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IMPIANTO FOTOVOLTAICO EG LAGO SRL E OPERE CONNESSE

POTENZA IMPIANTO 12,67 MWp - COMUNE DI ARGENTA (FE)

Proponente

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Titolo Elaborato

STIMA DI PRODUCIBILITA' DELL'IMPIANTO

LIVELLO PROGETTAZIONE	CODICE ELABORATO	FILENAME	RIFERIMENTO	DATA	SCALA
DEFINITIVO	REL20	-	-	30/11/23	

Revisioni

REV.	DATA	DESCRIZIONE	ESEGUITO	VERIFICATO	APPROVATO
0	30/11/23		FB - GB - SC	EF	DZ

COMUNE DI ARGENTA (FE)
REGIONE EMILIA ROMAGNA

enfinity

STIMA PRODUCIBILITA’

INDICE

1. STIMA PRODUCIBILITA'

Project summary

Geographical Site
Boccaleone, Argenta
Italy

Situation

Latitude	44.65 °N
Longitude	11.83 °E
Altitude	-3 m
Time zone	UTC

Project settings

Albedo	0.20

Meteo data
Boccaleone, Argenta
SolarGIS Monthly aver. , period not spec. - Synthetic

System summary

Grid-Connected System

Sheds system

PV Field Orientation
Fixed plane
Tilt/Azimuth 20 / 0.2 °

Near Shadings
Linear shadings : Fast (table)

User's needs
Unlimited load (grid)

System information

PV Array

Nb. of modules	18228 units
Pnom total	12.67 MWp

Inverters

Nb. of units	9 units
Pnom total	9900 kVA
Grid power limit	10.50 MVA
Grid lim. Pnom ratio	1.206

Results summary

Produced Energy	18359259 kWh/year	Specific production	1434 kWh/kWp/year	Perf. Ratio PR	88.3 %
Apparent energy	18359259 kVAh/year				

Table of contents

General parameters

Grid-Connected System

Sheds system

PV Field Orientation

Orientation
Fixed plane
Tilt/Azimuth 20 / 0.2 °

Sheds configuration
Nb. of sheds 362 units

Sizes
Sheds spacing 8.10 m
Collector width 4.82 m
Ground Cov. Ratio (GCR) 59.5 %

Shading limit angle
Limit profile angle 24.8 °

Models used
Transposition Perez
Diffuse Perez, Meteonorm
Circumsolar separate

Horizon
Free Horizon

Near Shadings
Linear shadings : Fast (table)

User's needs
Unlimited load (grid)

Bifacial system
Model 2D Calculation unlimited sheds

Bifacial model geometry

Sheds spacing	8.10 m
Sheds width	4.82 m
Limit profile angle	24.8 °
GCR	59.5 %
Height above ground	0.50 m

Bifacial model definitions

Ground albedo average	0.16
Bifaciality factor	80 %
Rear shading factor	7.0 %
Rear mismatch loss	5.0 %
Shed transparent fraction	4.0 %

Monthly ground albedo values

Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.	Year
0.13	0.16	0.17	0.19	0.19	0.20	0.19	0.17	0.16	0.14	0.13	0.13	0.16

Grid injection point

Grid power limitation
Apparent power 10.50 MVA
Pnom ratio 1.206

Power factor
Cos(phi) (lagging) 1.000

PV Array Characteristics

PV module
Manufacturer CSI Solar Co., Ltd.
Model CS7N-695TB-AG 1500V
(Custom parameters definition)
Unit Nom. Power 695 Wp
Number of PV modules 18228 units
Nominal (STC) 12.67 MWp
Modules 651 Strings x 28 In series
At operating cond. (50°C)
Pmpp 11.72 MWp
U mpp 1045 V
I mpp 11215 A

Inverter
Manufacturer Sungrow
Model SG1100UD
(Custom parameters definition)
Unit Nom. Power 1100 kVA
Number of inverters 9 units
Total power 9900 kVA
Operating voltage 895-1500 V
Max. power (=>22°C) 1265 kVA
Pnom ratio (DC:AC) 1.29

Total PV power
Nominal (STC) 12668 kWp
Total 18228 modules
Module area 56623 m²

Total inverter power
Total power 9900 kVA
Max. power 11385 kVA
Number of inverters 9 units
Pnom ratio 1.29

Array losses

Array Soiling Losses
Loss Fraction 1.5 %

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

DC wiring losses
Global array res. 1.4 mΩ
Loss Fraction 1.5 % at STC

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 -0.4 %

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

20°	40°	60°	65°	70°	75°	80°	85°	90°
1.000	1.000	1.000	0.990	0.960	0.920	0.840	0.720	0.000

System losses

Auxiliaries loss
Proportionnal to Power 4.0 W/kW
20.0 kW from Power thresh.
Night aux. cons. 5.00 kW

AC wiring losses

Inv. output line up to MV transfo
Inverter voltage 630 Vac tri
Loss Fraction 0.50 % at STC
Inverter: SG1100UD
Wire section (9 Inv.) Alu 9 x 3 x 3000 mm²
Average wires length 135 m

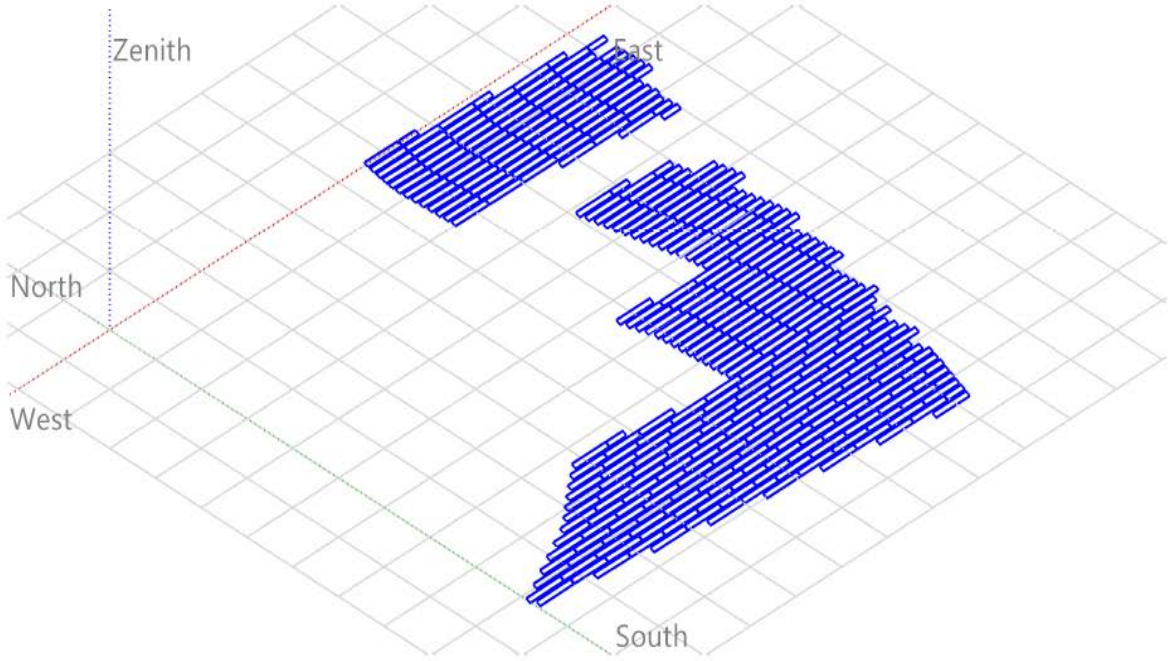
MV line up to Injection
MV Voltage 30 kV
Wires Copper 3 x 95 mm²
Length 3619 m
Loss Fraction 1.00 % at STC

AC losses in transformers

MV transfo
Medium voltage 30 kV
Transformer parameters
Nominal power at STC 12.57 MVA
Iron Loss (night disconnect) 12.57 kVA
Iron loss fraction 0.10 % at STC
Copper loss 138.22 kVA
Copper loss fraction 1.10 % at STC
Coils equivalent resistance 3 x 0.35 mΩ

Near shadings parameter

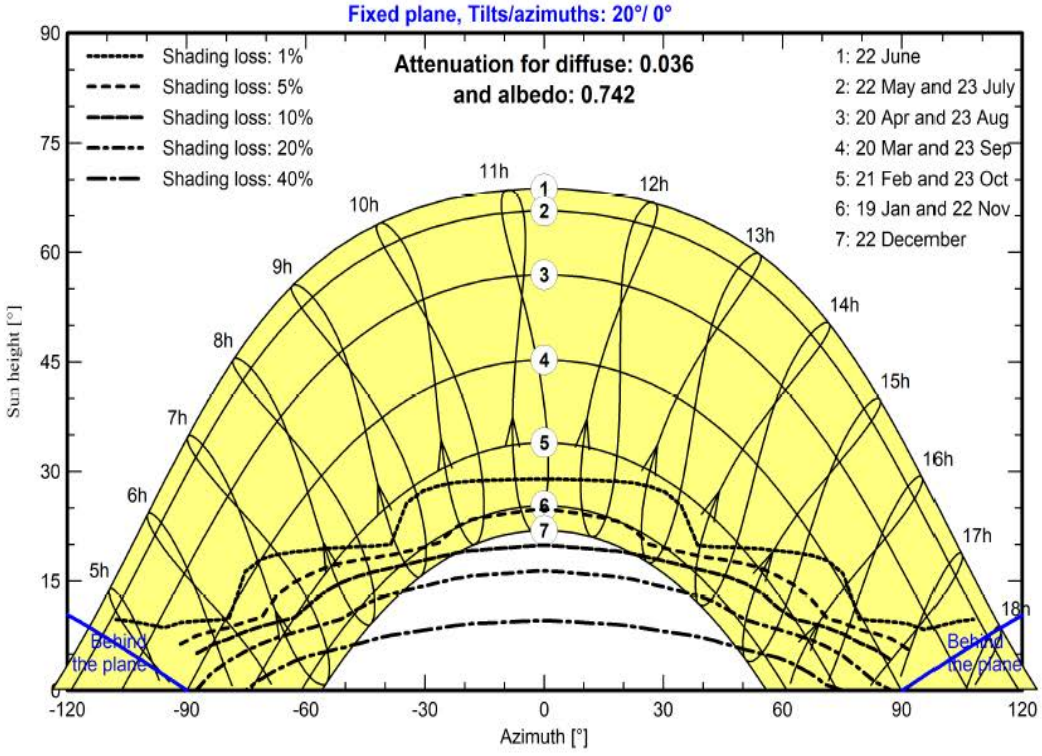
Perspective of the PV-field and surrounding shading scene



Iso-shadings diagram

Orientation #1

Fixed plane, Tilts/azimuths: 20°/ 0°

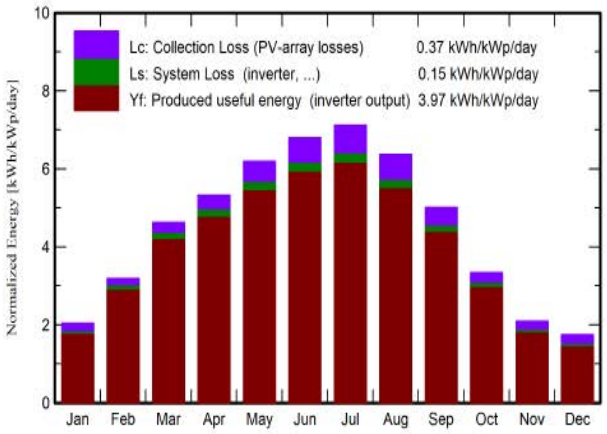


Main results

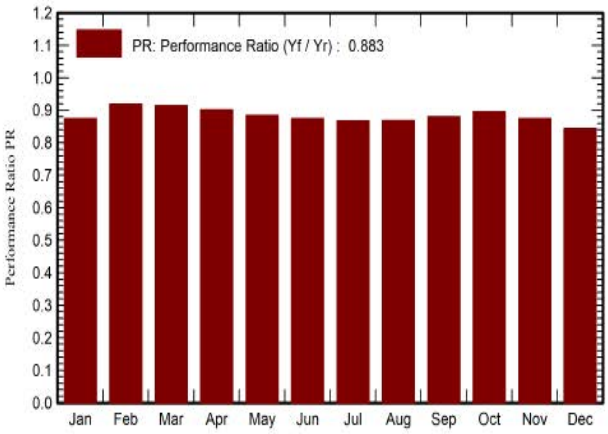
System Production

Produced Energy (P50)	18359259 kWh/year	Specific production (P50)	1434 kWh/kWp/year	Perf. Ratio PR	88.3 %
Produced Energy (P75)	17904660 kWh/year	Specific production (P75)	1398 kWh/kWp/year		
Produced Energy (P90)	17494597 kWh/year	Specific production (P90)	1366 kWh/kWp/year		
Apparent energy	18359259 kVAh/year				

Normalized productions (per installed kWp)



Performance Ratio PR



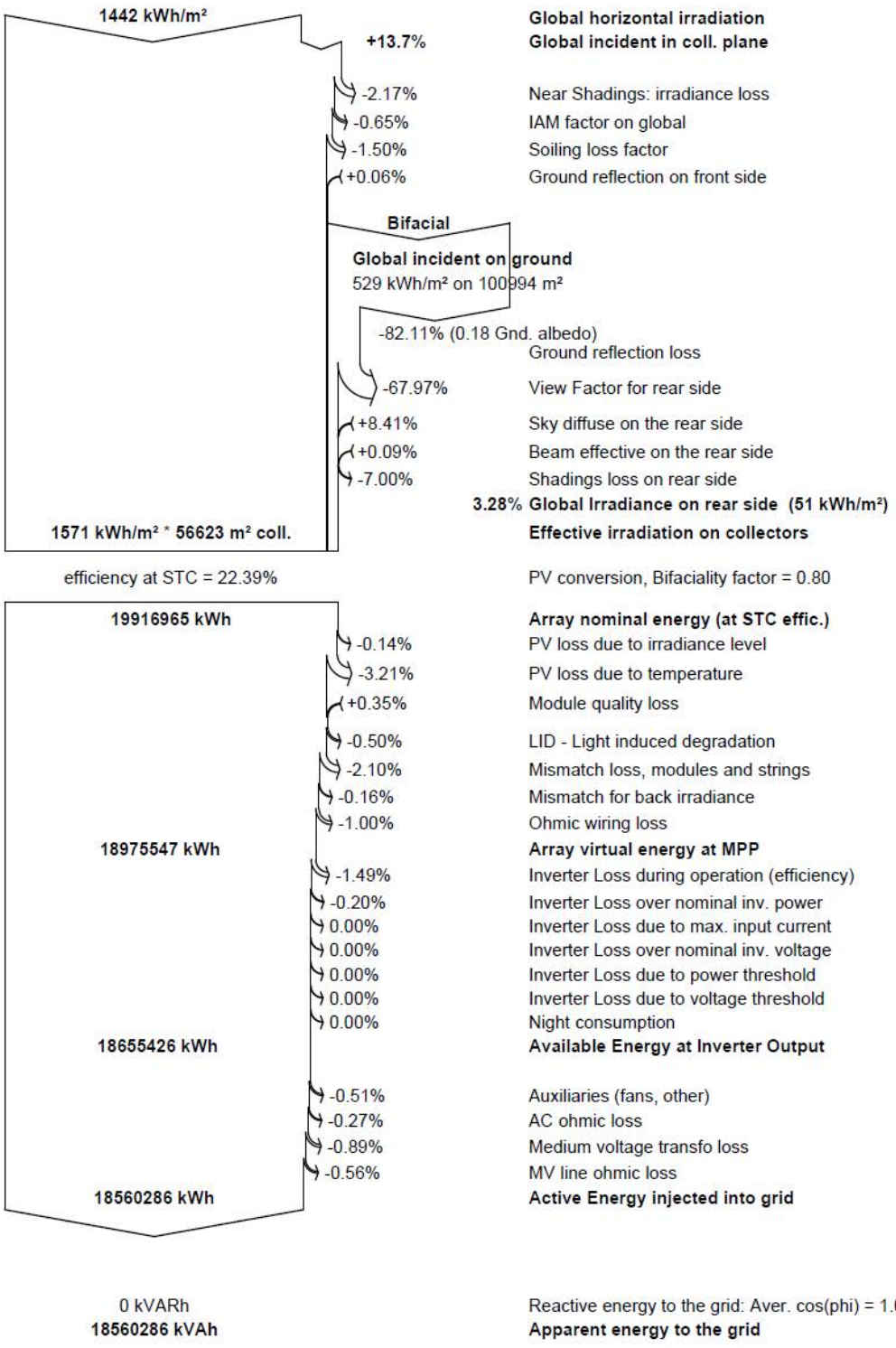
Balances and main results

	GlobHor kWh/m²	DiffHor kWh/m²	T_Amb °C	GlobInc kWh/m²	GlobEff kWh/m²	EArray kWh	E_Grid kWh	PR ratio
January	43.0	23.20	4.60	63.3	57.1	727211	702039	0.875
February	65.8	30.30	6.10	89.3	85.2	1077903	1039943	0.919
March	116.4	49.50	10.30	143.3	138.3	1722469	1659365	0.914
April	143.8	62.70	14.30	159.7	154.3	1893631	1823407	0.901
May	185.3	77.90	19.40	192.0	185.5	2235214	2151988	0.885
June	201.7	80.50	24.10	203.9	197.2	2349836	2261777	0.876
July	214.9	76.80	26.40	220.6	213.7	2520579	2425328	0.868
August	181.2	69.60	25.70	197.4	191.0	2254614	2171229	0.868
September	128.5	54.90	20.80	150.2	145.0	1738813	1675417	0.881
October	81.5	41.30	15.80	103.5	99.2	1216526	1173800	0.895
November	44.4	24.50	10.40	62.9	57.6	722488	697123	0.875
December	35.4	19.10	5.29	54.0	47.1	599673	577844	0.845
Year	1441.9	610.30	15.32	1640.0	1571.1	19058958	18359261	0.883

Legends

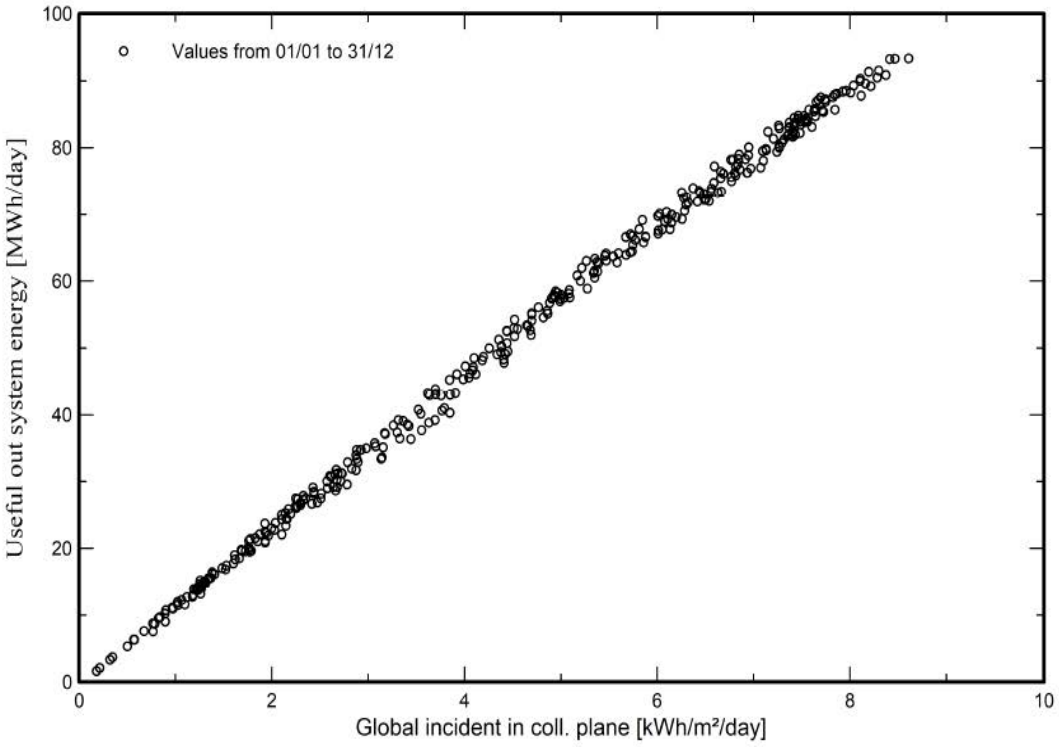
GlobHor	Global horizontal irradiation
DiffHor	Horizontal diffuse irradiation
T_Amb	Ambient Temperature
GlobInc	Global incident in coll. plane
GlobEff	Effective Global, corr. for IAM and shadings
EArray	Effective energy at the output of the array
E_Grid	Energy injected into grid
PR	Performance Ratio

Loss diagram

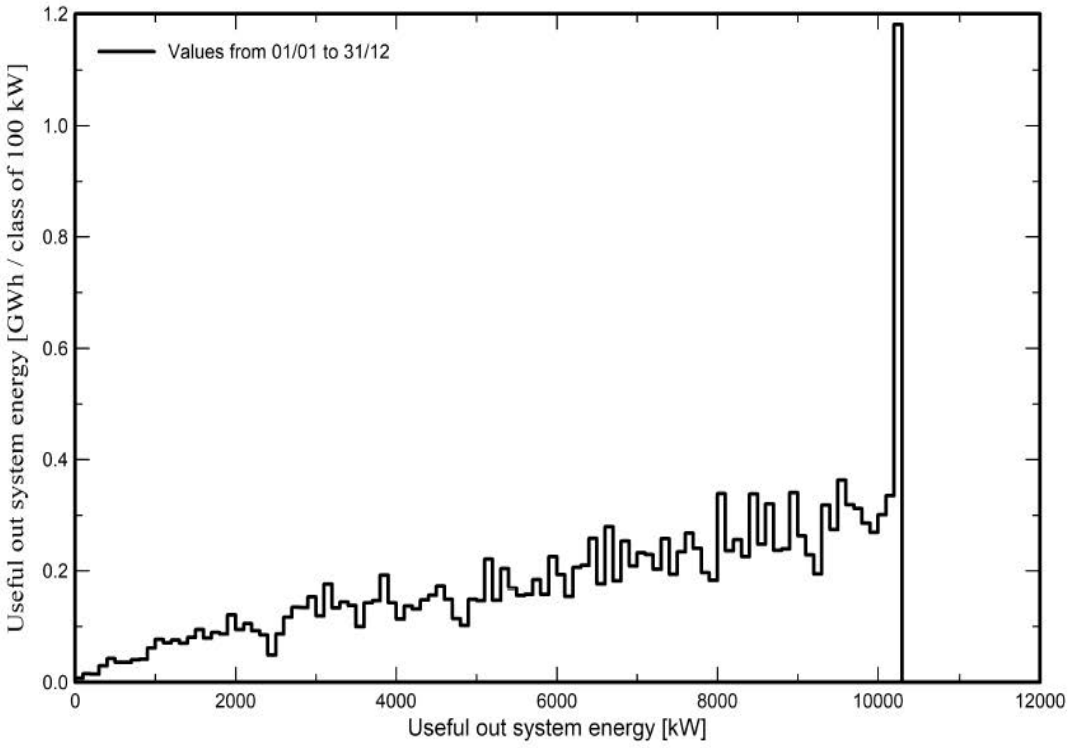


Predef. graphs

Daily Input/Output diagram



System Output Power Distribution



P50 - P90 evaluation

Meteo data

Source	SolarGIS Monthly aver. , period not spec.
Kind	TMY, multi-year
Year-to-year variability(Variance)	3.2 %
Specified Deviation	
Climate change	0.0 %

Global variability (meteo + system)

Variability (Quadratic sum)	3.7 %

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	674 MWh
P50	18360 MWh
P75	17904 MWh
P90	17495 MWh

Probability distribution