

PVsyst - Simulation report

Grid-Connected System

Project: Sistema Agrovoltáico TFM

Máster en Energías Renovables

System power: 5320 kWp

Pozo de la Serna - Spain



PVsyst V7.4.8

VC0, Simulation date:
06/09/24 19:17
with V7.4.8

Universidad Europea (Spain)

Project summary

Geographical Site

Pozo de la Serna

Spain

Situation

Latitude 38.77 °N

Longitude -3.19 °W

Altitude 788 m

Time zone UTC+1

Project settings

Albedo 0.20

Weather data

Pozo de la Serna

Meteonorm 8.1 (1996-2015), Sat=100% - Sintético

System summary

Grid-Connected System

PV Field Orientation

Orientation

Tracking plane, horizontal N-S axis

Axis azimuth 0 °

Tracking algorithm

Astronomic calculation

Near Shadings

No Shadings

User's needs

Unlimited load (grid)

System information

PV Array

Nb. of modules

13300 units

Pnom total

5320 kWp

Inverters

Nb. of units

35 units

Pnom total

5250 kWac

Pnom ratio

1.013

Results summary

Produced Energy	11265289 kWh/year	Specific production	2118 kWh/kWp/year	Perf. Ratio PR	87.23 %
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Table of contents

Project and results summary	2
General parameters, PV Array Characteristics, System losses	3
Main results	4
Loss diagram	5
Predef. graphs	6
P50 - P90 evaluation	12
Single-line diagram	13



General parameters

Grid-Connected System

Horizon

Free Horizon

PV Field Orientation

Orientation

Tracking plane, horizontal N-S axis

Axis azimuth 0 °

Models used

Transposition Perez

Diffuse Perez, Meteonorm

Circumsolar separate

Tracking algorithm

Astronomic calculation

Trackers configuration

No 3D scene defined

Near Shadings

No Shadings

User's needs

Unlimited load (grid)

PV Array Characteristics

PV module

Manufacturer

Generic

Model

TSM-400-NEG9-28

(Original PVsyst database)

Unit Nom. Power

400 Wp

Number of PV modules

13300 units

Nominal (STC)

5320 kWp

Modules

700 string x 19 In series

At operating cond. (50°C)

Pmpp

4930 kWp

U mpp

609 V

I mpp

8093 A

Total PV power

Nominal (STC)

5320 kWp

Total

13300 modules

Module area

25801 m²

Inverter

Manufacturer

Generic

Model

SUN2000-150K-MG0-400V

(Original PVsyst database)

Unit Nom. Power

150 kWac

Number of inverters

35 units

Total power

5250 kWac

Operating voltage

200-1000 V

Max. power (=>30°C)

165 kWac

Pnom ratio (DC:AC)

1.01

Power sharing within this inverter

Total inverter power

Total power

5250 kWac

Max. power

5775 kWac

Number of inverters

35 units

Pnom ratio

1.01

Array losses

Thermal Loss factor

Module temperature according to irradiance

Uc (const)

20.0 W/m²K

Uv (wind)

0.0 W/m²K/m/s

DC wiring losses

Global array res.

1.2 mΩ

Loss Fraction

1.5 % at STC

Module Quality Loss

Loss Fraction

-0.4 %

Module mismatch losses

Loss Fraction

2.0 % at MPP

Strings Mismatch loss

Loss Fraction

0.1 %

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



Main results

System Production

Produced Energy

11265289 kWh/year

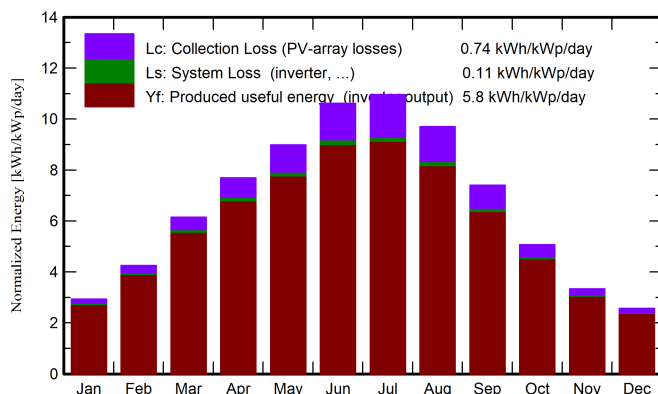
Specific production

2118 kWh/kWp/year

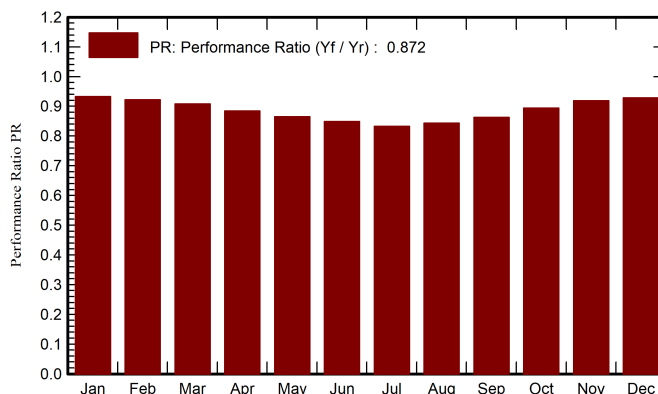
Perf. Ratio PR

87.23 %

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 kWh	E_Grid kWh	PR ratio
January	64.0	31.29	5.53	91.0	88.9	458394	451339	0.933
February	86.8	36.93	7.22	118.9	117.0	592978	583112	0.922
March	134.6	53.89	10.63	190.5	188.5	936035	919659	0.908
April	167.5	60.22	13.50	230.8	229.0	1107060	1086223	0.884
May	200.9	69.83	18.41	278.6	276.6	1307803	1282392	0.865
June	225.4	61.88	24.15	318.5	316.8	1468051	1438814	0.849
July	240.2	57.85	28.08	339.8	338.3	1537626	1506051	0.833
August	209.7	60.27	27.34	300.9	299.3	1377287	1350058	0.843
September	153.3	50.54	21.71	222.0	220.2	1038714	1019109	0.863
October	110.7	44.13	16.39	157.1	155.1	759673	746791	0.894
November	68.9	30.49	9.33	99.9	97.9	496437	488371	0.919
December	57.3	28.40	6.07	79.6	77.5	399607	393372	0.929
Year	1719.3	585.72	15.75	2427.4	2405.1	11479667	11265289	0.872

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

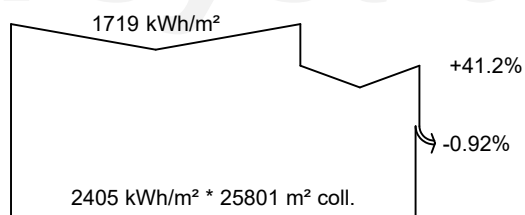
EArray Effective energy at the output of the array

E_Grid Energy injected into grid

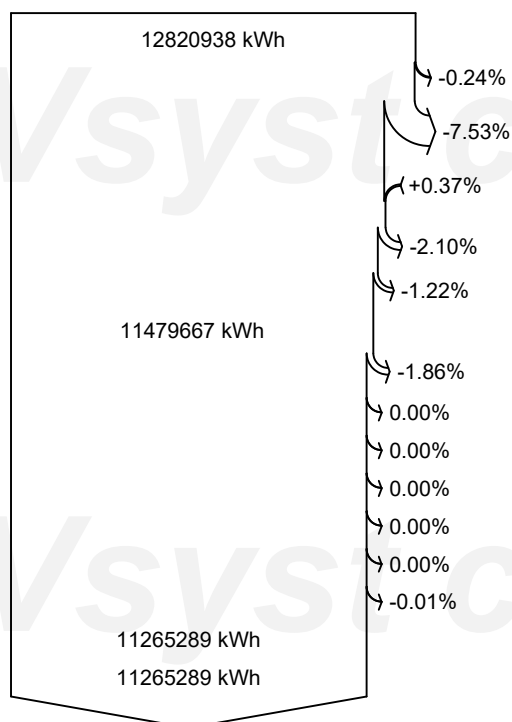
PR Performance Ratio



Loss diagram



efficiency at STC = 20.66%



Global horizontal irradiation

Global incident in coll. plane

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

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

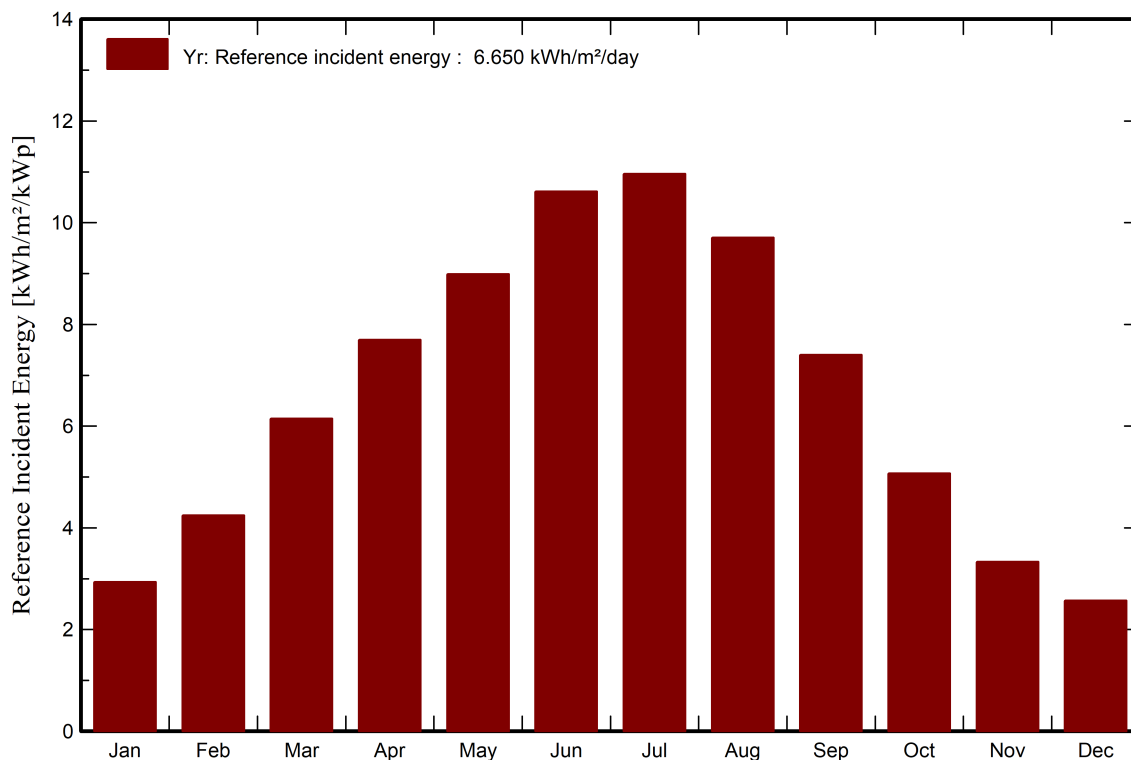
Available Energy at Inverter Output

Energy injected into grid

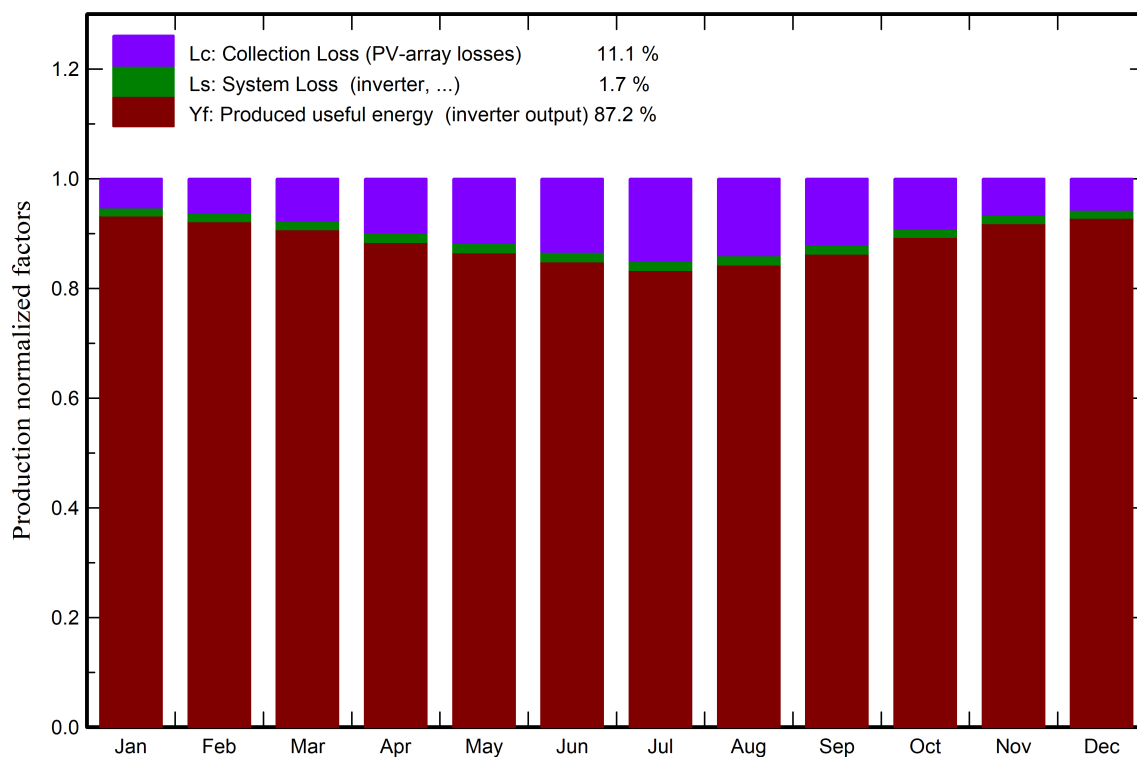


Predef. graphs

Energía incidente de referencia en el plano colector



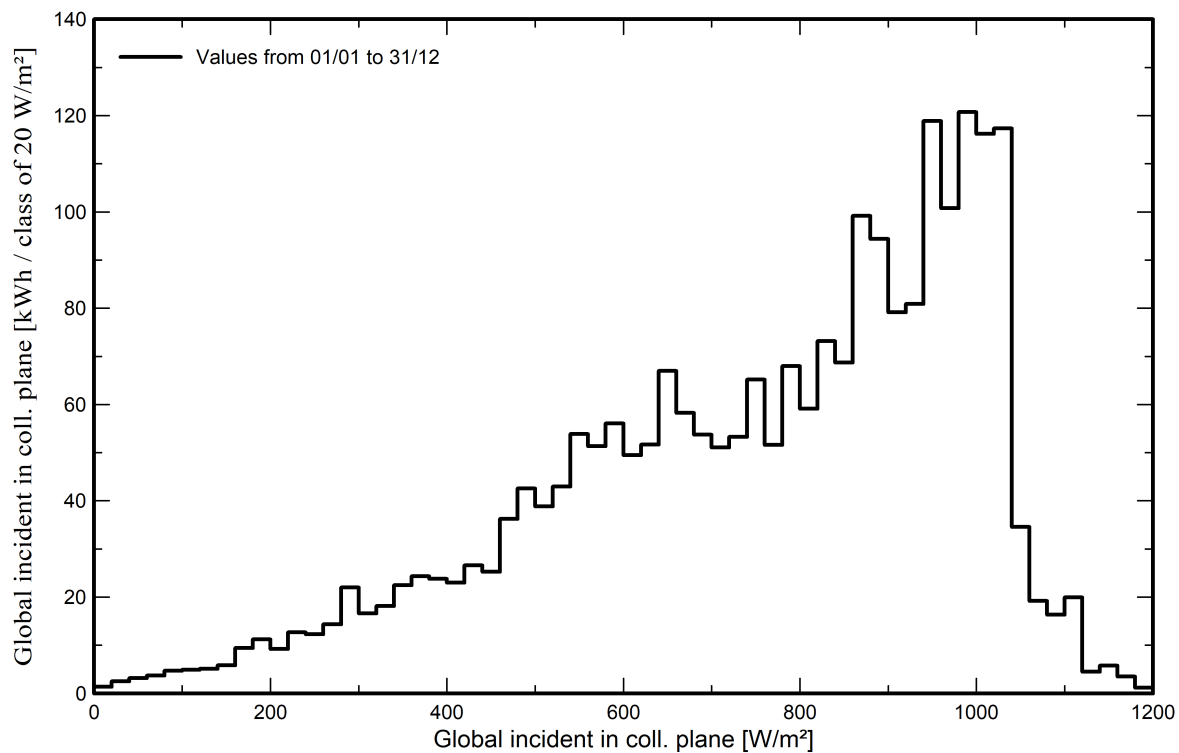
Producción normalizada y factores de pérdida



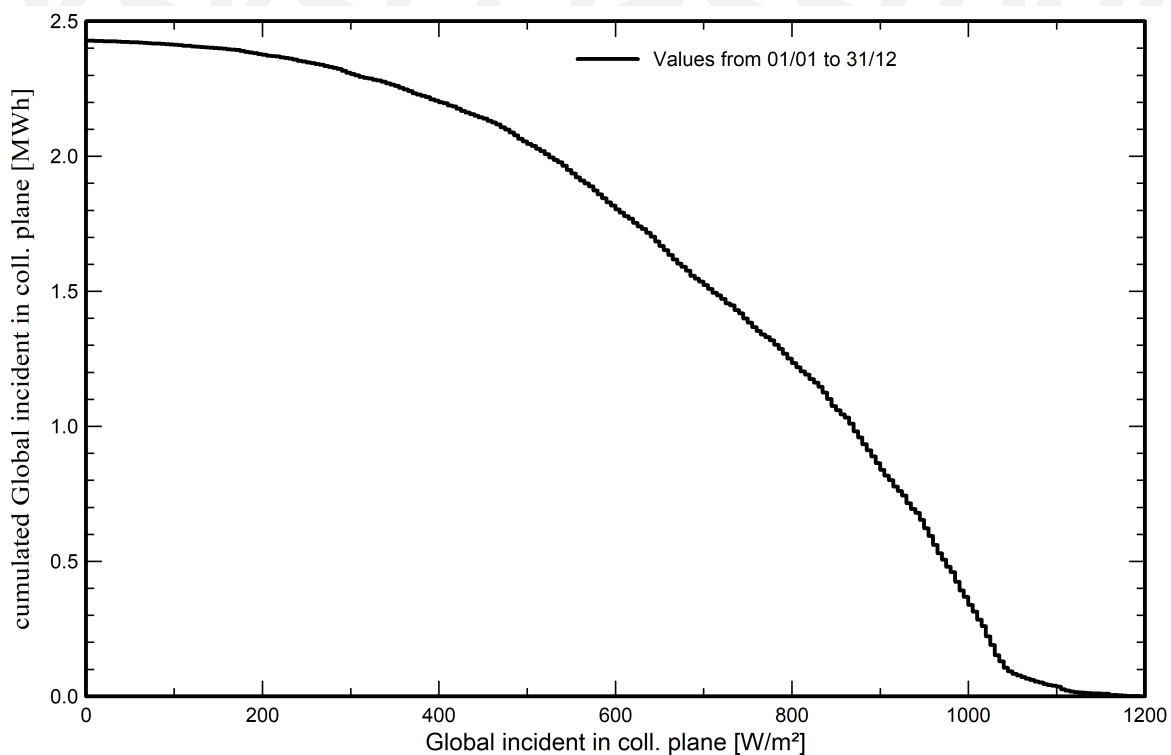


Predef. graphs

Distribución de irradiación incidente



Distribución acumulativa de la irradiación incidente





Predef. graphs

Temperatura del conjunto vs irradiancia efectiva

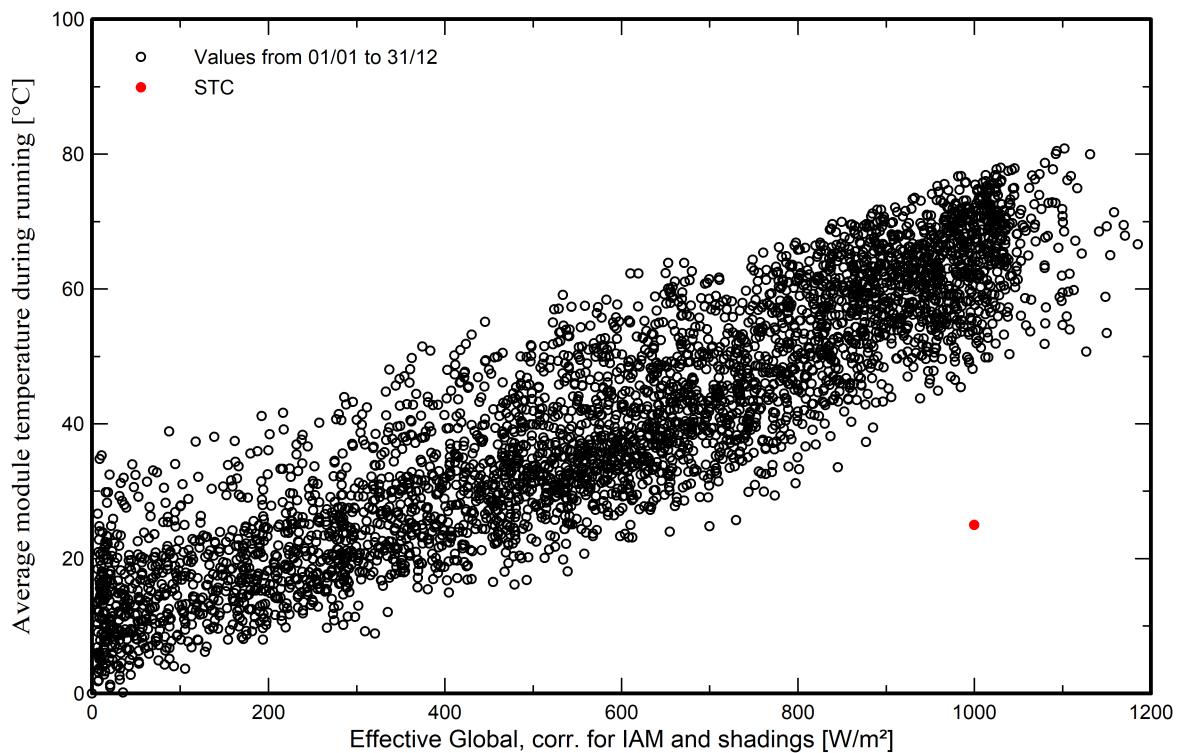
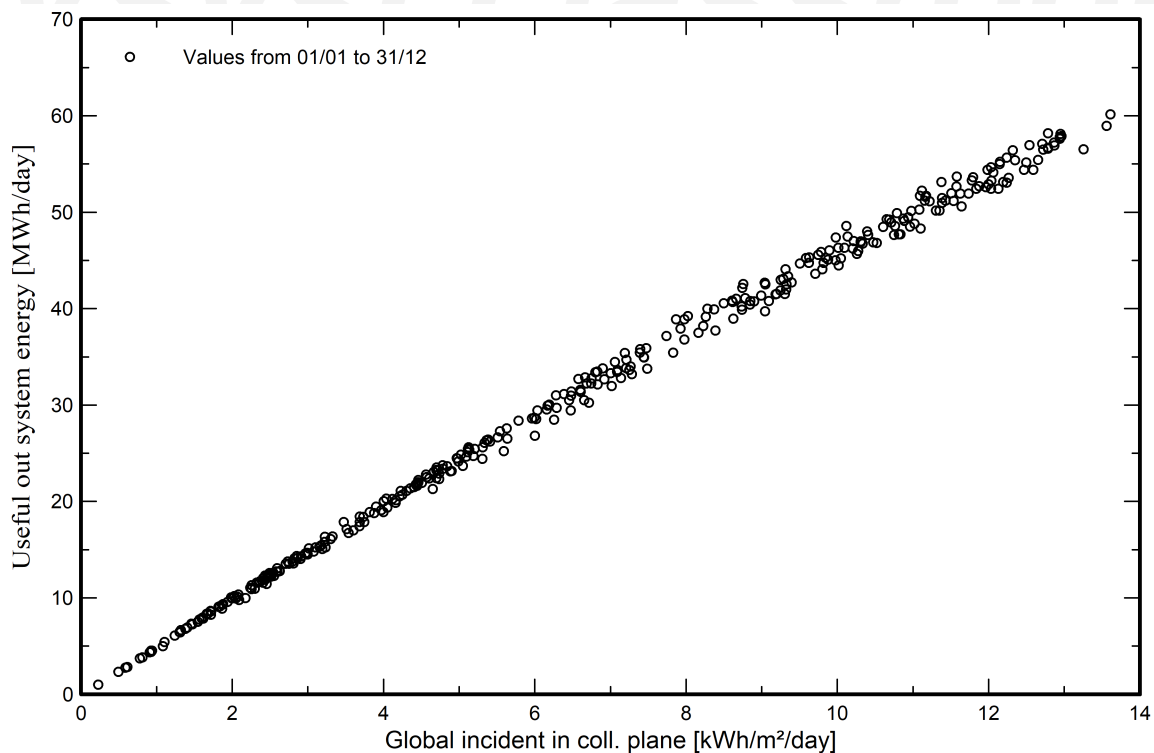


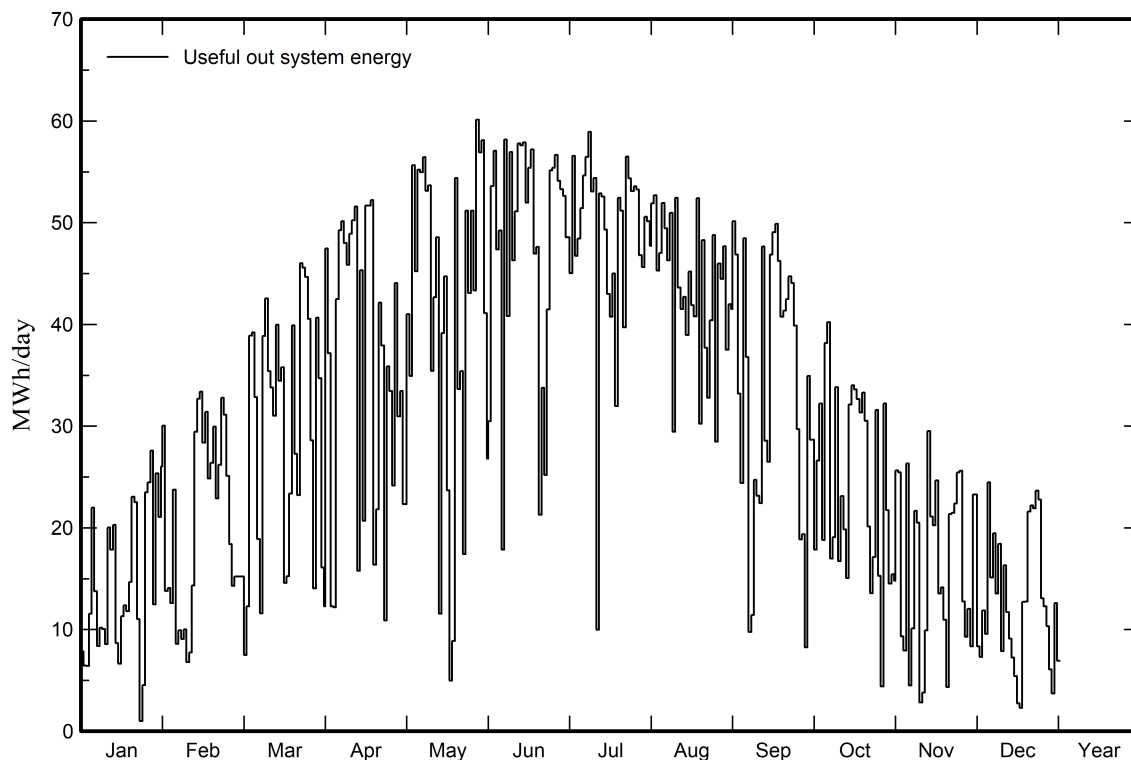
Diagrama entrada/salida diaria



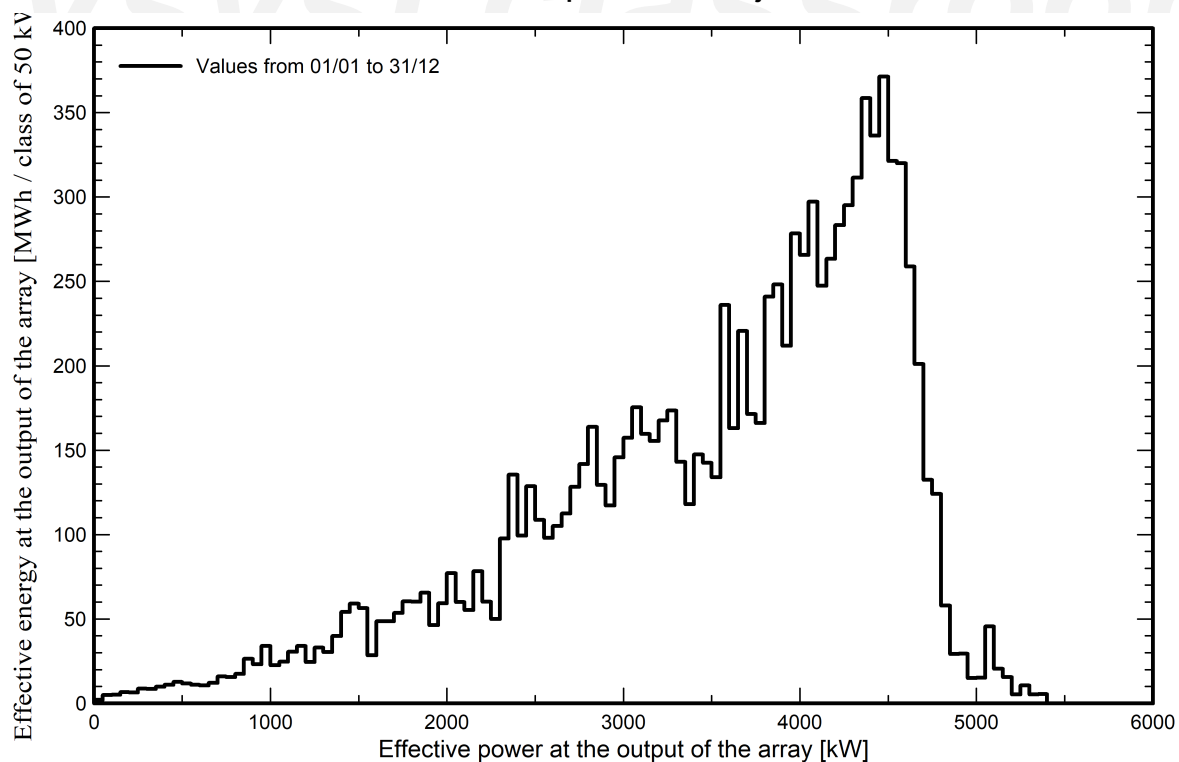


Predef. graphs

Energía diaria a la salida del sistema



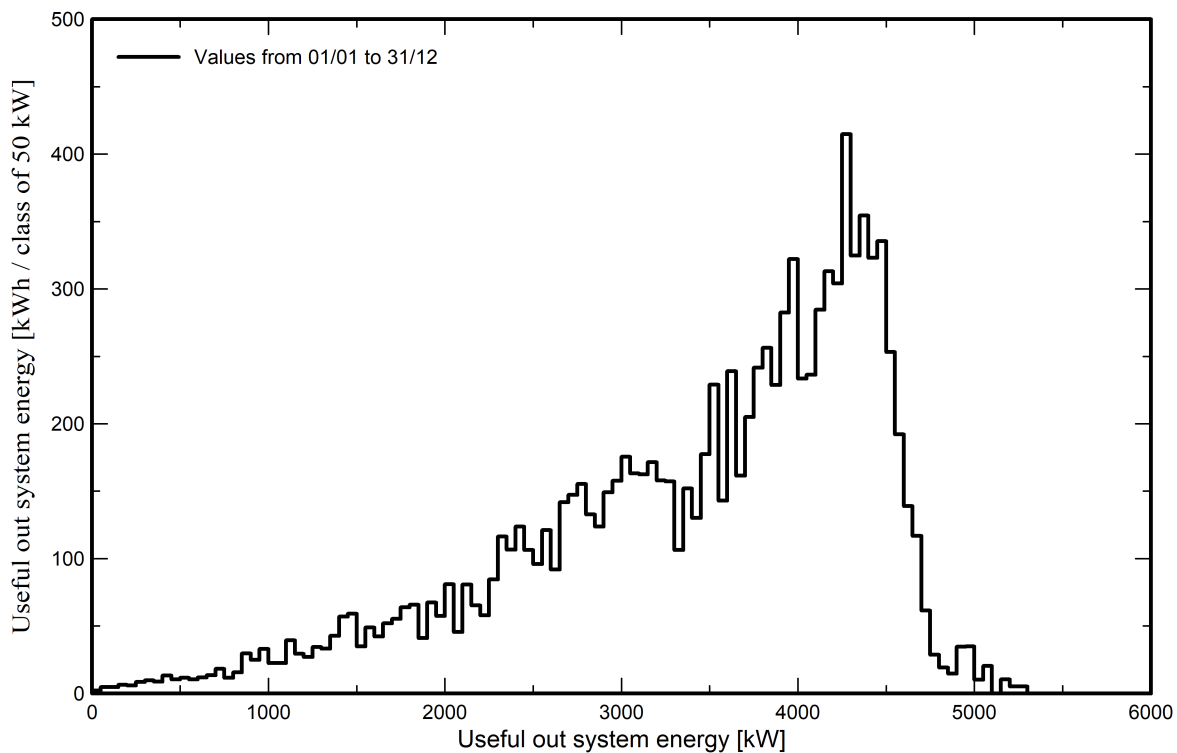
Distribución de la potencia del conjunto



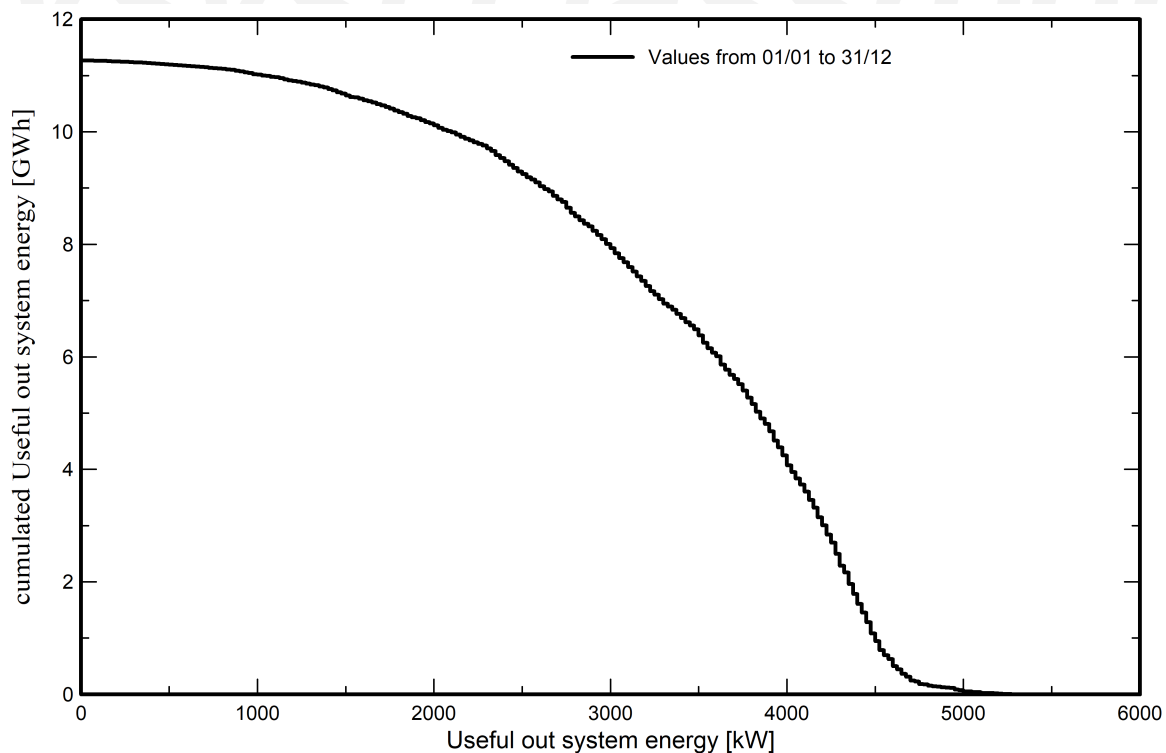


Predef. graphs

Distribución de potencia de salida del sistema



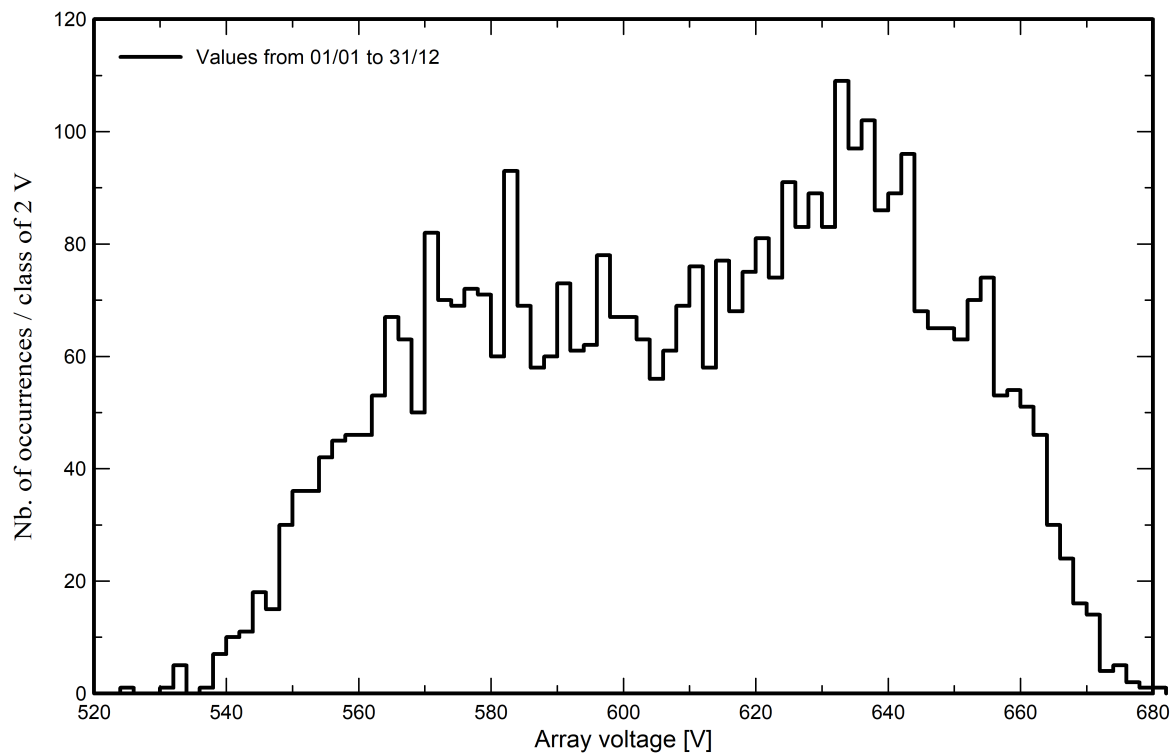
Distribución acumulativa de la potencia de salida del sistema



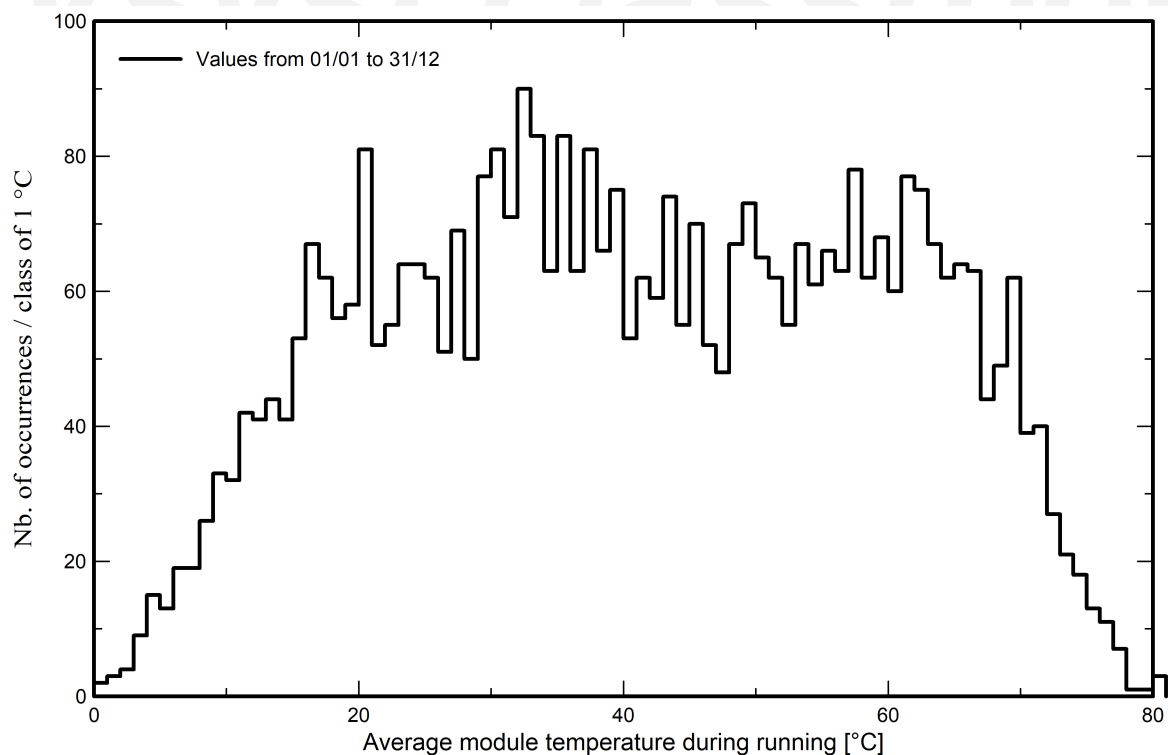


Predef. graphs

Distribución del voltaje del conjunto



Distribución de la temperatura del conjunto durante la ejecución





P50 - P90 evaluation

Weather data

Source Meteonorm 8.1 (1996-2015), Sat=100%
Kind Monthly averages
Sintético - Multi-year average
Year-to-year variability(Variance) 2.9 %

Specified Deviation

Climate change 0.0 %

Global variability (weather data + system)

Variability (Quadratic sum) 3.4 %

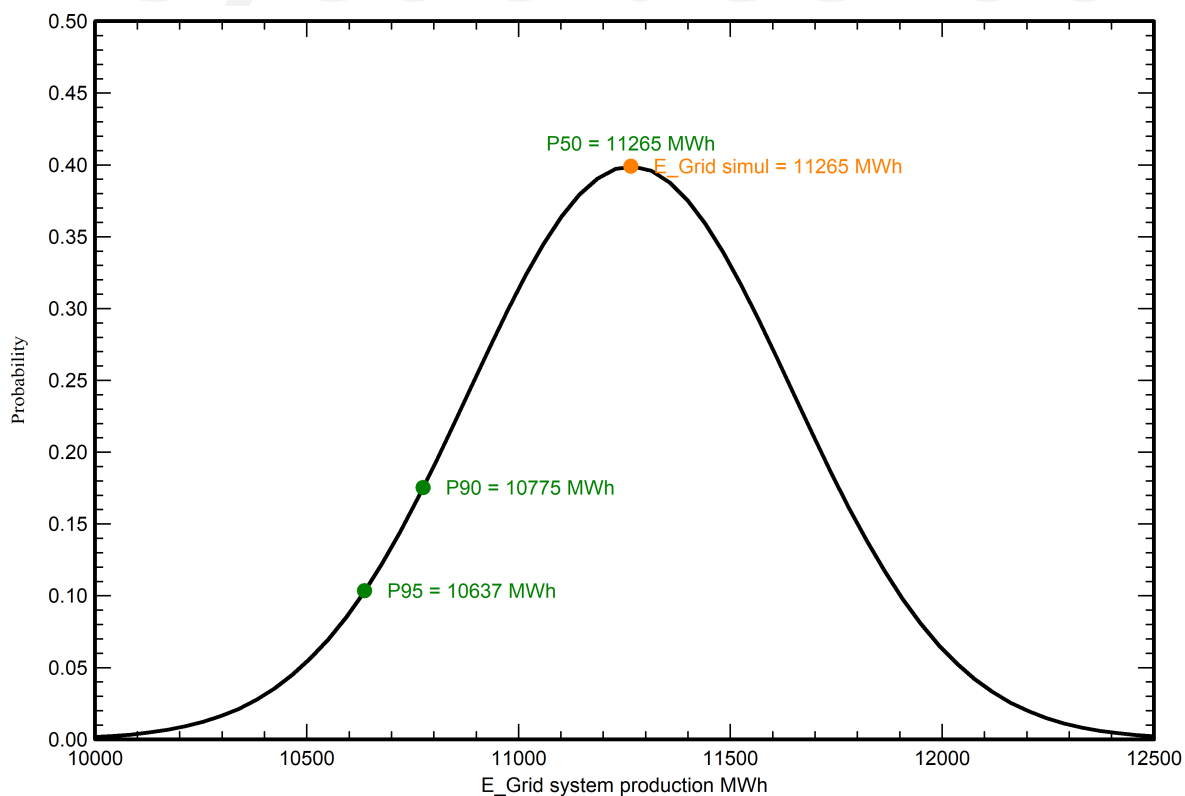
Simulation and parameters uncertainties

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 382 MWh
P50 11265 MWh
P90 10775 MWh
P95 10637 MWh

Probability distribution

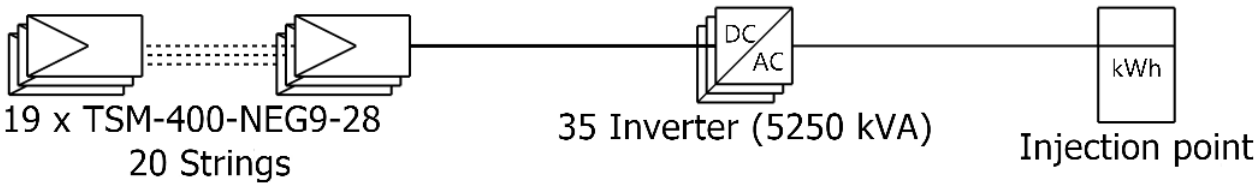




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Single-line diagram



PV module	TSM-400-NEG9-28
Inverter	SUN2000-150K-MG0-400V
String	19 x TSM-400-NEG9-28

Sistema Agrovoltaico TFM

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VC0 : TFM F

06/09/24