

IMPIANTO AGROVOLTAICO "TRIVIGNANO"

E OPERE CONNESSE

POTENZA IMPIANTO 17,18 MWp - SISTEMA DI ACCUMULO 1,575 MW
Comuni di Trivignano Udinese (UD) e Santa Maria la Longa (UD)

PROPONENTE

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COLLABORATORI

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TITOLO ELABORATO

STIMA PRODUCIBILITA'

LIVELLO PROGETTAZIONE	CODICE ELABORATO	FILENAME	RIFERIMENTO	DATA	SCALA
Definitivo	TRI-REL-09	-	-	08.02.2022	--

REVISIONI

REV.	DATA	DESCRIZIONE	ESEGUITO	VERIFICATO	APPROVATO
00	08.02.2022	-	GM	GM	JM



REGIONE FRIULI



COMUNE DI TRIVIGNANO UDINESE (UD)

COMUNE DI SANTA MARIA LA LONGA (UD)

PVsyst - Simulation report

Grid-Connected System

Project: Trivignano

Variant: Trivignano (TR2V, Trina 580Wp, 10m) 17.1808MWp 1580

Tracking system with backtracking

System power: 17.18 MWp

Trivignane - Italy



Project: Trivignano

Variant: Trivignano (TR2V, Trina 580Wp, 10m) 17.1808MWp 1580

PVsyst V7.2.11

VD2, Simulation date:
27/01/22 16:50
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Project summary

Geographical Site	Situation	Project settings
Trivignano	Latitude 45.93 °N	Albedo 0.20
Italy	Longitude 13.35 °E	
	Altitude 30 m	
	Time zone UTC+1	
Meteo data		
Trivignano		
SolarGIS Monthly aver. , period not spec. - Synthetic		

System summary

Grid-Connected System	Tracking system with backtracking	
PV Field Orientation	Near Shadings	User's needs
Tracking plane, horizontal N-S axis	Linear shadings	Unlimited load (grid)
Axis azimuth 0 °		
System information		
PV Array	Inverters	
Nb. of modules 29120 units	Nb. of units 70 units	
Pnom total 17.18 MWp	Pnom total 14.00 MWac	
	Grid power limit 13.07 MWac	
	Grid lim. Pnom ratio 1.315	

Results summary

Produced Energy 27 GWh/year	Specific production 1580 kWh/kWp/year	Perf. Ratio PR 89.41 %
Apparent energy 27152 MVAh		

Table of contents

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



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General parameters

Grid-Connected System		Tracking system with backtracking	
PV Field Orientation		Backtracking strategy	
Orientation		Nb. of trackers	364 units
Tracking plane, horizontal N-S axis		Sizes	
Axis azimuth	0 °	Tracker Spacing	10.00 m
		Collector width	4.49 m
		Ground Cov. Ratio (GCR)	44.9 %
		Phi min / max.	-/+ 60.0 °
		Backtracking limit angle	
		Phi limits	+/- 63.2 °
Horizon		Near Shadings	
Free Horizon		Linear shadings	
Bifacial system		User's needs	
Model	2D Calculation	Unlimited load (grid)	
	unlimited trackers		
Bifacial model geometry		Bifacial model definitions	
Tracker Spacing	10.00 m	Ground albedo	0.20
Tracker width	4.49 m	Bifaciality factor	70 %
GCR	44.9 %	Rear shading factor	0.0 %
Axis height above ground	2.50 m	Rear mismatch loss	3.5 %
		Shed transparent fraction	10.0 %
Grid injection point		Power factor	
Grid power limitation		Cos(phi) (leading)	1.000
Active Power	13.07 MWac		
Pnom ratio	1.315		

PV Array Characteristics

PV module		Inverter	
Manufacturer	Trina Solar	Manufacturer	Huawei Technologies
Model	TSM-590DEG20C.20	Model	SUN2000-215KTL-H3
(Custom parameters definition)		(Custom parameters definition)	
Unit Nom. Power	590 Wp	Unit Nom. Power	200 kWac
Number of PV modules	29120 units	Number of inverters	70 units
Nominal (STC)	17.18 MWp	Total power	14000 kWac
Modules	910 Strings x 32 In series	Operating voltage	500-1500 V
At operating cond. (50°C)		Max. power (=>33°C)	215 kWac
Pmpp	15.72 MWp	Pnom ratio (DC:AC)	1.23
U mpp	990 V		
I mpp	15882 A		
Total PV power		Total inverter power	
Nominal (STC)	17181 kWp	Total power	14000 kWac
Total	29120 modules	Number of inverters	70 units
Module area	82413 m ²	Pnom ratio	1.23
Cell area	77052 m ²		



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Array losses

Array Soiling Losses		Thermal Loss factor		DC wiring losses				
Loss Fraction	1.5 %	Module temperature according to irradiance		Global array res.	0.46 mΩ			
		Uc (const)	30.0 W/m²K	Loss Fraction	0.7 % at STC			
		Uv (wind)	1.2 W/m²K/m/s					
Serie Diode Loss		LID - Light Induced Degradation		Module Quality Loss				
Voltage drop	0.7 V	Loss Fraction	1.5 %	Loss Fraction	-0.7 %			
Loss Fraction	0.1 % at STC							
Module mismatch losses		Strings Mismatch loss						
Loss Fraction	1.0 % at MPP	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

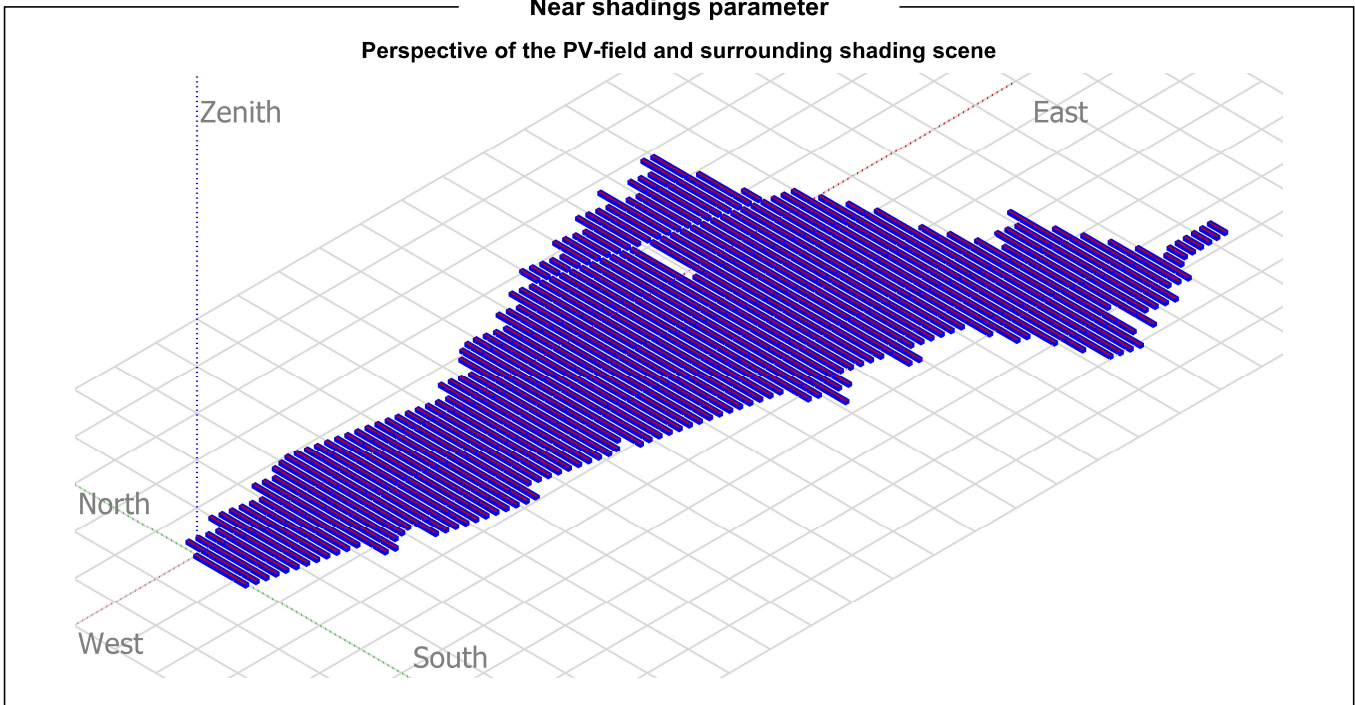
Inv. output line up to MV transfo	
Inverter voltage	800 Vac tri
Loss Fraction	1.77 % at STC
Inverter: SUN2000-215KTL-H3	
Wire section (70 Inv.)	Copper 70 x 3 x 240 mm²
Average wires length	600 m
MV line up to Injection	
MV Voltage	30 kV
Wires	Copper 3 x 150 mm²
Length	3912 m
Loss Fraction	0.92 % at STC

AC losses in transformers

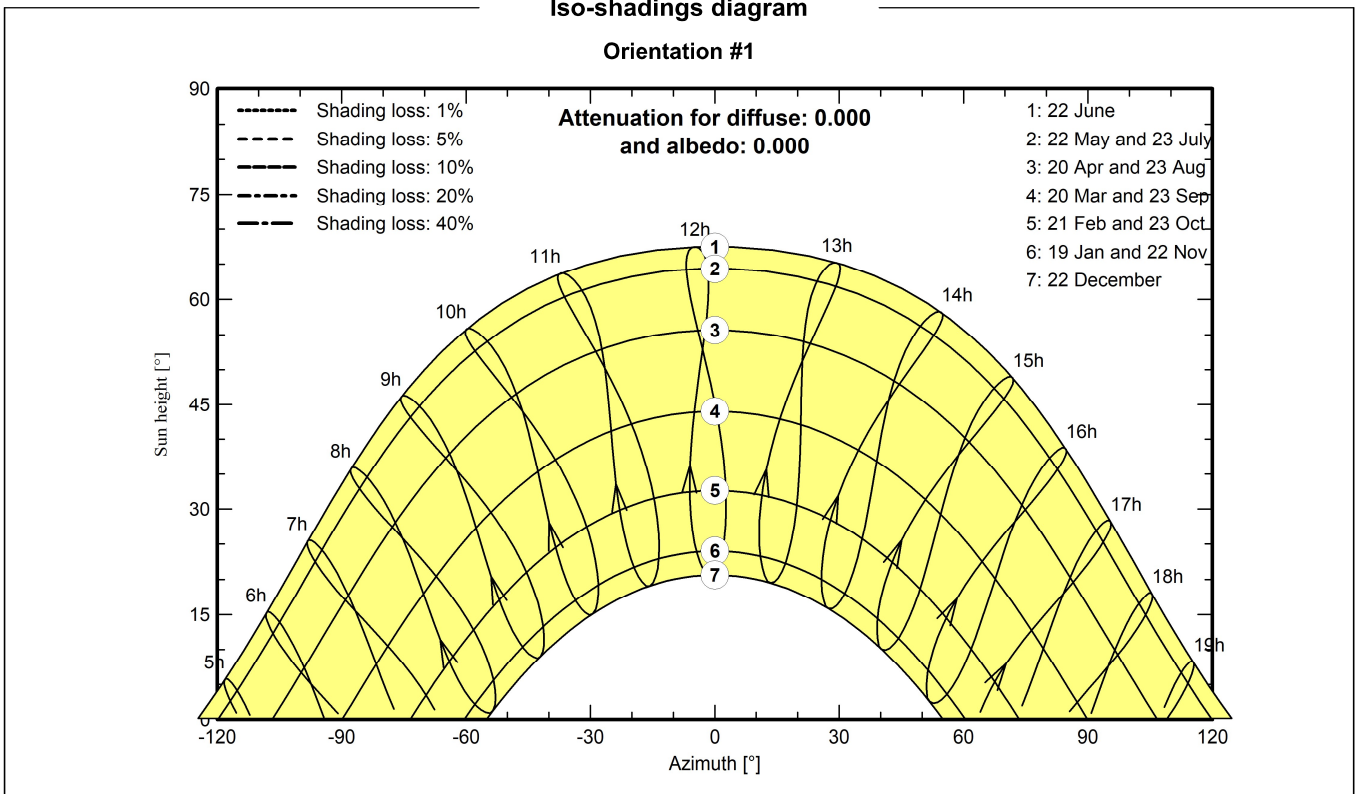
MV transfo	
Grid voltage	30 kV
Operating losses at STC	
Nominal power at STC	16863 kVA
Iron loss (24/24 Connexion)	25.29 kW
Loss Fraction	0.15 % at STC
Coils equivalent resistance	3 x 0.63 mΩ
Loss Fraction	1.65 % at STC



Near shadings parameter



Iso-shadings diagram





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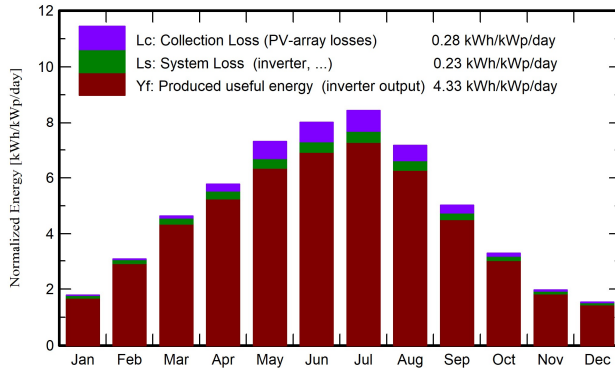
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Main results

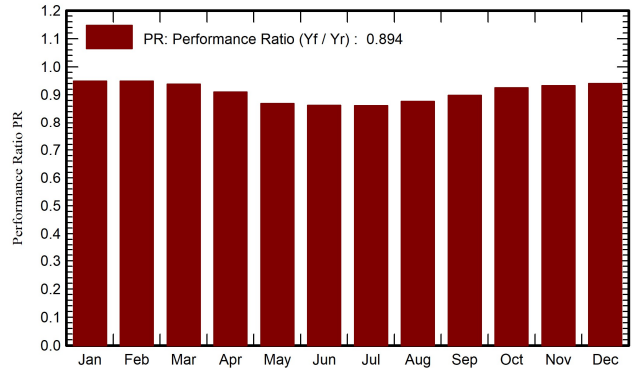
System Production

Produced Energy (P50)	27 GWh/year	Specific production (P50)	1580 kWh/kWp/year	Performance Ratio PR	89.41 %
Produced Energy (P90)	26.5 GWh/year	Specific production (P90)	1542 kWh/kWp/year		
Produced Energy (P95)	26.3 GWh/year	Specific production (P95)	1532 kWh/kWp/year		
Apparent energy	27152 MVAh				

Normalized productions (per installed kWp)



Performance Ratio PR



Balances and main results

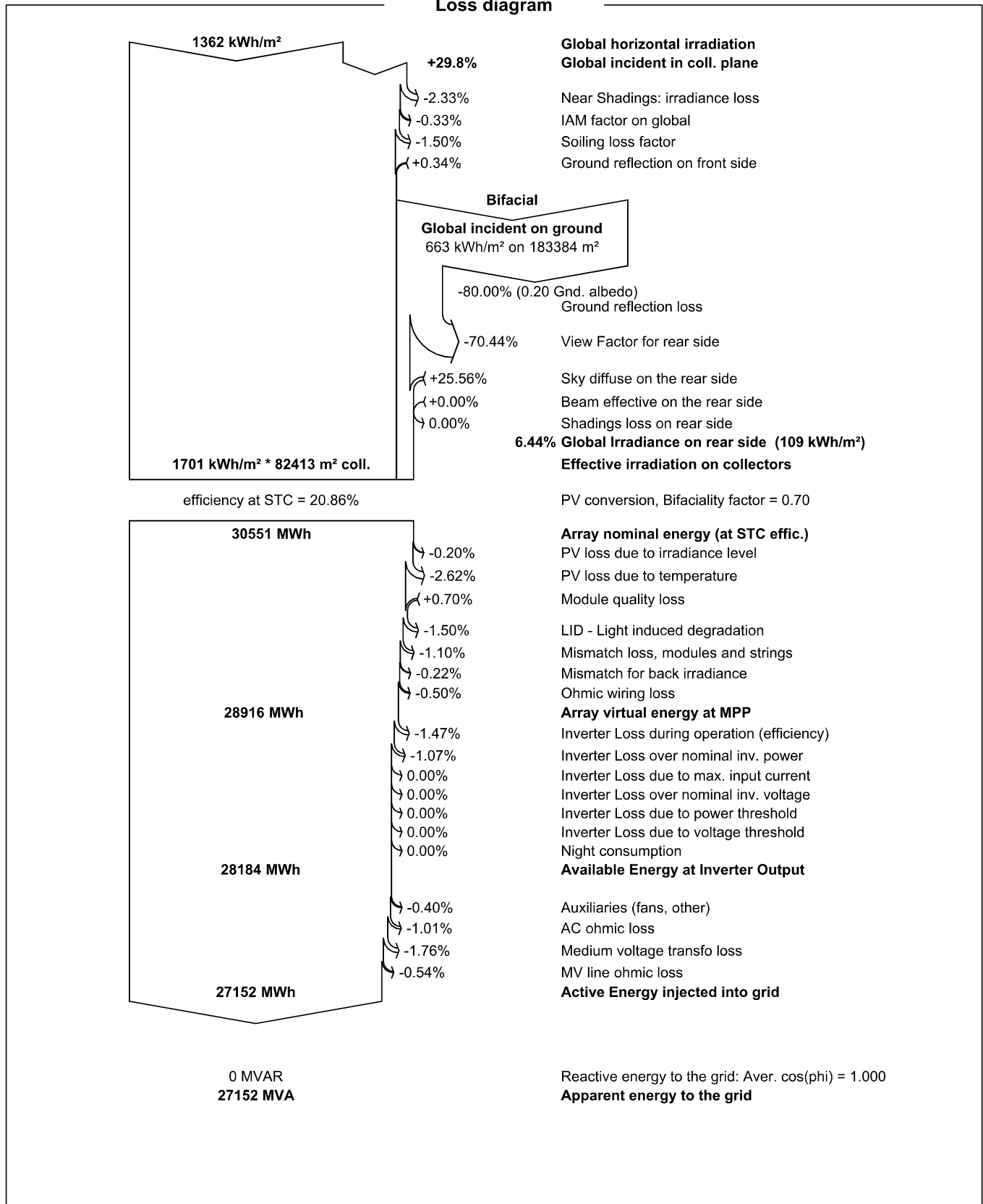
	GlobHor	DiffHor	T_Amb	GlobInc	GlobEff	EArray	E_Grid	PR
	kWh/m ²	kWh/m ²	°C	kWh/m ²	kWh/m ²	GWh	GWh	ratio
January	42.3	20.50	3.20	55.2	52.6	0.948	0.899	0.948
February	63.7	26.60	4.30	85.8	82.4	1.470	1.399	0.949
March	109.0	46.50	7.70	143.7	138.2	2.434	2.317	0.939
April	135.3	62.70	11.10	173.2	166.7	2.855	2.709	0.910
May	176.8	77.80	16.40	226.6	218.3	3.569	3.385	0.870
June	189.0	82.80	19.80	240.8	232.2	3.767	3.570	0.863
July	201.4	81.20	22.20	261.9	252.9	4.093	3.879	0.862
August	171.1	71.60	22.20	222.0	214.2	3.529	3.345	0.877
September	117.6	54.30	17.40	150.6	144.6	2.451	2.325	0.899
October	76.3	37.50	13.00	101.1	97.0	1.687	1.608	0.925
November	43.9	22.50	8.00	59.0	56.2	0.995	0.945	0.933
December	35.4	17.10	3.90	47.6	45.3	0.813	0.770	0.941
Year	1361.8	601.10	12.48	1767.5	1700.6	28.611	27.152	0.894

Legends

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



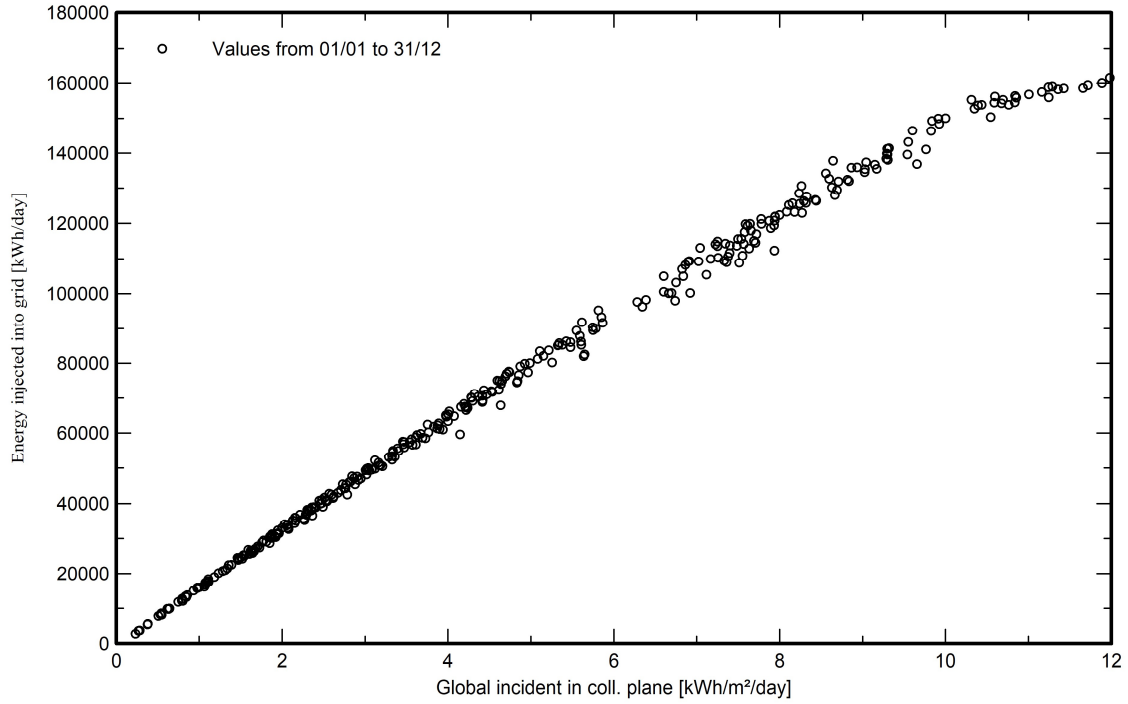
Loss diagram



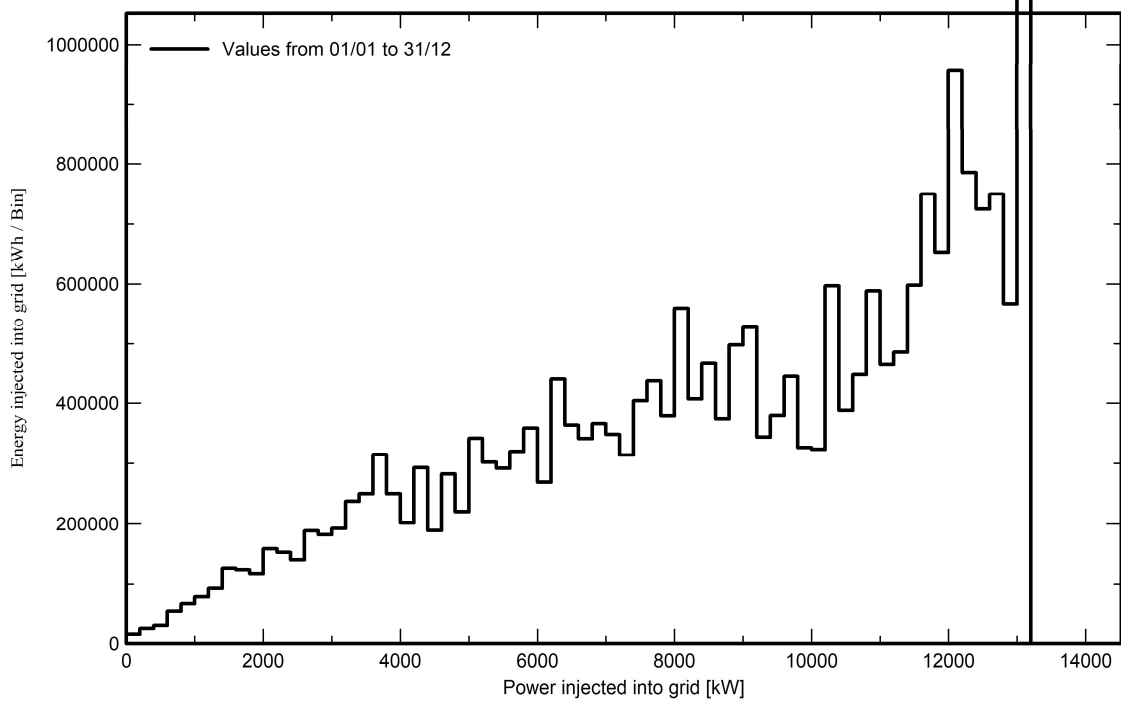


Special graphs

Daily Input/Output diagram



System Output Power Distribution





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P50 - P90 evaluation

Meteo data

Source SolarGIS Monthly aver. , period not spec.
Kind Monthly averages
Synthetic - Multi-year average
Year-to-year variability(Variance) 0.5 %

Specified Deviation

Climate change 0.0 %

Global variability (meteo + system)

Variability (Quadratic sum) 1.9 %

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 0.51 GWh
P50 27.15 GWh
P90 26.50 GWh
P95 26.32 GWh

Probability distribution

