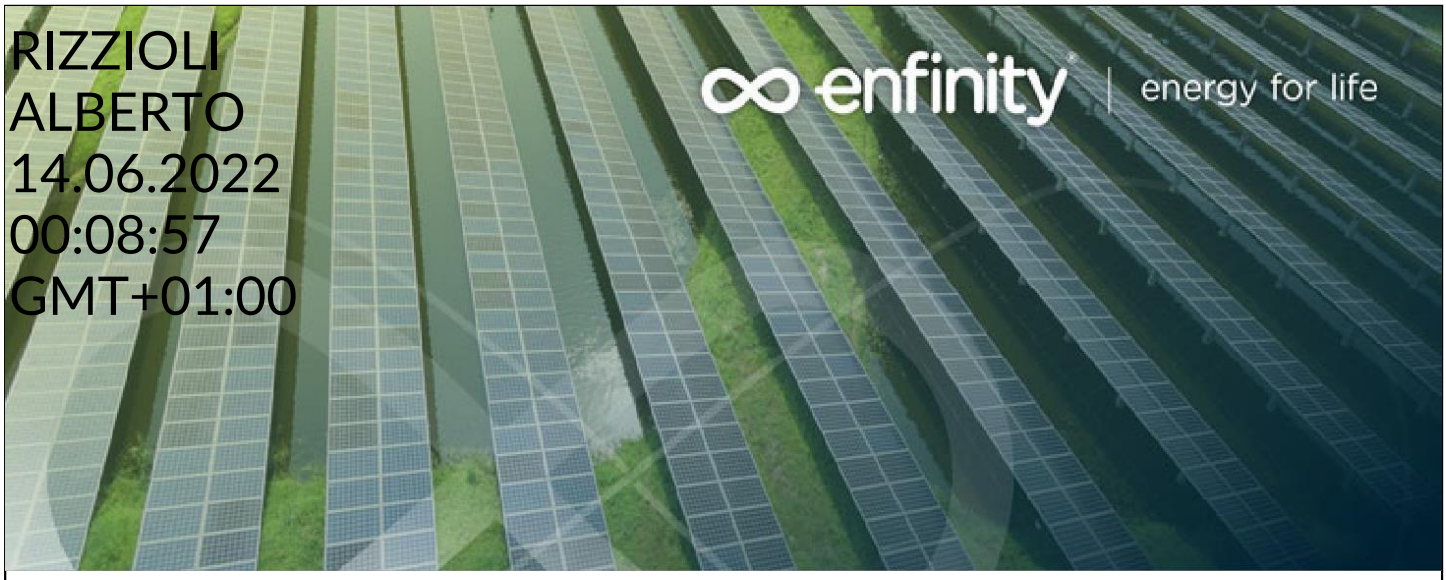

IMPIANTO FOTOVOLTAICO EG MARCO POLO SRL E OPERE CONNESSE

POTENZA IMPIANTO 29,73 MWp - COMUNE DI CANARO (RO)

Proponente

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Titolo Elaborato

STIMA PRODUCIBILITA'

LIVELLO PROGETTAZIONE	CODICE ELABORATO	FILE NAME	DATA
DEFINITIVO	PD_REL04	IT-2021-0130_PD_REL04.01-Stima producibilità	24/05/2022

Revisioni

REV.	DATA	DESCRIZIONE	ESEGUITO	VERIFICATO	APPROVATO
0	21/11/21	EMISSIONE PER PERMITTING	MB	MB	EG
1	24/05/22	INCREMENTO POTENZA	STR	MLA	AFA

REGIONE DEL VENETO

COMUNE DI CANARO (RO)

REGIONE VENERO

STIMA PRODUCIBILITA’

INDICE

Contenuto del documento

1. STIMA PRODUCIBILITA'

Project summary

Geographical Site
Canaro
Italy

Situation

Latitude	44.93 °N
Longitude	11.71 °E
Altitude	2 m
Time zone	UTC

Project settings

Albedo	0.20

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

System summary

Grid-Connected System

Sheds system

PV Field Orientation

Fixed plane	
Tilt/Azimuth	22 / 1 °

Near Shadings

According to strings	
Electrical effect	80 %

User's needs
Unlimited load (grid)

System information

PV Array

Nb. of modules	51264 units
Pnom total	29.73 MWp

Inverters

Nb. of units	121 units
Pnom total	24.20 MWac
Grid power limit	24.49 MVA
Grid lim. Pnom ratio	1.214

Results summary

Produced Energy	42 GWh/year	Specific production	1429 kWh/kWp/year	Perf. Ratio PR	87.60 %
Apparent energy	42478 MVAh				

Table of contents

General parameters

Grid-Connected System

Sheds system

PV Field Orientation

Orientation		Sheds configuration		Models used	
Fixed plane		Nb. of sheds	361 units	Transposition	Perez
Tilt/Azimuth	22 / 1 °	**Sizes**		Diffuse	Perez, Meteonorm
		Sheds spacing	10.7 m	Circumsolar	separate
		Collector width	5.27 m		
		Ground Cov. Ratio (GCR)	49.1 %		
		Shading limit angle			
		Limit profile angle	18.6 °		

Horizon	Near Shadings		User's needs
Free Horizon	According to strings		Unlimited load (grid)
	Electrical effect	80 %	

Bifacial system

Model: 2D Calculation, unlimited sheds

Bifacial model geometry		Bifacial model definitions	
Sheds spacing	10.73 m	Ground albedo average	0.14
Sheds width	5.27 m	Bifaciality factor	70 %
Limit profile angle	18.6 °	Rear shading factor	7.0 %
GCR	49.1 %	Rear mismatch loss	5.0 %
Height above ground	1.50 m	Shed transparent fraction	4.0 %

Monthly ground albedo values

Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.	Year
0.13	0.13	0.14	0.15	0.16	0.16	0.16	0.15	0.13	0.12	0.11	0.13	0.14

Grid injection point

Grid power limitation		Power factor	
Apparent power	24.49 MVA	Cos(phi) (leading)	1.000
Pnom ratio	1.214		

PV Array Characteristics

PV module

Manufacturer	Trina Solar
Model	TSM-580DEG20C.20
(Custom parameters definition)	
Unit Nom. Power	580 Wp
Number of PV modules	51264 units
Nominal (STC)	29.73 MWp
Modules	1602 Strings x 32 In series
At operating cond. (50°C)	
Pmpp	27.21 MWp
U mpp	979 V
I mpp	27793 A

Inverter

Manufacturer	Huawei Technologies
Model	SUN2000-215KTL-H3
(Custom parameters definition)	
Unit Nom. Power	200 kVA
Number of inverters	121 units
Total power	24200 kVA
Operating voltage	500-1500 V
Max. power (=>33°C)	215 kVA
Pnom ratio (DC:AC)	1.23

Total PV power

Nominal (STC)	29733 kWp
Total	51264 modules
Module area	145083 m²
Cell area	135645 m²

Total inverter power

Total power	24200 kVA
Number of inverters	121 units
Pnom ratio	1.23

Array losses

Array Soiling Losses
Loss Fraction 1.8 %

Thermal Loss factor
Module temperature according to irradiance
Uc (const) 30.0 W/m²K
Uv (wind) 1.2 W/m²K/m/s

DC wiring losses
Global array res. 0.31 mΩ
Loss Fraction 0.8 % at STC

LID - Light Induced Degradation
Loss Fraction 1.5 %

Module Quality Loss
Loss Fraction -0.8 %

Module mismatch losses
Loss Fraction 1.0 % at MPP

Strings Mismatch loss
Loss Fraction 0.1 %

IAM loss factor
Incidence effect (IAM): User defined profile

0°	40°	50°	60°	70°	75°	80°	85°	90°
1.000	1.000	0.998	0.992	0.983	0.961	0.933	0.853	0.000

System losses

Auxiliaries loss
Proportionnal to Power 4.0 W/kW
0.0 kW from Power thresh.

AC wiring losses

Inv. output line up to MV transfo
Inverter voltage 800 Vac tri
Loss Fraction 1.82 % at STC

Inverter: SUN2000-215KTL-H3
Wire section (121 Inv.) Copper 121 x 3 x 50 mm²
Average wires length 128 m

MV line up to Injection
MV Voltage 30 kV
Wires Alu 3 x 300 mm²
Length 3761 m
Loss Fraction 1.28 % at STC

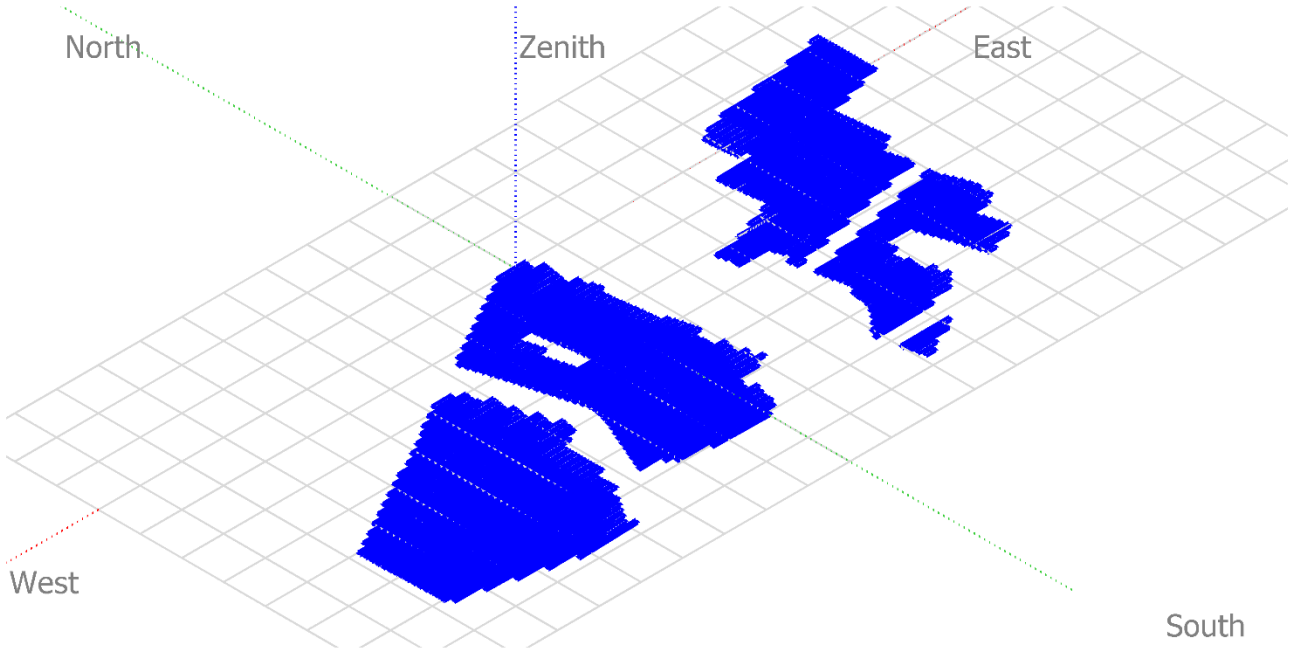
AC losses in transformers

MV transfo
Grid voltage 30 kV

Operating losses at STC
Nominal power at STC 29183 kVA
Iron loss (24/24 Connexion) 43.77 kW
Loss Fraction 0.15 % at STC
Coils equivalent resistance 3 x 0.36 mΩ
Loss Fraction 1.65 % at STC

Near shadings parameter

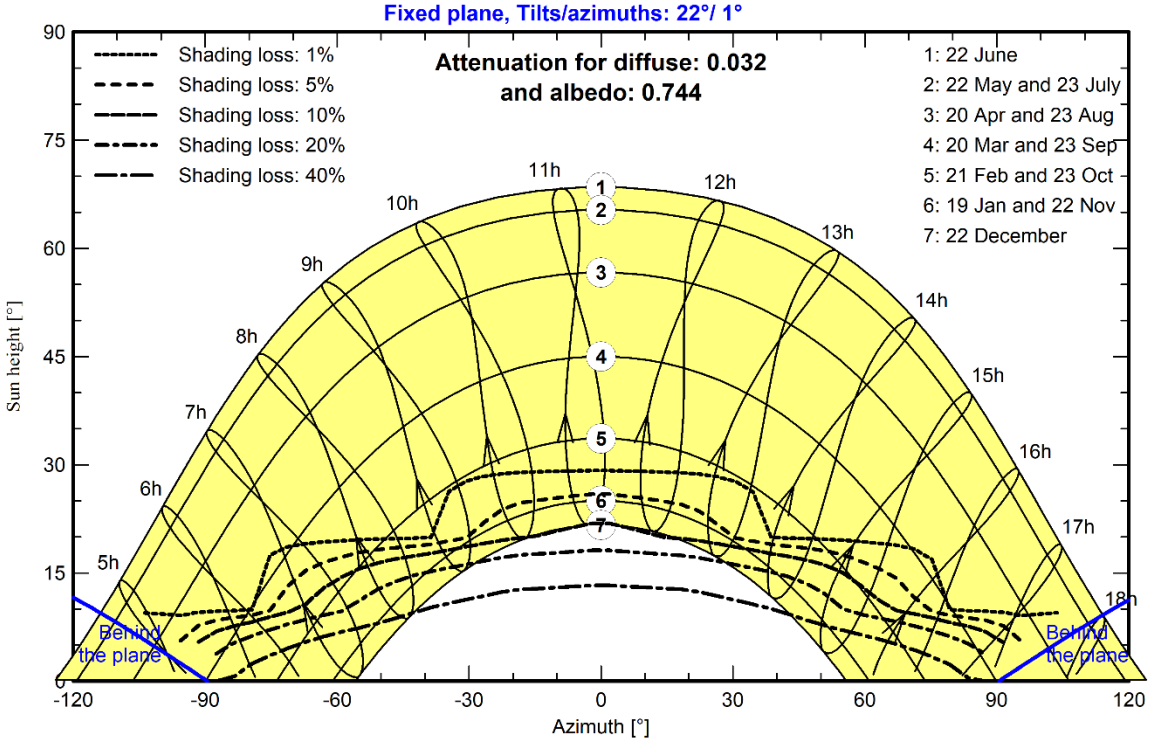
Perspective of the PV-field and surrounding shading scene



Iso-shadings diagram

Orientation #1

Fixed plane, Tilts/azimuths: 22°/ 1°

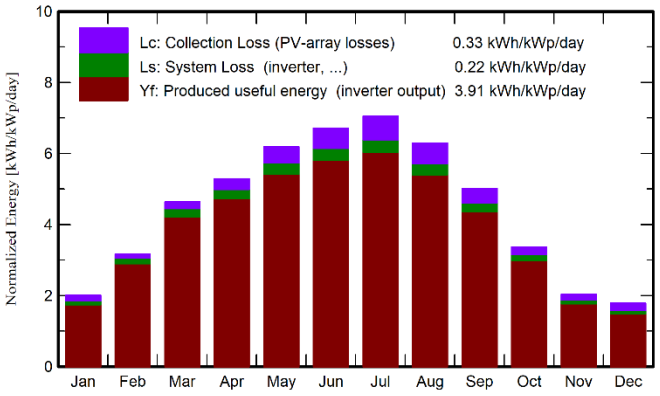


Main results

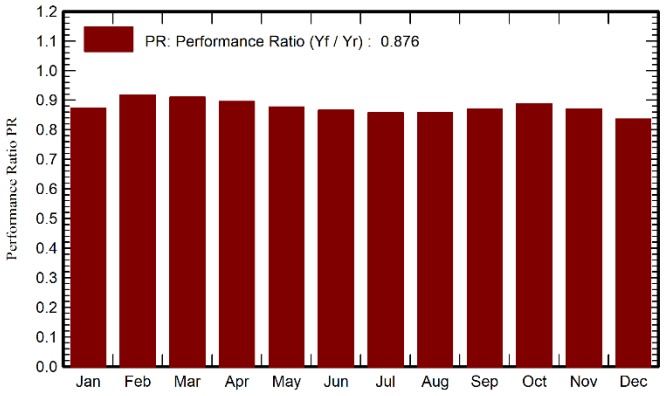
System Production

Produced Energy (P50)	42 GWh/year	Specific production (P50)	1429 kWh/kWp/year	Performance Ratio PR	87.60 %
Produced Energy (P90)	37.9 GWh/year	Specific production (P90)	1276 kWh/kWp/year		
Produced Energy (P95)	36.7 GWh/year	Specific production (P95)	1233 kWh/kWp/year		
Apparent energy	42478 MVAh				

Normalized productions (per installed kWp)



Performance Ratio PR



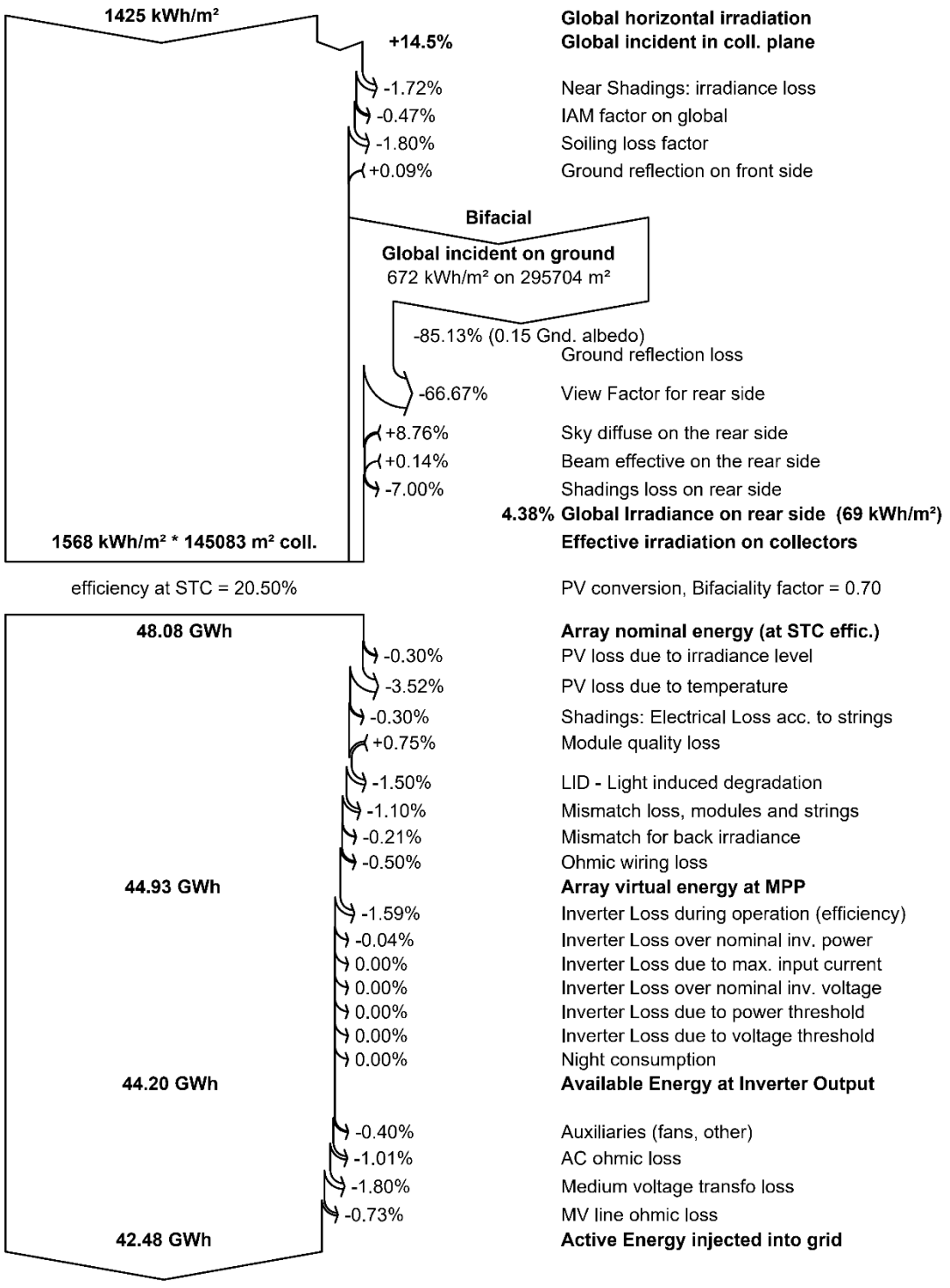
Balances and main results

	GlobHor kWh/m²	DiffHor kWh/m²	T_Amb °C	GlobInc kWh/m²	GlobEff kWh/m²	EArray GWh	E_Grid GWh	PR ratio
January	41.2	22.40	4.30	62.0	57.7	1.706	1.611	0.873
February	64.1	30.50	5.80	88.6	85.2	2.550	2.417	0.917
March	114.9	50.10	10.20	143.7	138.8	4.106	3.888	0.910
April	142.3	63.20	14.40	158.6	153.2	4.456	4.218	0.895
May	185.9	78.90	19.50	191.8	185.2	5.288	5.001	0.877
June	199.9	82.90	23.90	201.4	194.6	5.488	5.189	0.867
July	213.2	78.20	26.20	218.6	211.5	5.895	5.570	0.857
August	179.0	71.40	25.60	195.1	188.6	5.267	4.982	0.859
September	126.1	55.70	20.60	150.2	145.1	4.113	3.890	0.871
October	80.3	41.00	15.60	104.4	100.4	2.909	2.757	0.888
November	43.2	24.30	10.10	61.0	57.7	1.675	1.580	0.871
December	34.5	18.70	4.80	55.3	50.1	1.457	1.375	0.836
Year	1424.6	617.30	15.14	1630.8	1568.0	44.912	42.478	0.876

Legends

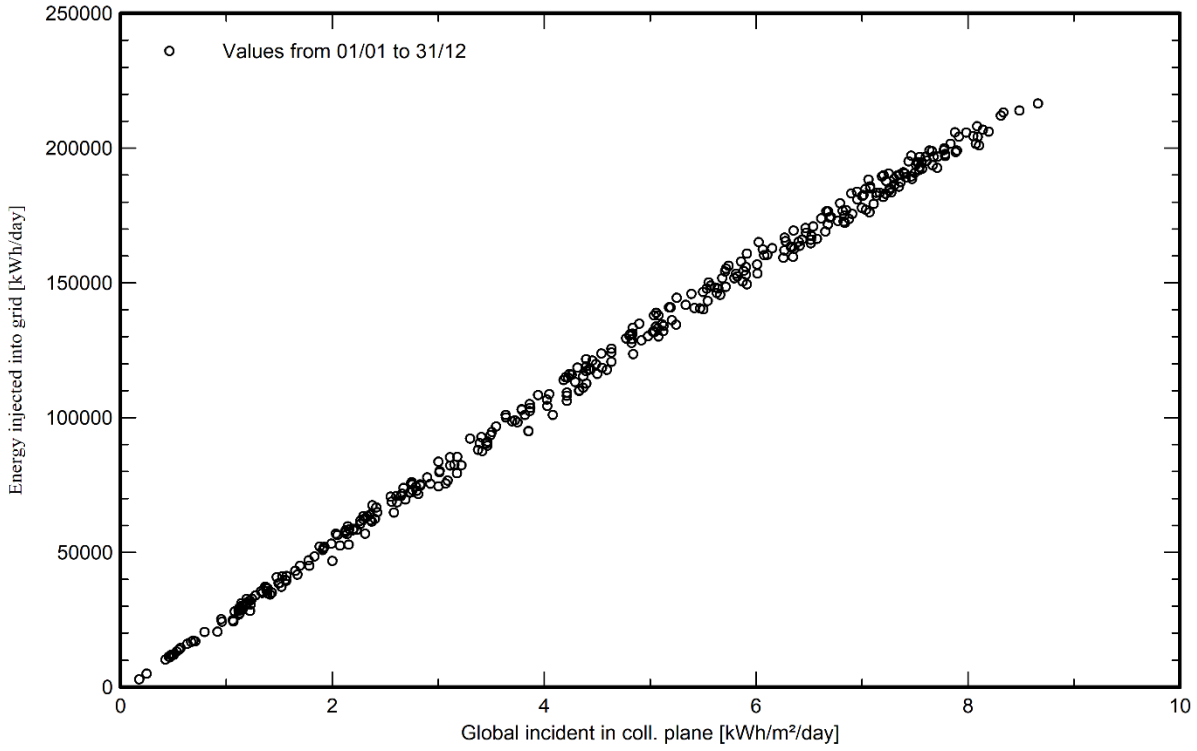
GlobHor	Global horizontal irradiation
DiffHor	Horizontal diffuse irradiation
T_Amb	Ambient Temperature
GlobInc	Global incident in coll. plane
GlobEff	Effective Global, corr. for IAM and shadings
EArray	Effective energy at the output of the array
E_Grid	Energy injected into grid
PR	Performance Ratio

Loss diagram

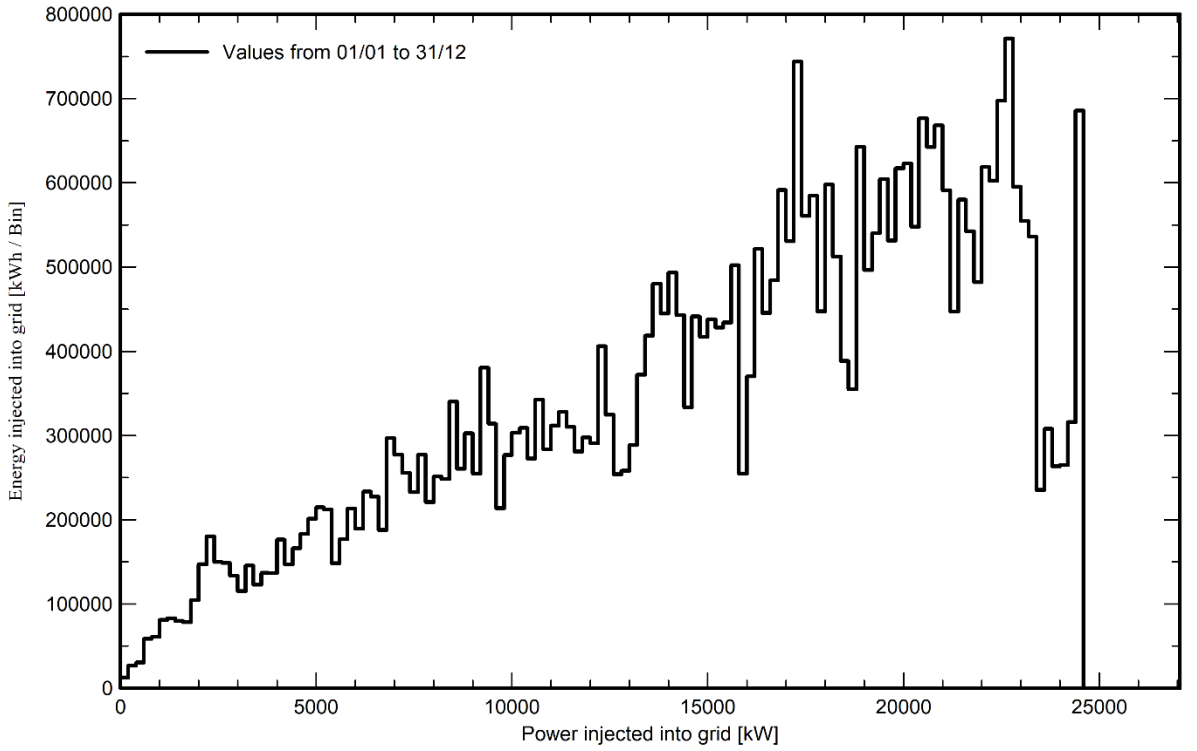


Special graphs

Daily Input/Output diagram



System Output Power Distribution



P50 - P90 evaluation

Meteo data

Source	SolarGIS Monthly aver. , period not spec.
Kind	Monthly averages
Synthetic - Multi-year average	
Year-to-year variability(Variance)	8.2 %
Specified Deviation	
Climate change	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 (meteo + system)

Variability (Quadratic sum)	8.3 %

Annual production probability

Variability	3.55 GWh
P50	42.48 GWh
P90	37.93 GWh
P95	36.65 GWh

Probability distribution