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REVISIONE	DATA	DESCRIZIONE	PREPARATO	CONTROLLATO	VALIDATO

CODICE IDENTIFICATIVO ELABORATO

17-PD.00

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TIMBRO E FIRMA

Firmato digitalmente da:
Raffaele Galata
Data: 04/04/2024 11:51:02

TITOLO INIZIATIVA

PROGETTO PER LA REALIZZAZIONE DI UN IMPIANTO AGRIVOLTAICO DENOMINATO " SAN GIULIANO ", DI POTENZA NOMINALE PARI A 80MW INTEGRATO DA UN SISTEMA DI ACCUMULO DA 100MW, SITO NEL COMUNE DI BUTERA (CL)

SOCIETÀ PROGETTAZIONE

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TIMBRO E FIRMA TECNICO ABILITATO

ORDINE DEGLI INGEGNERI DELLA PROVINCIA CATANIA
DOTT ING RAPICAVOLI FABIO
Sez. A
a) Civile ed ambientale
b) Industriale
c) dell'informazione
n° A6222

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FORMATO

A4

SCALA

FOGLIO

TITOLO DOCUMENTO

RELAZIONE ANALISI DI PRODUCIBILITA'

LIVELLO DI PROGETTAZIONE

PROGETTO DEFINITIVO

Version 7.4.6

PVsyst - Simulation report

Grid-Connected System

Progetto: Butera 80 MW

PV Area Est

Impianto a strutture fisse

System power: 39.24 MWp

Pozzillo - Italy

PVsyst V7.4.6
VC1, Simulation date:
25/03/24 12:19
with V7.4.6

Project summary

Geographical Site
Pozzillo
Italy

Situation

Latitude	37.23 °N
Longitude	14.23 °E
Altitude	343 m
Time zone	UTC+1

Project settings

Albedo	0.20

Weather data
Butera
SolarGIS Monthly aver. , period not spec. - Sintetico

System summary

Grid-Connected System
Simulation for year no 1

Impianto a strutture fisse

PV Field Orientation
Fixed plane
Tilt/Azimuth 25.1 / 0.7 °

Near Shadings
According to strings : Fast (table)
Electrical effect 100 %

User's needs
Unlimited load (grid)

System information

PV Array

Nb. of modules	58140 units
Pnom total	39.24 MWp

Inverters

Nb. of units	31 units
Pnom total	34.10 MWac
Pnom ratio	1.151

Results summary

Produced Energy	69059392 kWh/year	Specific production	1760 kWh/kWp/year	Perf. Ratio PR	86.82 %

Table of contents

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PVsyst V7.4.6
VC1, Simulation date:
25/03/24 12:19
with V7.4.6

General parameters

Grid-Connected System — **Impianto a strutture fisse**

PV Field Orientation

Orientation
Fixed plane
Tilt/Azimuth 25.1 / 0.7 °

Sheds configuration
Nb. of sheds 1938 units
Identical arrays

Sizes
Sheds spacing 8.40 m
Collector width 4.79 m
Ground Cov. Ratio (GCR) 57.0 %

Shading limit angle
Limit profile angle 26.6 °

Models used
Transposition Perez
Diffuse Perez, Meteonorm
Circumsolar separate

Horizon
Average Height 5.9 °

Near Shadings
According to strings : Fast (table)
Electrical effect 100 %

User's needs
Unlimited load (grid)

Bifacial system
Model 2D Calculation
unlimited sheds

Bifacial model geometry		Bifacial model definitions	
Sheds spacing	8.40 m	Ground albedo	0.20
Sheds width	4.79 m	Bifaciality factor	80 %
Limit profile angle	26.6 °	Rear shading factor	10.0 %
GCR	57.0 %	Rear mismatch loss	10.0 %
Height above ground	1.50 m	Shed transparent fraction	0.0 %

PV Array Characteristics

PV module
Manufacturer CSI Solar
Model CS7N-675TB-AG 1500V
(Original PVsyst database)
Unit Nom. Power 675 Wp
Number of PV modules 58140 units
Nominal (STC) 39.24 MWp

Inverter
Manufacturer Sungrow
Model SG1100-UD
(Custom parameters definition)
Unit Nom. Power 1100 kWac
Number of inverters 31 units
Total power 34100 kWac

Array #1 - Sottocampo #16
Number of PV modules 10800 units
Nominal (STC) 7290 kWp
Modules 360 string x 30 In series
At operating cond. (50°C)
Pmpp 6743 kWp
U mpp 1078 V
I mpp 6254 A

Number of inverters 6 units
Total power 6600 kWac
Operating voltage 895-1500 V
Pnom ratio (DC:AC) 1.10

Array #2 - Sottocampo #17
Number of PV modules 1920 units
Nominal (STC) 1296 kWp
Modules 64 string x 30 In series
At operating cond. (50°C)
Pmpp 1199 kWp
U mpp 1078 V
I mpp 1112 A

Number of inverters 1 unit
Total power 1100 kWac
Operating voltage 895-1500 V
Pnom ratio (DC:AC) 1.18

PV Array Characteristics

Array #3 - Sottocampo #18

Number of PV modules	5850 units	Number of inverters	3 units
Nominal (STC)	3949 kWp	Total power	3300 kWac
Modules	195 string x 30 In series		
At operating cond. (50°C)		Operating voltage	895-1500 V
Pmpp	3652 kWp	Pnom ratio (DC:AC)	1.20
U mpp	1078 V		
I mpp	3388 A		

Array #4 - Sottocampo #19

Number of PV modules	3750 units	Number of inverters	2 units
Nominal (STC)	2531 kWp	Total power	2200 kWac
Modules	125 string x 30 In series		
At operating cond. (50°C)		Operating voltage	895-1500 V
Pmpp	2341 kWp	Pnom ratio (DC:AC)	1.15
U mpp	1078 V		
I mpp	2171 A		

Array #5 - Sottocampo #20

Number of PV modules	5700 units	Number of inverters	3 units
Nominal (STC)	3848 kWp	Total power	3300 kWac
Modules	190 string x 30 In series		
At operating cond. (50°C)		Operating voltage	895-1500 V
Pmpp	3559 kWp	Pnom ratio (DC:AC)	1.17
U mpp	1078 V		
I mpp	3301 A		

Array #6 - Sottocampo #21

Number of PV modules	5940 units	Number of inverters	3 units
Nominal (STC)	4010 kWp	Total power	3300 kWac
Modules	198 string x 30 In series		
At operating cond. (50°C)		Operating voltage	895-1500 V
Pmpp	3708 kWp	Pnom ratio (DC:AC)	1.22
U mpp	1078 V		
I mpp	3440 A		

Array #7 - Sottocampo #22

Number of PV modules	7950 units	Number of inverters	4 units
Nominal (STC)	5366 kWp	Total power	4400 kWac
Modules	265 string x 30 In series		
At operating cond. (50°C)		Operating voltage	895-1500 V
Pmpp	4963 kWp	Pnom ratio (DC:AC)	1.22
U mpp	1078 V		
I mpp	4604 A		

Array #8 - Sottocampo #23

Number of PV modules	2010 units	Number of inverters	1 unit
Nominal (STC)	1357 kWp	Total power	1100 kWac
Modules	67 string x 30 In series		
At operating cond. (50°C)		Operating voltage	895-1500 V
Pmpp	1255 kWp	Pnom ratio (DC:AC)	1.23
U mpp	1078 V		
I mpp	1164 A		

PV Array Characteristics

Array #9 - Sottocampo #24

Number of PV modules	2010 units	Number of inverters	1 unit
Nominal (STC)	1357 kWp	Total power	1100 kWac
Modules	67 string x 30 In series		
At operating cond. (50°C)		Operating voltage	895-1500 V
Pmpp	1255 kWp	Pnom ratio (DC:AC)	1.23
U mpp	1078 V		
I mpp	1164 A		

Array #10 - Sottocampo #25

Number of PV modules	2010 units	Number of inverters	1 unit
Nominal (STC)	1357 kWp	Total power	1100 kWac
Modules	67 string x 30 In series		
At operating cond. (50°C)		Operating voltage	895-1500 V
Pmpp	1255 kWp	Pnom ratio (DC:AC)	1.23
U mpp	1078 V		
I mpp	1164 A		

Array #11 - Sottocampo #26

Number of PV modules	5130 units	Number of inverters	3 units
Nominal (STC)	3463 kWp	Total power	3300 kWac
Modules	171 string x 30 In series		
At operating cond. (50°C)		Operating voltage	895-1500 V
Pmpp	3203 kWp	Pnom ratio (DC:AC)	1.05
U mpp	1078 V		
I mpp	2971 A		

Array #12 - Sottocampo #27

Number of PV modules	5070 units	Number of inverters	3 units
Nominal (STC)	3422 kWp	Total power	3300 kWac
Modules	169 string x 30 In series		
At operating cond. (50°C)		Operating voltage	895-1500 V
Pmpp	3165 kWp	Pnom ratio (DC:AC)	1.04
U mpp	1078 V		
I mpp	2936 A		

Total PV power

Nominal (STC)	39245 kWp
Total	58140 modules
Module area	180603 m²

Total inverter power

Total power	34100 kWac
Number of inverters	31 units
Pnom ratio	1.15

Array losses

Array Soiling Losses

Loss Fraction	3.0 %

Thermal Loss factor

Module temperature according to irradiance	
Uc (const)	29.0 W/m²K
Uv (wind)	0.0 W/m²K/m/s

Serie Diode Loss

Voltage drop	0.7 V
Loss Fraction	0.1 % at STC

LID - Light Induced Degradation

Loss Fraction	1.0 %

Module Quality Loss

Loss Fraction	-0.4 %

Module mismatch losses

Loss Fraction	0.5 % at MPP

Strings Mismatch loss

Loss Fraction	0.2 %

Module average degradation

Year no	1
Loss factor	0.4 %/year
Mismatch due to degradation	
Imp RMS dispersion	0.4 %/year
Vmp RMS dispersion	0.4 %/year

Array losses

IAM loss factor

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

DC wiring losses

Global wiring resistance 0.52 mΩ
Loss Fraction 1.5 % at STC

Array #1 - Sottocampo #16
Global array res. 2.8 mΩ
Loss Fraction 1.5 % at STC

Array #2 - Sottocampo #17
Global array res. 16 mΩ
Loss Fraction 1.5 % at STC

Array #3 - Sottocampo #18
Global array res. 5.2 mΩ
Loss Fraction 1.5 % at STC

Array #4 - Sottocampo #19
Global array res. 8.1 mΩ
Loss Fraction 1.5 % at STC

Array #5 - Sottocampo #20
Global array res. 5.3 mΩ
Loss Fraction 1.5 % at STC

Array #6 - Sottocampo #21
Global array res. 5.1 mΩ
Loss Fraction 1.5 % at STC

Array #7 - Sottocampo #22
Global array res. 3.8 mΩ
Loss Fraction 1.5 % at STC

Array #8 - Sottocampo #23
Global array res. 15 mΩ
Loss Fraction 1.5 % at STC

Array #9 - Sottocampo #24
Global array res. 15 mΩ
Loss Fraction 1.5 % at STC

Array #10 - Sottocampo #25
Global array res. 15 mΩ
Loss Fraction 1.5 % at STC

Array #11 - Sottocampo #26
Global array res. 5.9 mΩ
Loss Fraction 1.5 % at STC

Array #12 - Sottocampo #27
Global array res. 6.0 mΩ
Loss Fraction 1.5 % at STC

System losses

Auxiliaries loss

Proportionnal to Power 3.0 W/kW
0.0 kW from Power thresh.

AC wiring losses

Inv. output line up to MV transfo

Inverter voltage 630 Vac tri
Loss Fraction 0.06 % at STC

Inverter: SG1100-UD
Wire section (31 Inv.) Copper 31 x 3 x 1000 mm²
Average wires length 10 m

MV line up to Injection

MV Voltage 36 kV
Average each inverter
Wires Alu 3 x 700 mm²
Length 6250 m
Loss Fraction 0.42 % at STC

AC losses in transformers

MV transfo

Medium voltage	36 kV

One transfo parameters	
Nominal power at STC	19.38 MVA
Iron Loss (night disconnect)	18.41 kVA
Iron loss fraction	0.10 % at STC
Copper loss	202.49 kVA
Copper loss fraction	1.05 % at STC
Coils equivalent resistance	3 x 0.21 mΩ

Operating losses at STC (full system)	
Nb. identical MV transfos	2
Nominal power at STC	38.75 MVA
Iron loss (night disconnect)	36.82 kVA
Copper loss	404.98 kVA

Horizon definition

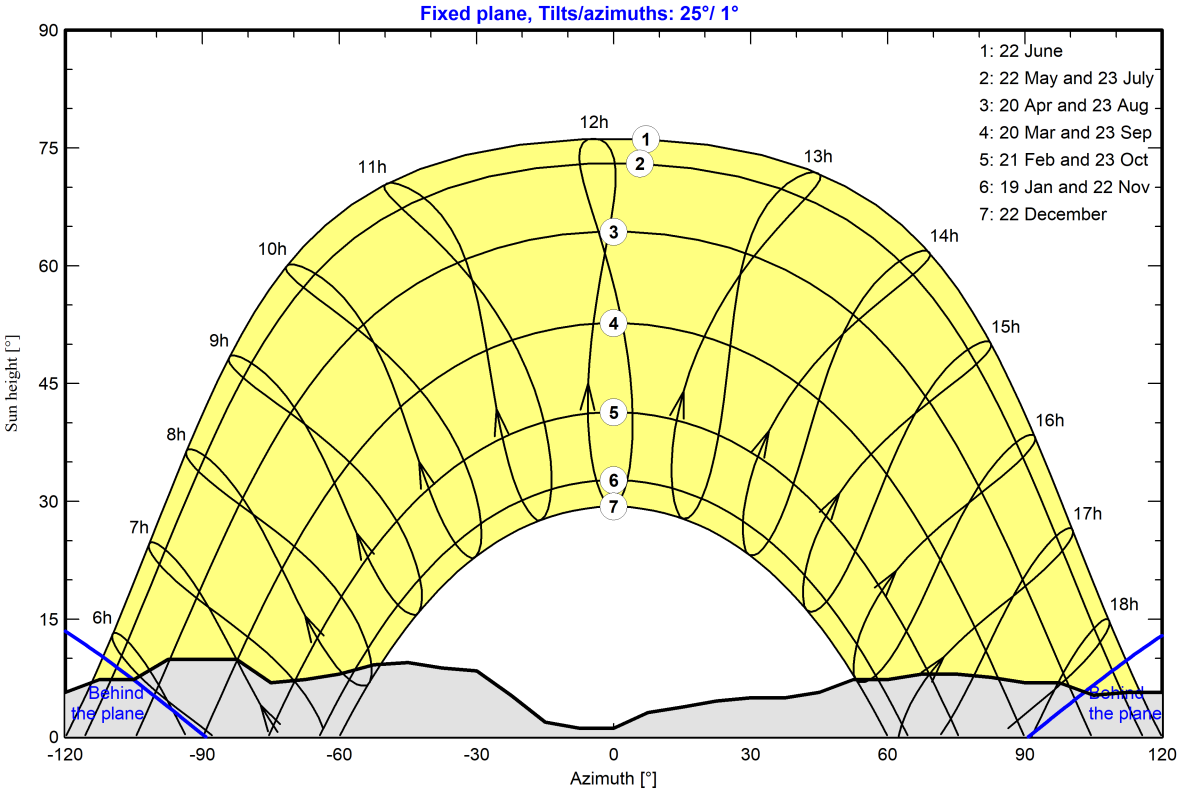
Horizon from PVGIS website API, Lat=37°13'33", Long=14°13'51", Alt=343m

Average Height	5.9 °	Albedo Factor	0.75
Diffuse Factor	0.96	Albedo Fraction	100 %

Horizon profile

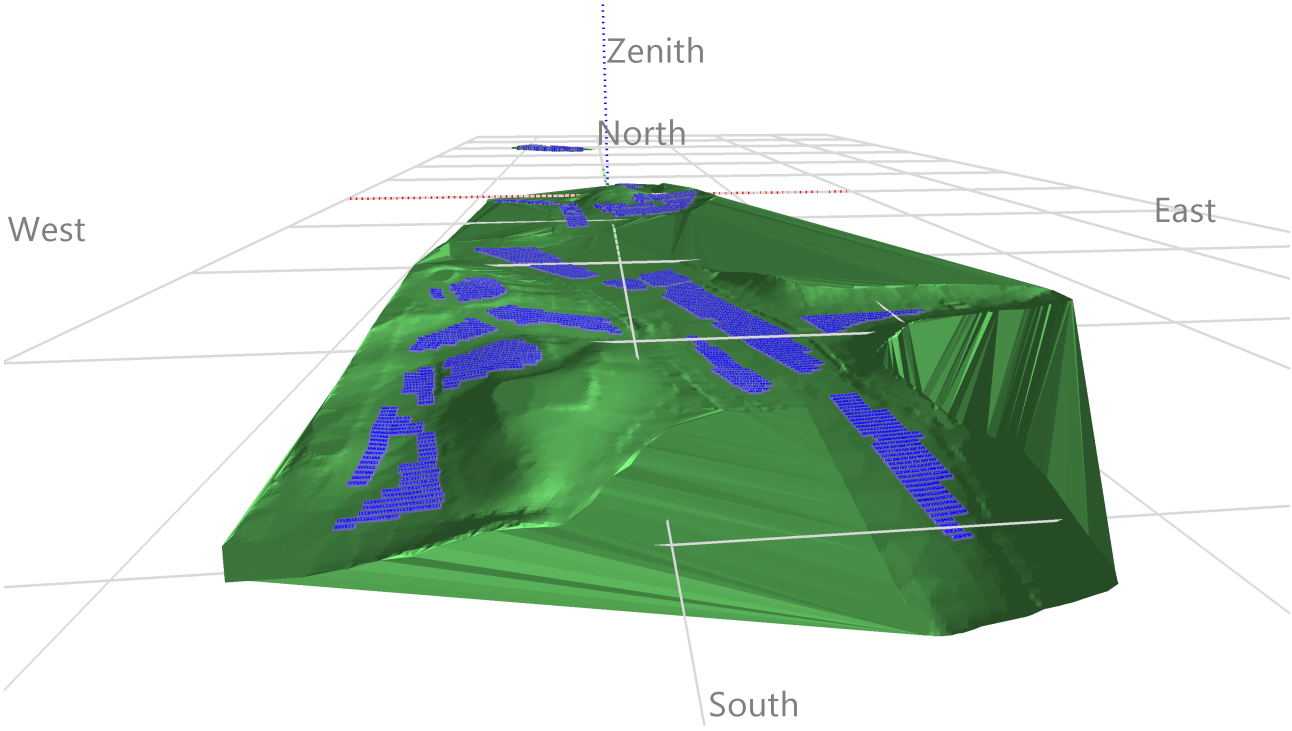
Azimuth [°]	-180	-173	-165	-158	-143	-135	-128	-120	-113	-105	-98	-83
Height [°]	3.8	4.6	5.7	6.1	6.1	5.3	5.0	5.7	7.3	7.3	9.9	9.9
Azimuth [°]	-75	-68	-60	-53	-45	-38	-30	-23	-15	-8	0	8
Height [°]	6.9	7.3	8.0	9.2	9.5	8.8	8.4	5.3	1.9	1.1	1.1	3.1
Azimuth [°]	15	23	30	38	45	53	60	68	75	83	90	98
Height [°]	3.8	4.6	5.0	5.0	5.7	7.3	7.3	8.0	8.0	7.6	6.9	6.9
Azimuth [°]	105	113	120	128	135	143	150	158	165	173	180	
Height [°]	5.3	5.7	5.7	5.3	4.2	2.7	3.1	3.4	3.1	3.4	3.8	

Sun Paths (Height / Azimuth diagram)



Near shadings parameter

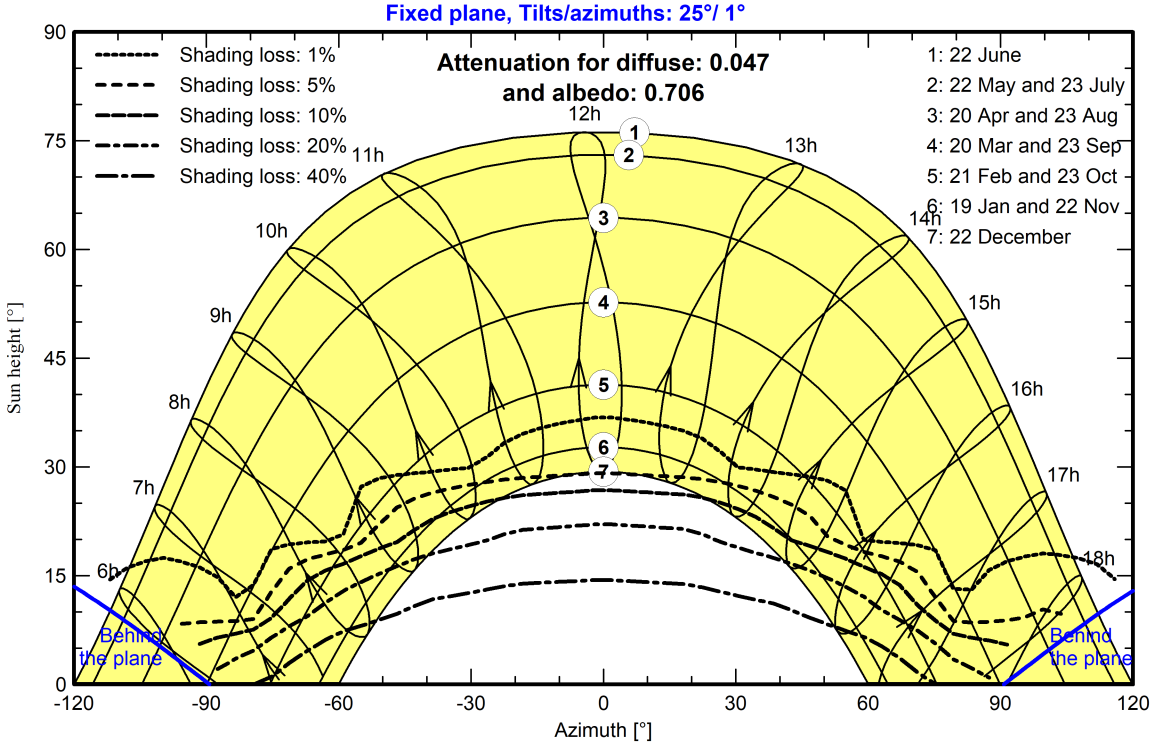
Perspective of the PV-field and surrounding shading scene



Iso-shadings diagram

Orientation #1

Fixed plane, Tilts/azimuths: 25°/ 1°

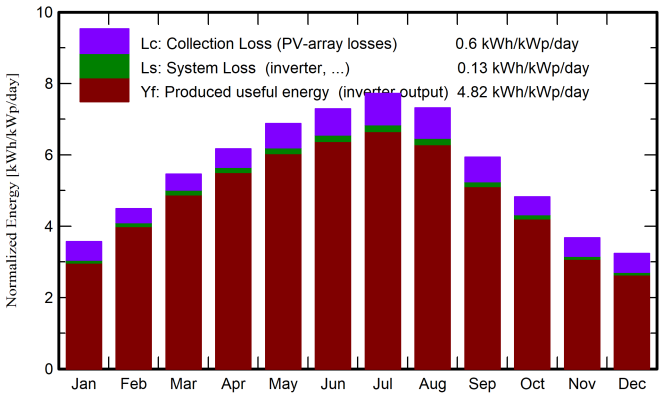


Main results

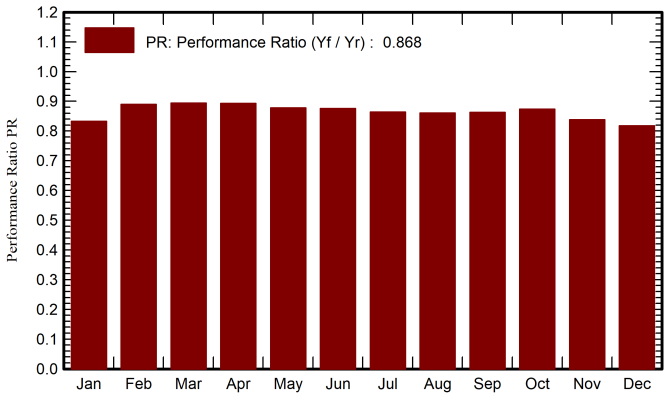
System Production

Produced Energy (P50)	69059392 kWh/year	Specific production (P50)	1760 kWh/kWp/year	Perf. Ratio PR	86.82 %
Produced Energy (P90)	65254657 kWh/year	Specific production (P90)	1663 kWh/kWp/year		
Produced Energy (P75)	67059039 kWh/year	Specific production (P75)	1709 kWh/kWp/year		

Normalized productions (per installed kWp)



Performance Ratio PR



Balances and main results

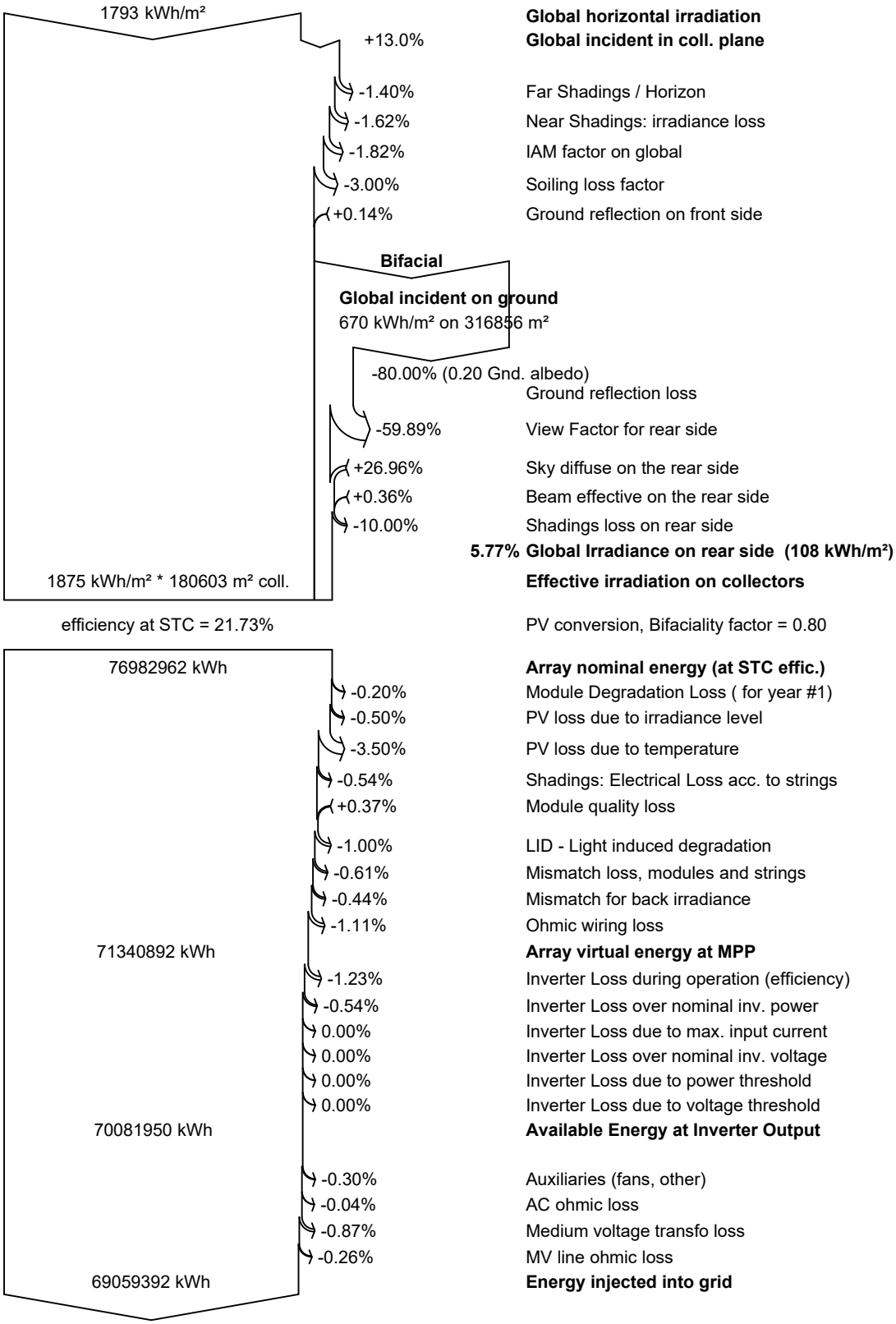
	GlobHor kWh/m²	DiffHor kWh/m²	T_Amb °C	GlobInc kWh/m²	GlobEff kWh/m²	EArray kWh	E_Grid kWh	PR ratio
January	73.4	30.70	9.60	110.6	98.3	3712333	3615438	0.833
February	92.6	37.60	9.70	125.8	116.1	4509780	4390182	0.890
March	140.4	54.90	11.50	169.3	157.5	6107128	5943911	0.894
April	170.8	67.30	14.30	185.0	172.2	6662502	6485320	0.893
May	214.8	73.90	18.50	213.3	198.8	7552201	7346011	0.878
June	228.3	71.60	22.70	218.7	204.3	7723578	7516051	0.876
July	244.9	67.20	25.20	239.2	224.0	8334505	8107060	0.864
August	214.6	64.00	25.50	226.8	212.3	7873185	7658055	0.860
September	155.3	58.00	22.30	178.0	165.4	6189253	6024428	0.862
October	116.4	48.10	18.70	149.5	138.6	5267542	5128713	0.874
November	76.4	34.10	14.50	110.3	98.8	3724416	3627657	0.838
December	65.4	28.40	10.89	100.3	88.6	3304134	3216566	0.818
Year	1793.3	635.80	16.99	2026.8	1874.9	70960557	69059392	0.868

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
E_Grid	Energy injected into grid
PR	Performance Ratio

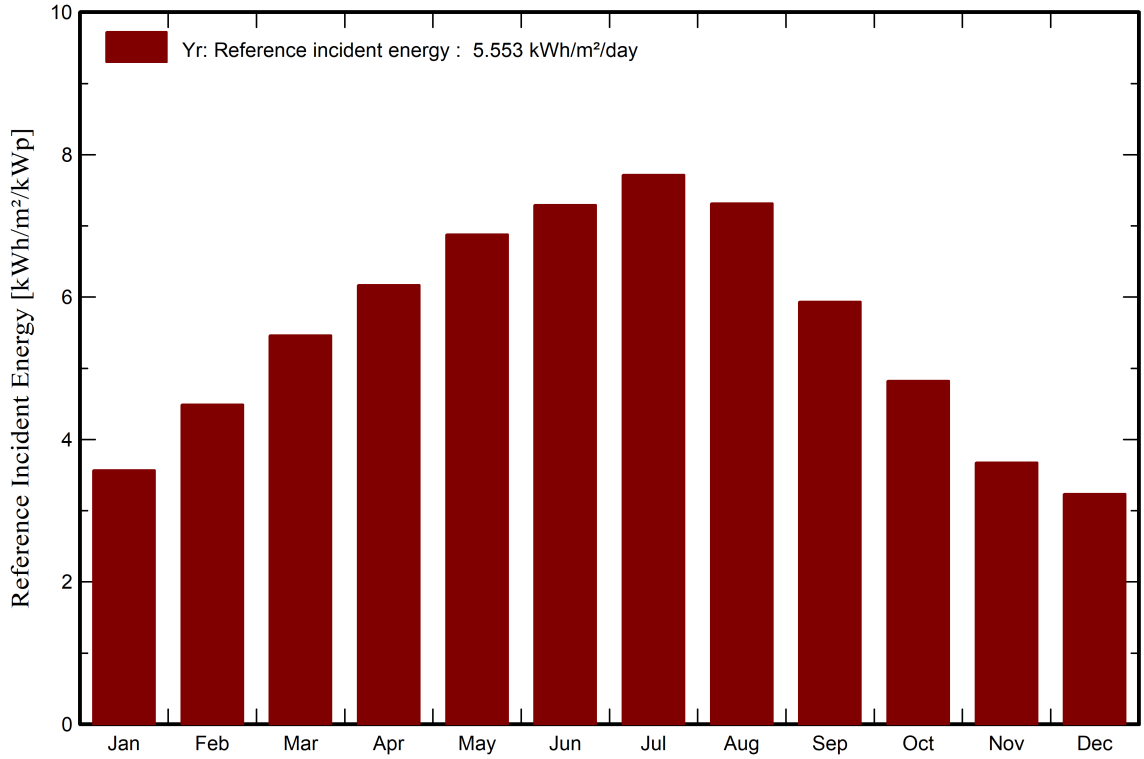
PVsyst V7.4.6
VC1, Simulation date:
25/03/24 12:19
with V7.4.6

Loss diagram

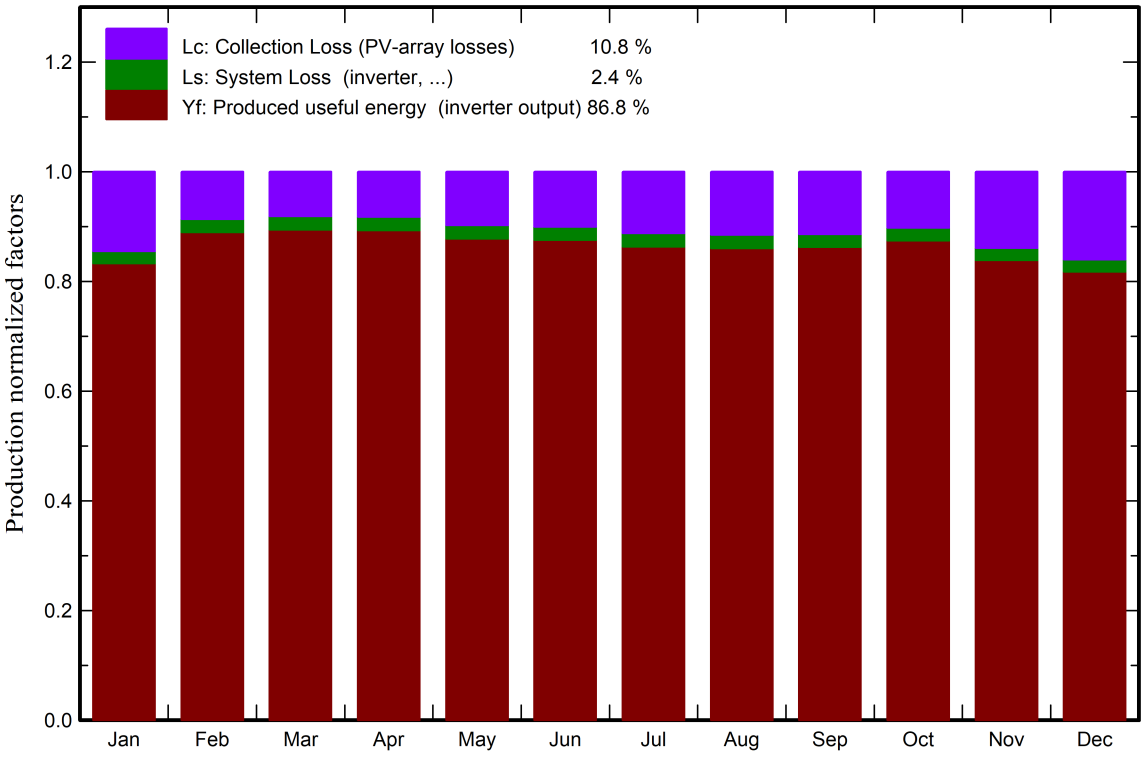


Predef. graphs

Energia incidente di riferimento su piano collettori

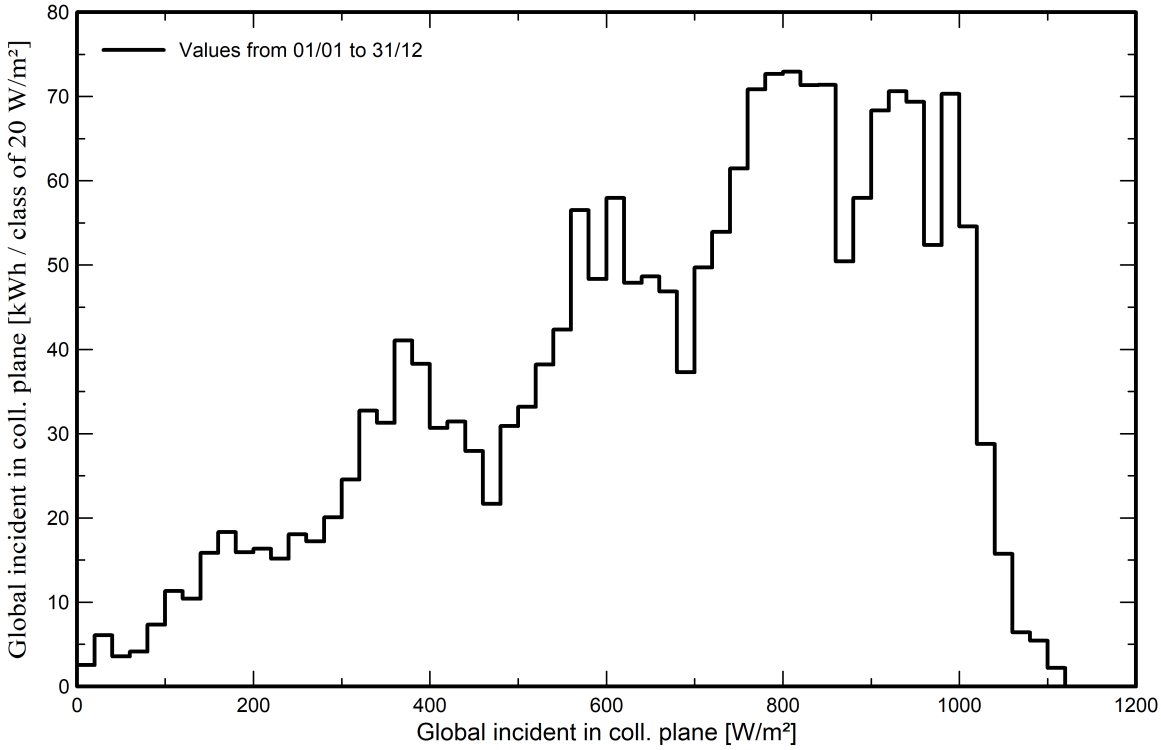


Fattori normalizzati di produzione e di perdita

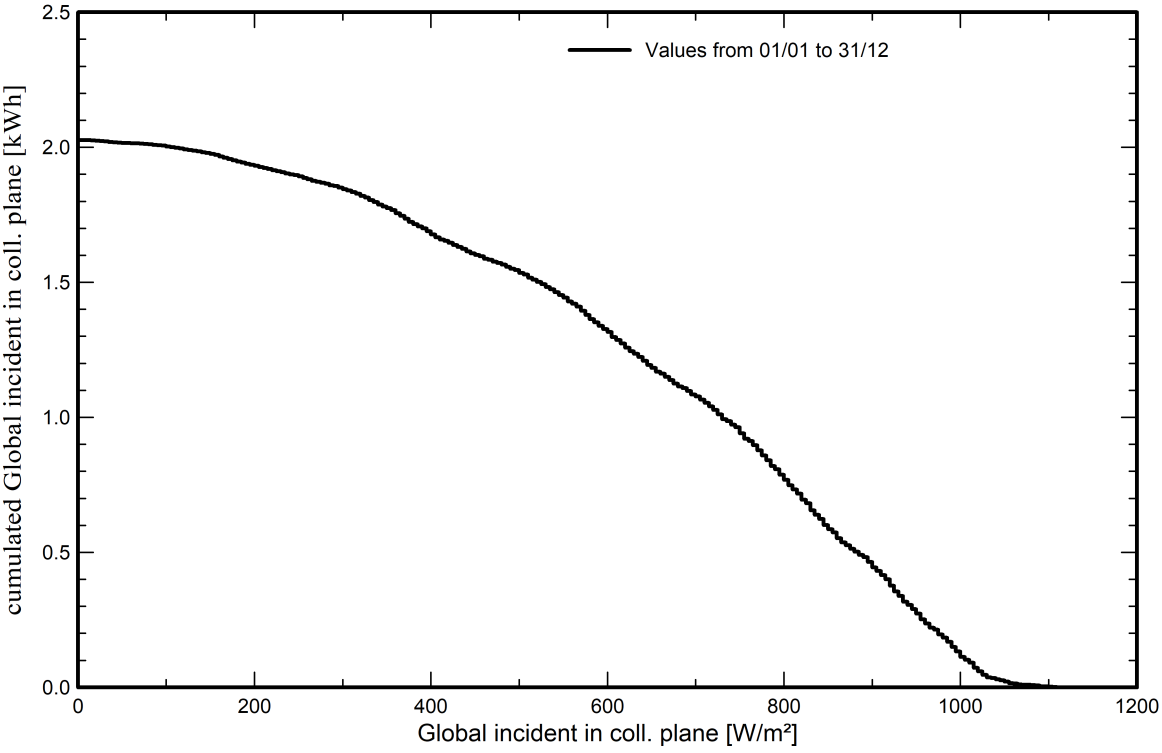


Predef. graphs

Distribuzione irraggiamento incidente



Coda della distribuzione di irradiazione incidente



Predef. graphs

Temperatura del campo vs.irradiazione efficace

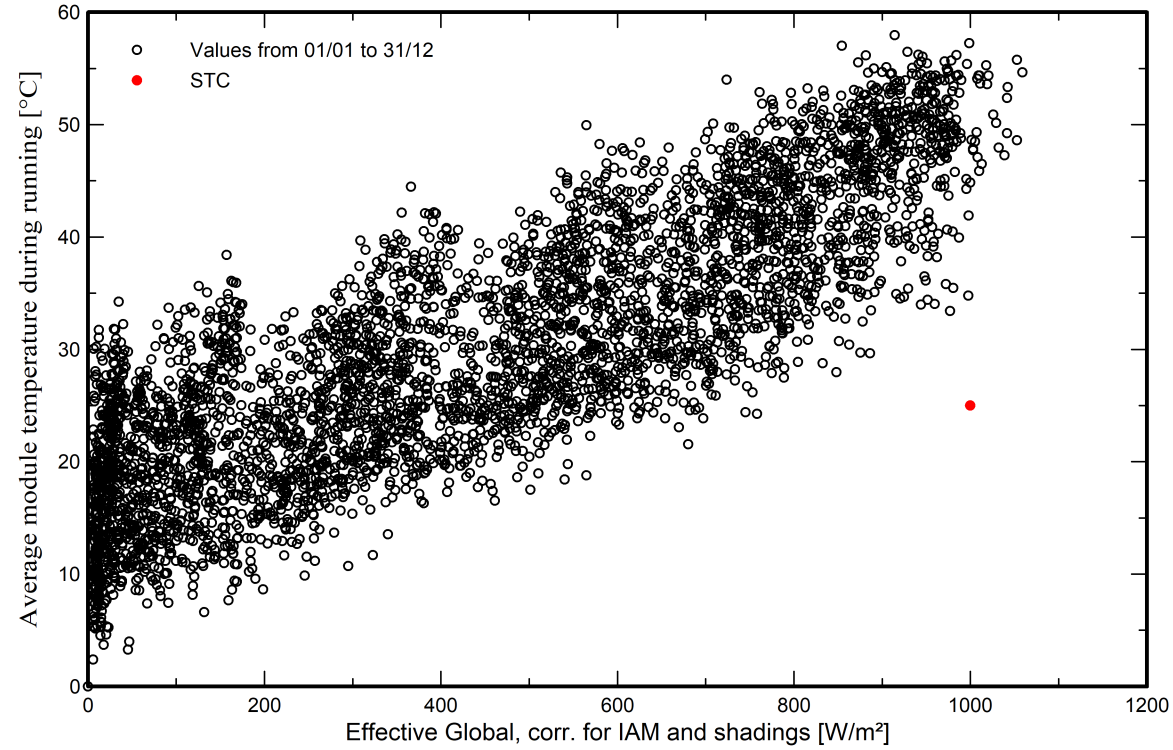
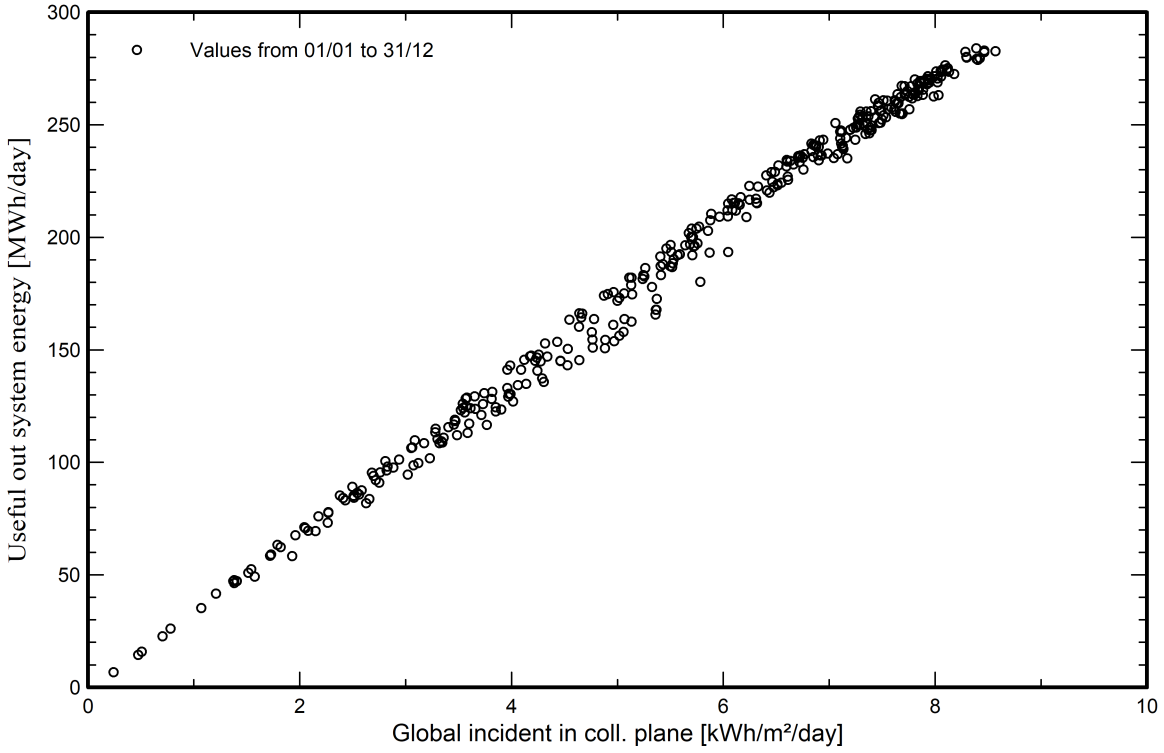
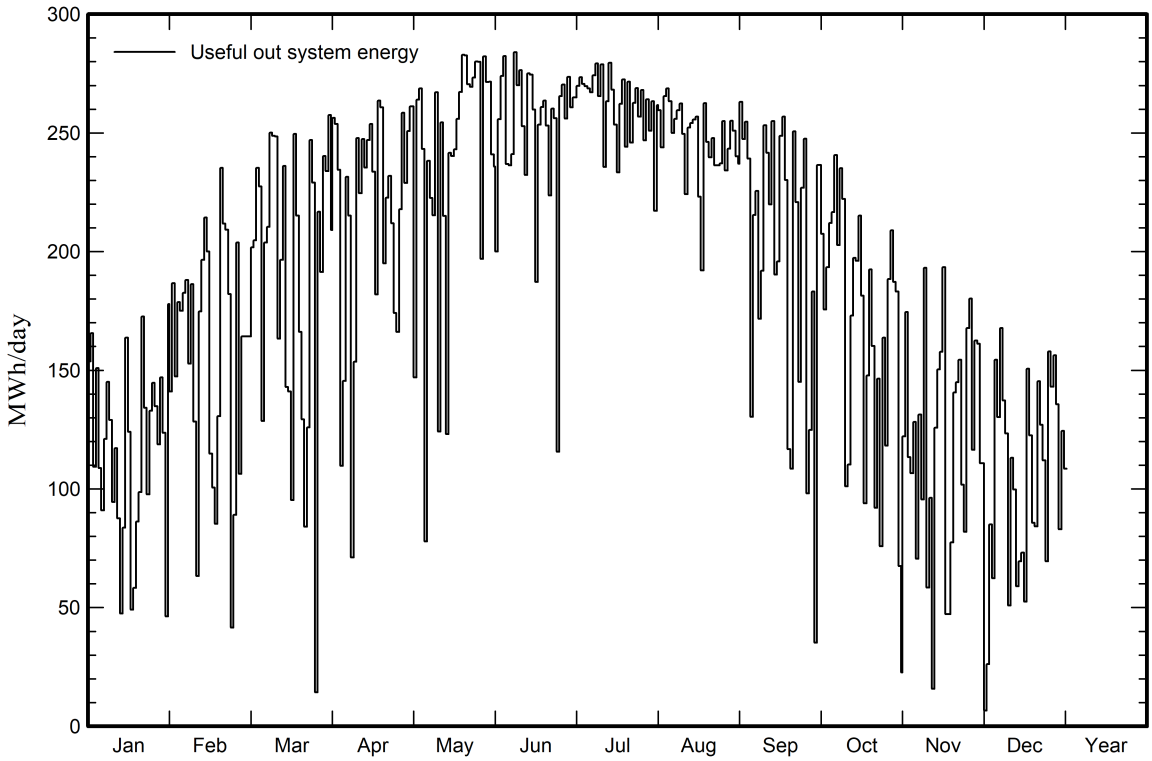


Diagramma giornaliero entrata/uscita

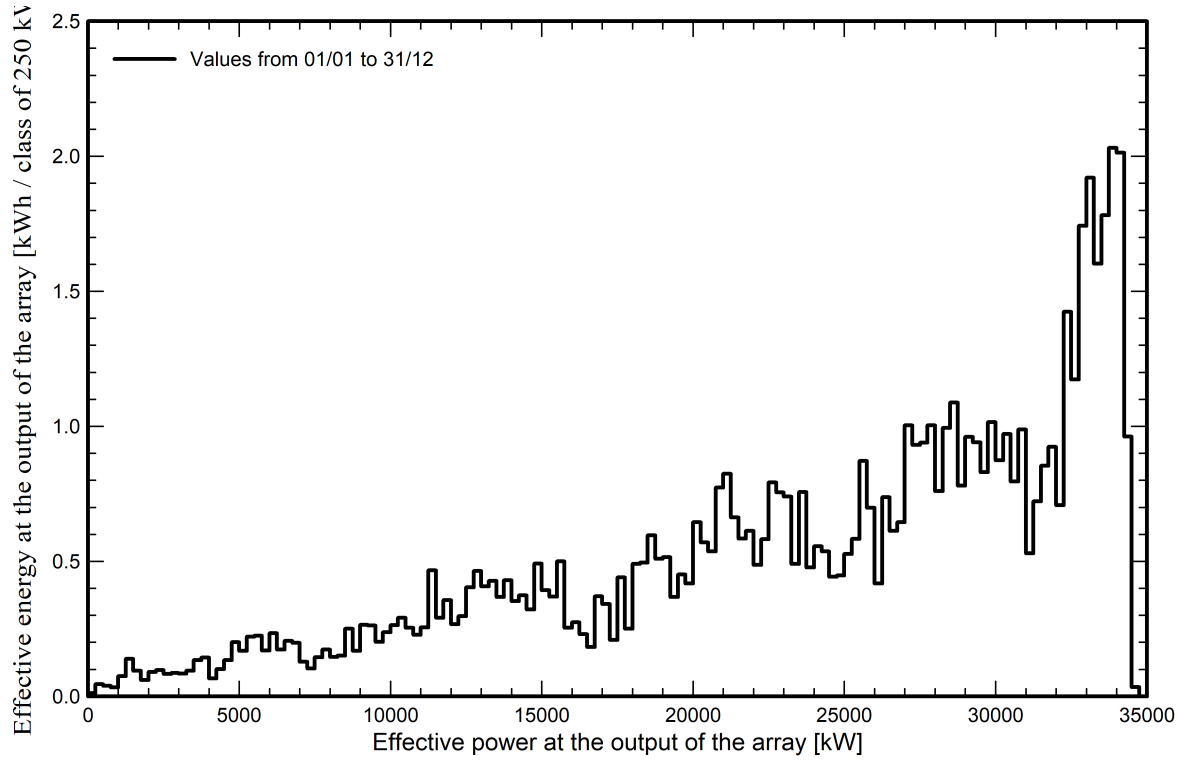


Predef. graphs

Energia giornaliera in uscita sistema

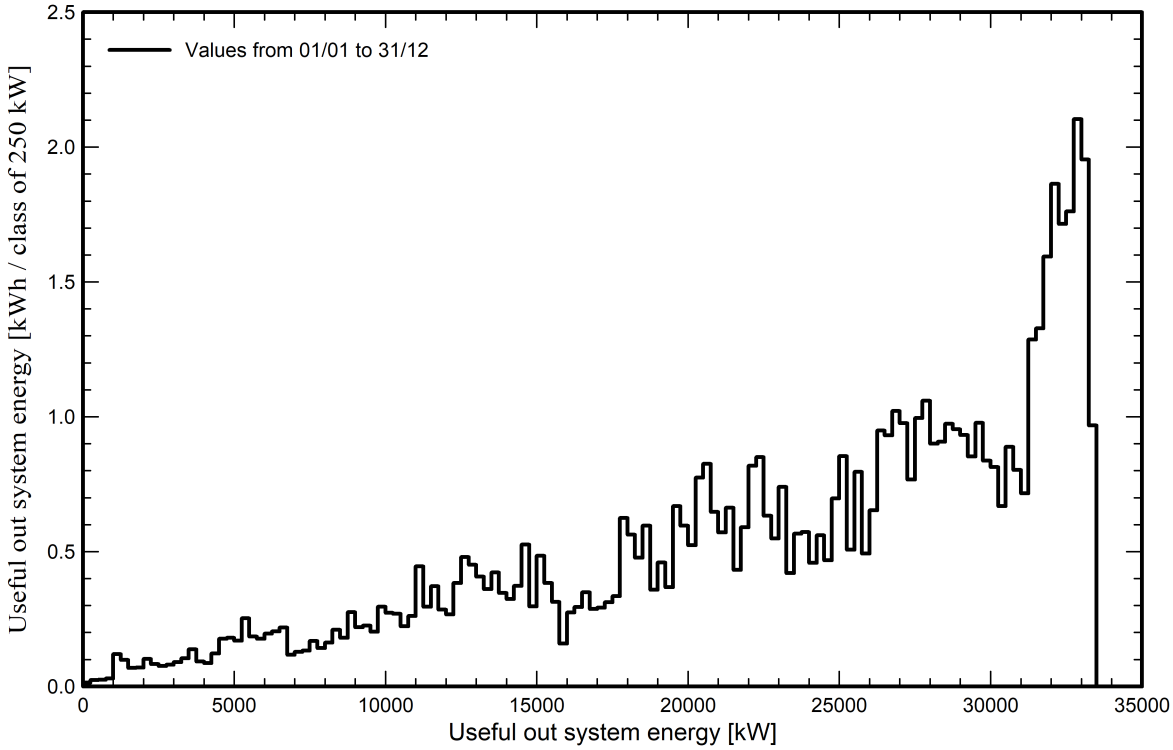


Distribuzione potenza dell'impianto

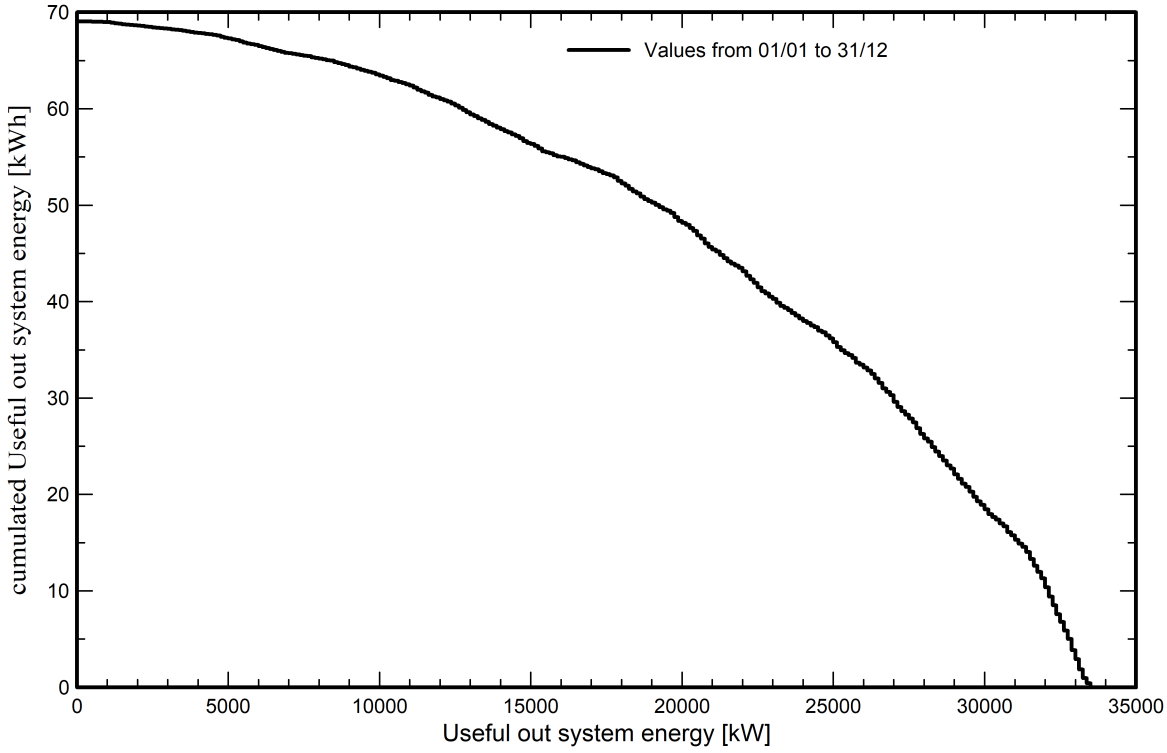


Predef. graphs

Distribuzione potenza in uscita sistema

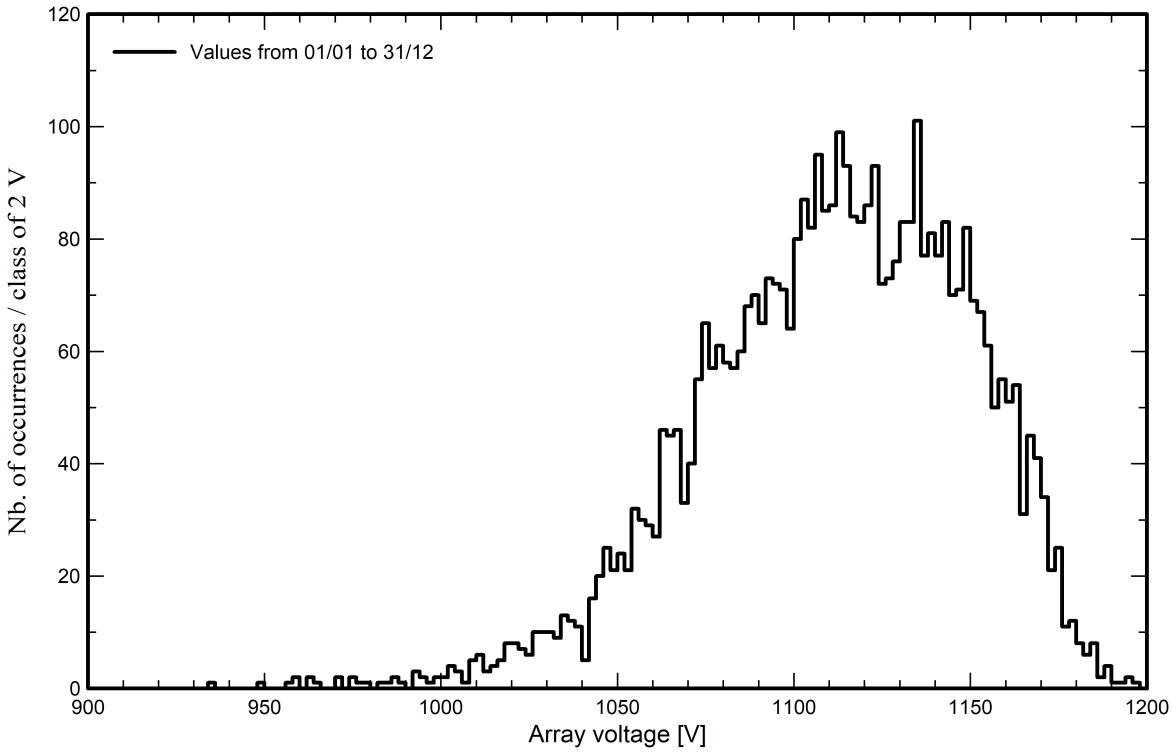


Coda della distribuzione della potenza in uscita

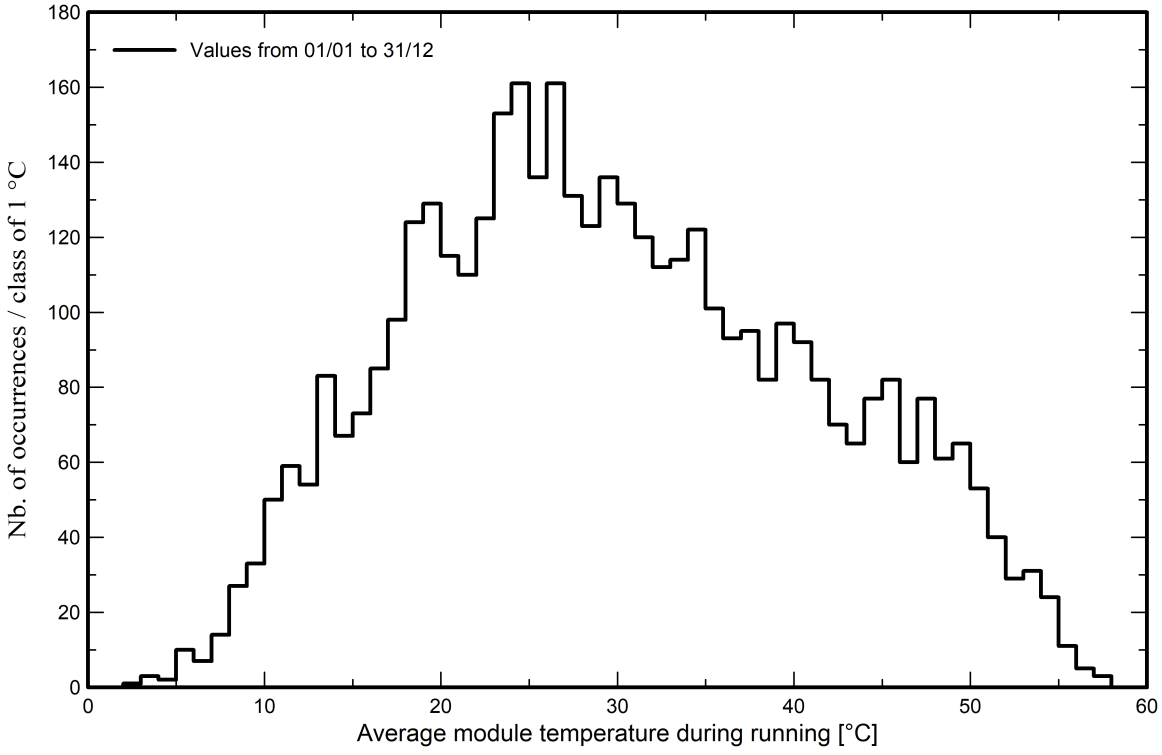


Predef. graphs

Distribuzione tensione impianto



Distribuzione temperatura impianto



P50 - P90 evaluation

Weather data

Source	SolarGIS Monthly aver. , period not spec.
Kind	Specific year
Year	Sintetico
Year-to-year variability(Variance)	3.9 %

Specified Deviation

Year deviation from average	0.0 %

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 %

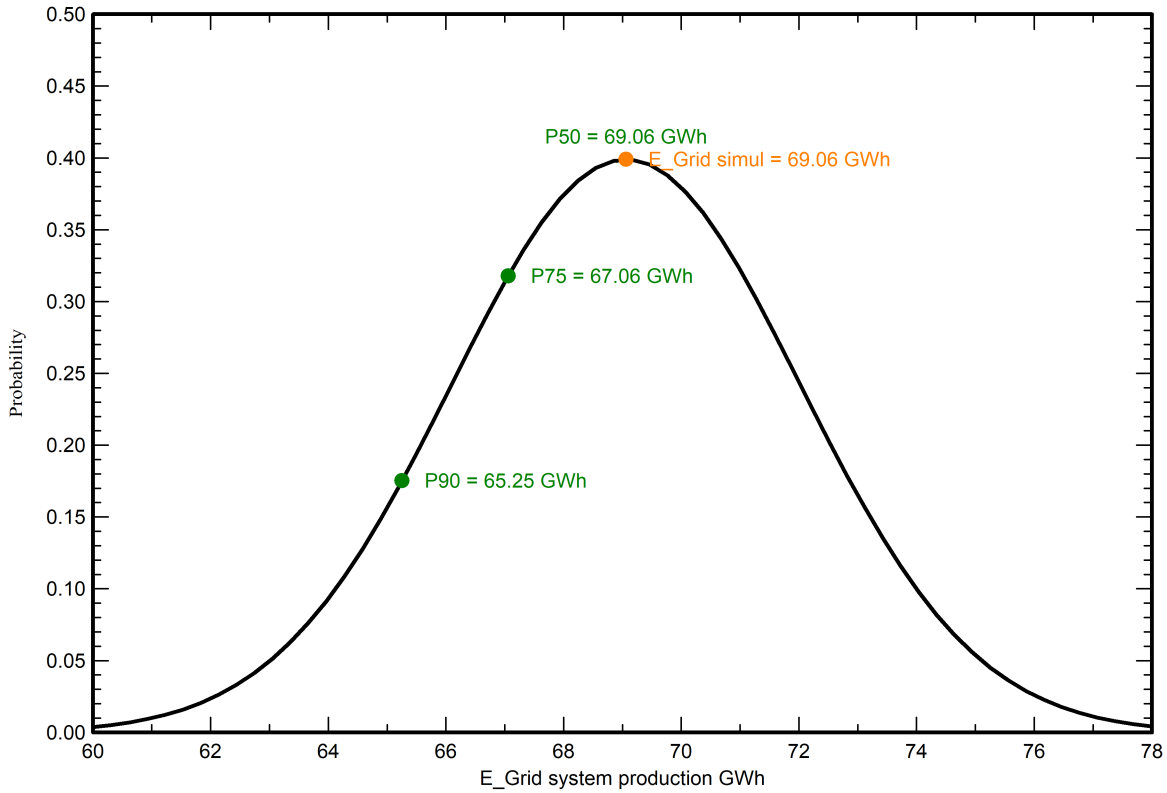
Global variability (weather data + system)

Variability (Quadratic sum)	4.3 %

Annual production probability

Variability	2.97 GWh
P50	69.06 GWh
P90	65.25 GWh
P75	67.06 GWh

Probability distribution



CO_2 Emission Balance

Total: 1093672.4 tCO_2

Generated emissions

Total: 92752.40 tCO_2

Source: Detailed calculation from table below

Replaced Emissions

Total: 1367376.0 tCO_2

System production: 69059.39 MWh/yr

Grid Lifecycle Emissions: 660 gCO_2/kWh

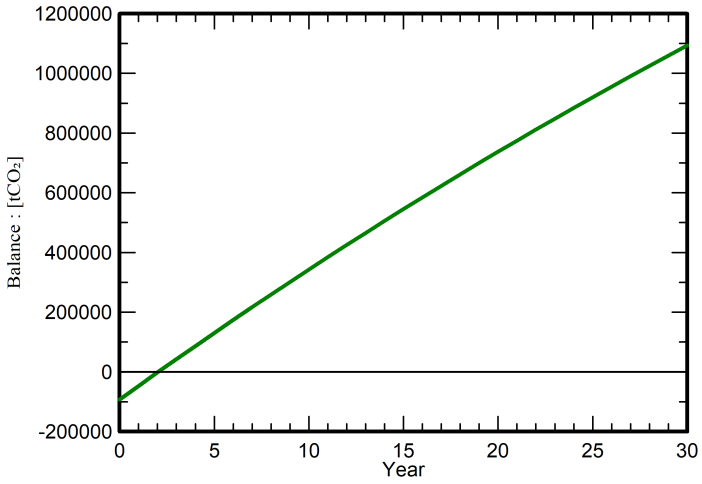
Source: IEA List

Country: Zimbabwe

Lifetime: 30 years

Annual degradation: 1.0 %

Saved CO_2 Emission vs. Time



System Lifecycle Emissions Details

Item	LCE	Quantity	Subtotal
			[$kgCO_2$]
Modules	1649 kgCO2/kWp	54088 kWp	89206165
Supports	4.40 kgCO2/kg	801300 kg	3527483
Inverters	436 kgCO2/units	43.0 units	18754

Version 7.4.6

PVsyst - Simulation report

Grid-Connected System

Progetto: Butera 80 MW

Variante: PV Area Ovest

Impianto a strutture fisse

System power: 54.09 MWp

Pozzillo - Italia

PVsyst V7.4.6
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Project summary

Geographical Site
Pozzillo
Italia

Situation

Latitude	37.23 °N
Longitude	14.23 °E
Altitude	343 m
Time zone	UTC+1

Project settings
Albedo 0.20

Weather data
Butera
SolarGIS Monthly aver. , period not spec. - Sintetico

System summary

Grid-Connected System
Simulation for year no 1

Impianto a strutture fisse

PV Field Orientation
Fixed plane
Tilt/Azimuth 25.2 / -1.8 °

Near Shadings
According to strings : Fast (table)
Electrical effect 100 %

User's needs
Unlimited load (grid)

System information

PV Array

Nb. of modules	80130 units
Pnom total	54.09 MWp

Inverters

Nb. of units	43 units
Pnom total	47.30 MWac
Pnom ratio	1.144

Results summary

Produced Energy	95464593 kWh/year	Specific production	1765 kWh/kWp/year	Perf. Ratio PR	87.10 %

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General parameters

Grid-Connected System — **Impianto a strutture fisse**

PV Field Orientation

Orientation
Fixed plane
Tilt/Azimuth 25.2 / -1.8 °

Sheds configuration
Nb. of sheds 2671 units
Identical arrays
Sizes
Sheds spacing 8.40 m
Collector width 4.79 m
Ground Cov. Ratio (GCR) 57.0 %
Shading limit angle
Limit profile angle 26.6 °

Models used
Transposition Perez
Diffuse Perez, Meteonorm
Circumsolar separate

Horizon
Average Height 5.9 °

Near Shadings
According to strings : Fast (table)
Electrical effect 100 %

User's needs
Unlimited load (grid)

Bifacial system
Model 2D Calculation
unlimited sheds

Bifacial model geometry		Bifacial model definitions	
Sheds spacing	8.40 m	Ground albedo	0.20
Sheds width	4.79 m	Bifaciality factor	80 %
Limit profile angle	26.6 °	Rear shading factor	10.0 %
GCR	57.0 %	Rear mismatch loss	10.0 %
Height above ground	1.50 m	Shed transparent fraction	0.0 %

PV Array Characteristics

PV module
Manufacturer CSI Solar
Model CS7N-675TB-AG 1500V
(Original PVsyst database)
Unit Nom. Power 675 Wp
Number of PV modules 80130 units
Nominal (STC) 54.09 MWp

Inverter
Manufacturer Sungrow
Model SG1100-UD
(Custom parameters definition)
Unit Nom. Power 1100 kWac
Number of inverters 43 units
Total power 47300 kWac

Array #1 - Sottocampo #1
Number of PV modules 10920 units
Nominal (STC) 7371 kWp
Modules 364 string x 30 In series
At operating cond. (50°C)
Pmpp 6817 kWp
U mpp 1078 V
I mpp 6323 A

Number of inverters 6 units
Total power 6600 kWac
Operating voltage 895-1500 V
Pnom ratio (DC:AC) 1.12

Array #2 - Sottocampo #2
Number of PV modules 3870 units
Nominal (STC) 2612 kWp
Modules 129 string x 30 In series
At operating cond. (50°C)
Pmpp 2416 kWp
U mpp 1078 V
I mpp 2241 A

Number of inverters 2 units
Total power 2200 kWac
Operating voltage 895-1500 V
Pnom ratio (DC:AC) 1.19

PV Array Characteristics

Array #3 - Sottocampo #3

Number of PV modules	3900 units	Number of inverters	2 units
Nominal (STC)	2633 kWp	Total power	2200 kWac
Modules	130 string x 30 In series		
At operating cond. (50°C)		Operating voltage	895-1500 V
Pmpp	2435 kWp	Pnom ratio (DC:AC)	1.20
U mpp	1078 V		
I mpp	2258 A		

Array #4 - Sottocampo #4

Number of PV modules	3420 units	Number of inverters	2 units
Nominal (STC)	2309 kWp	Total power	2200 kWac
Modules	114 string x 30 In series		
At operating cond. (50°C)		Operating voltage	895-1500 V
Pmpp	2135 kWp	Pnom ratio (DC:AC)	1.05
U mpp	1078 V		
I mpp	1980 A		

Array #5 - Sottocampo #5

Number of PV modules	3720 units	Number of inverters	2 units
Nominal (STC)	2511 kWp	Total power	2200 kWac
Modules	124 string x 30 In series		
At operating cond. (50°C)		Operating voltage	895-1500 V
Pmpp	2322 kWp	Pnom ratio (DC:AC)	1.14
U mpp	1078 V		
I mpp	2154 A		

Array #6 - Sottocampo #6

Number of PV modules	3750 units	Number of inverters	2 units
Nominal (STC)	2531 kWp	Total power	2200 kWac
Modules	125 string x 30 In series		
At operating cond. (50°C)		Operating voltage	895-1500 V
Pmpp	2341 kWp	Pnom ratio (DC:AC)	1.15
U mpp	1078 V		
I mpp	2171 A		

Array #7 - Sottocampo #7

Number of PV modules	5760 units	Number of inverters	3 units
Nominal (STC)	3888 kWp	Total power	3300 kWac
Modules	192 string x 30 In series		
At operating cond. (50°C)		Operating voltage	895-1500 V
Pmpp	3596 kWp	Pnom ratio (DC:AC)	1.18
U mpp	1078 V		
I mpp	3335 A		

Array #8 - Sottocampo #8

Number of PV modules	3870 units	Number of inverters	2 units
Nominal (STC)	2612 kWp	Total power	2200 kWac
Modules	129 string x 30 In series		
At operating cond. (50°C)		Operating voltage	895-1500 V
Pmpp	2416 kWp	Pnom ratio (DC:AC)	1.19
U mpp	1078 V		
I mpp	2241 A		

PV Array Characteristics

Array #9 - Sottocampo #9

Number of PV modules	5160 units	Number of inverters	3 units
Nominal (STC)	3483 kWp	Total power	3300 kWac
Modules	172 string x 30 In series		
At operating cond. (50°C)		Operating voltage	895-1500 V
Pmpp	3221 kWp	Pnom ratio (DC:AC)	1.06
U mpp	1078 V		
I mpp	2988 A		

Array #10 - Sottocampo #10

Number of PV modules	9600 units	Number of inverters	5 units
Nominal (STC)	6480 kWp	Total power	5500 kWac
Modules	320 string x 30 In series		
At operating cond. (50°C)		Operating voltage	895-1500 V
Pmpp	5993 kWp	Pnom ratio (DC:AC)	1.18
U mpp	1078 V		
I mpp	5559 A		

Array #11 - Sottocampo #11

Number of PV modules	5700 units	Number of inverters	3 units
Nominal (STC)	3848 kWp	Total power	3300 kWac
Modules	190 string x 30 In series		
At operating cond. (50°C)		Operating voltage	895-1500 V
Pmpp	3559 kWp	Pnom ratio (DC:AC)	1.17
U mpp	1078 V		
I mpp	3301 A		

Array #12 - Sottocampo #12

Number of PV modules	5670 units	Number of inverters	3 units
Nominal (STC)	3827 kWp	Total power	3300 kWac
Modules	189 string x 30 In series		
At operating cond. (50°C)		Operating voltage	895-1500 V
Pmpp	3540 kWp	Pnom ratio (DC:AC)	1.16
U mpp	1078 V		
I mpp	3283 A		

Array #13 - Sottocampo #13

Number of PV modules	5670 units	Number of inverters	3 units
Nominal (STC)	3827 kWp	Total power	3300 kWac
Modules	189 string x 30 In series		
At operating cond. (50°C)		Operating voltage	895-1500 V
Pmpp	3540 kWp	Pnom ratio (DC:AC)	1.16
U mpp	1078 V		
I mpp	3283 A		

Array #14 - Sottocampo #14

Number of PV modules	5670 units	Number of inverters	3 units
Nominal (STC)	3827 kWp	Total power	3300 kWac
Modules	189 string x 30 In series		
At operating cond. (50°C)		Operating voltage	895-1500 V
Pmpp	3540 kWp	Pnom ratio (DC:AC)	1.16
U mpp	1078 V		
I mpp	3283 A		

PV Array Characteristics

Array #15 - Sottocampo #15

Number of PV modules	3450 units	Number of inverters	2 units
Nominal (STC)	2329 kWp	Total power	2200 kWac
Modules	115 string x 30 In series		
At operating cond. (50°C)		Operating voltage	895-1500 V
Pmpp	2154 kWp	Pnom ratio (DC:AC)	1.06
U mpp	1078 V		
I mpp	1998 A		

Total PV power		**Total inverter power**	
Nominal (STC)	54088 kWp	Total power	47300 kWac
Total	80130 modules	Number of inverters	43 units
Module area	248912 m²	Pnom ratio	1.14

Array losses

Array Soiling Losses
Loss Fraction 3.0 %

Thermal Loss factor
Module temperature according to irradiance
Uc (const) 29.0 W/m²K
Uv (wind) 0.0 W/m²K/m/s

Serie Diode Loss
Voltage drop 0.7 V
Loss Fraction 0.1 % at STC

LID - Light Induced Degradation
Loss Fraction 0.5 %

Module Quality Loss
Loss Fraction -0.5 %

Module mismatch losses
Loss Fraction 0.5 % at MPP

Strings Mismatch loss
Loss Fraction 0.2 %

Module average degradation
Year no 1
Loss factor 0.4 %/year

Mismatch due to degradation
Imp RMS dispersion 0.4 %/year
Vmp RMS dispersion 0.4 %/year

IAM loss factor
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

DC wiring losses

Global wiring resistance 0.38 mΩ
Loss Fraction 1.5 % at STC

Array #1 - Sottocampo #1		**Array #2 - Sottocampo #2**	
Global array res.	2.8 mΩ	Global array res.	7.8 mΩ
Loss Fraction	1.5 % at STC	Loss Fraction	1.5 % at STC
Array #3 - Sottocampo #3		**Array #4 - Sottocampo #4**	
Global array res.	7.8 mΩ	Global array res.	8.9 mΩ
Loss Fraction	1.5 % at STC	Loss Fraction	1.5 % at STC
Array #5 - Sottocampo #5		**Array #6 - Sottocampo #6**	
Global array res.	8.2 mΩ	Global array res.	8.1 mΩ
Loss Fraction	1.5 % at STC	Loss Fraction	1.5 % at STC
Array #7 - Sottocampo #7		**Array #8 - Sottocampo #8**	
Global array res.	5.3 mΩ	Global array res.	7.8 mΩ
Loss Fraction	1.5 % at STC	Loss Fraction	1.5 % at STC
Array #9 - Sottocampo #9		**Array #10 - Sottocampo #10**	
Global array res.	5.9 mΩ	Global array res.	3.2 mΩ
Loss Fraction	1.5 % at STC	Loss Fraction	1.5 % at STC

DC wiring losses

Array #11 - Sottocampo #11

Global array res.	5.3 mΩ
Loss Fraction	1.5 % at STC

Array #12 - Sottocampo #12

Global array res.	5.3 mΩ
Loss Fraction	1.5 % at STC

Array #13 - Sottocampo #13

Global array res.	5.3 mΩ
Loss Fraction	1.5 % at STC

Array #14 - Sottocampo #14

Global array res.	5.3 mΩ
Loss Fraction	1.5 % at STC

Array #15 - Sottocampo #15

Global array res.	8.8 mΩ
Loss Fraction	1.5 % at STC

System losses

Auxiliaries loss

Proportionnal to Power 3.0 W/kW
0.0 kW from Power thresh.

AC wiring losses

Inv. output line up to MV transfo

Inverter voltage	630 Vac tri
Loss Fraction	0.06 % at STC

Inverter: SG1100-UD

Wire section (43 Inv.)	Copper 43 x 3 x 1000 mm²
Average wires length	10 m

MV line up to Injection

MV Voltage	36 kV
Average each inverter	
Wires	Alu 3 x 700 mm²
Length	18675 m
Loss Fraction	1.15 % at STC

AC losses in transformers

MV transfo

Medium voltage 36 kV

One transfo parameters

Nominal power at STC	17.80 MVA
Iron Loss (24/24 Connexion)	17.80 kVA
Iron loss fraction	0.10 % at STC
Copper loss	178.04 kVA
Copper loss fraction	1.00 % at STC
Coils equivalent resistance	3 x 0.22 mΩ

Operating losses at STC (full system)

Nb. identical MV transfos	3
Nominal power at STC	53.41 MVA
Iron loss (24/24 Connexion)	53.41 kVA
Copper loss	534.13 kVA

Horizon definition

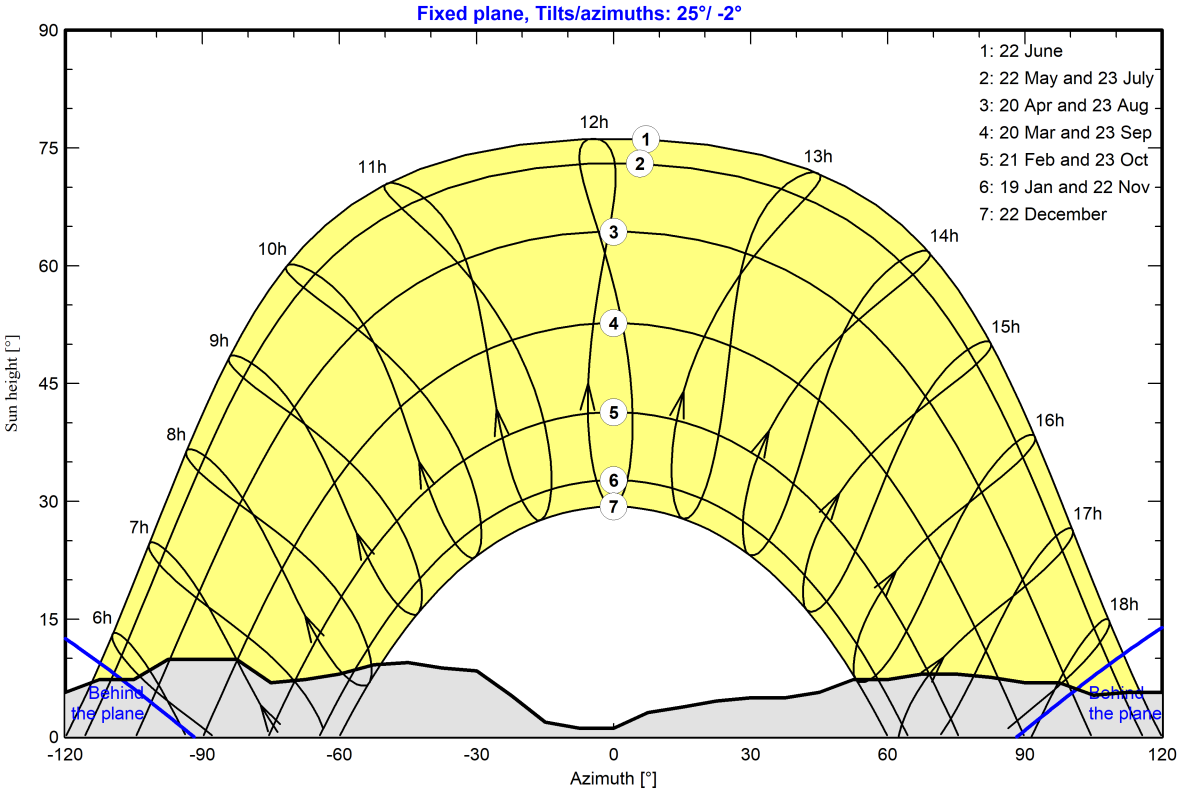
Horizon from PVGIS website API, Lat=37°13'33", Long=14°13'51", Alt=343m

Average Height	5.9 °	Albedo Factor	0.75
Diffuse Factor	0.97	Albedo Fraction	100 %

Horizon profile

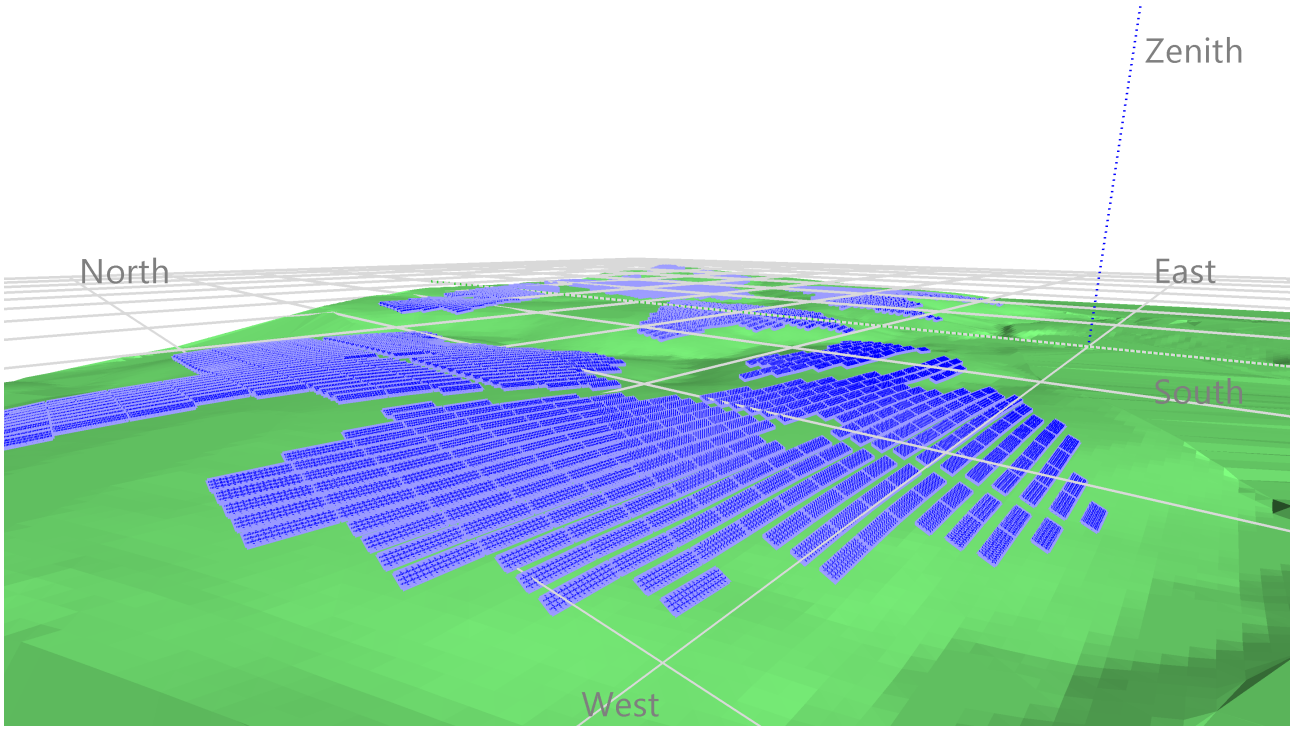
Azimuth [°]	-180	-173	-165	-158	-143	-135	-128	-120	-113	-105	-98	-83
Height [°]	3.8	4.6	5.7	6.1	6.1	5.3	5.0	5.7	7.3	7.3	9.9	9.9
Azimuth [°]	-75	-68	-60	-53	-45	-38	-30	-23	-15	-8	0	8
Height [°]	6.9	7.3	8.0	9.2	9.5	8.8	8.4	5.3	1.9	1.1	1.1	3.1
Azimuth [°]	15	23	30	38	45	53	60	68	75	83	90	98
Height [°]	3.8	4.6	5.0	5.0	5.7	7.3	7.3	8.0	8.0	7.6	6.9	6.9
Azimuth [°]	105	113	120	128	135	143	150	158	165	173	180	
Height [°]	5.3	5.7	5.7	5.3	4.2	2.7	3.1	3.4	3.1	3.4	3.8	

Sun Paths (Height / Azimuth diagram)



Near shadings parameter

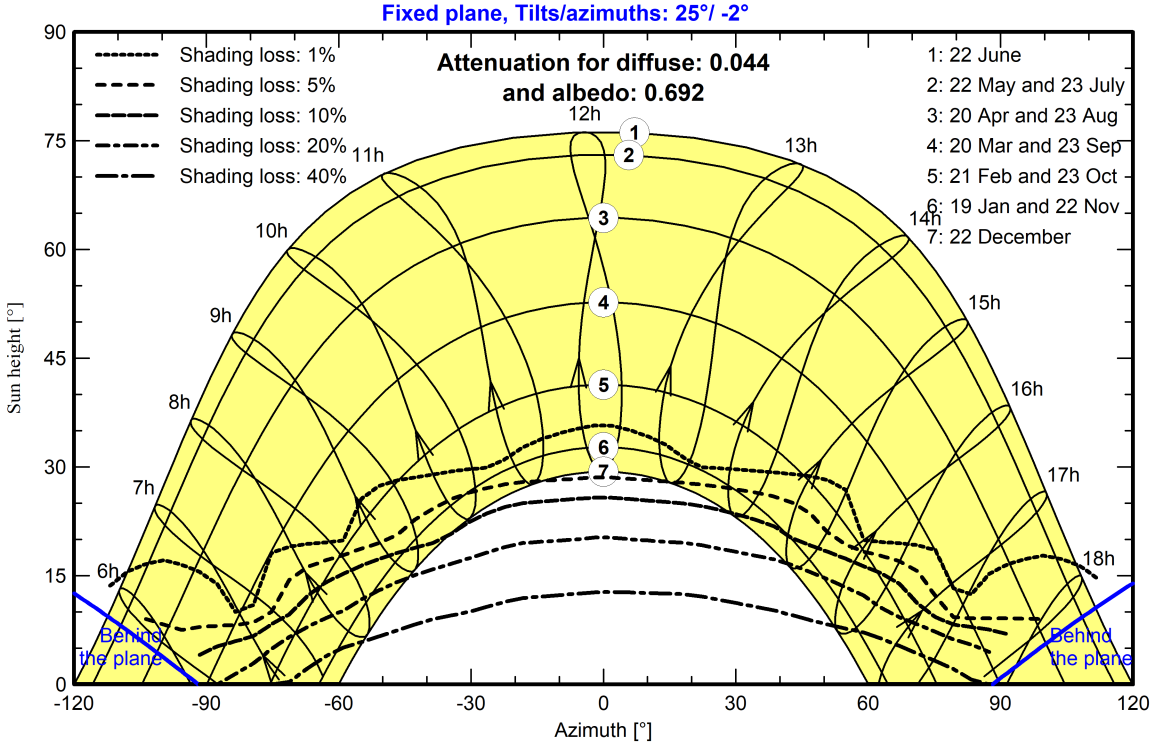
Perspective of the PV-field and surrounding shading scene



Iso-shadings diagram

Orientation #1

Fixed plane, Tilts/azimuths: 25° / -2°

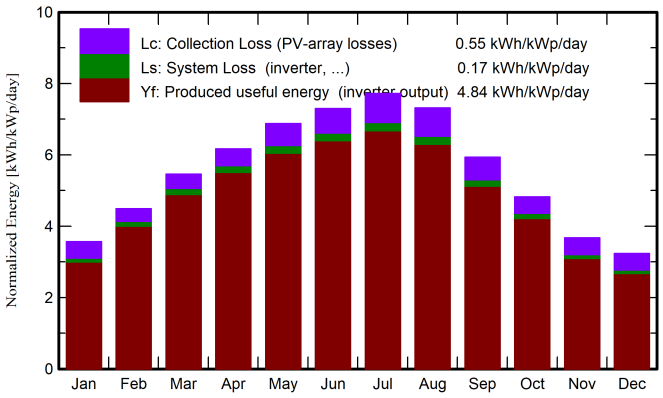


Main results

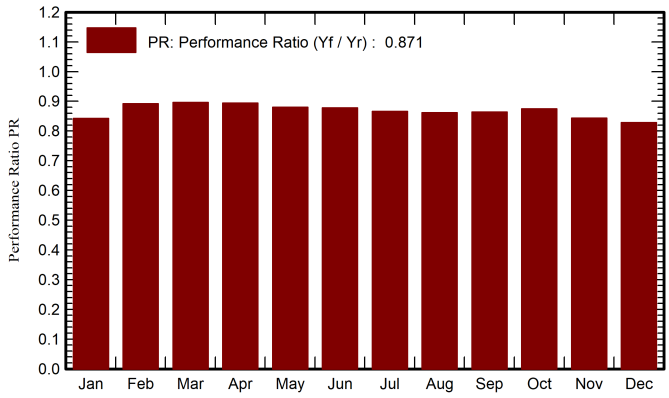
System Production

Produced Energy (P50)	95464593 kWh/year	Specific production (P50)	1765 kWh/kWp/year	Perf. Ratio PR	87.10 %
Produced Energy (P90)	90205099 kWh/year	Specific production (P90)	1668 kWh/kWp/year		
Produced Energy (P75)	92699395 kWh/year	Specific production (P75)	1714 kWh/kWp/year		

Normalized productions (per installed kWp)



Performance Ratio PR



Balances and main results

	GlobHor kWh/m²	DiffHor kWh/m²	T_Amb °C	GlobInc kWh/m²	GlobEff kWh/m²	EArray kWh	E_Grid kWh	PR ratio
January	73.4	30.70	9.60	110.6	98.7	5214151	5034967	0.842
February	92.6	37.60	9.70	125.7	116.2	6273405	6060778	0.891
March	140.4	54.90	11.50	169.3	157.6	8486642	8201112	0.896
April	170.8	67.30	14.30	185.0	172.2	9255510	8949092	0.894
May	214.8	73.90	18.50	213.2	198.9	10500235	10147986	0.880
June	228.3	71.60	22.70	218.8	204.5	10739433	10384599	0.877
July	244.9	67.20	25.20	239.3	224.2	11593295	11204153	0.866
August	214.6	64.00	25.50	226.7	212.3	10943195	10573630	0.862
September	155.3	58.00	22.30	178.1	165.5	8603688	8316471	0.863
October	116.4	48.10	18.70	149.4	138.6	7315771	7070823	0.875
November	76.4	34.10	14.50	110.3	99.1	5209476	5032692	0.844
December	65.4	28.40	10.89	100.2	89.1	4652013	4488289	0.828
Year	1793.3	635.80	16.99	2026.5	1876.6	98786815	95464593	0.871

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
E_Grid	Energy injected into grid
PR	Performance Ratio

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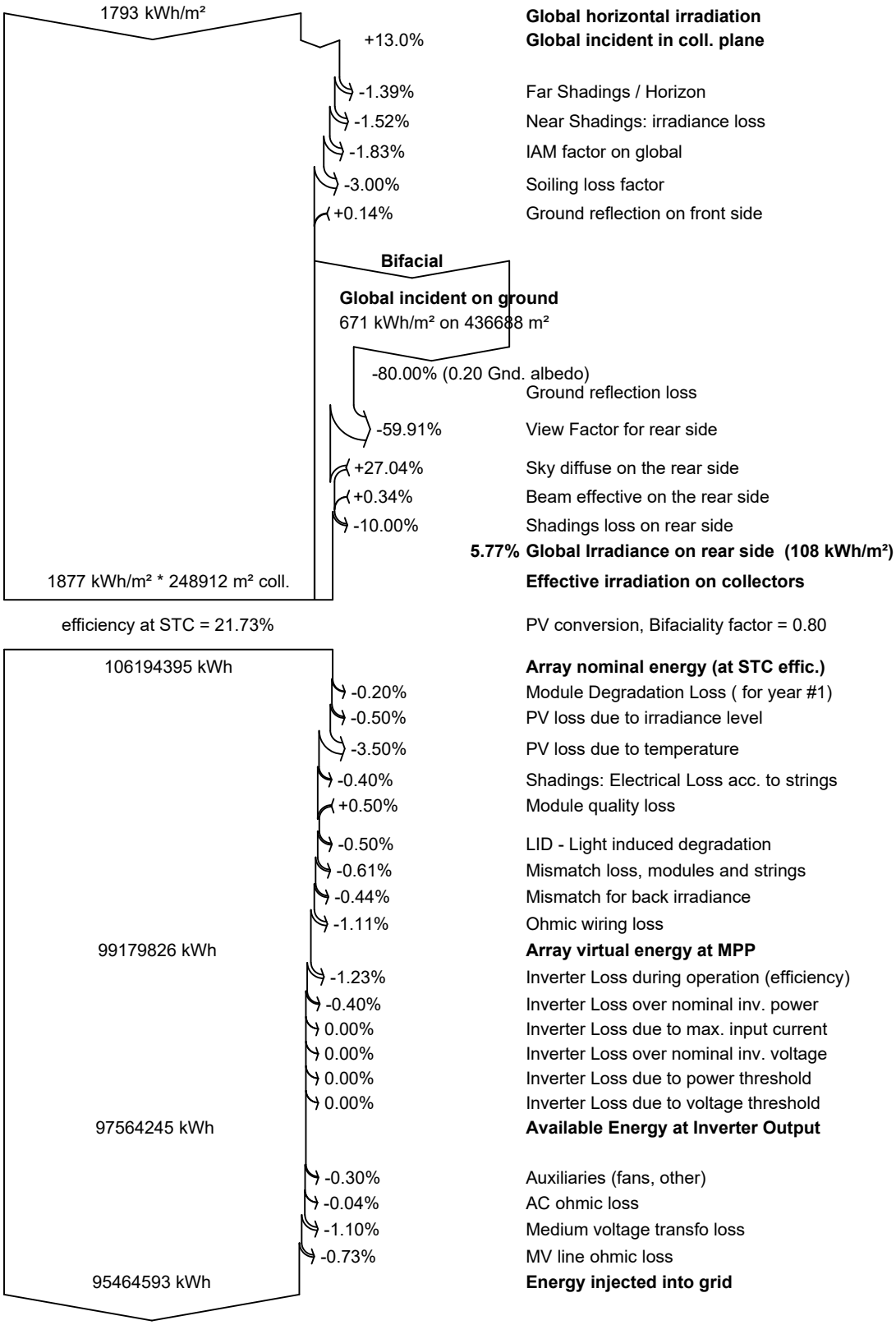
Loss diagram



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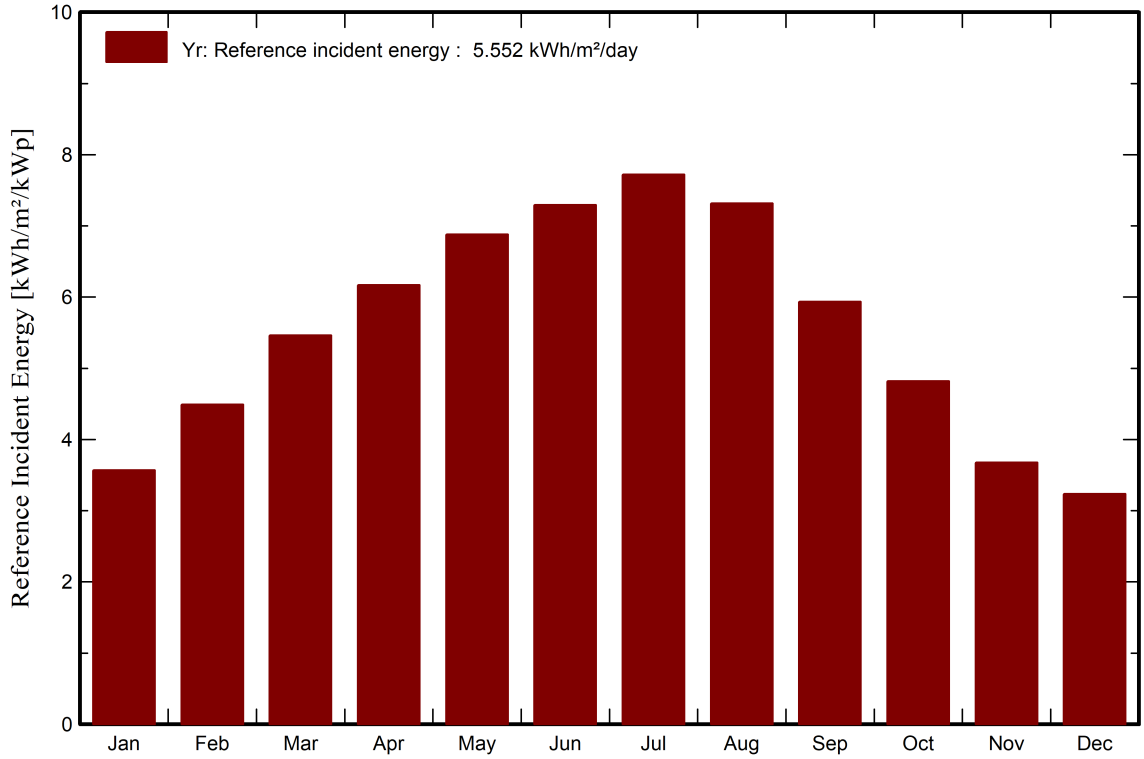
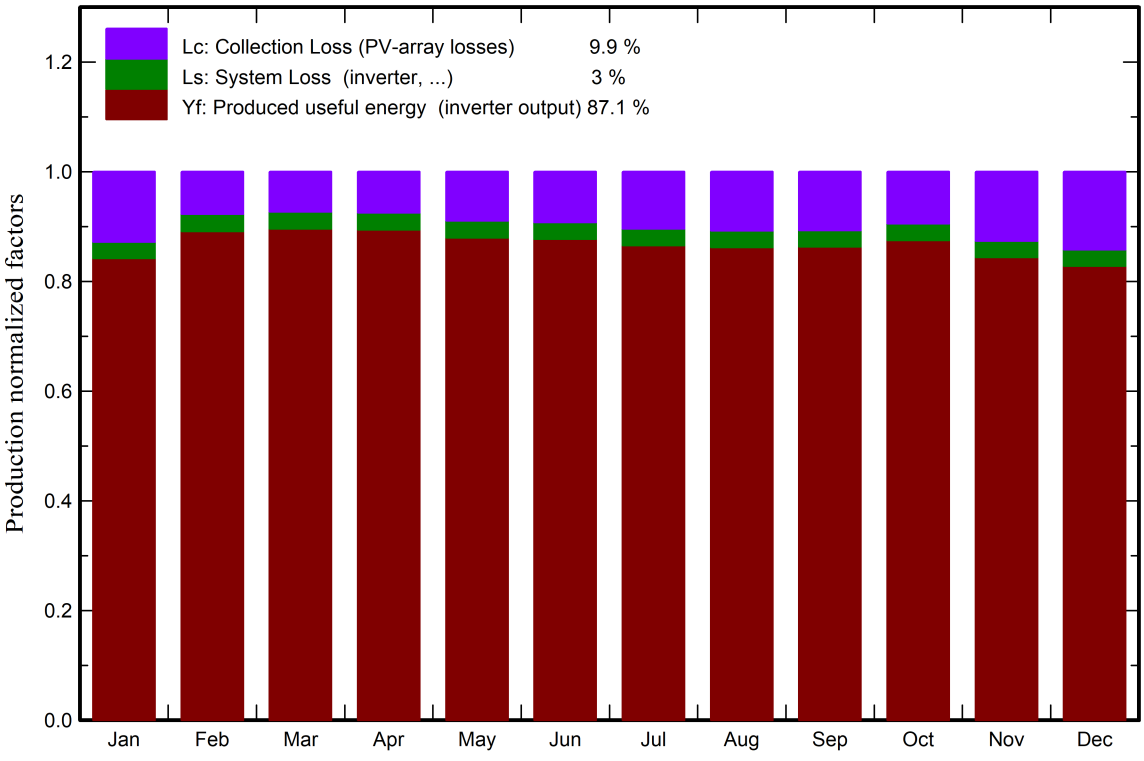
Predef. graphs

Energia incidente di riferimento su piano collettori

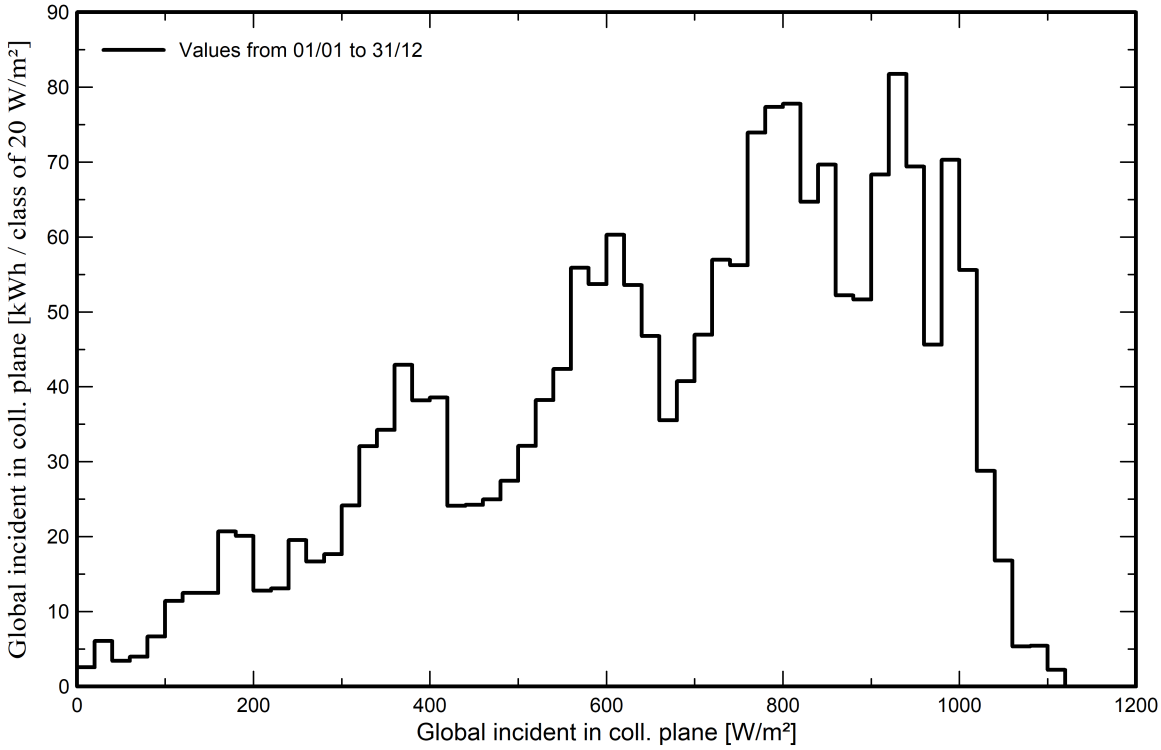


Fattori normalizzati di produzione e di perdita

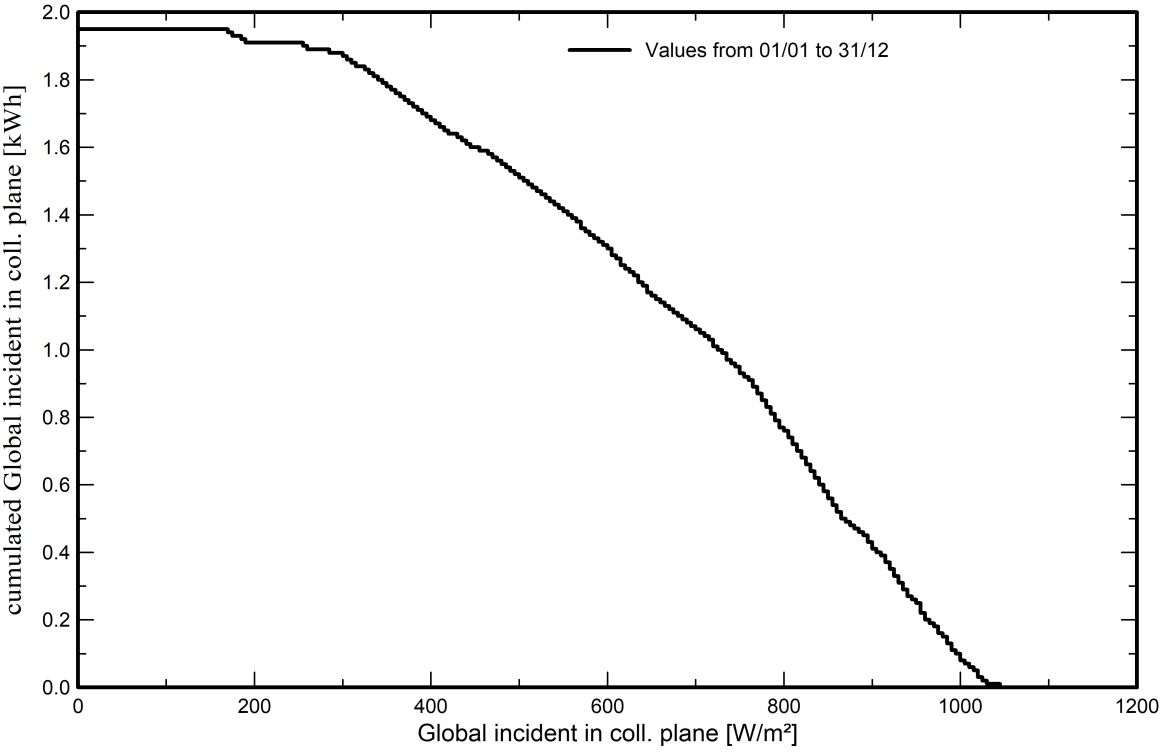


Predef. graphs

Distribuzione irraggiamento incidente



Coda della distribuzione di irradiazione incidente



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Predef. graphs

Temperatura del campo vs.irradiazione efficace

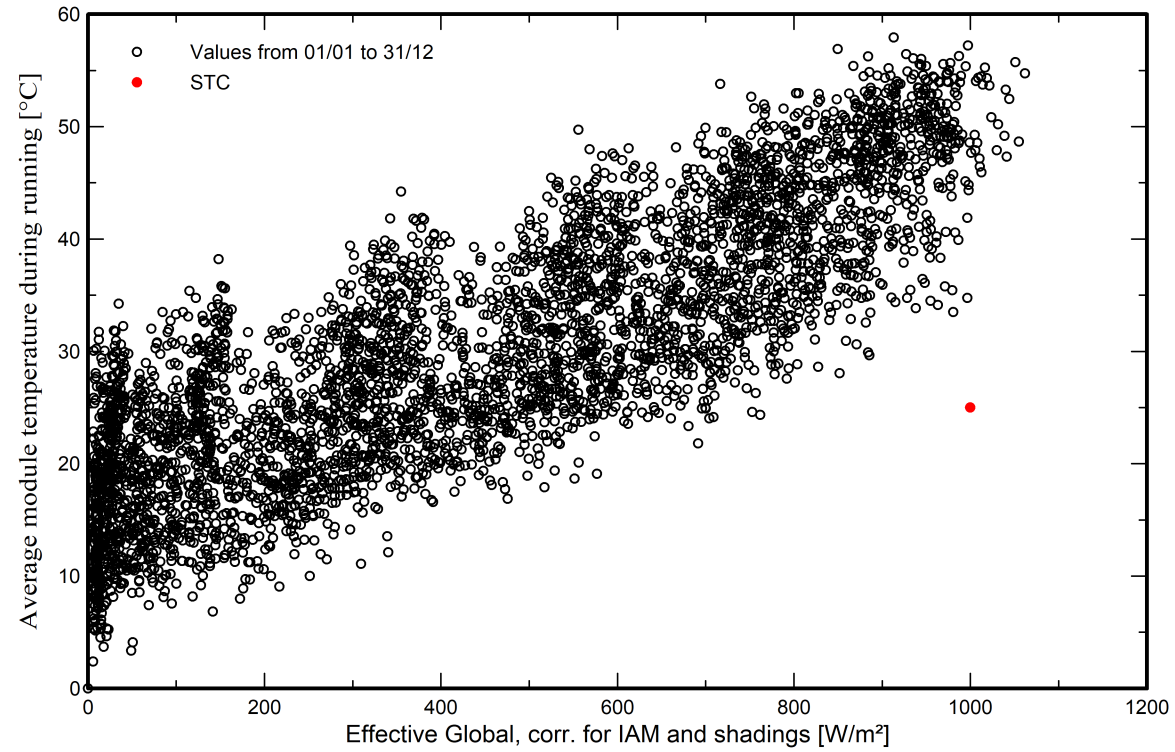
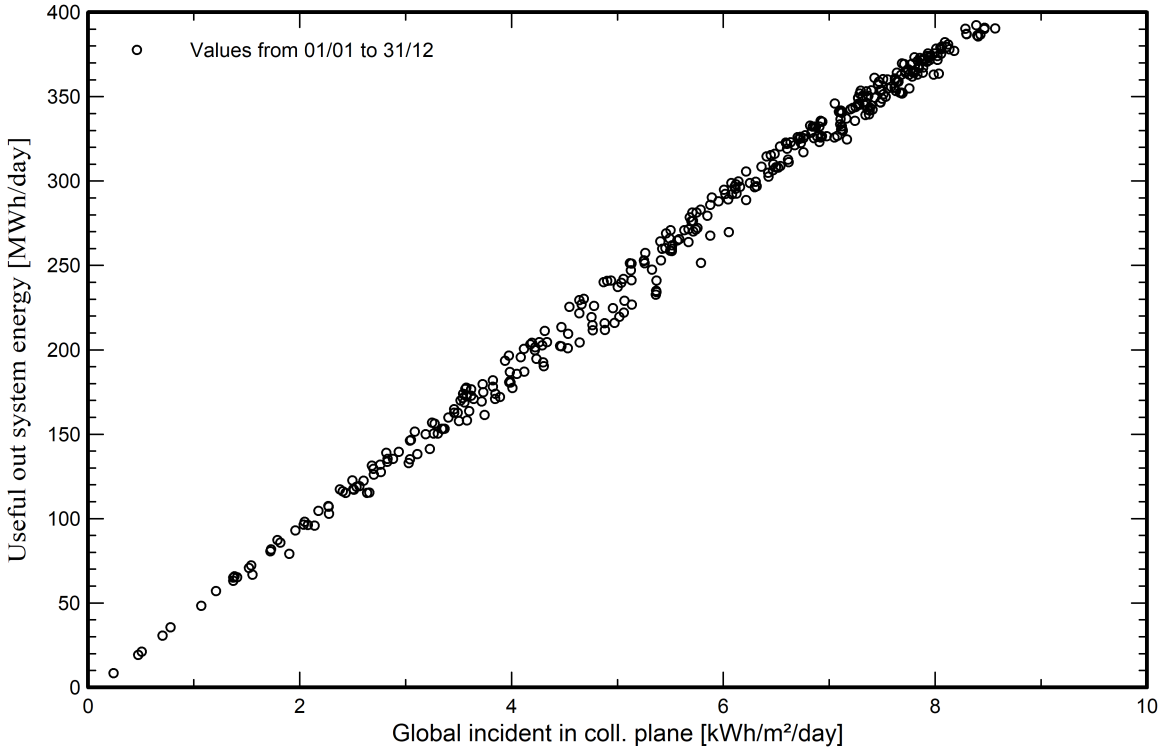
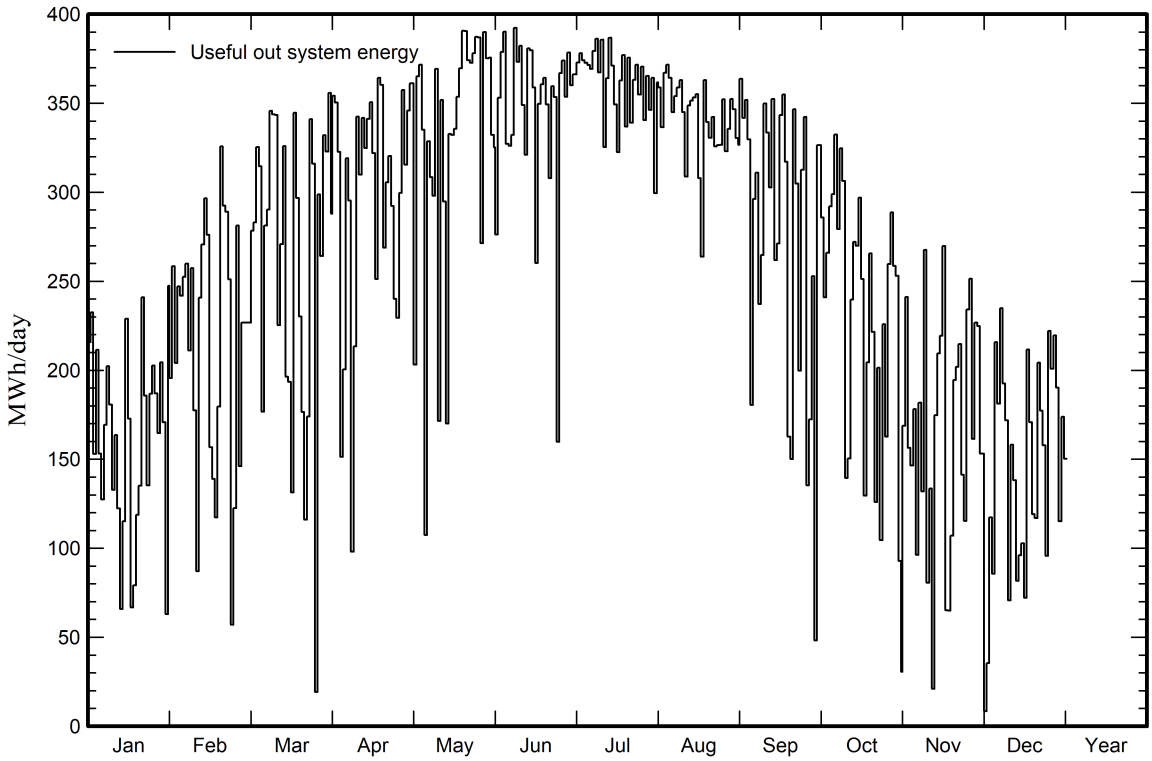


Diagramma giornaliero entrata/uscita

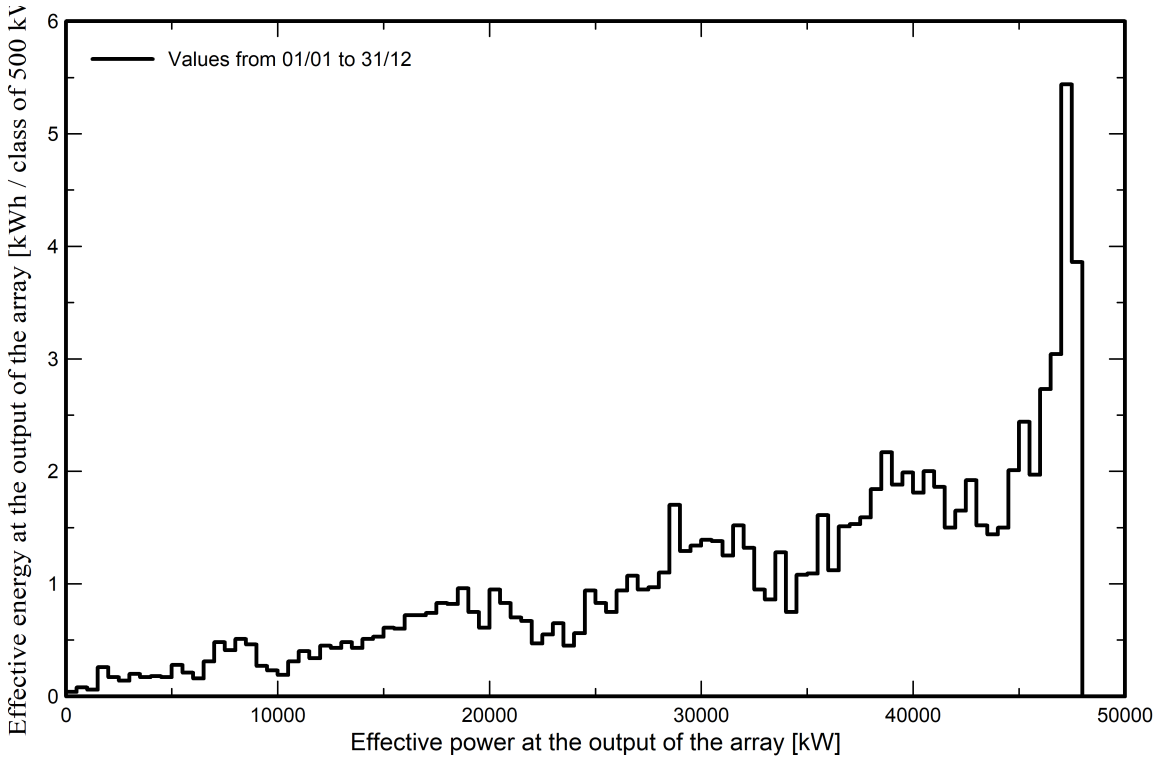


Predef. graphs

Energia giornaliera in uscita sistema

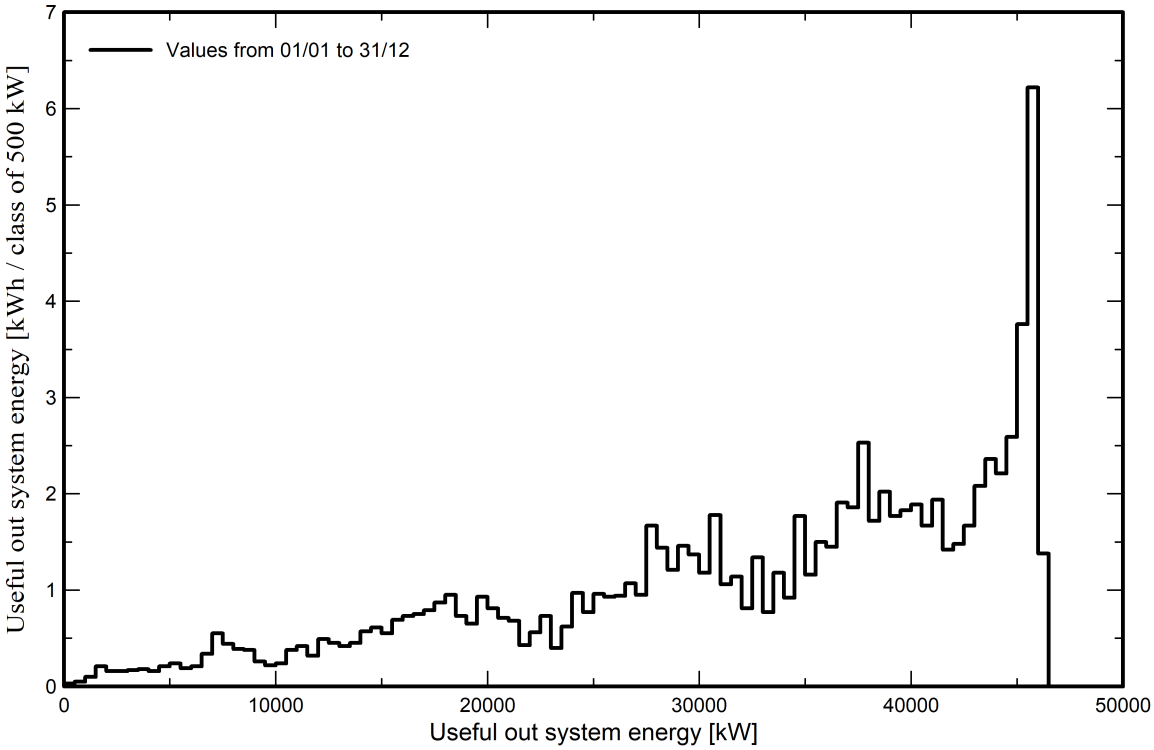


Distribuzione potenza dell'impianto

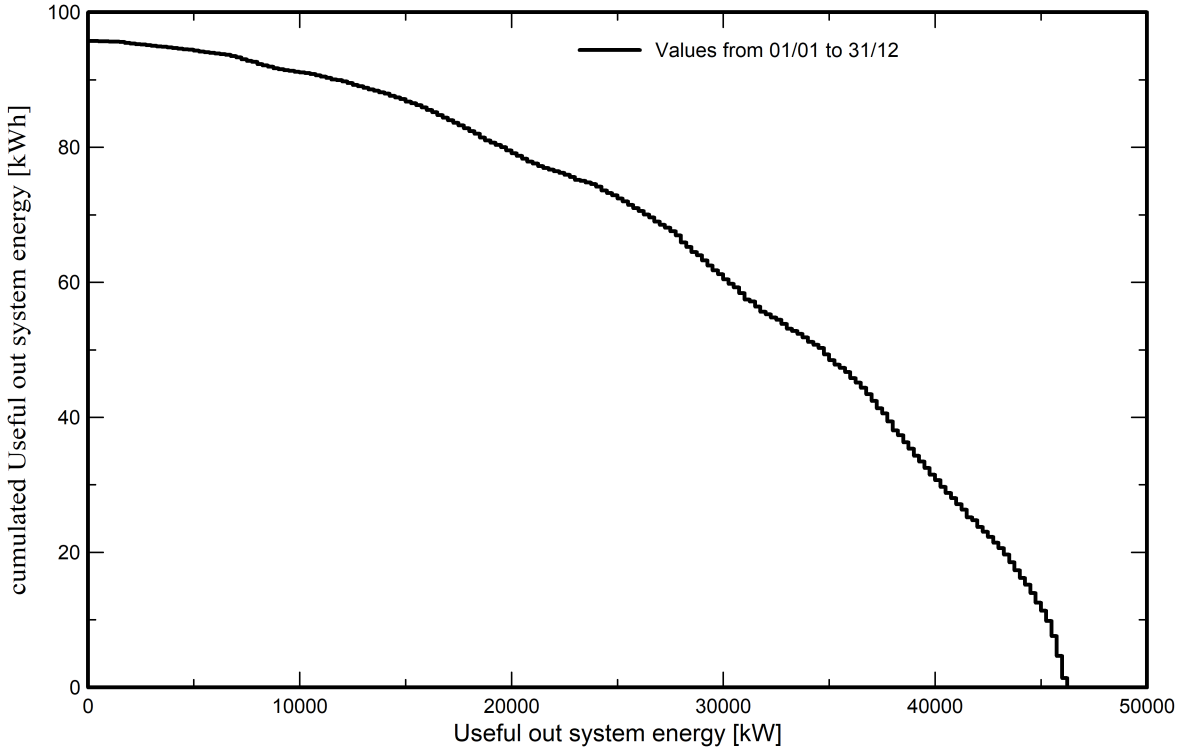


Predef. graphs

Distribuzione potenza in uscita sistema

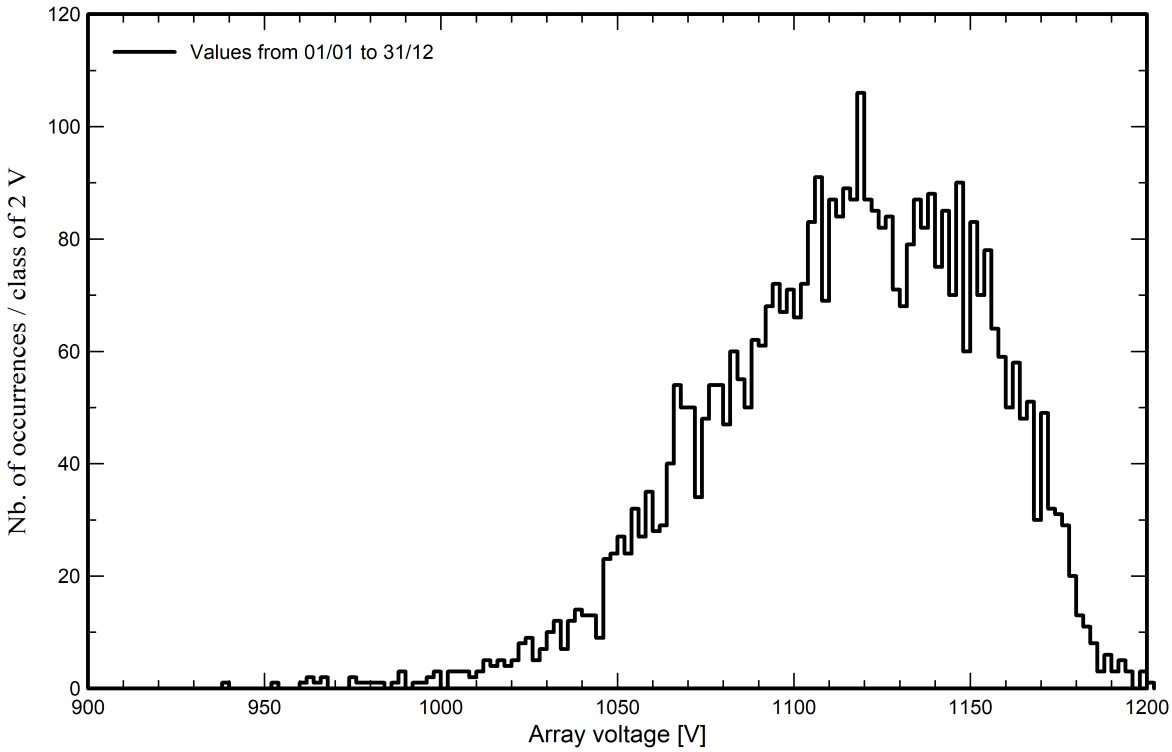


Coda della distribuzione della potenza in uscita

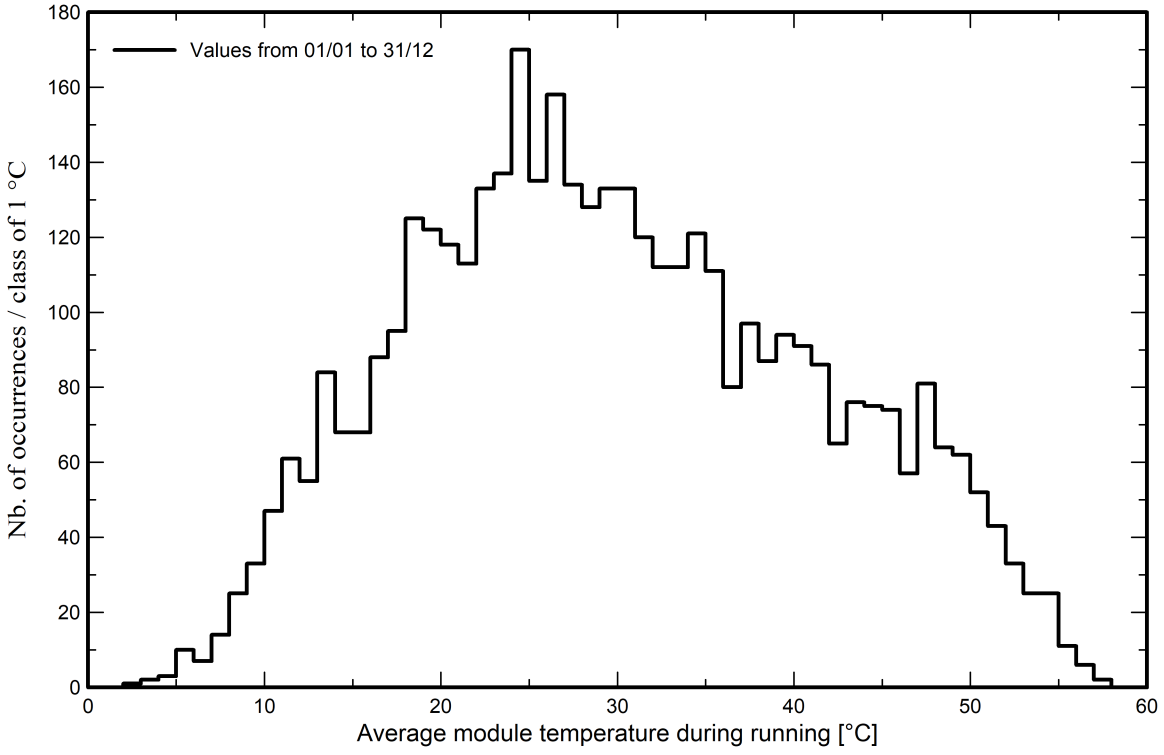


Predef. graphs

Distribuzione tensione impianto



Distribuzione temperatura impianto



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P50 - P90 evaluation

Weather data

Source	SolarGIS Monthly aver. , period not spec.
Kind	Specific year
Year	Sintetico
Year-to-year variability(Variance)	3.9 %

Specified Deviation

Year deviation from average	0.0 %

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 %

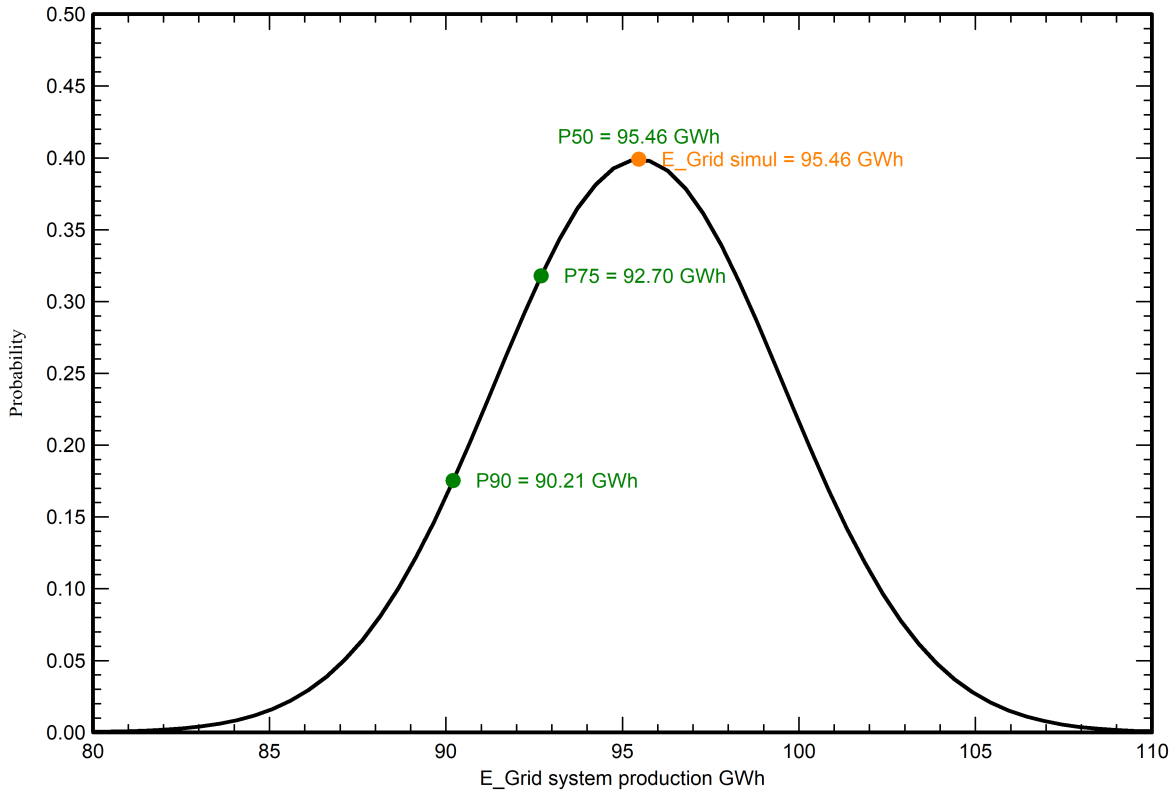
Global variability (weather data + system)

Variability (Quadratic sum)	4.3 %

Annual production probability

Variability	4.10 GWh
P50	95.46 GWh
P90	90.21 GWh
P75	92.70 GWh

Probability distribution



CO_2 Emission Balance

Total: 1547307.9 tCO_2

Generated emissions

Total: 92752.40 tCO_2

Source: Detailed calculation from table below

Replaced Emissions

Total: 1890198.9 tCO_2

System production: 95464.59 MWh/yr

Grid Lifecycle Emissions: 660 gCO_2/kWh

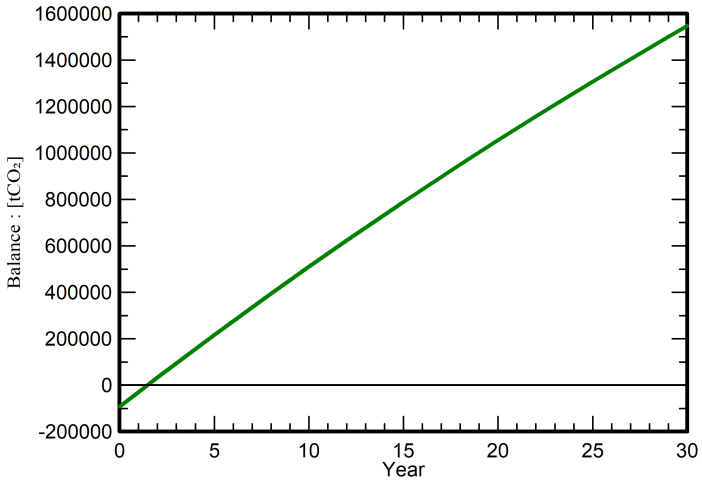
Source: IEA List

Country: Zimbabwe

Lifetime: 30 years

Annual degradation: 1.0 %

Saved CO_2 Emission vs. Time



System Lifecycle Emissions Details

Item	LCE	Quantity	Subtotal
			[$kgCO_2$]
Modules	1649 kgCO2/kWp	54088 kWp	89206165
Supports	4.40 kgCO2/kg	801300 kg	3527483
Inverters	436 kgCO2/units	43.0 units	18754

Version 7.4.6

PVsyst - Simulation report

Grid-Connected System

Progetto: Butera 80 MW

Variante: PV Area Ovest

Impianto a strutture fisse

System power: 54.09 MWp

Pozzillo - Italia

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Project summary

Geographical Site
Pozzillo
Italia

Situation

Latitude	37.23 °N
Longitude	14.23 °E
Altitude	343 m
Time zone	UTC+1

Project settings
Albedo 0.20

Weather data
Butera
SolarGIS Monthly aver. , period not spec. - Sintetico

System summary

Grid-Connected System
Simulation for year no 1

Impianto a strutture fisse

PV Field Orientation
Fixed plane
Tilt/Azimuth 25.2 / -1.8 °

Near Shadings
According to strings : Fast (table)
Electrical effect 100 %

User's needs
Unlimited load (grid)

System information

PV Array

Nb. of modules	80130 units
Pnom total	54.09 MWp

Inverters

Nb. of units	43 units
Pnom total	47.30 MWac
Pnom ratio	1.144

Results summary

Produced Energy	95464593 kWh/year	Specific production	1765 kWh/kWp/year	Perf. Ratio PR	87.10 %

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General parameters

Grid-Connected System — **Impianto a strutture fisse**

PV Field Orientation

Orientation
Fixed plane
Tilt/Azimuth 25.2 / -1.8 °

Sheds configuration
Nb. of sheds 2671 units
Identical arrays
Sizes
Sheds spacing 8.40 m
Collector width 4.79 m
Ground Cov. Ratio (GCR) 57.0 %
Shading limit angle
Limit profile angle 26.6 °

Models used
Transposition Perez
Diffuse Perez, Meteonorm
Circumsolar separate

Horizon
Average Height 5.9 °

Near Shadings
According to strings : Fast (table)
Electrical effect 100 %

User's needs
Unlimited load (grid)

Bifacial system
Model 2D Calculation
unlimited sheds

Bifacial model geometry		Bifacial model definitions	
Sheds spacing	8.40 m	Ground albedo	0.20
Sheds width	4.79 m	Bifaciality factor	80 %
Limit profile angle	26.6 °	Rear shading factor	10.0 %
GCR	57.0 %	Rear mismatch loss	10.0 %
Height above ground	1.50 m	Shed transparent fraction	0.0 %

PV Array Characteristics

PV module
Manufacturer CSI Solar
Model CS7N-675TB-AG 1500V
(Original PVsyst database)
Unit Nom. Power 675 Wp
Number of PV modules 80130 units
Nominal (STC) 54.09 MWp

Inverter
Manufacturer Sungrow
Model SG1100-UD
(Custom parameters definition)
Unit Nom. Power 1100 kWac
Number of inverters 43 units
Total power 47300 kWac

Array #1 - Sottocampo #1
Number of PV modules 10920 units
Nominal (STC) 7371 kWp
Modules 364 string x 30 In series
At operating cond. (50°C)
Pmpp 6817 kWp
U mpp 1078 V
I mpp 6323 A

Number of inverters 6 units
Total power 6600 kWac
Operating voltage 895-1500 V
Pnom ratio (DC:AC) 1.12

Array #2 - Sottocampo #2
Number of PV modules 3870 units
Nominal (STC) 2612 kWp
Modules 129 string x 30 In series
At operating cond. (50°C)
Pmpp 2416 kWp
U mpp 1078 V
I mpp 2241 A

Number of inverters 2 units
Total power 2200 kWac
Operating voltage 895-1500 V
Pnom ratio (DC:AC) 1.19

PV Array Characteristics

Array #3 - Sottocampo #3

Number of PV modules	3900 units	Number of inverters	2 units
Nominal (STC)	2633 kWp	Total power	2200 kWac
Modules	130 string x 30 In series		
At operating cond. (50°C)		Operating voltage	895-1500 V
Pmpp	2435 kWp	Pnom ratio (DC:AC)	1.20
U mpp	1078 V		
I mpp	2258 A		

Array #4 - Sottocampo #4

Number of PV modules	3420 units	Number of inverters	2 units
Nominal (STC)	2309 kWp	Total power	2200 kWac
Modules	114 string x 30 In series		
At operating cond. (50°C)		Operating voltage	895-1500 V
Pmpp	2135 kWp	Pnom ratio (DC:AC)	1.05
U mpp	1078 V		
I mpp	1980 A		

Array #5 - Sottocampo #5

Number of PV modules	3720 units	Number of inverters	2 units
Nominal (STC)	2511 kWp	Total power	2200 kWac
Modules	124 string x 30 In series		
At operating cond. (50°C)		Operating voltage	895-1500 V
Pmpp	2322 kWp	Pnom ratio (DC:AC)	1.14
U mpp	1078 V		
I mpp	2154 A		

Array #6 - Sottocampo #6

Number of PV modules	3750 units	Number of inverters	2 units
Nominal (STC)	2531 kWp	Total power	2200 kWac
Modules	125 string x 30 In series		
At operating cond. (50°C)		Operating voltage	895-1500 V
Pmpp	2341 kWp	Pnom ratio (DC:AC)	1.15
U mpp	1078 V		
I mpp	2171 A		

Array #7 - Sottocampo #7

Number of PV modules	5760 units	Number of inverters	3 units
Nominal (STC)	3888 kWp	Total power	3300 kWac
Modules	192 string x 30 In series		
At operating cond. (50°C)		Operating voltage	895-1500 V
Pmpp	3596 kWp	Pnom ratio (DC:AC)	1.18
U mpp	1078 V		
I mpp	3335 A		

Array #8 - Sottocampo #8

Number of PV modules	3870 units	Number of inverters	2 units
Nominal (STC)	2612 kWp	Total power	2200 kWac
Modules	129 string x 30 In series		
At operating cond. (50°C)		Operating voltage	895-1500 V
Pmpp	2416 kWp	Pnom ratio (DC:AC)	1.19
U mpp	1078 V		
I mpp	2241 A		

PV Array Characteristics

Array #9 - Sottocampo #9

Number of PV modules	5160 units	Number of inverters	3 units
Nominal (STC)	3483 kWp	Total power	3300 kWac
Modules	172 string x 30 In series		
At operating cond. (50°C)		Operating voltage	895-1500 V
Pmpp	3221 kWp	Pnom ratio (DC:AC)	1.06
U mpp	1078 V		
I mpp	2988 A		

Array #10 - Sottocampo #10

Number of PV modules	9600 units	Number of inverters	5 units
Nominal (STC)	6480 kWp	Total power	5500 kWac
Modules	320 string x 30 In series		
At operating cond. (50°C)		Operating voltage	895-1500 V
Pmpp	5993 kWp	Pnom ratio (DC:AC)	1.18
U mpp	1078 V		
I mpp	5559 A		

Array #11 - Sottocampo #11

Number of PV modules	5700 units	Number of inverters	3 units
Nominal (STC)	3848 kWp	Total power	3300 kWac
Modules	190 string x 30 In series		
At operating cond. (50°C)		Operating voltage	895-1500 V
Pmpp	3559 kWp	Pnom ratio (DC:AC)	1.17
U mpp	1078 V		
I mpp	3301 A		

Array #12 - Sottocampo #12

Number of PV modules	5670 units	Number of inverters	3 units
Nominal (STC)	3827 kWp	Total power	3300 kWac
Modules	189 string x 30 In series		
At operating cond. (50°C)		Operating voltage	895-1500 V
Pmpp	3540 kWp	Pnom ratio (DC:AC)	1.16
U mpp	1078 V		
I mpp	3283 A		

Array #13 - Sottocampo #13

Number of PV modules	5670 units	Number of inverters	3 units
Nominal (STC)	3827 kWp	Total power	3300 kWac
Modules	189 string x 30 In series		
At operating cond. (50°C)		Operating voltage	895-1500 V
Pmpp	3540 kWp	Pnom ratio (DC:AC)	1.16
U mpp	1078 V		
I mpp	3283 A		

Array #14 - Sottocampo #14

Number of PV modules	5670 units	Number of inverters	3 units
Nominal (STC)	3827 kWp	Total power	3300 kWac
Modules	189 string x 30 In series		
At operating cond. (50°C)		Operating voltage	895-1500 V
Pmpp	3540 kWp	Pnom ratio (DC:AC)	1.16
U mpp	1078 V		
I mpp	3283 A		

PV Array Characteristics

Array #15 - Sottocampo #15

Number of PV modules	3450 units	Number of inverters	2 units
Nominal (STC)	2329 kWp	Total power	2200 kWac
Modules	115 string x 30 In series		
At operating cond. (50°C)		Operating voltage	895-1500 V
Pmpp	2154 kWp	Pnom ratio (DC:AC)	1.06
U mpp	1078 V		
I mpp	1998 A		

Total PV power		**Total inverter power**	
Nominal (STC)	54088 kWp	Total power	47300 kWac
Total	80130 modules	Number of inverters	43 units
Module area	248912 m²	Pnom ratio	1.14

Array losses

Array Soiling Losses
Loss Fraction 3.0 %

Thermal Loss factor
Module temperature according to irradiance
Uc (const) 29.0 W/m²K
Uv (wind) 0.0 W/m²K/m/s

Serie Diode Loss
Voltage drop 0.7 V
Loss Fraction 0.1 % at STC

LID - Light Induced Degradation
Loss Fraction 0.5 %

Module Quality Loss
Loss Fraction -0.5 %

Module mismatch losses
Loss Fraction 0.5 % at MPP

Strings Mismatch loss
Loss Fraction 0.2 %

Module average degradation
Year no 1
Loss factor 0.4 %/year

Mismatch due to degradation
Imp RMS dispersion 0.4 %/year
Vmp RMS dispersion 0.4 %/year

IAM loss factor
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

DC wiring losses

Global wiring resistance 0.38 mΩ
Loss Fraction 1.5 % at STC

Array #1 - Sottocampo #1		**Array #2 - Sottocampo #2**	
Global array res.	2.8 mΩ	Global array res.	7.8 mΩ
Loss Fraction	1.5 % at STC	Loss Fraction	1.5 % at STC
Array #3 - Sottocampo #3		**Array #4 - Sottocampo #4**	
Global array res.	7.8 mΩ	Global array res.	8.9 mΩ
Loss Fraction	1.5 % at STC	Loss Fraction	1.5 % at STC
Array #5 - Sottocampo #5		**Array #6 - Sottocampo #6**	
Global array res.	8.2 mΩ	Global array res.	8.1 mΩ
Loss Fraction	1.5 % at STC	Loss Fraction	1.5 % at STC
Array #7 - Sottocampo #7		**Array #8 - Sottocampo #8**	
Global array res.	5.3 mΩ	Global array res.	7.8 mΩ
Loss Fraction	1.5 % at STC	Loss Fraction	1.5 % at STC
Array #9 - Sottocampo #9		**Array #10 - Sottocampo #10**	
Global array res.	5.9 mΩ	Global array res.	3.2 mΩ
Loss Fraction	1.5 % at STC	Loss Fraction	1.5 % at STC

DC wiring losses

Array #11 - Sottocampo #11

Global array res.	5.3 mΩ
Loss Fraction	1.5 % at STC

Array #12 - Sottocampo #12

Global array res.	5.3 mΩ
Loss Fraction	1.5 % at STC

Array #13 - Sottocampo #13

Global array res.	5.3 mΩ
Loss Fraction	1.5 % at STC

Array #14 - Sottocampo #14

Global array res.	5.3 mΩ
Loss Fraction	1.5 % at STC

Array #15 - Sottocampo #15

Global array res.	8.8 mΩ
Loss Fraction	1.5 % at STC

System losses

Auxiliaries loss

Proportionnal to Power 3.0 W/kW
0.0 kW from Power thresh.

AC wiring losses

Inv. output line up to MV transfo

Inverter voltage	630 Vac tri
Loss Fraction	0.06 % at STC

Inverter: SG1100-UD

Wire section (43 Inv.)	Copper 43 x 3 x 1000 mm²
Average wires length	10 m

MV line up to Injection

MV Voltage	36 kV
Average each inverter	
Wires	Alu 3 x 700 mm²
Length	18675 m
Loss Fraction	1.15 % at STC

AC losses in transformers

MV transfo

Medium voltage 36 kV

One transfo parameters

Nominal power at STC	17.80 MVA
Iron Loss (24/24 Connexion)	17.80 kVA
Iron loss fraction	0.10 % at STC
Copper loss	178.04 kVA
Copper loss fraction	1.00 % at STC
Coils equivalent resistance	3 x 0.22 mΩ

Operating losses at STC (full system)

Nb. identical MV transfos	3
Nominal power at STC	53.41 MVA
Iron loss (24/24 Connexion)	53.41 kVA
Copper loss	534.13 kVA

Horizon definition

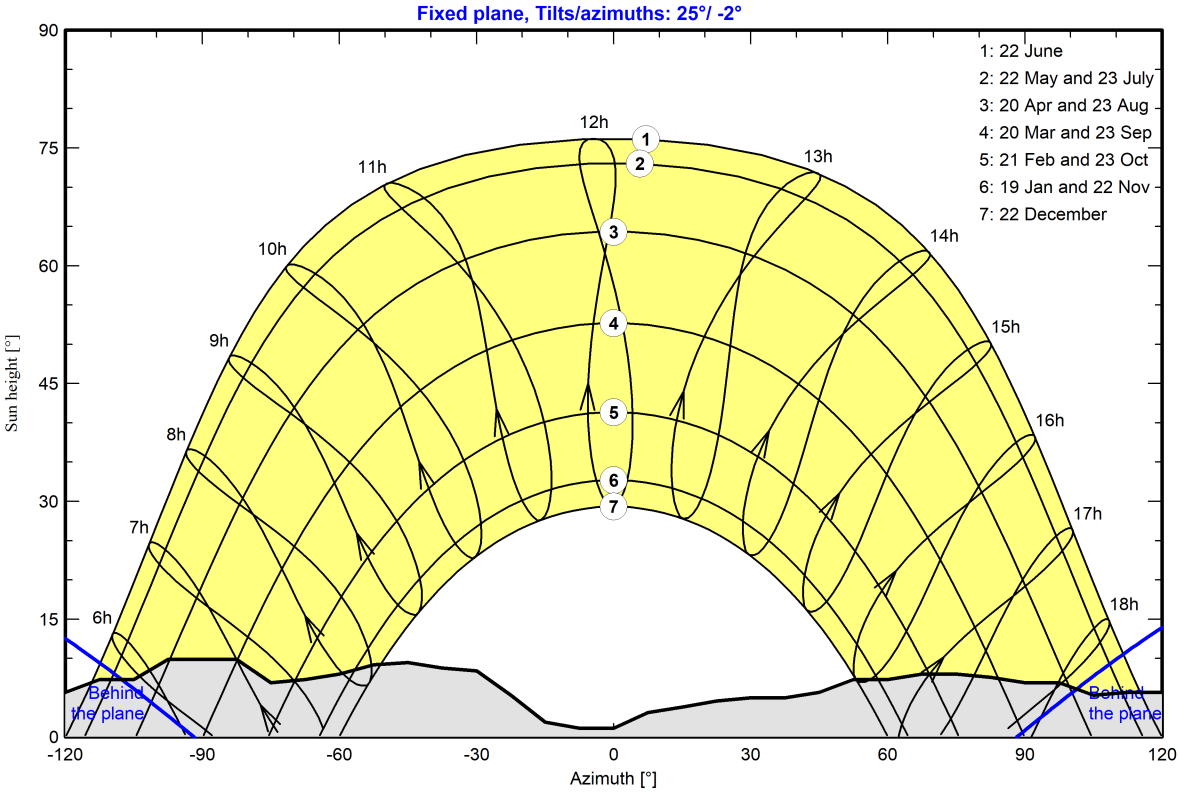
Horizon from PVGIS website API, Lat=37°13'33", Long=14°13'51", Alt=343m

Average Height	5.9 °	Albedo Factor	0.75
Diffuse Factor	0.97	Albedo Fraction	100 %

Horizon profile

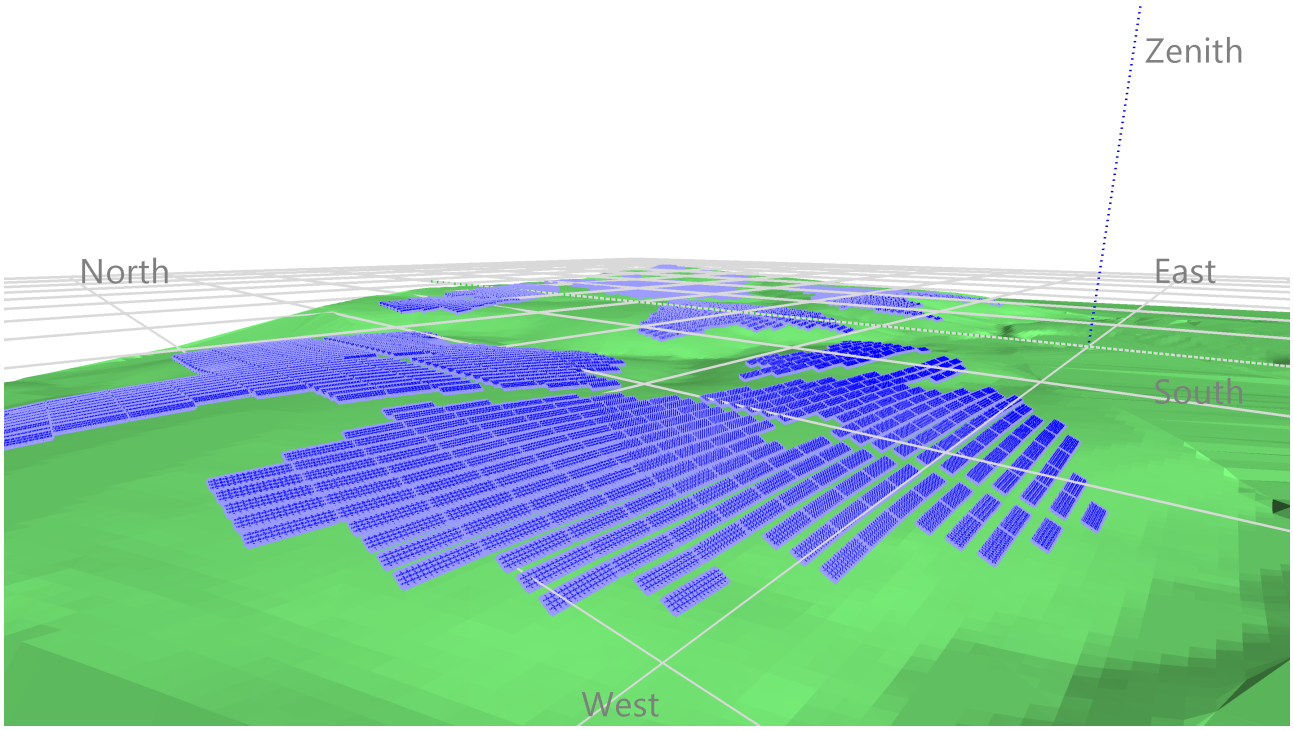
Azimuth [°]	-180	-173	-165	-158	-143	-135	-128	-120	-113	-105	-98	-83
Height [°]	3.8	4.6	5.7	6.1	6.1	5.3	5.0	5.7	7.3	7.3	9.9	9.9
Azimuth [°]	-75	-68	-60	-53	-45	-38	-30	-23	-15	-8	0	8
Height [°]	6.9	7.3	8.0	9.2	9.5	8.8	8.4	5.3	1.9	1.1	1.1	3.1
Azimuth [°]	15	23	30	38	45	53	60	68	75	83	90	98
Height [°]	3.8	4.6	5.0	5.0	5.7	7.3	7.3	8.0	8.0	7.6	6.9	6.9
Azimuth [°]	105	113	120	128	135	143	150	158	165	173	180	
Height [°]	5.3	5.7	5.7	5.3	4.2	2.7	3.1	3.4	3.1	3.4	3.8	

Sun Paths (Height / Azimuth diagram)



Near shadings parameter

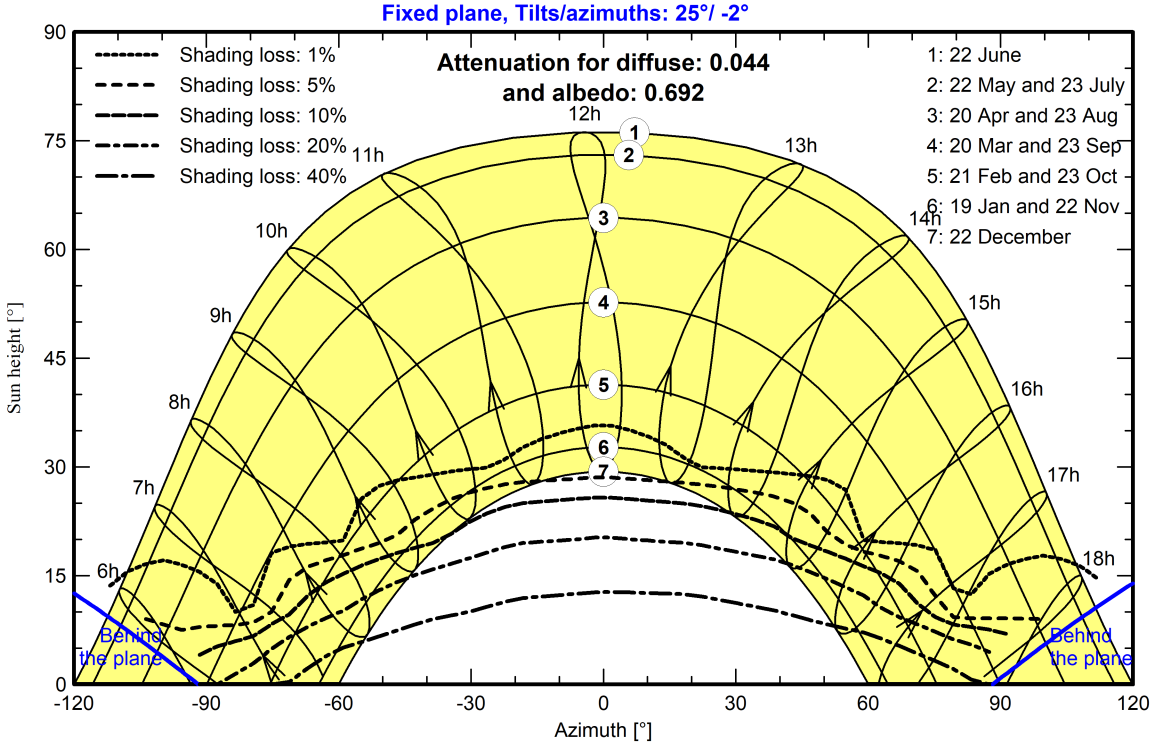
Perspective of the PV-field and surrounding shading scene



Iso-shadings diagram

Orientation #1

Fixed plane, Tilts/azimuths: 25° / -2°

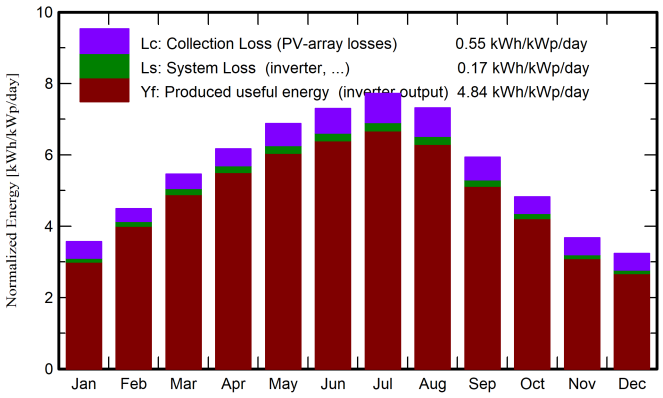


Main results

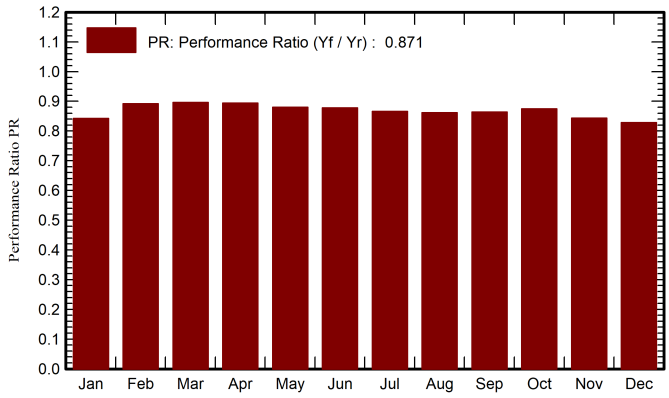
System Production

Produced Energy (P50)	95464593 kWh/year	Specific production (P50)	1765 kWh/kWp/year	Perf. Ratio PR	87.10 %
Produced Energy (P90)	90205099 kWh/year	Specific production (P90)	1668 kWh/kWp/year		
Produced Energy (P75)	92699395 kWh/year	Specific production (P75)	1714 kWh/kWp/year		

Normalized productions (per installed kWp)



Performance Ratio PR



Balances and main results

	GlobHor kWh/m²	DiffHor kWh/m²	T_Amb °C	GlobInc kWh/m²	GlobEff kWh/m²	EArray kWh	E_Grid kWh	PR ratio
January	73.4	30.70	9.60	110.6	98.7	5214151	5034967	0.842
February	92.6	37.60	9.70	125.7	116.2	6273405	6060778	0.891
March	140.4	54.90	11.50	169.3	157.6	8486642	8201112	0.896
April	170.8	67.30	14.30	185.0	172.2	9255510	8949092	0.894
May	214.8	73.90	18.50	213.2	198.9	10500235	10147986	0.880
June	228.3	71.60	22.70	218.8	204.5	10739433	10384599	0.877
July	244.9	67.20	25.20	239.3	224.2	11593295	11204153	0.866
August	214.6	64.00	25.50	226.7	212.3	10943195	10573630	0.862
September	155.3	58.00	22.30	178.1	165.5	8603688	8316471	0.863
October	116.4	48.10	18.70	149.4	138.6	7315771	7070823	0.875
November	76.4	34.10	14.50	110.3	99.1	5209476	5032692	0.844
December	65.4	28.40	10.89	100.2	89.1	4652013	4488289	0.828
Year	1793.3	635.80	16.99	2026.5	1876.6	98786815	95464593	0.871

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
E_Grid	Energy injected into grid
PR	Performance Ratio

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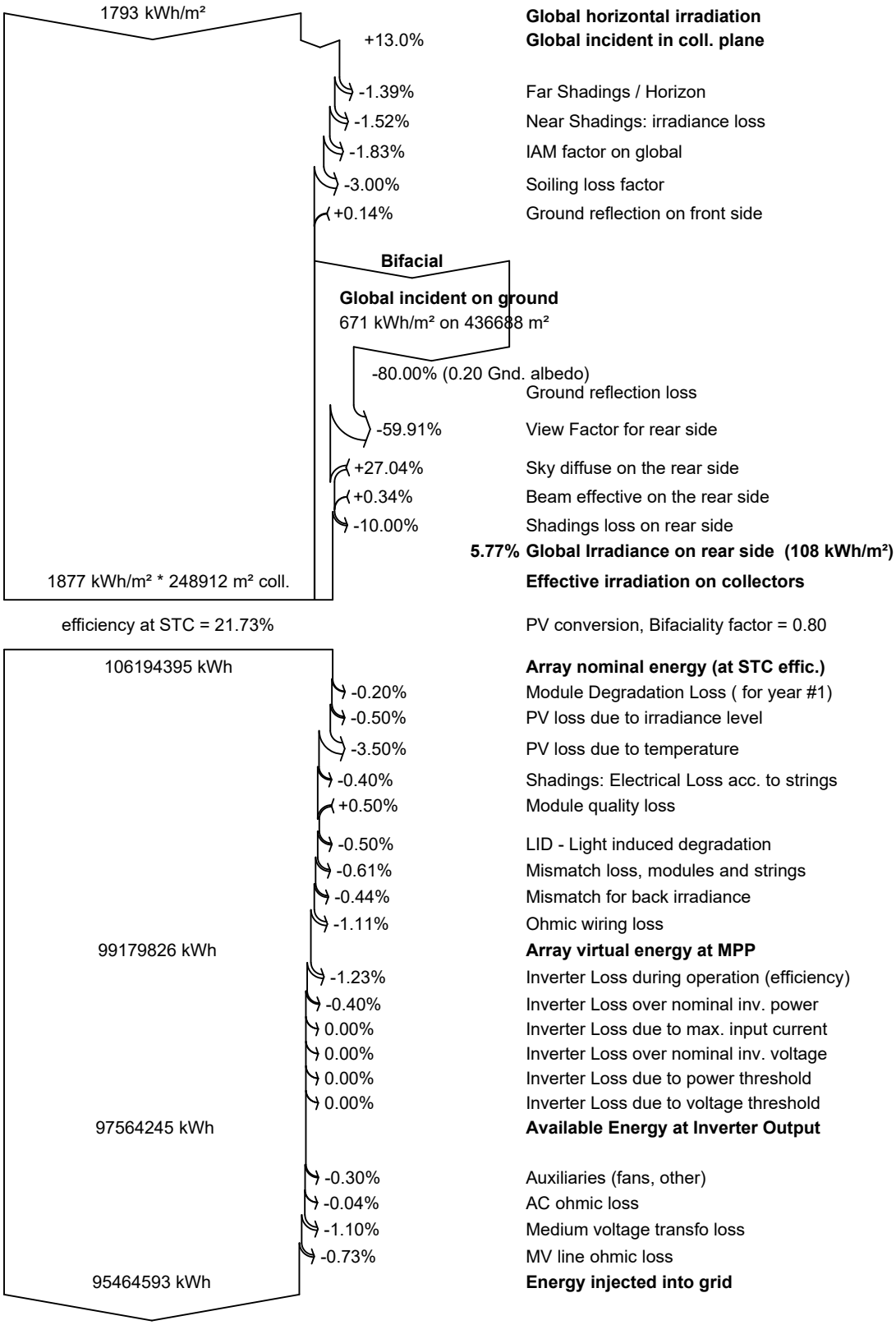
with V7.4.6

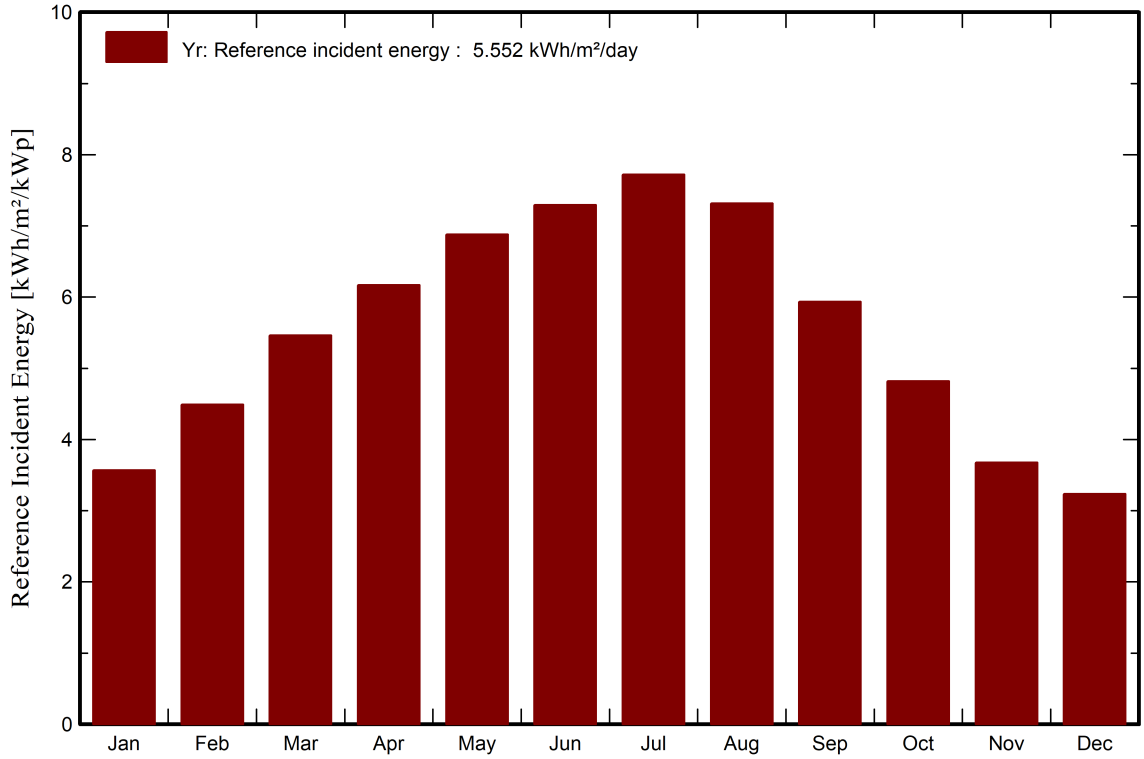
Loss diagram



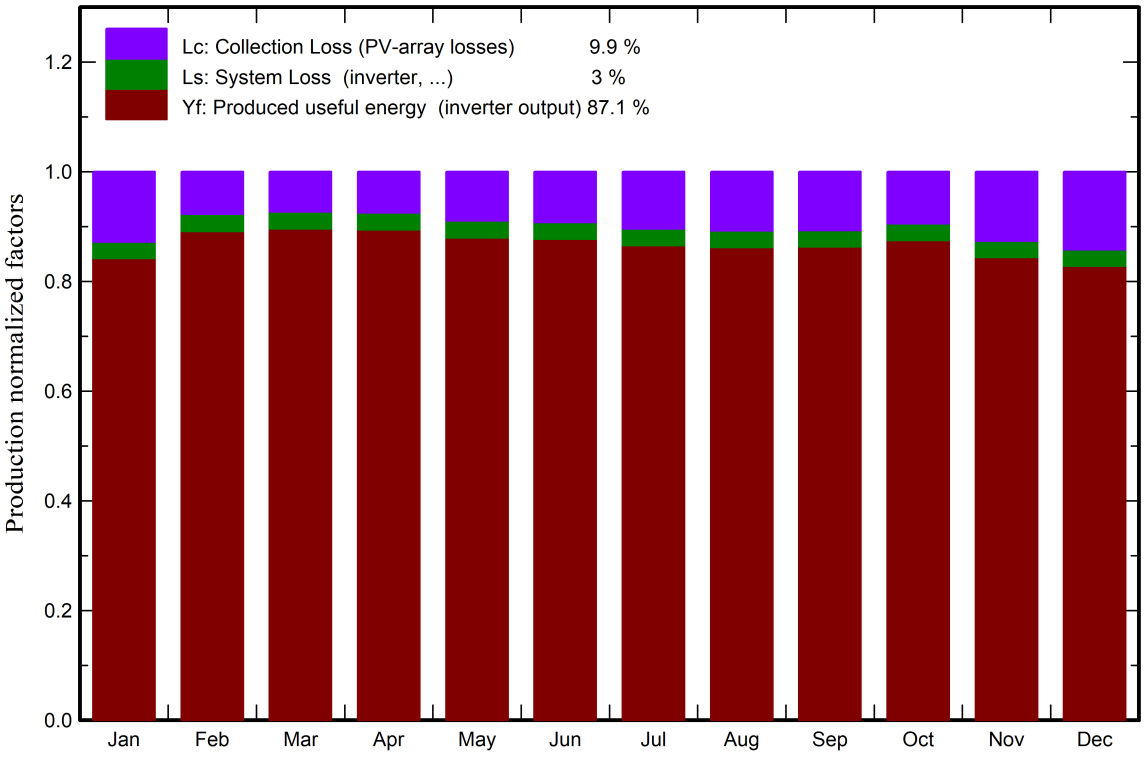
PVsyst V7.4.6
VC0, Simulation date:
25/03/24 11:39
with V7.4.6

Predef. graphs

Energia incidente di riferimento su piano collettori

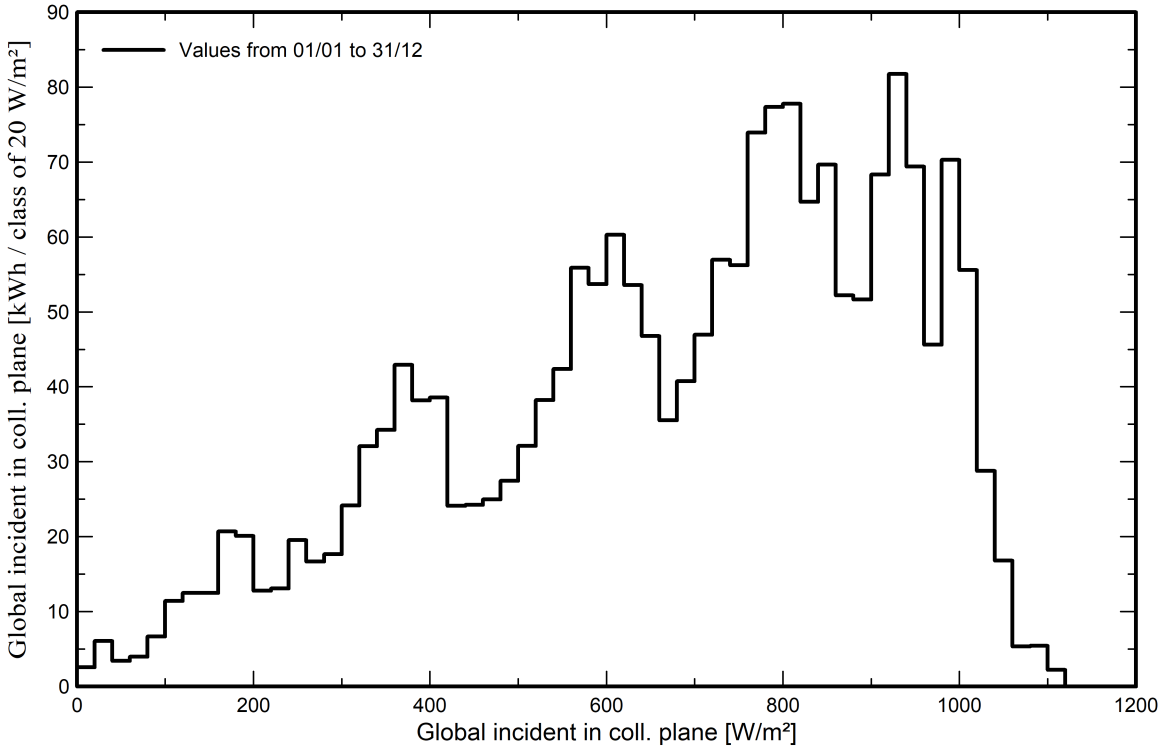


Fattori normalizzati di produzione e di perdita

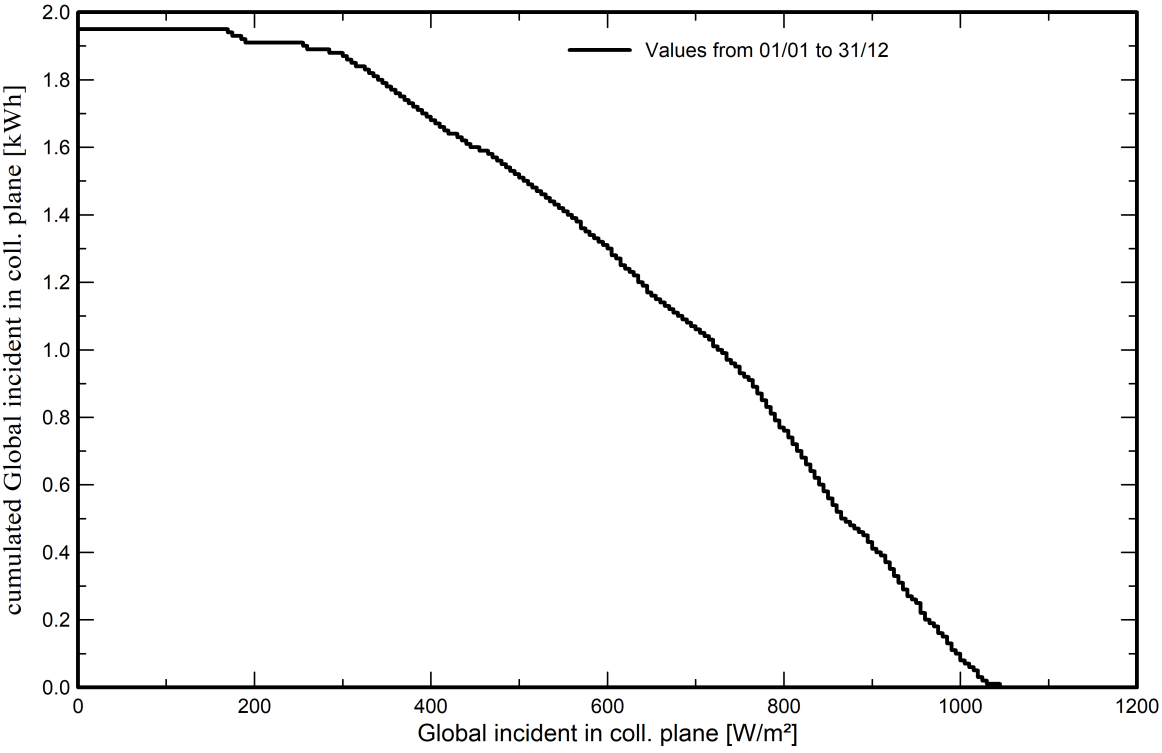


Predef. graphs

Distribuzione irraggiamento incidente



Coda della distribuzione di irradiazione incidente



PVsyst V7.4.6
VC0, Simulation date:
25/03/24 11:39
with V7.4.6

Predef. graphs

Temperatura del campo vs.irradiazione efficace

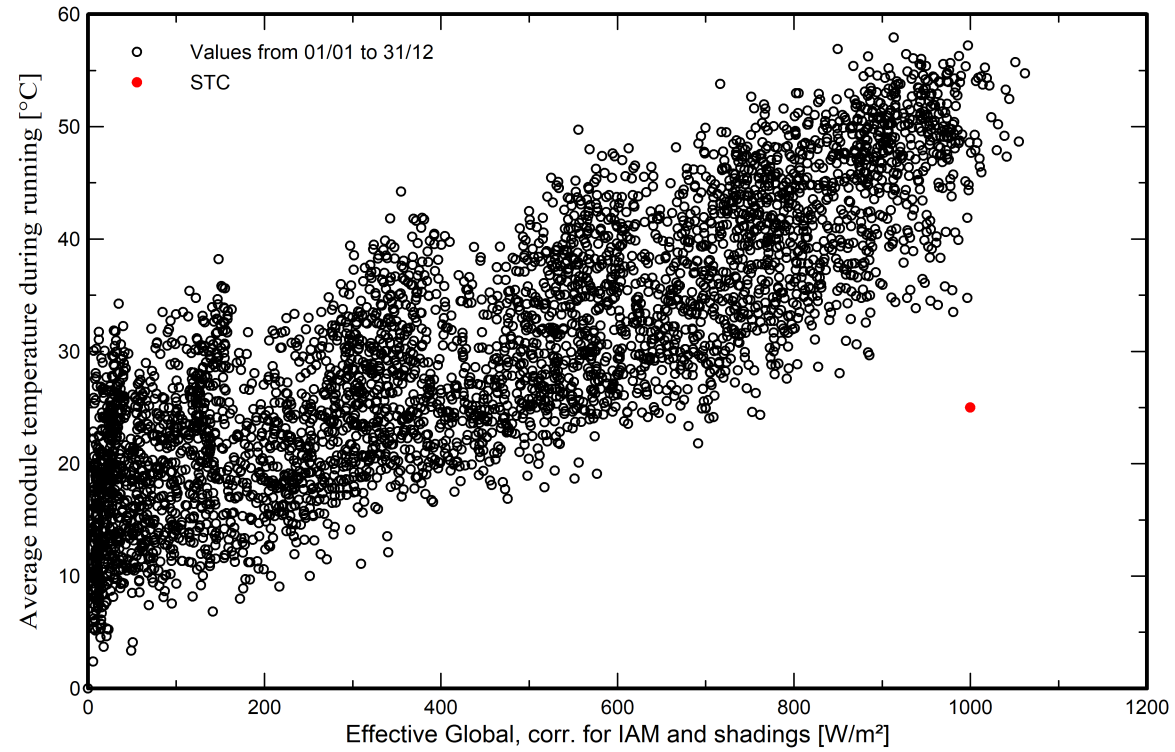
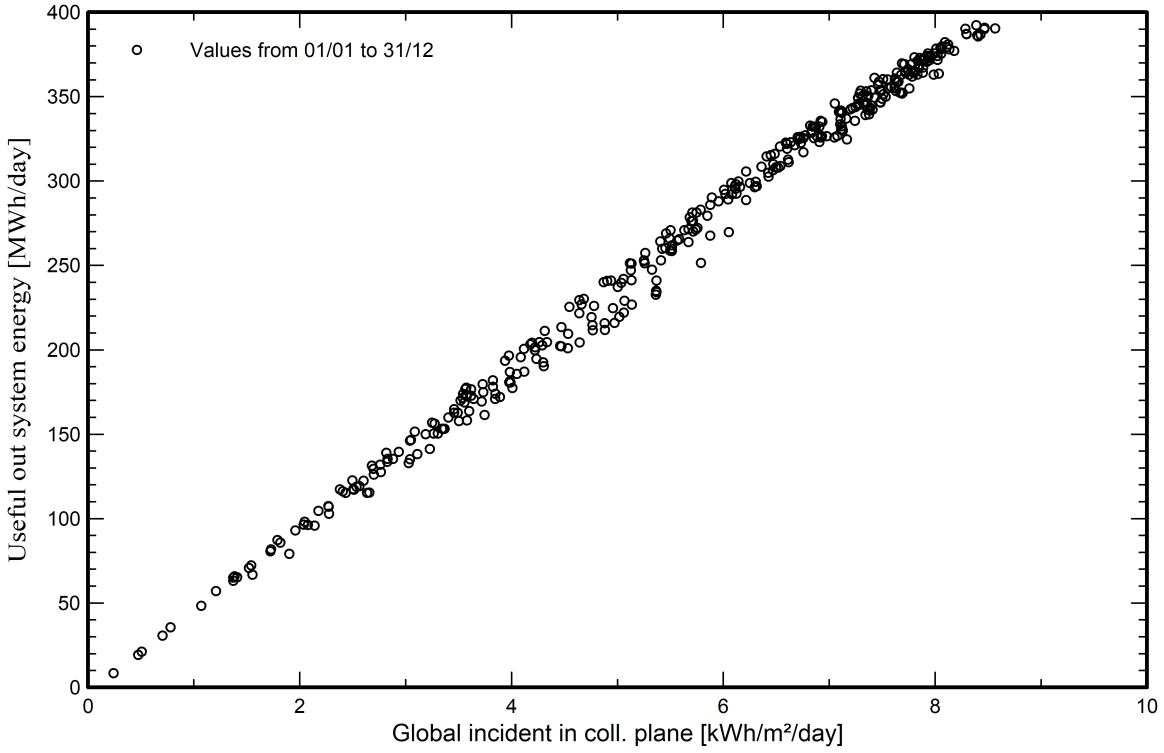
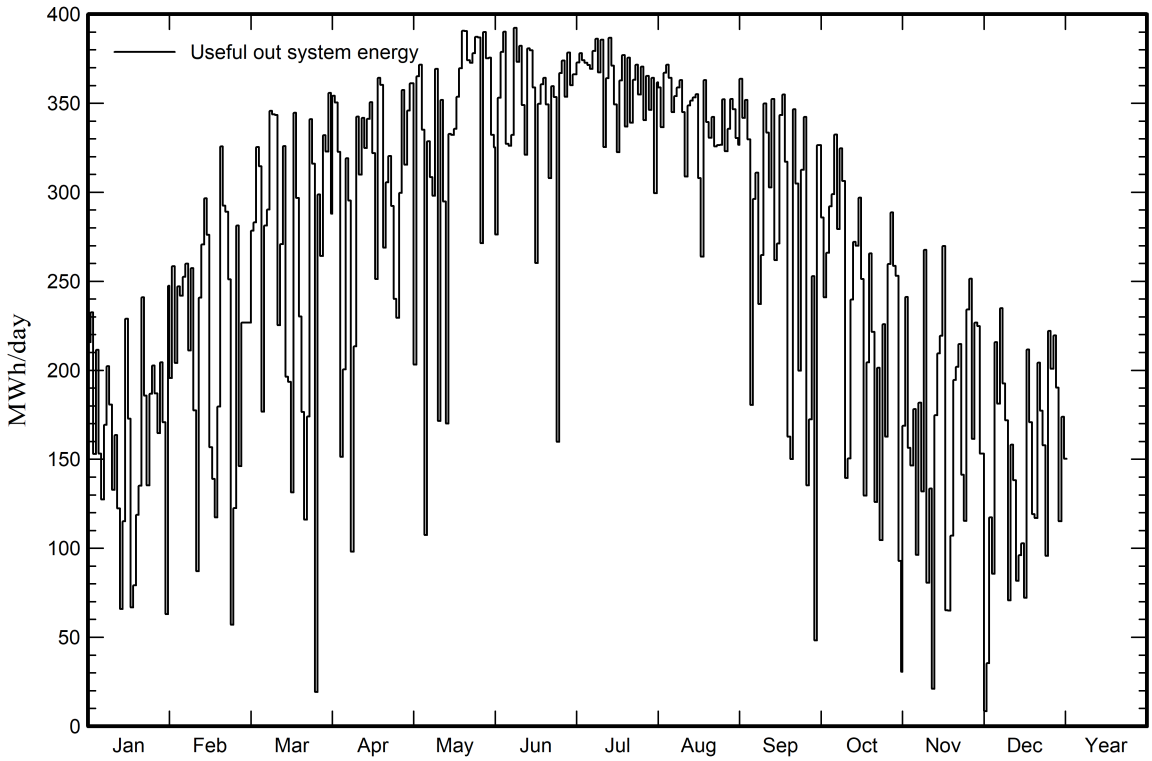


Diagramma giornaliero entrata/uscita

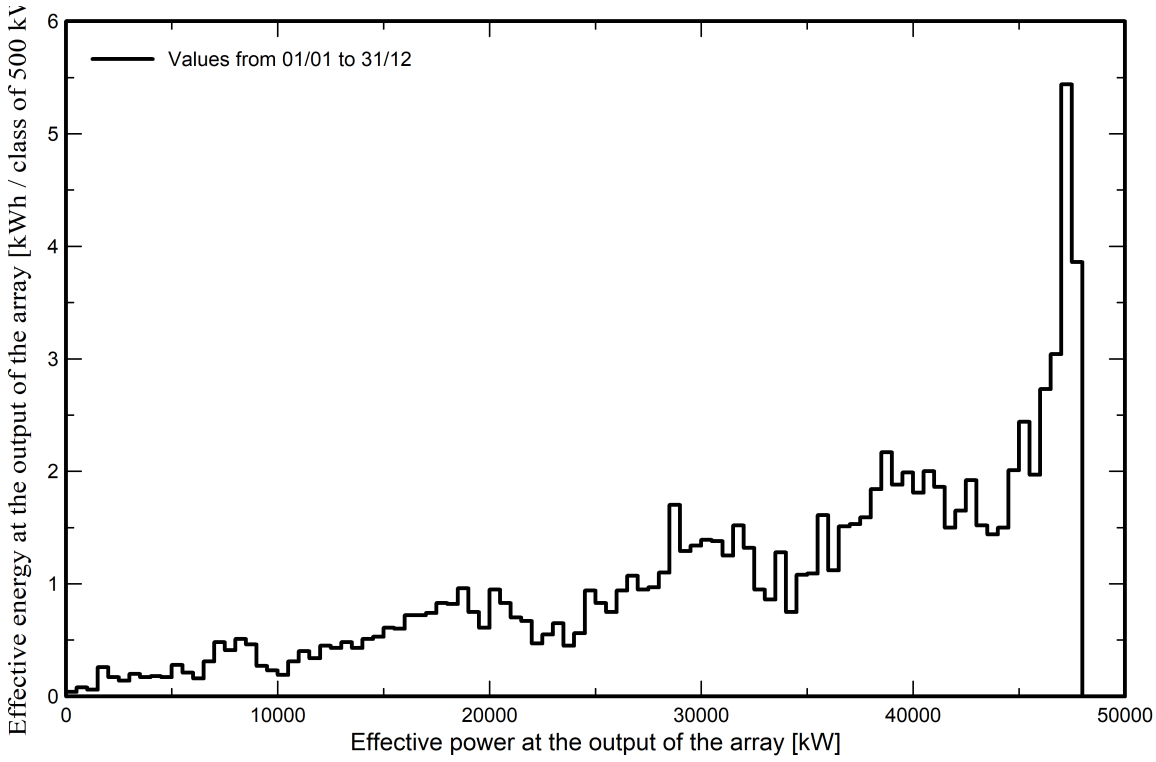


Predef. graphs

Energia giornaliera in uscita sistema

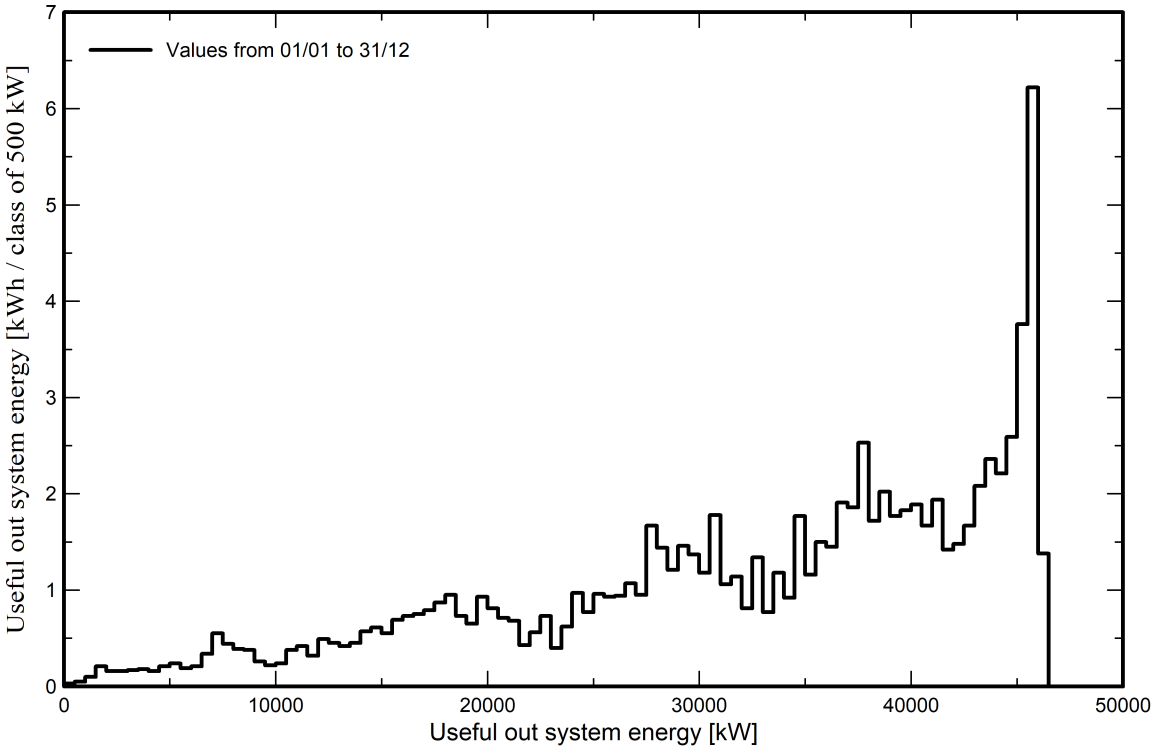


Distribuzione potenza dell'impianto

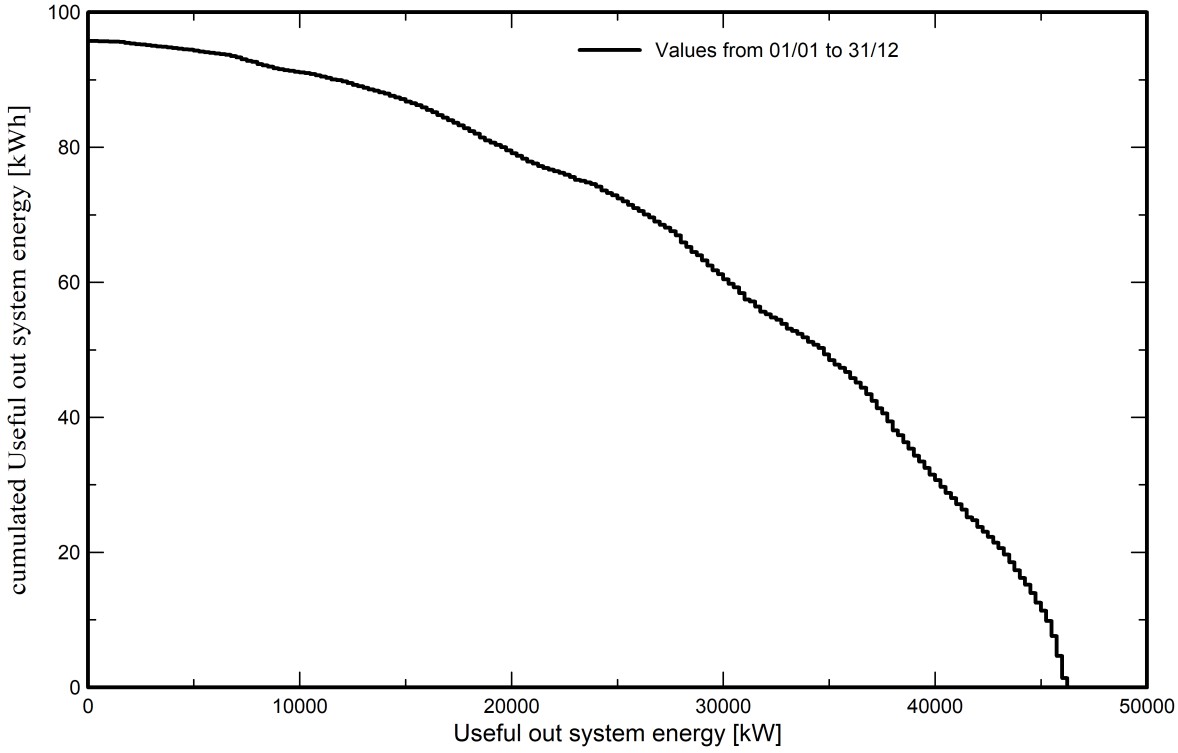


Predef. graphs

Distribuzione potenza in uscita sistema

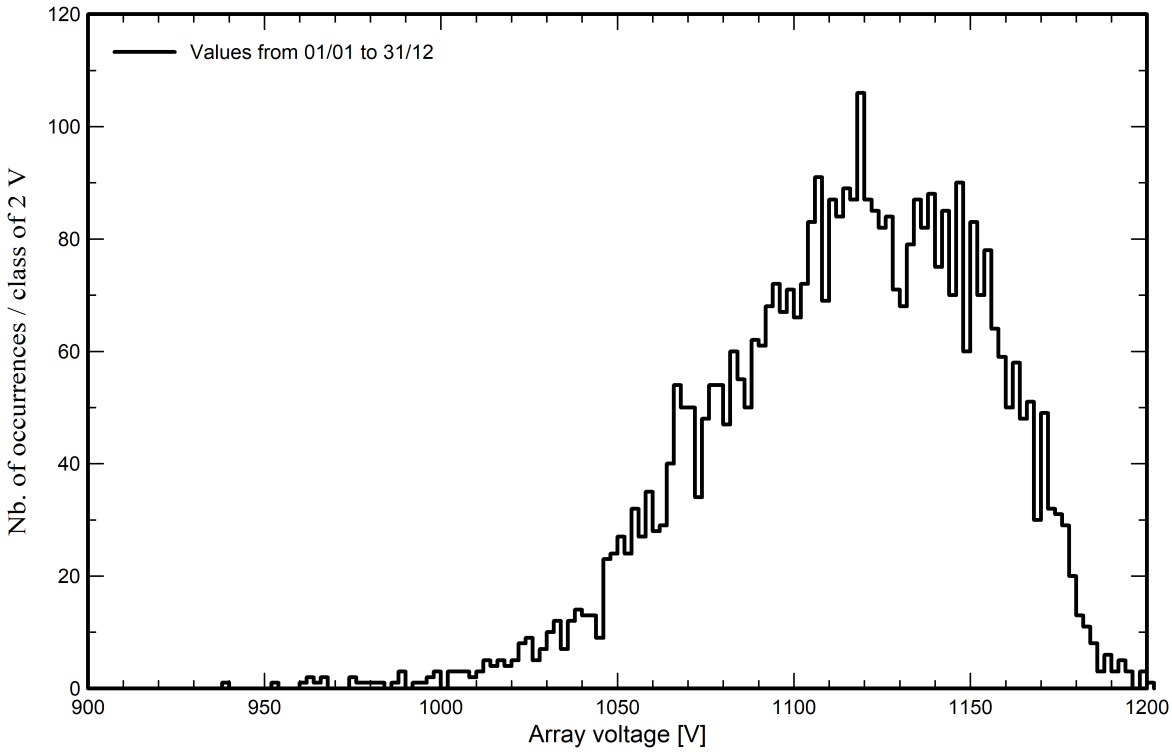


Coda della distribuzione della potenza in uscita

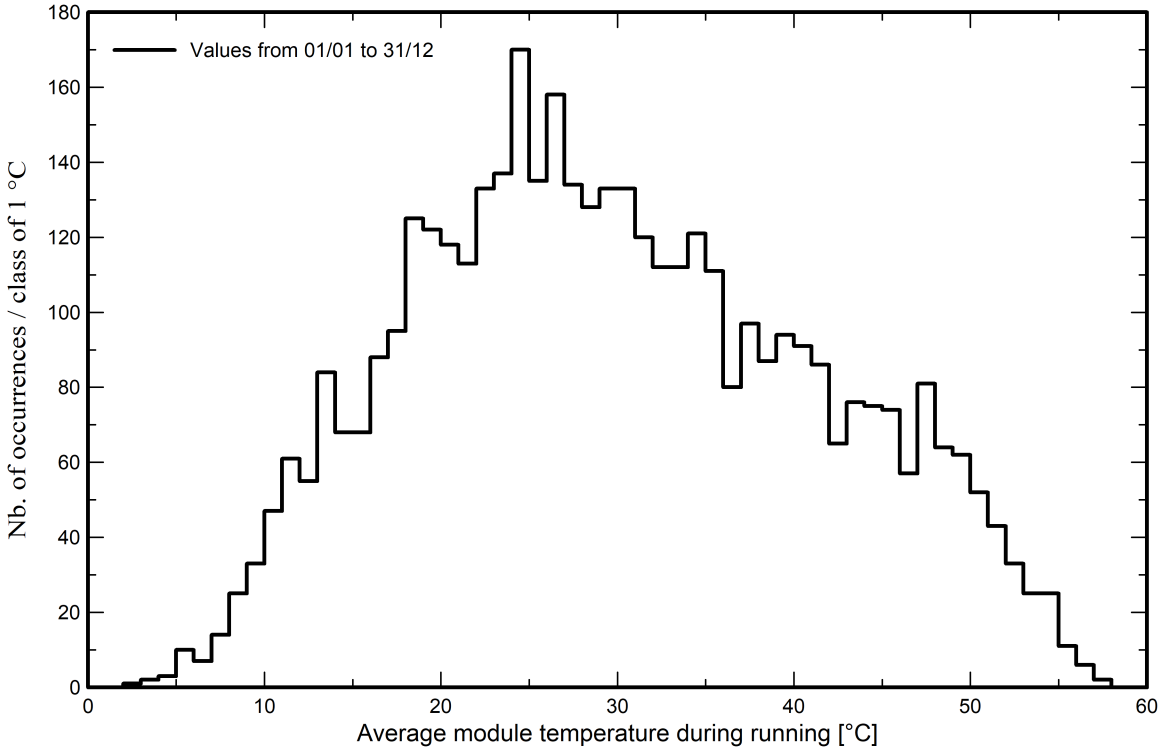


Predef. graphs

Distribuzione tensione impianto



Distribuzione temperatura impianto



PVsyst V7.4.6
VC0, Simulation date:
25/03/24 11:39
with V7.4.6

P50 - P90 evaluation

Weather data

Source	SolarGIS Monthly aver. , period not spec.
Kind	Specific year
Year	Sintetico
Year-to-year variability(Variance)	3.9 %

Specified Deviation

Year deviation from average	0.0 %

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 %

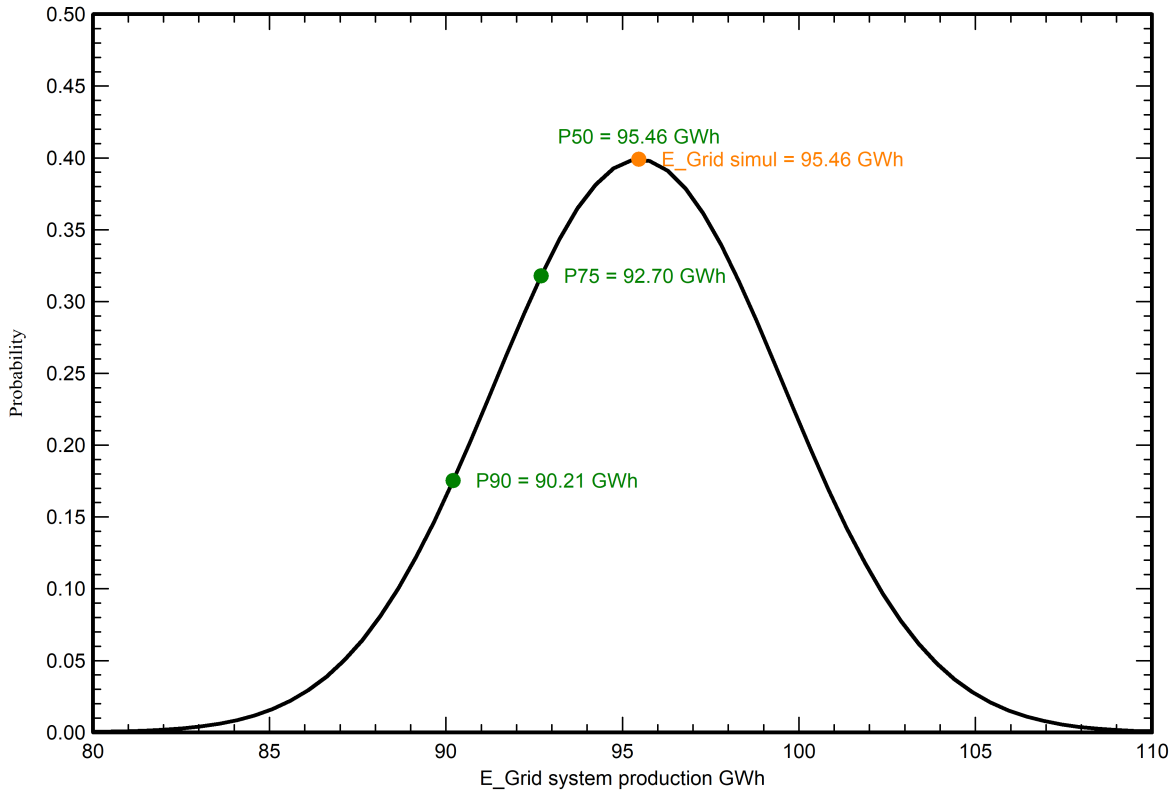
Global variability (weather data + system)

Variability (Quadratic sum)	4.3 %

Annual production probability

Variability	4.10 GWh
P50	95.46 GWh
P90	90.21 GWh
P75	92.70 GWh

Probability distribution



CO_2 Emission Balance

Total: 1547307.9 tCO_2

Generated emissions

Total: 92752.40 tCO_2

Source: Detailed calculation from table below

Replaced Emissions

Total: 1890198.9 tCO_2

System production: 95464.59 MWh/yr

Grid Lifecycle Emissions: 660 gCO_2/kWh

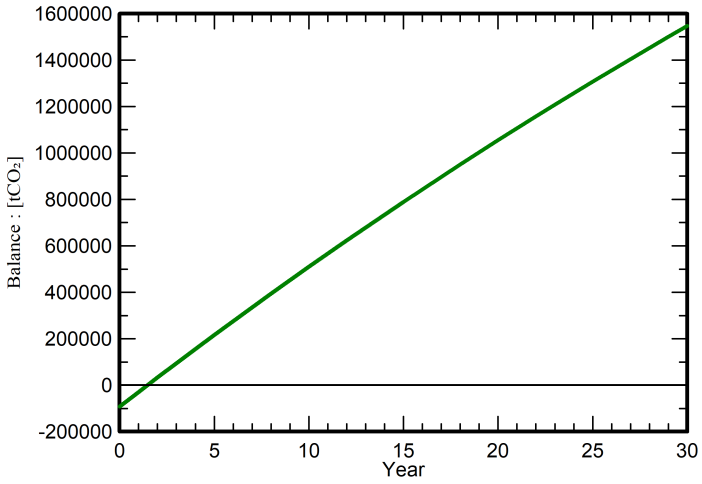
Source: IEA List

Country: Zimbabwe

Lifetime: 30 years

Annual degradation: 1.0 %

Saved CO_2 Emission vs. Time



System Lifecycle Emissions Details

Item	LCE	Quantity	Subtotal
			[$kgCO_2$]
Modules	1649 kgCO2/kWp	54088 kWp	89206165
Supports	4.40 kgCO2/kg	801300 kg	3527483
Inverters	436 kgCO2/units	43.0 units	18754

Version 7.4.6

PVsyst - Simulation report

Grid-Connected System

Progetto: Butera 80 MW

PV Area Est

Impianto a strutture fisse

System power: 39.24 MWp

Pozzillo - Italy

PVsyst V7.4.6
VC1, Simulation date:
25/03/24 12:19
with V7.4.6

Project summary

Geographical Site
Pozzillo
Italy

Situation

Latitude	37.23 °N
Longitude	14.23 °E
Altitude	343 m
Time zone	UTC+1

Project settings

Albedo	0.20

Weather data
Butera
SolarGIS Monthly aver. , period not spec. - Sintetico

System summary

Grid-Connected System
Simulation for year no 1

Impianto a strutture fisse

PV Field Orientation
Fixed plane
Tilt/Azimuth 25.1 / 0.7 °

Near Shadings
According to strings : Fast (table)
Electrical effect 100 %

User's needs
Unlimited load (grid)

System information

PV Array

Nb. of modules	58140 units
Pnom total	39.24 MWp

Inverters

Nb. of units	31 units
Pnom total	34.10 MWac
Pnom ratio	1.151

Results summary

Produced Energy	69059392 kWh/year	Specific production	1760 kWh/kWp/year	Perf. Ratio PR	86.82 %

Table of contents

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PVsyst V7.4.6
VC1, Simulation date:
25/03/24 12:19
with V7.4.6

General parameters

Grid-Connected System — **Impianto a strutture fisse**

PV Field Orientation

Orientation
Fixed plane
Tilt/Azimuth 25.1 / 0.7 °

Sheds configuration
Nb. of sheds 1938 units
Identical arrays

Sizes
Sheds spacing 8.40 m
Collector width 4.79 m
Ground Cov. Ratio (GCR) 57.0 %

Shading limit angle
Limit profile angle 26.6 °

Models used
Transposition Perez
Diffuse Perez, Meteonorm
Circumsolar separate

Horizon
Average Height 5.9 °

Near Shadings
According to strings : Fast (table)
Electrical effect 100 %

User's needs
Unlimited load (grid)

Bifacial system
Model 2D Calculation
unlimited sheds

Bifacial model geometry		Bifacial model definitions	
Sheds spacing	8.40 m	Ground albedo	0.20
Sheds width	4.79 m	Bifaciality factor	80 %
Limit profile angle	26.6 °	Rear shading factor	10.0 %
GCR	57.0 %	Rear mismatch loss	10.0 %
Height above ground	1.50 m	Shed transparent fraction	0.0 %

PV Array Characteristics

PV module
Manufacturer CSI Solar
Model CS7N-675TB-AG 1500V
(Original PVsyst database)
Unit Nom. Power 675 Wp
Number of PV modules 58140 units
Nominal (STC) 39.24 MWp

Inverter
Manufacturer Sungrow
Model SG1100-UD
(Custom parameters definition)
Unit Nom. Power 1100 kWac
Number of inverters 31 units
Total power 34100 kWac

Array #1 - Sottocampo #16
Number of PV modules 10800 units
Nominal (STC) 7290 kWp
Modules 360 string x 30 In series
At operating cond. (50°C)
Pmpp 6743 kWp
U mpp 1078 V
I mpp 6254 A

Number of inverters 6 units
Total power 6600 kWac
Operating voltage 895-1500 V
Pnom ratio (DC:AC) 1.10

Array #2 - Sottocampo #17
Number of PV modules 1920 units
Nominal (STC) 1296 kWp
Modules 64 string x 30 In series
At operating cond. (50°C)
Pmpp 1199 kWp
U mpp 1078 V
I mpp 1112 A

Number of inverters 1 unit
Total power 1100 kWac
Operating voltage 895-1500 V
Pnom ratio (DC:AC) 1.18

PV Array Characteristics

Array #3 - Sottocampo #18

Number of PV modules	5850 units	Number of inverters	3 units
Nominal (STC)	3949 kWp	Total power	3300 kWac
Modules	195 string x 30 In series		
At operating cond. (50°C)		Operating voltage	895-1500 V
Pmpp	3652 kWp	Pnom ratio (DC:AC)	1.20
U mpp	1078 V		
I mpp	3388 A		

Array #4 - Sottocampo #19

Number of PV modules	3750 units	Number of inverters	2 units
Nominal (STC)	2531 kWp	Total power	2200 kWac
Modules	125 string x 30 In series		
At operating cond. (50°C)		Operating voltage	895-1500 V
Pmpp	2341 kWp	Pnom ratio (DC:AC)	1.15
U mpp	1078 V		
I mpp	2171 A		

Array #5 - Sottocampo #20

Number of PV modules	5700 units	Number of inverters	3 units
Nominal (STC)	3848 kWp	Total power	3300 kWac
Modules	190 string x 30 In series		
At operating cond. (50°C)		Operating voltage	895-1500 V
Pmpp	3559 kWp	Pnom ratio (DC:AC)	1.17
U mpp	1078 V		
I mpp	3301 A		

Array #6 - Sottocampo #21

Number of PV modules	5940 units	Number of inverters	3 units
Nominal (STC)	4010 kWp	Total power	3300 kWac
Modules	198 string x 30 In series		
At operating cond. (50°C)		Operating voltage	895-1500 V
Pmpp	3708 kWp	Pnom ratio (DC:AC)	1.22
U mpp	1078 V		
I mpp	3440 A		

Array #7 - Sottocampo #22

Number of PV modules	7950 units	Number of inverters	4 units
Nominal (STC)	5366 kWp	Total power	4400 kWac
Modules	265 string x 30 In series		
At operating cond. (50°C)		Operating voltage	895-1500 V
Pmpp	4963 kWp	Pnom ratio (DC:AC)	1.22
U mpp	1078 V		
I mpp	4604 A		

Array #8 - Sottocampo #23

Number of PV modules	2010 units	Number of inverters	1 unit
Nominal (STC)	1357 kWp	Total power	1100 kWac
Modules	67 string x 30 In series		
At operating cond. (50°C)		Operating voltage	895-1500 V
Pmpp	1255 kWp	Pnom ratio (DC:AC)	1.23
U mpp	1078 V		
I mpp	1164 A		

PV Array Characteristics

Array #9 - Sottocampo #24

Number of PV modules	2010 units	Number of inverters	1 unit
Nominal (STC)	1357 kWp	Total power	1100 kWac
Modules	67 string x 30 In series		
At operating cond. (50°C)		Operating voltage	895-1500 V
Pmpp	1255 kWp	Pnom ratio (DC:AC)	1.23
U mpp	1078 V		
I mpp	1164 A		

Array #10 - Sottocampo #25

Number of PV modules	2010 units	Number of inverters	1 unit
Nominal (STC)	1357 kWp	Total power	1100 kWac
Modules	67 string x 30 In series		
At operating cond. (50°C)		Operating voltage	895-1500 V
Pmpp	1255 kWp	Pnom ratio (DC:AC)	1.23
U mpp	1078 V		
I mpp	1164 A		

Array #11 - Sottocampo #26

Number of PV modules	5130 units	Number of inverters	3 units
Nominal (STC)	3463 kWp	Total power	3300 kWac
Modules	171 string x 30 In series		
At operating cond. (50°C)		Operating voltage	895-1500 V
Pmpp	3203 kWp	Pnom ratio (DC:AC)	1.05
U mpp	1078 V		
I mpp	2971 A		

Array #12 - Sottocampo #27

Number of PV modules	5070 units	Number of inverters	3 units
Nominal (STC)	3422 kWp	Total power	3300 kWac
Modules	169 string x 30 In series		
At operating cond. (50°C)		Operating voltage	895-1500 V
Pmpp	3165 kWp	Pnom ratio (DC:AC)	1.04
U mpp	1078 V		
I mpp	2936 A		

Total PV power

Nominal (STC)	39245 kWp
Total	58140 modules
Module area	180603 m²

Total inverter power

Total power	34100 kWac
Number of inverters	31 units
Pnom ratio	1.15

Array losses

Array Soiling Losses

Loss Fraction	3.0 %

Thermal Loss factor

Module temperature according to irradiance	
Uc (const)	29.0 W/m²K
Uv (wind)	0.0 W/m²K/m/s

Serie Diode Loss

Voltage drop	0.7 V
Loss Fraction	0.1 % at STC

LID - Light Induced Degradation

Loss Fraction	1.0 %

Module Quality Loss

Loss Fraction	-0.4 %

Module mismatch losses

Loss Fraction	0.5 % at MPP

Strings Mismatch loss

Loss Fraction	0.2 %

Module average degradation

Year no	1
Loss factor	0.4 %/year
Mismatch due to degradation	
Imp RMS dispersion	0.4 %/year
Vmp RMS dispersion	0.4 %/year

Array losses

IAM loss factor

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

DC wiring losses

Global wiring resistance 0.52 mΩ
Loss Fraction 1.5 % at STC

Array #1 - Sottocampo #16
Global array res. 2.8 mΩ
Loss Fraction 1.5 % at STC

Array #2 - Sottocampo #17
Global array res. 16 mΩ
Loss Fraction 1.5 % at STC

Array #3 - Sottocampo #18
Global array res. 5.2 mΩ
Loss Fraction 1.5 % at STC

Array #4 - Sottocampo #19
Global array res. 8.1 mΩ
Loss Fraction 1.5 % at STC

Array #5 - Sottocampo #20
Global array res. 5.3 mΩ
Loss Fraction 1.5 % at STC

Array #6 - Sottocampo #21
Global array res. 5.1 mΩ
Loss Fraction 1.5 % at STC

Array #7 - Sottocampo #22
Global array res. 3.8 mΩ
Loss Fraction 1.5 % at STC

Array #8 - Sottocampo #23
Global array res. 15 mΩ
Loss Fraction 1.5 % at STC

Array #9 - Sottocampo #24
Global array res. 15 mΩ
Loss Fraction 1.5 % at STC

Array #10 - Sottocampo #25
Global array res. 15 mΩ
Loss Fraction 1.5 % at STC

Array #11 - Sottocampo #26
Global array res. 5.9 mΩ
Loss Fraction 1.5 % at STC

Array #12 - Sottocampo #27
Global array res. 6.0 mΩ
Loss Fraction 1.5 % at STC

System losses

Auxiliaries loss

Proportionnal to Power 3.0 W/kW
0.0 kW from Power thresh.

AC wiring losses

Inv. output line up to MV transfo

Inverter voltage 630 Vac tri
Loss Fraction 0.06 % at STC

Inverter: SG1100-UD
Wire section (31 Inv.) Copper 31 x 3 x 1000 mm²
Average wires length 10 m

MV line up to Injection

MV Voltage 36 kV
Average each inverter
Wires Alu 3 x 700 mm²
Length 6250 m
Loss Fraction 0.42 % at STC

AC losses in transformers

MV transfo

Medium voltage	36 kV

One transfo parameters	
Nominal power at STC	19.38 MVA
Iron Loss (night disconnect)	18.41 kVA
Iron loss fraction	0.10 % at STC
Copper loss	202.49 kVA
Copper loss fraction	1.05 % at STC
Coils equivalent resistance	3 x 0.21 mΩ

Operating losses at STC (full system)	
Nb. identical MV transfos	2
Nominal power at STC	38.75 MVA
Iron loss (night disconnect)	36.82 kVA
Copper loss	404.98 kVA

Horizon definition

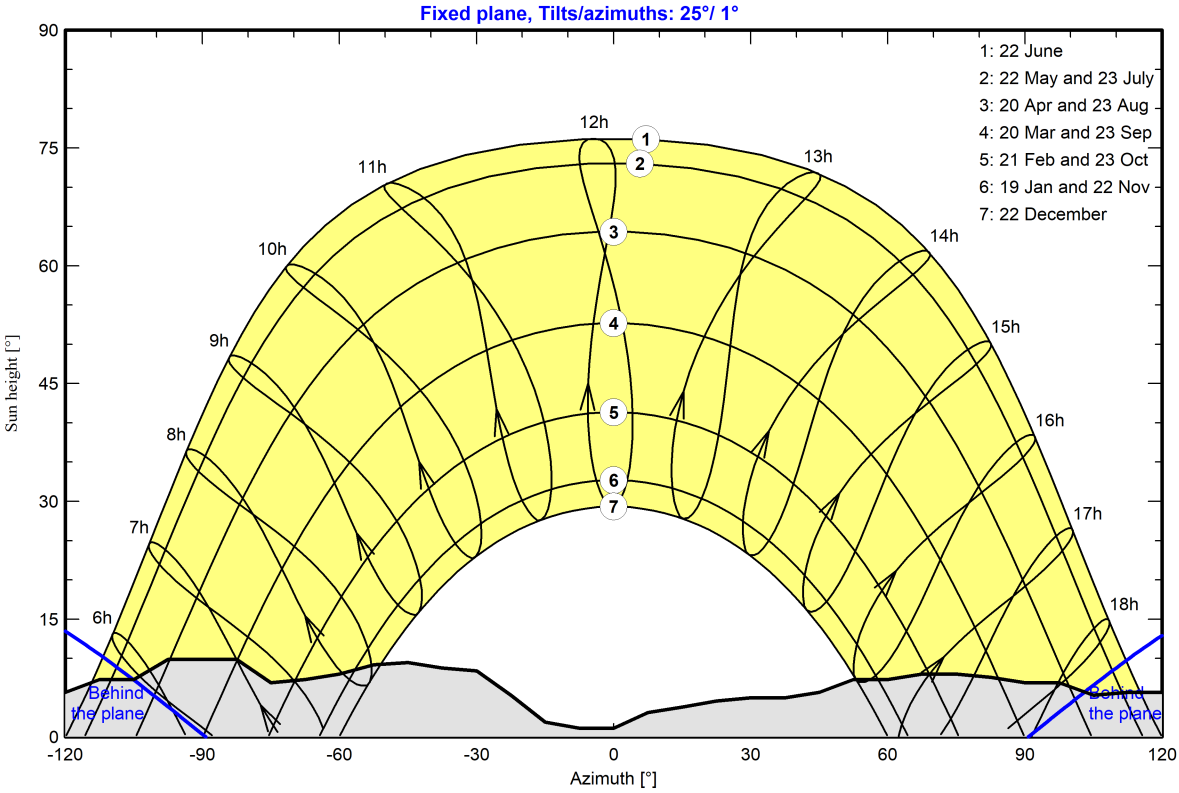
Horizon from PVGIS website API, Lat=37°13'33", Long=14°13'51", Alt=343m

Average Height	5.9 °	Albedo Factor	0.75
Diffuse Factor	0.96	Albedo Fraction	100 %

Horizon profile

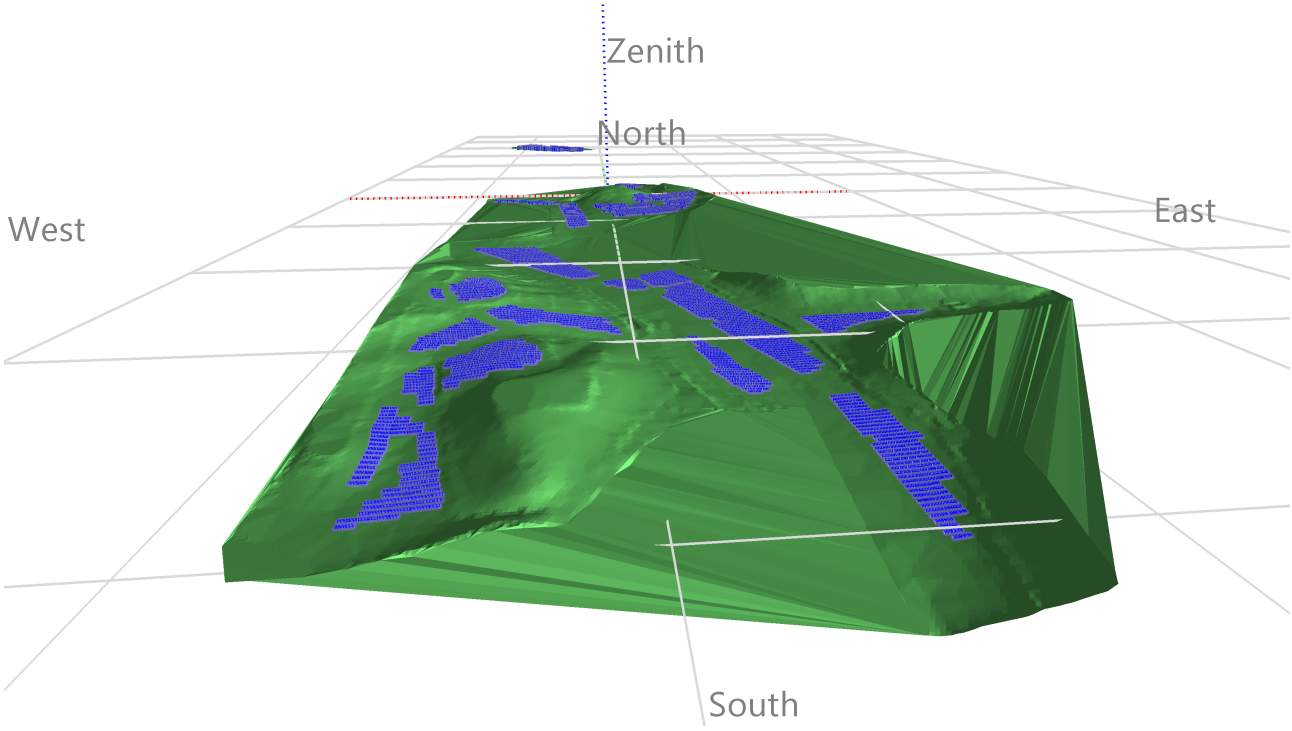
Azimuth [°]	-180	-173	-165	-158	-143	-135	-128	-120	-113	-105	-98	-83
Height [°]	3.8	4.6	5.7	6.1	6.1	5.3	5.0	5.7	7.3	7.3	9.9	9.9
Azimuth [°]	-75	-68	-60	-53	-45	-38	-30	-23	-15	-8	0	8
Height [°]	6.9	7.3	8.0	9.2	9.5	8.8	8.4	5.3	1.9	1.1	1.1	3.1
Azimuth [°]	15	23	30	38	45	53	60	68	75	83	90	98
Height [°]	3.8	4.6	5.0	5.0	5.7	7.3	7.3	8.0	8.0	7.6	6.9	6.9
Azimuth [°]	105	113	120	128	135	143	150	158	165	173	180	
Height [°]	5.3	5.7	5.7	5.3	4.2	2.7	3.1	3.4	3.1	3.4	3.8	

Sun Paths (Height / Azimuth diagram)



Near shadings parameter

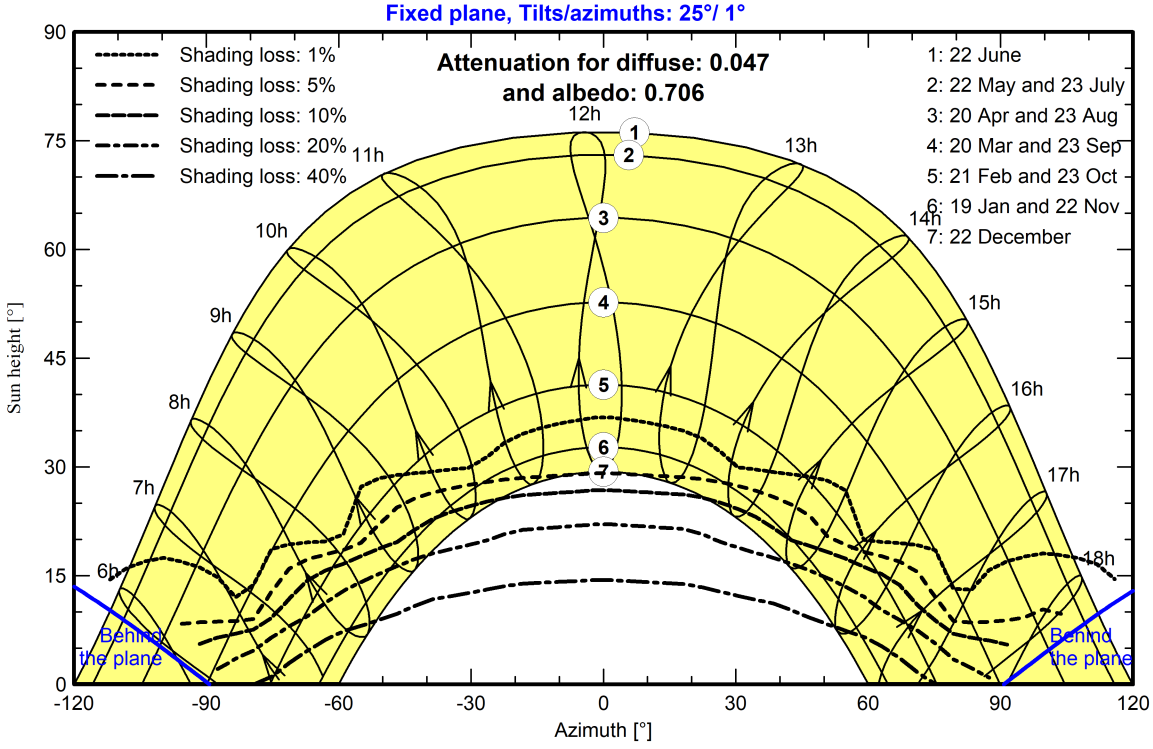
Perspective of the PV-field and surrounding shading scene



Iso-shadings diagram

Orientation #1

Fixed plane, Tilts/azimuths: 25°/ 1°

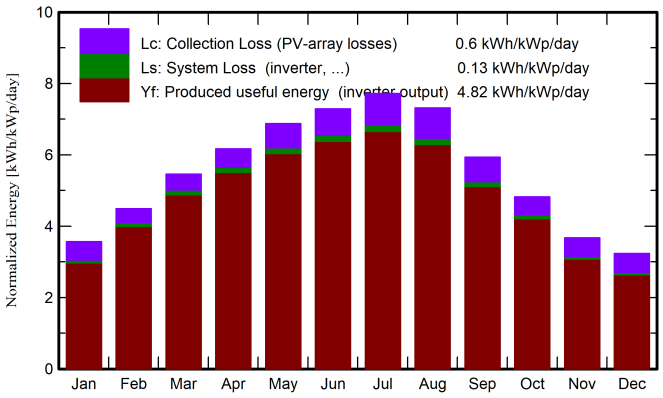


Main results

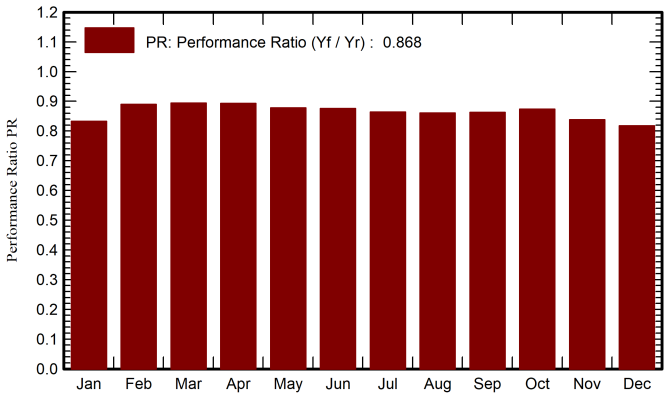
System Production

Produced Energy (P50)	69059392 kWh/year	Specific production (P50)	1760 kWh/kWp/year	Perf. Ratio PR	86.82 %
Produced Energy (P90)	65254657 kWh/year	Specific production (P90)	1663 kWh/kWp/year		
Produced Energy (P75)	67059039 kWh/year	Specific production (P75)	1709 kWh/kWp/year		

Normalized productions (per installed kWp)



Performance Ratio PR



Balances and main results

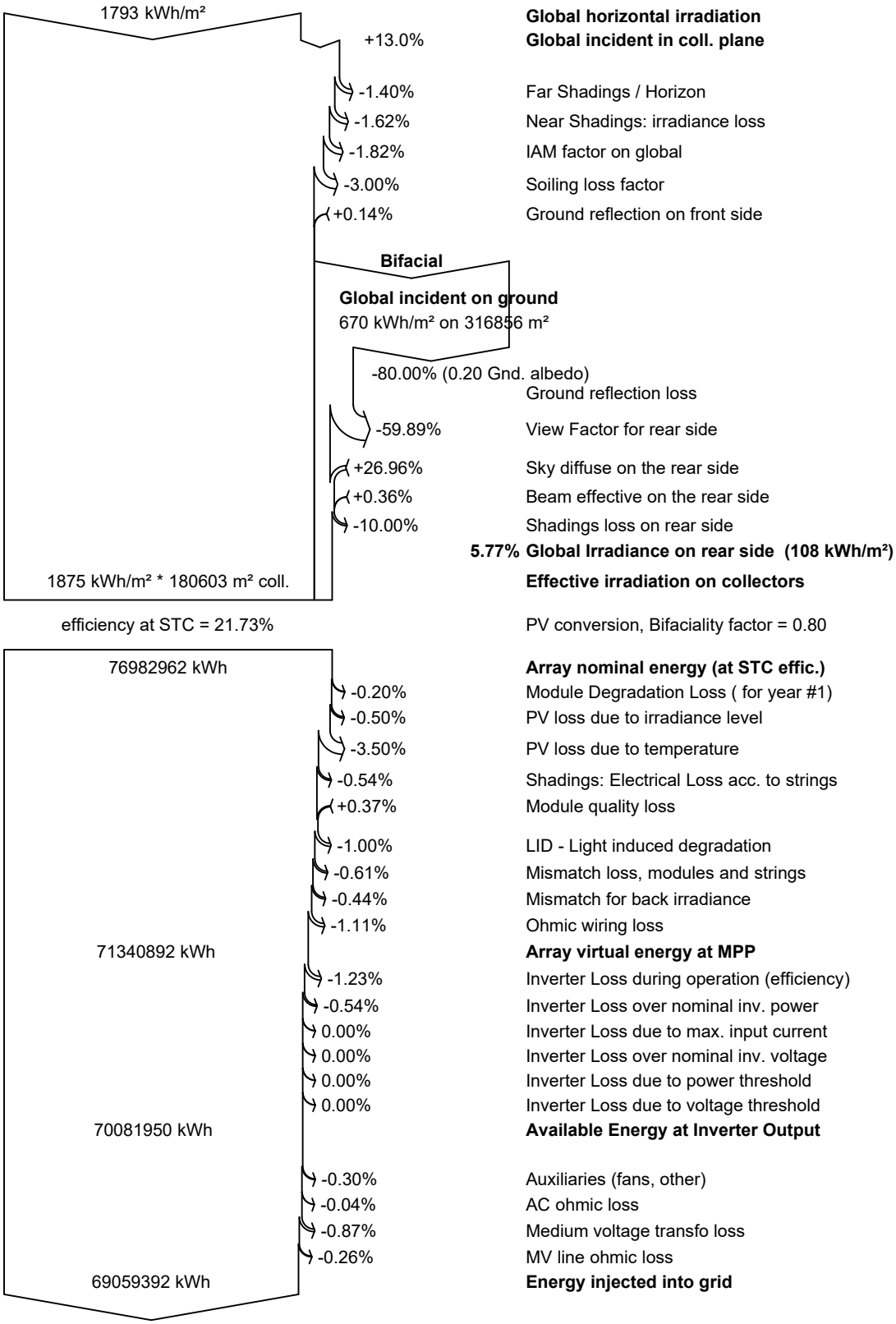
	GlobHor kWh/m²	DiffHor kWh/m²	T_Amb °C	GlobInc kWh/m²	GlobEff kWh/m²	EArray kWh	E_Grid kWh	PR ratio
January	73.4	30.70	9.60	110.6	98.3	3712333	3615438	0.833
February	92.6	37.60	9.70	125.8	116.1	4509780	4390182	0.890
March	140.4	54.90	11.50	169.3	157.5	6107128	5943911	0.894
April	170.8	67.30	14.30	185.0	172.2	6662502	6485320	0.893
May	214.8	73.90	18.50	213.3	198.8	7552201	7346011	0.878
June	228.3	71.60	22.70	218.7	204.3	7723578	7516051	0.876
July	244.9	67.20	25.20	239.2	224.0	8334505	8107060	0.864
August	214.6	64.00	25.50	226.8	212.3	7873185	7658055	0.860
September	155.3	58.00	22.30	178.0	165.4	6189253	6024428	0.862
October	116.4	48.10	18.70	149.5	138.6	5267542	5128713	0.874
November	76.4	34.10	14.50	110.3	98.8	3724416	3627657	0.838
December	65.4	28.40	10.89	100.3	88.6	3304134	3216566	0.818
Year	1793.3	635.80	16.99	2026.8	1874.9	70960557	69059392	0.868

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
E_Grid	Energy injected into grid
PR	Performance Ratio

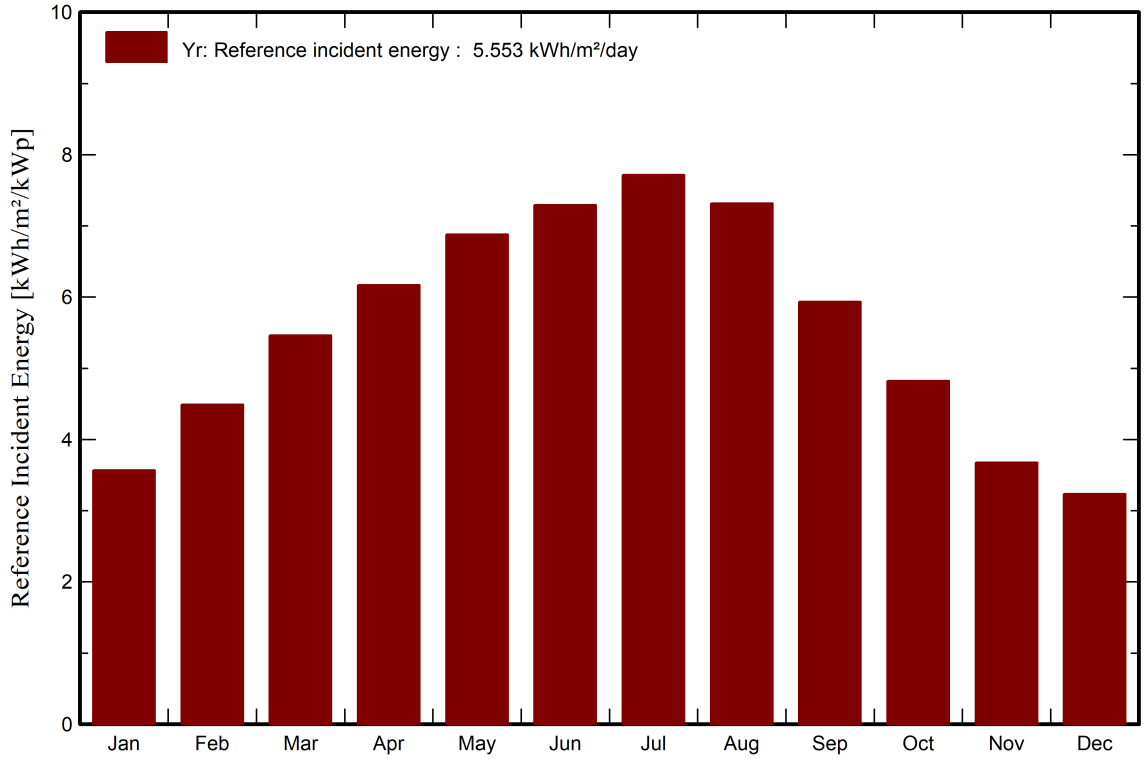
PVsyst V7.4.6
VC1, Simulation date:
25/03/24 12:19
with V7.4.6

Loss diagram

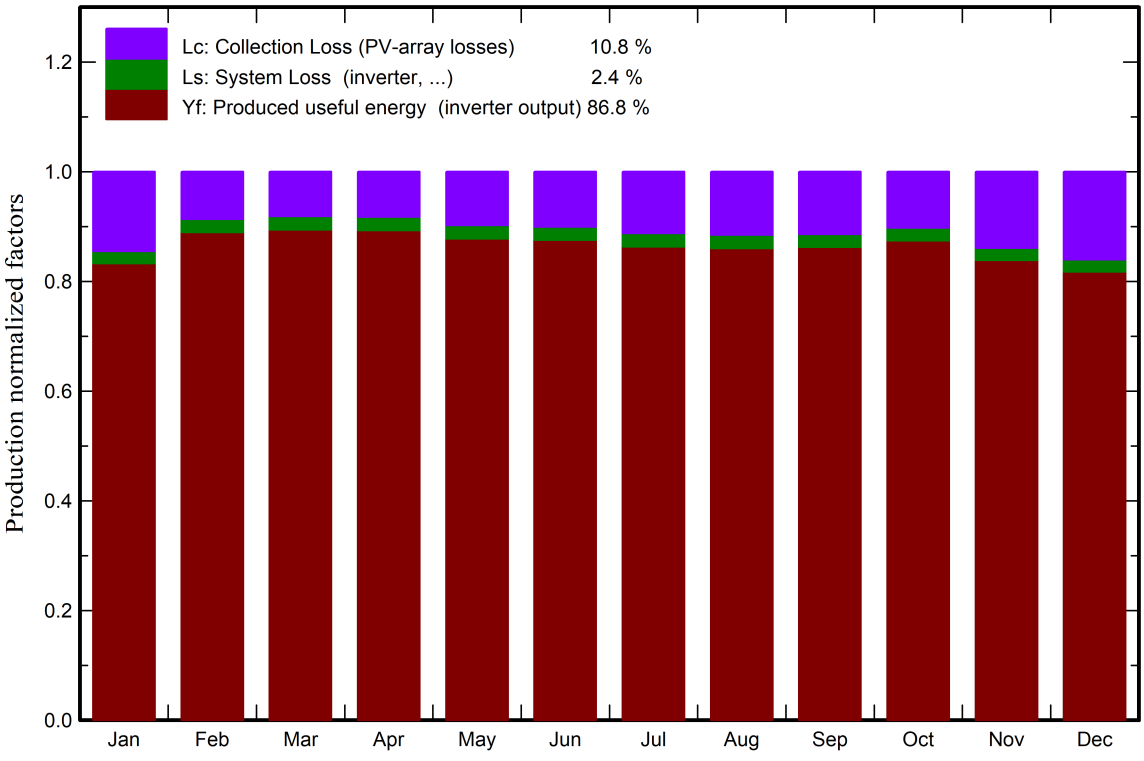


Predef. graphs

Energia incidente di riferimento su piano collettori

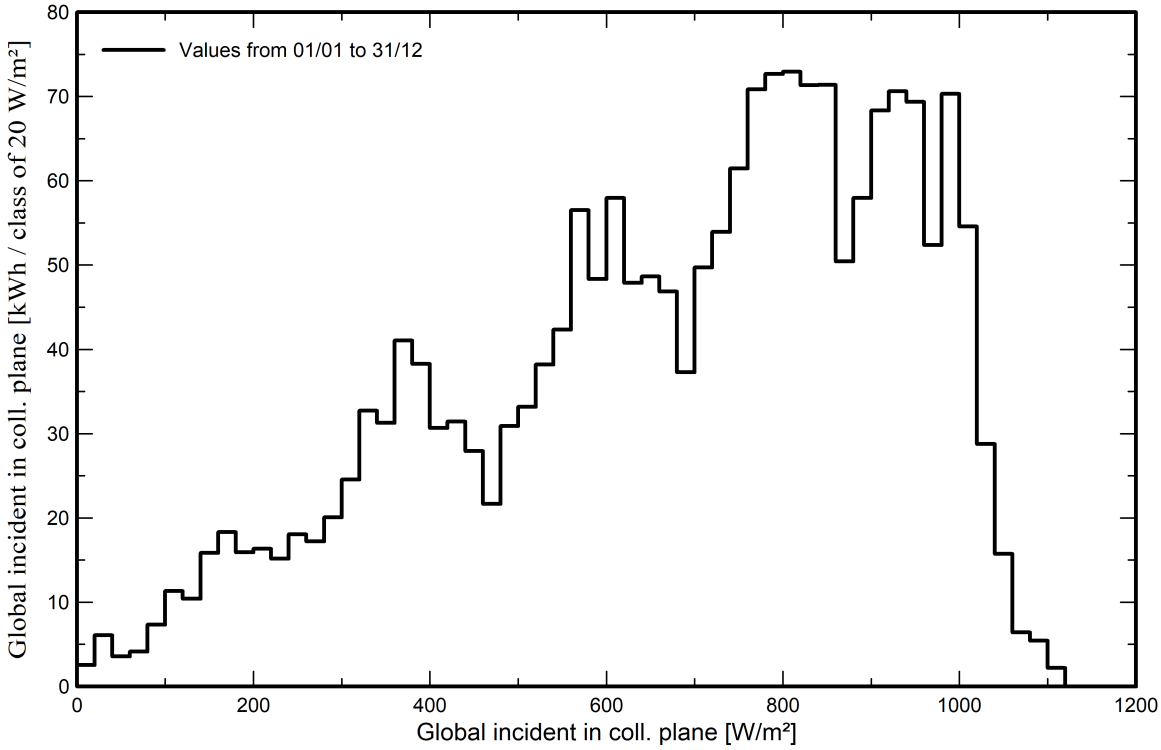


Fattori normalizzati di produzione e di perdita

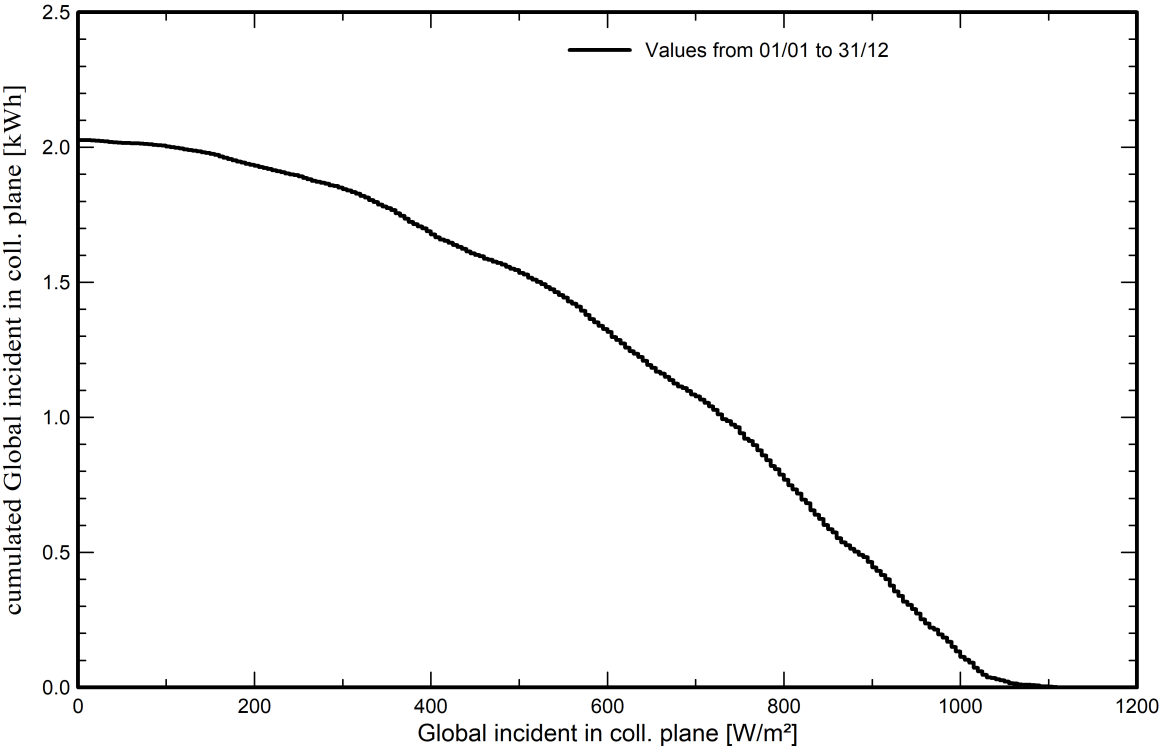


Predef. graphs

Distribuzione irraggiamento incidente



Coda della distribuzione di irradiazione incidente



Predef. graphs

Temperatura del campo vs.irradiazione efficace

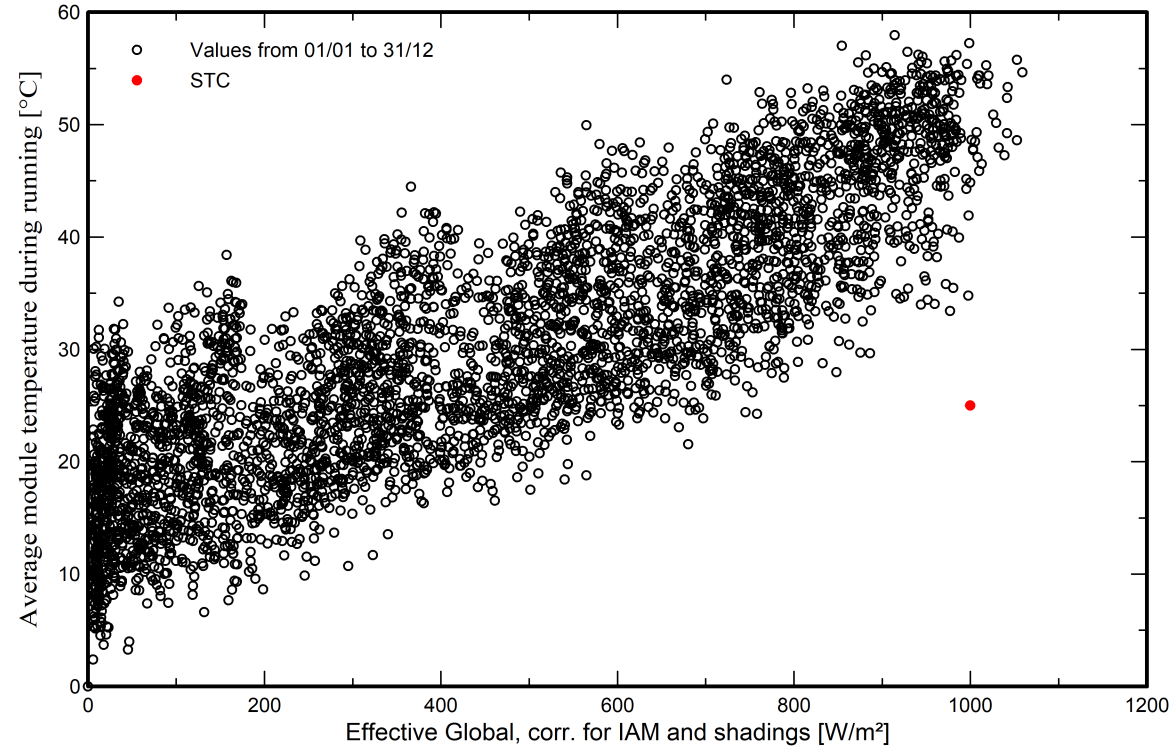
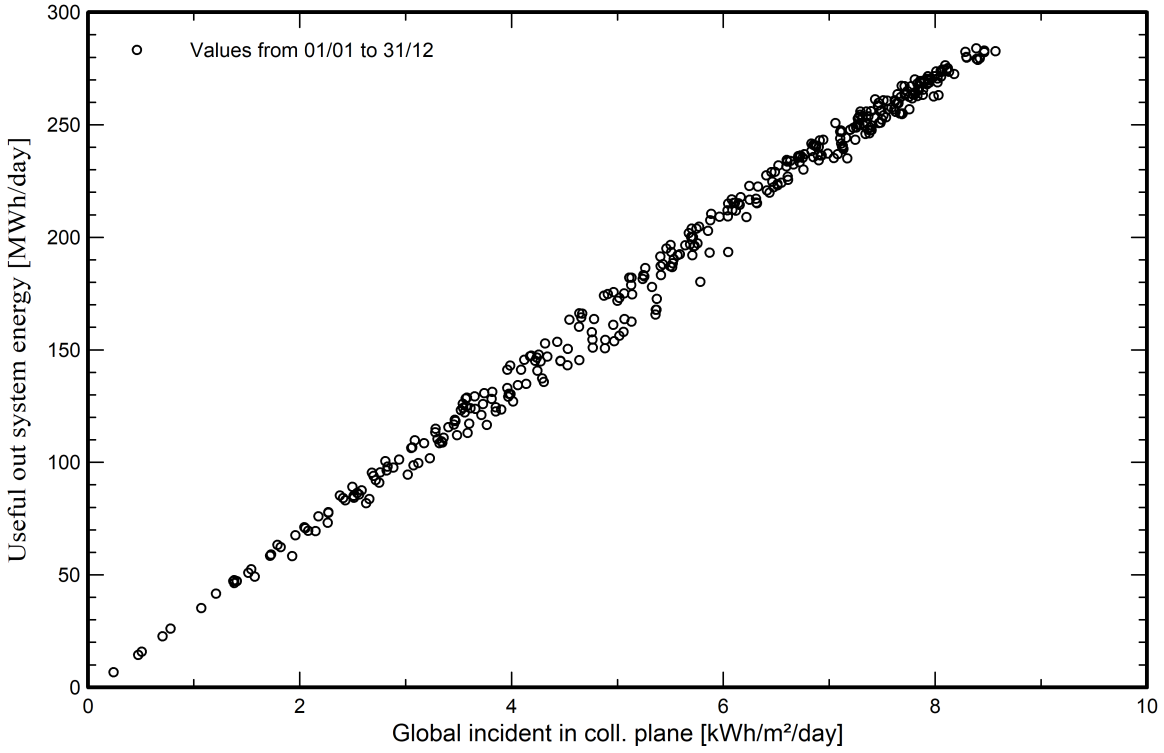
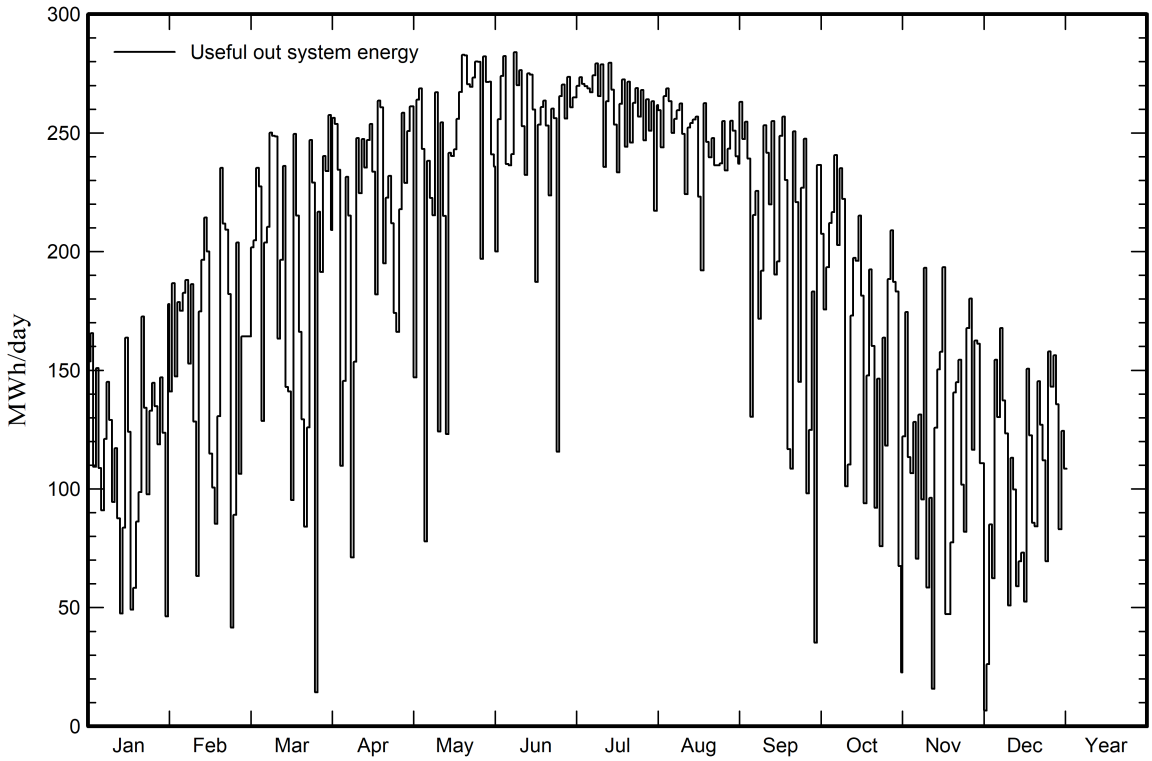


Diagramma giornaliero entrata/uscita

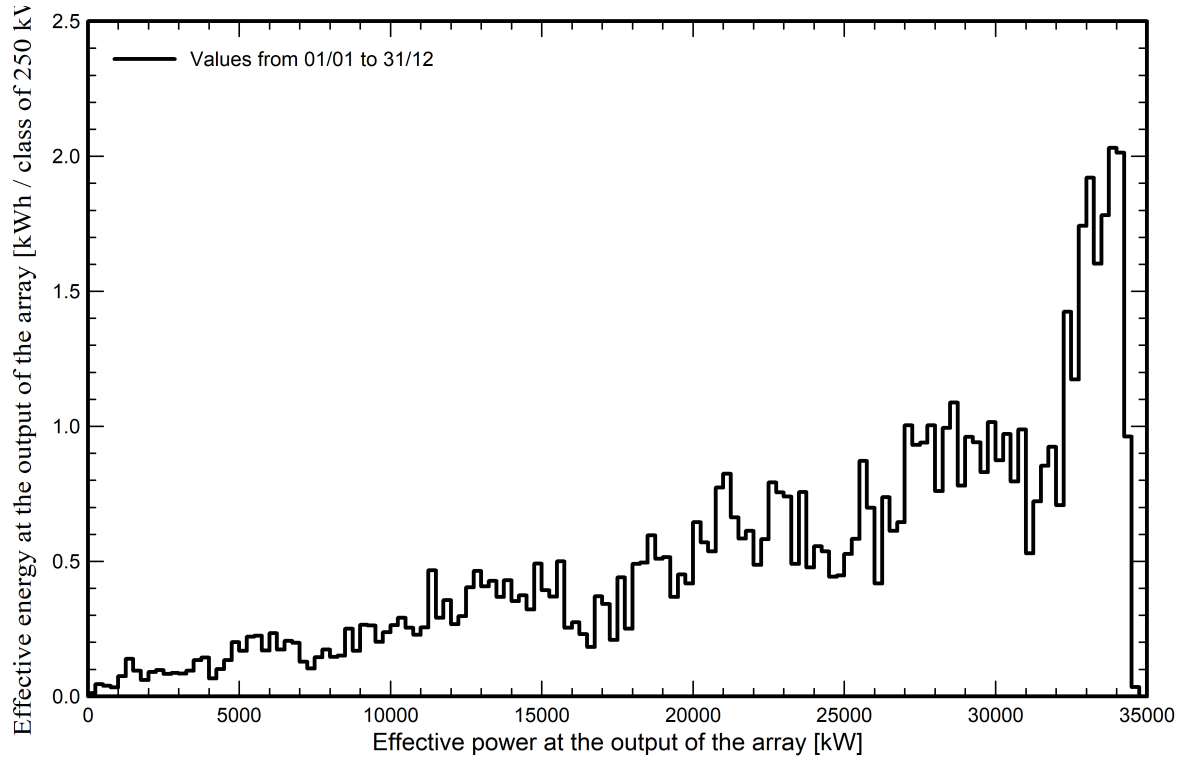


Predef. graphs

Energia giornaliera in uscita sistema

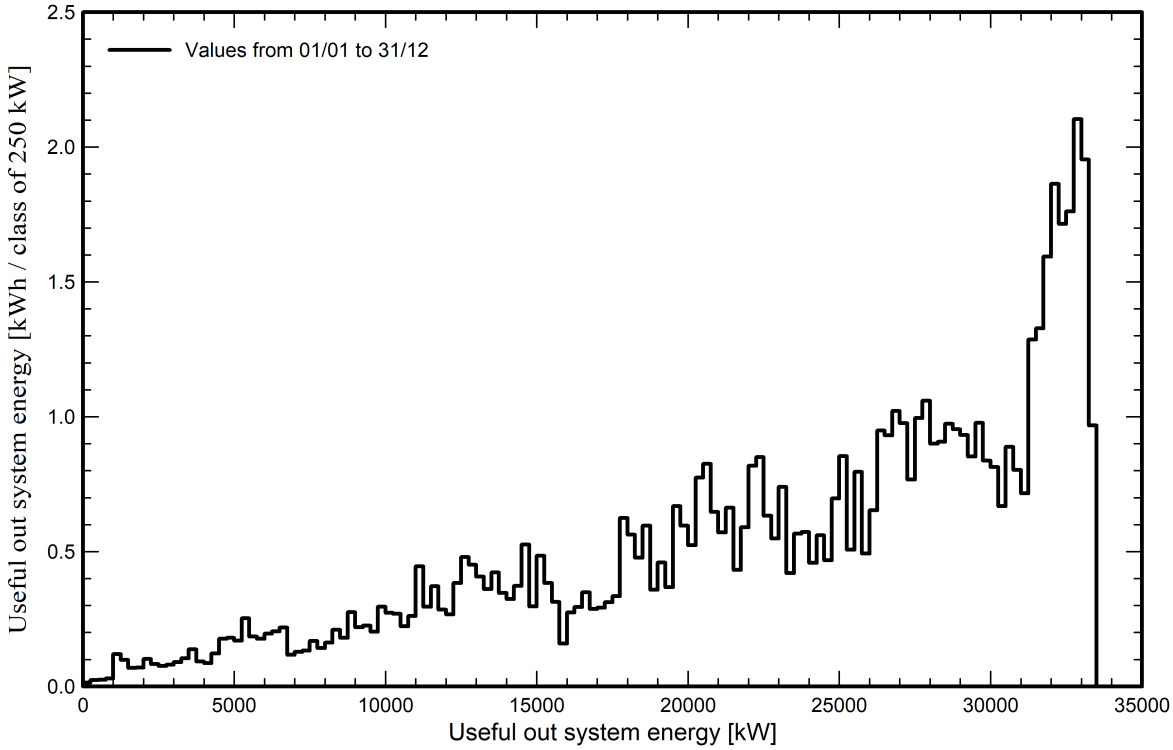


Distribuzione potenza dell'impianto

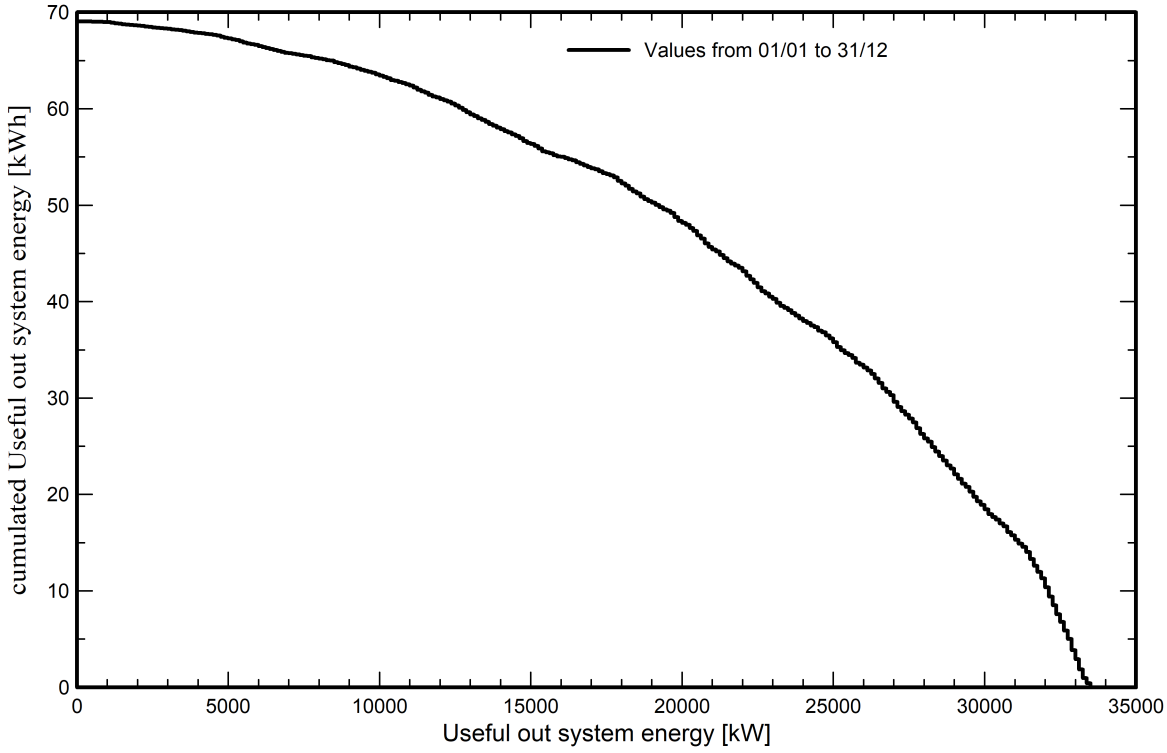


Predef. graphs

Distribuzione potenza in uscita sistema

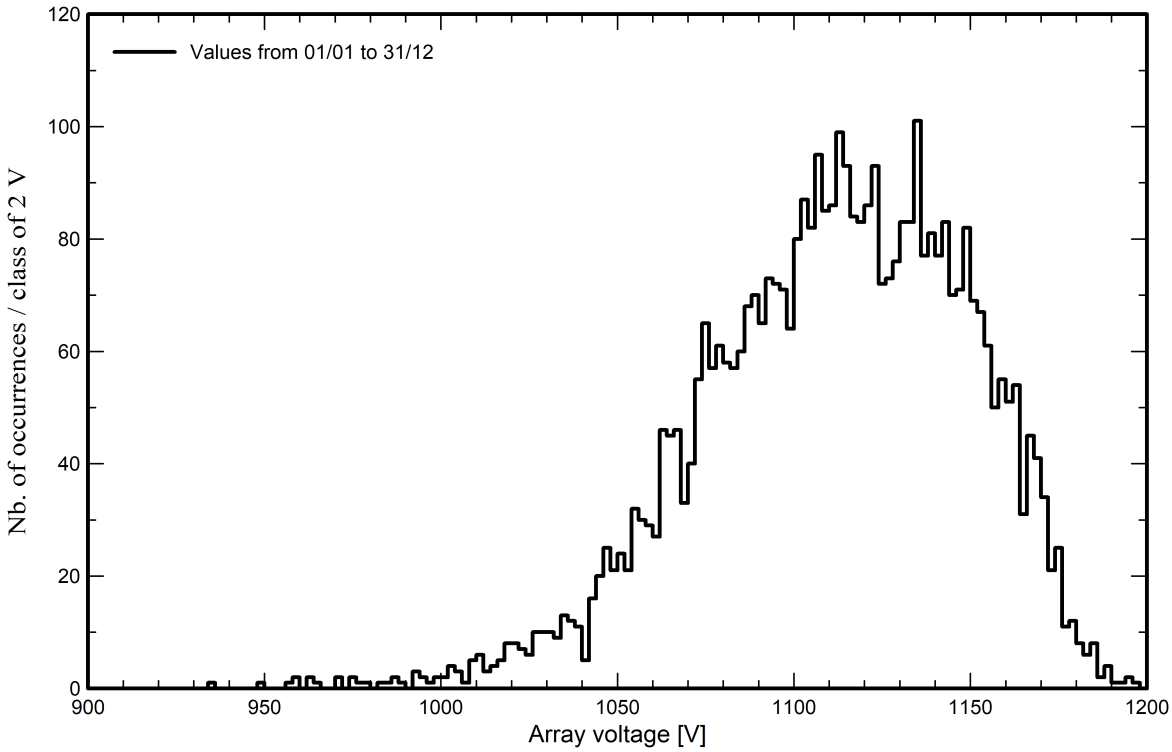


Coda della distribuzione della potenza in uscita

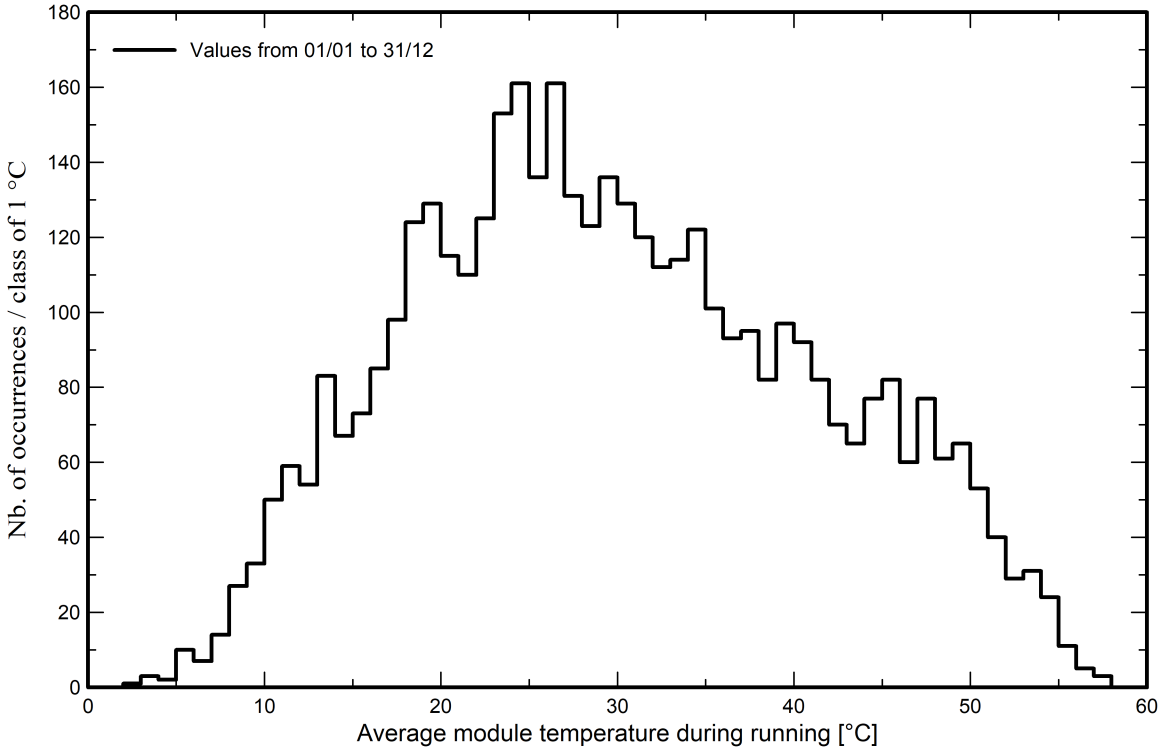


Predef. graphs

Distribuzione tensione impianto



Distribuzione temperatura impianto



P50 - P90 evaluation

Weather data

Source	SolarGIS Monthly aver. , period not spec.
Kind	Specific year
Year	Sintetico
Year-to-year variability(Variance)	3.9 %

Specified Deviation

Year deviation from average	0.0 %

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 %

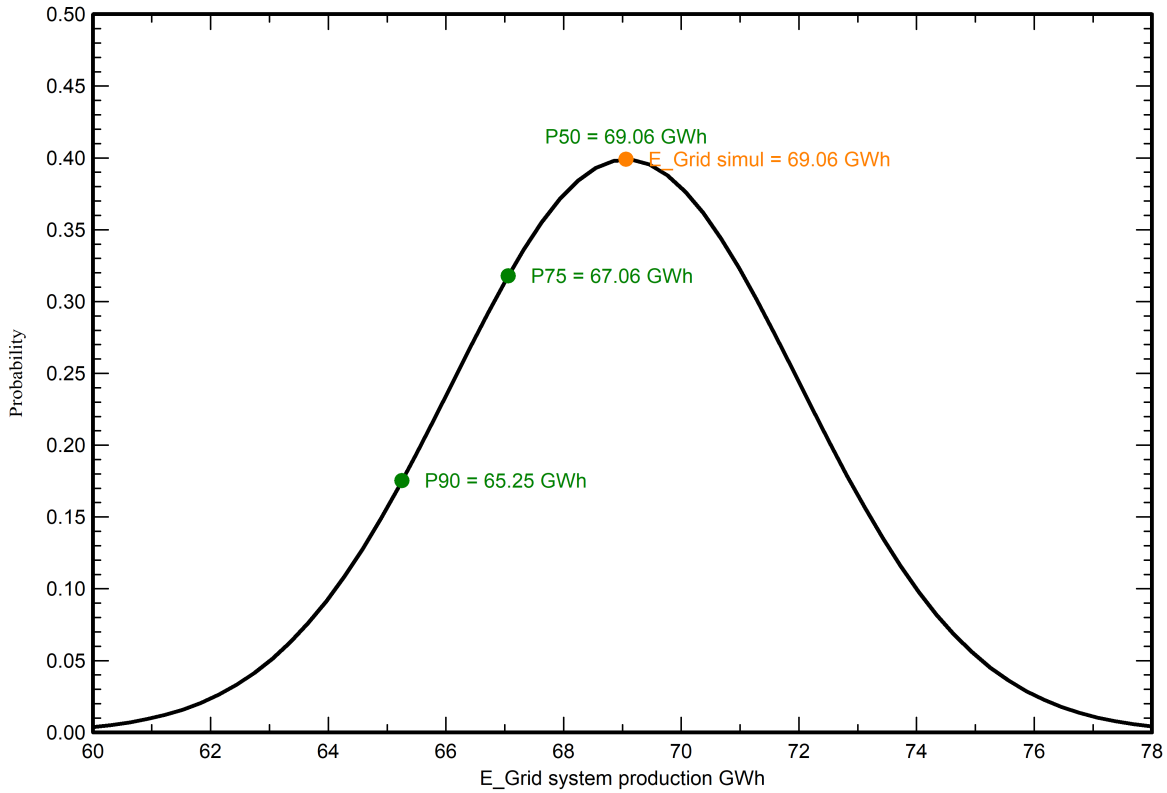
Global variability (weather data + system)

Variability (Quadratic sum)	4.3 %

Annual production probability

Variability	2.97 GWh
P50	69.06 GWh
P90	65.25 GWh
P75	67.06 GWh

Probability distribution



CO_2 Emission Balance

Total: 1093672.4 tCO_2

Generated emissions

Total: 92752.40 tCO_2

Source: Detailed calculation from table below

Replaced Emissions

Total: 1367376.0 tCO_2

System production: 69059.39 MWh/yr

Grid Lifecycle Emissions: 660 gCO_2/kWh

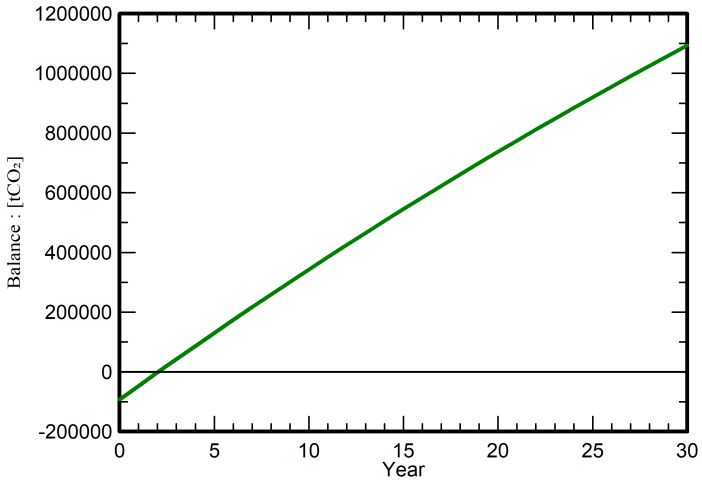
Source: IEA List

Country: Zimbabwe

Lifetime: 30 years

Annual degradation: 1.0 %

Saved CO_2 Emission vs. Time



System Lifecycle Emissions Details

Item	LCE	Quantity	Subtotal
			[$kgCO_2$]
Modules	1649 kgCO2/kWp	54088 kWp	89206165
Supports	4.40 kgCO2/kg	801300 kg	3527483
Inverters	436 kgCO2/units	43.0 units	18754