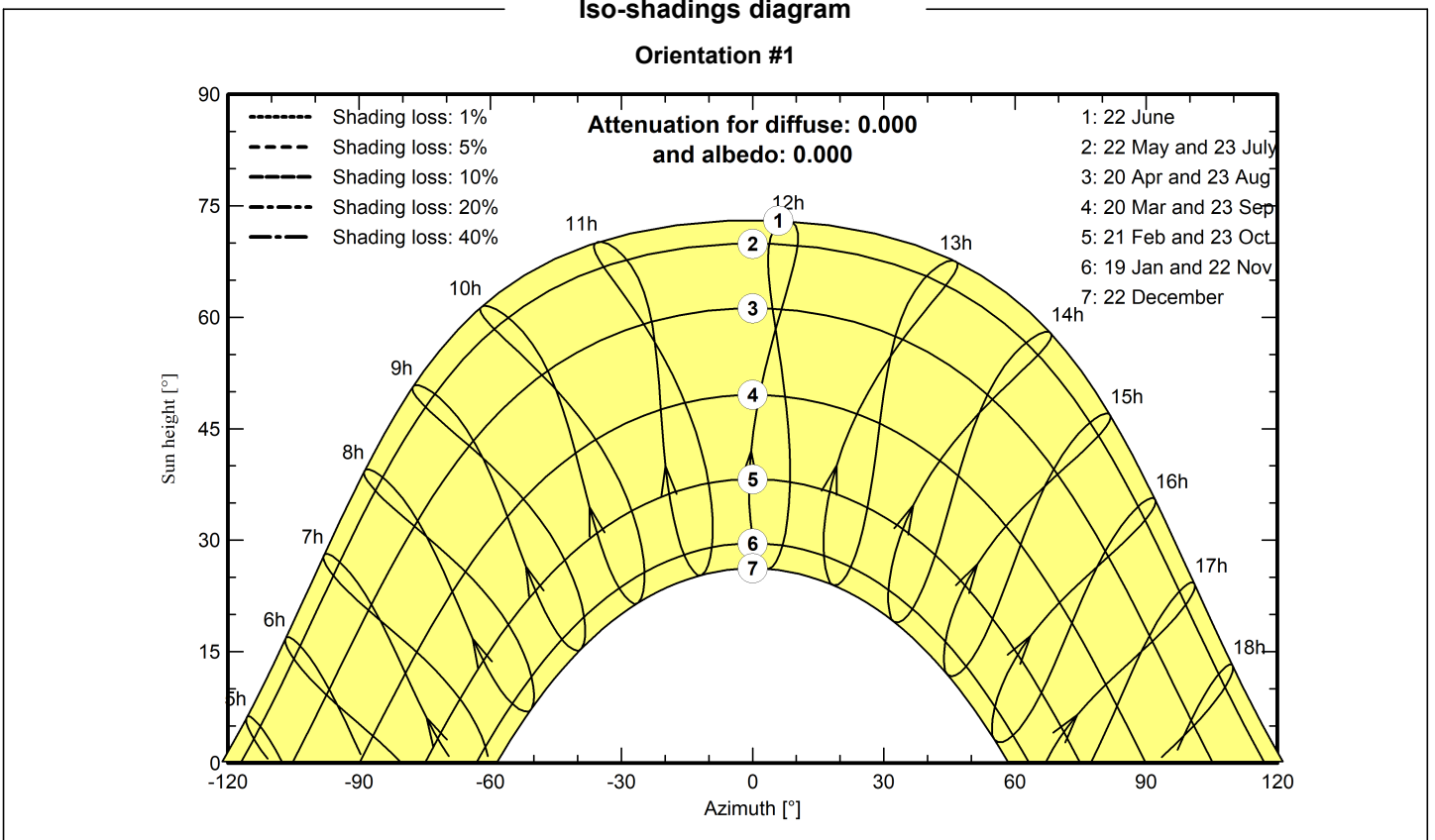
Near shadings parameter

Perspective of the PV-field and surrounding shading scene



Iso-shadings diagram

Orientation #1





Project: Salice San Chirico

Variant: Nuova variante di simulazione

PVsyst V7.2.13

VCO, Simulation date:
14/07/22 13:12
with v7.2.13

Trina Solar Italy Systems S.r.l. (Italy)

Main results

System Production

Produced Energy

74 GWh/year

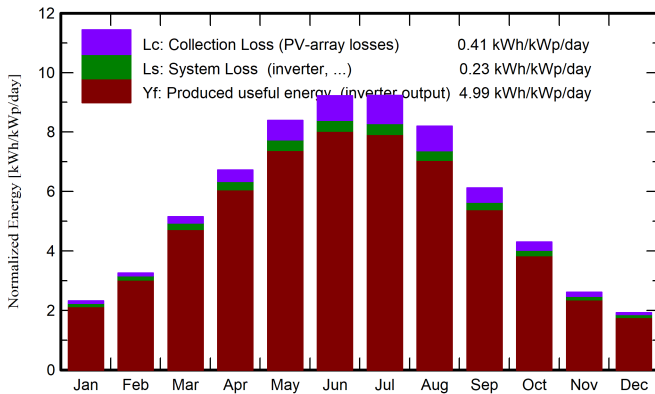
Specific production

1822 kWh/kWp/year

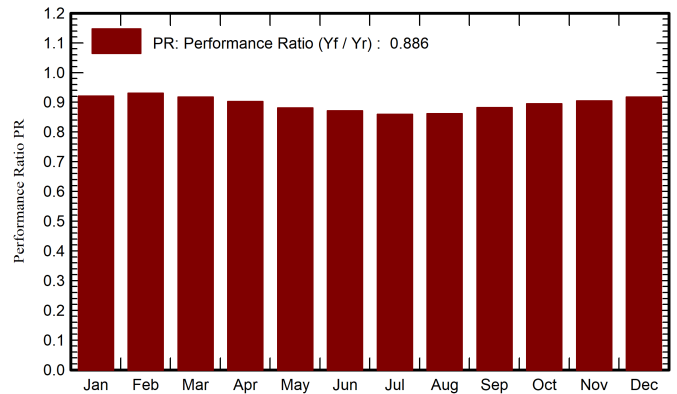
Performance Ratio PR

88.58 %

Normalized productions (per installed kWp)



Performance Ratio PR



Balances and main results

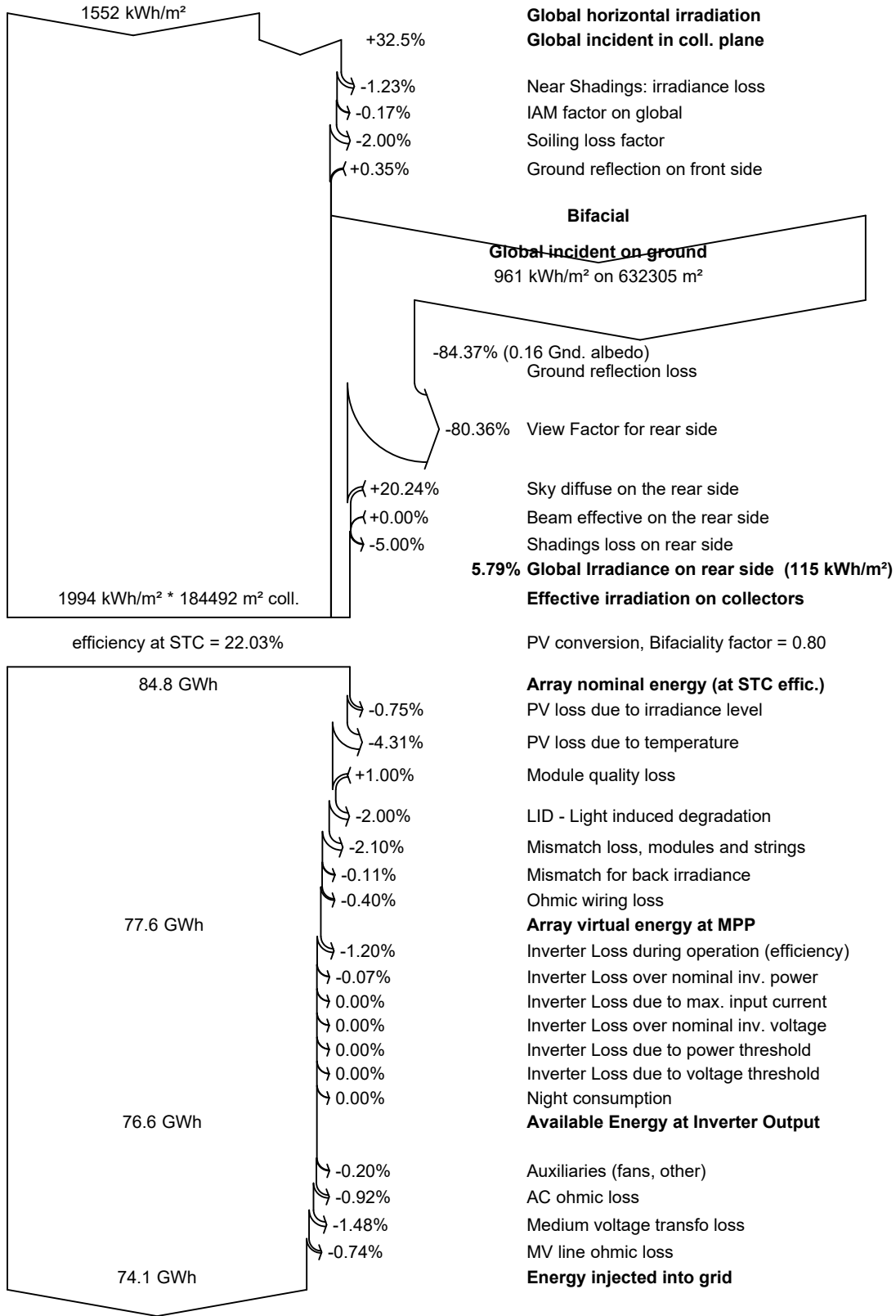
	GlobHor kWh/m ²	DiffHor kWh/m ²	T_Amb °C	GlobInc kWh/m ²	GlobEff kWh/m ²	EArray GWh	E_Grid GWh	PR ratio
January	53.5	28.76	9.15	71.9	69.6	2.83	2.693	0.921
February	71.0	41.13	9.86	91.2	88.2	3.61	3.452	0.931
March	123.4	61.36	12.54	159.7	154.7	6.24	5.966	0.918
April	152.6	68.54	15.55	201.5	195.4	7.75	7.402	0.903
May	197.1	77.61	20.50	260.2	252.6	9.76	9.326	0.881
June	210.9	85.20	25.36	276.7	268.5	10.26	9.809	0.871
July	215.7	82.36	28.68	286.0	277.6	10.46	9.999	0.859
August	189.6	75.17	28.57	254.0	246.4	9.31	8.901	0.861
September	136.7	58.51	23.08	183.8	178.2	6.89	6.592	0.882
October	98.8	46.22	19.06	133.4	129.2	5.08	4.857	0.895
November	56.9	28.48	14.58	78.5	76.1	3.03	2.888	0.905
December	45.3	26.60	10.66	59.7	57.7	2.35	2.227	0.917
Year	1551.7	679.93	18.18	2056.5	1994.1	77.58	74.112	0.886

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		



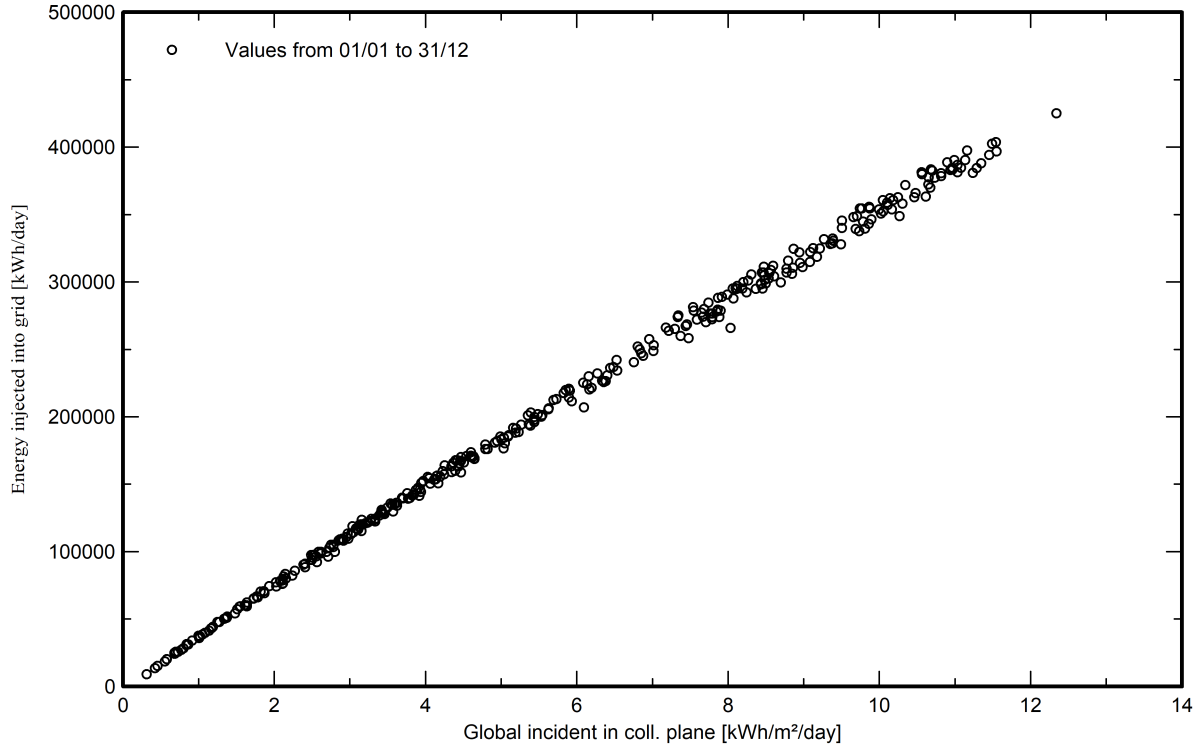
Loss diagram



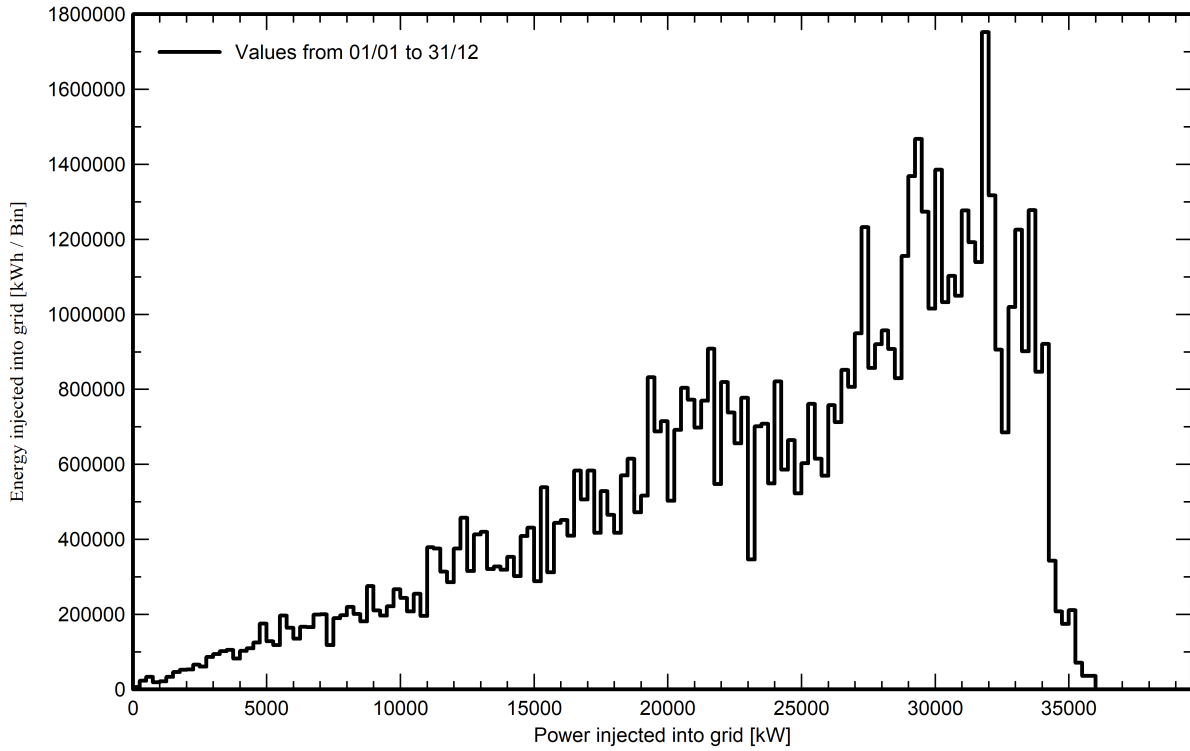


Special graphs

Daily Input/Output diagram



Distribuzione potenza in uscita sistema





P50 - P90 evaluation

Meteo data

Source Meteonorm 8.0, Sat=100%
Kind Monthly averages
Sintetico - Multi-year average
Year-to-year variability(Variance) 3.5 %

Specified Deviation

Climate change 0.0 %

Global variability (meteo + system)

Variability (Quadratic sum) 4.0 %

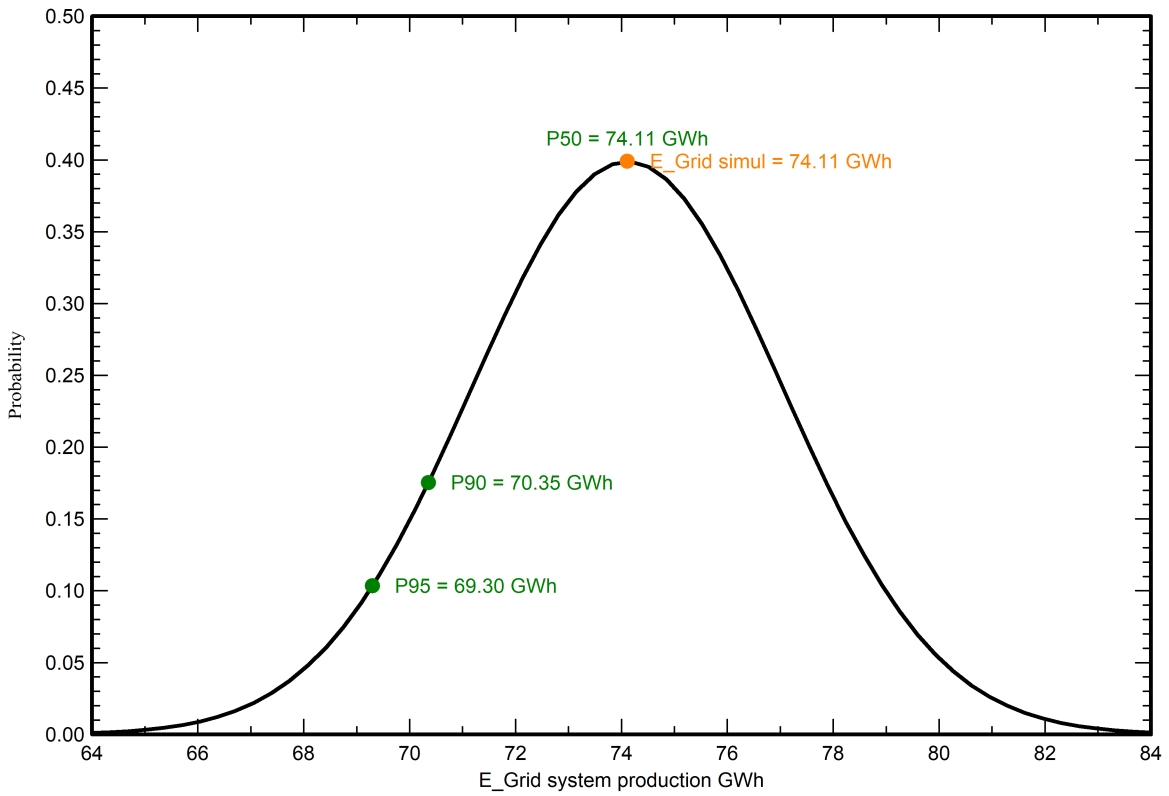
Simulation and parameters uncertainties

PV module modelling/parameters 1.0 %
Inverter efficiency uncertainty 0.5 %
Soiling and mismatch uncertainties 1.0 %
Degradation uncertainty 1.0 %

Annual production probability

Variability 2.93 GWh
P50 74.11 GWh
P90 70.35 GWh
P95 69.30 GWh

Probability distribution





Project: Salice San Chirico

Variant: Nuova variante di simulazione

Trina Solar Italy Systems S.r.l. (Italy)

PVsyst V7.2.13

VCO, Simulation date:
14/07/22 13:12
with v7.2.13

CO₂ Emission Balance

Total: 737916.7 tCO₂

Generated emissions

Total: 78107.13 tCO₂

Source: Detailed calculation from table below:

Replaced Emissions

Total: 940482.1 tCO₂

System production: 74112.07 MWh/yr

Grid Lifecycle Emissions: 423 gCO₂/kWh

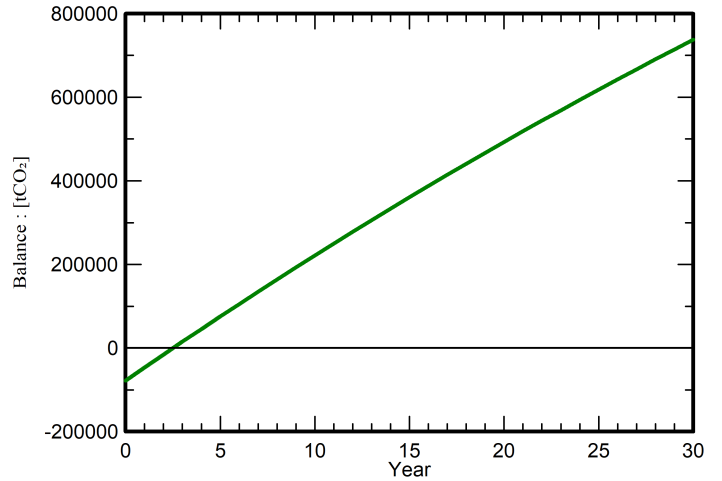
Source: IEA List

Country: Italy

Lifetime: 30 years

Annual degradation: 1.0 %

Saved CO₂ Emission vs. Time



System Lifecycle Emissions Details

Item	LCE	Quantity	Subtotal
			[kgCO ₂]
Modules	1713 kgCO ₂ /kWp	40684 kWp	69679478
Supports	2.82 kgCO ₂ /kg	2969600 kg	8378459
Inverters	280 kgCO ₂ /units	176 units	49195