

IMPIANTO FOTOVOLTAICO EG FAUNA SRL E OPERE CONNESSE

POTENZA IMPIANTO 19,90 MWp - COMUNE DI TRECENTA (RO)

Proponente

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Titolo Elaborato

STIMA PRODUCIBILITÀ

LIVELLO PROGETTAZIONE	CODICE ELABORATO	FILENAME	RIFERIMENTO	DATA	SCALA
DEFINITIVO	TR-R003_00	-	-	16/12/2021	-

Revisioni

REV.	DATA	DESCRIZIONE	ESEGUITO	VERIFICATO	APPROVATO
	16/12/2021		MB	MB/MP	EG



Comune di Trecenta (RO)
Regione VENETO



REGIONE DEL VENETO



STIMA PRODUCIBILITÀ

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1. STIMA PRODUCIBILITA'

Di seguito si riportano il dettaglio di calcolo relativo alla stima di producibilità degli impianti in esame.

Project summary					
Geographical Site		Situation		Project settings	
Trecenta		Latitude	45.02 °N	Albedo	0.20
Italy		Longitude	11.47 °E		
		Altitude	6 m		
		Time zone	UTC+1		
Meteo data					
Trecenta					
SolarGIS Monthly aver. , period not spec. - Synthetic					

System summary					
Grid-Connected System		Ground system (tables) on a hill		User's needs	
PV Field Orientation		Near Shadings		Unlimited load (grid)	
Fixed plane		According to strings			
Tilt/Azimuth	22 / 1 °	Electrical effect	80 %		
System information					
PV Array					
Nb. of modules	33728 units	Inverters		Nb. of units	
Pnom total	19.90 MWp	Nb. of units		86 units	
		Pnom total		17.20 MWac	
		Grid power limit		15.86 MVA	
		Grid lim. Pnom ratio		1.255	

Results summary					
Produced Energy	28 GWh/year	Specific production	1390 kWh/kWp/year	Perf. Ratio PR	85.12 %
Apparent energy	27688 MVAh				

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General parameters

Grid-Connected System		Ground system (tables) on a hill										
PV Field Orientation		Sheds configuration										
Orientation		Nb. of sheds	331 units									
Fixed plane		Sizes										
Tilt/Azimuth	22 / 1 °	Sheds spacing	8.25 m									
		Collector width	5.27 m									
		Ground Cov. Ratio (GCR)	63.8 %									
Horizon		Near Shadings										
Free Horizon		According to strings										
		Electrical effect	80 %									
Bifacial system		User's needs										
Model	2D Calculation unlimited sheds	Unlimited load (grid)										
Bifacial model geometry		Bifacial model definitions										
Sheds spacing	8.25 m	Ground albedo average	0.16									
Sheds width	5.27 m	Bifaciality factor	70 %									
Limit profile angle	0.0 °	Rear shading factor	7.0 %									
GCR	63.8 %	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	0.16	0.18	0.18	0.19	0.19	0.17	0.16	0.13	0.12	0.12	0.16
Grid injection point		Power factor										
Grid power limitation		Cos(phi) (leading)	1.000									
Apparent power	15.86 MVA											
Pnom ratio	1.255											

PV Array Characteristics

PV module		Inverter	
Manufacturer	Trina Solar	Manufacturer	Huawei Technologies
Model	TSM-690DEG20C.20	Model	SUN2000-215KTL-H0
(Custom parameters definition)		(Custom parameters definition)	
Unit Nom. Power	590 Wp	Unit Nom. Power	200 kVA
Number of PV modules	33728 units	Number of inverters	86 units
Nominal (STC)	19.90 MWp	Total power	17200 kVA
Modules	1054 Strings x 32 In series	Operating voltage	500-1500 V
At operating cond. (50°C)		Max. power (=>33°C)	215 kVA
Pmpp	18.21 MWp	Pnom ratio (DC:AC)	1.16
U mpp	990 V		
I mpp	18395 A		
Total PV power		Total inverter power	
Nominal (STC)	19900 kWp	Total power	17200 kVA
Total	33728 modules	Number of inverters	86 units
Module area	95454 m ²	Pnom ratio	1.16
Cell area	89244 m ²		

Array losses

Array Soiling Losses Loss Fraction 1.5 %	Thermal Loss factor Module temperature according to irradiance U _c (const) 29.0 W/m ² K U _v (wind) 0.0 W/m ² K/m/s	DC wiring losses Global array res. 0.48 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

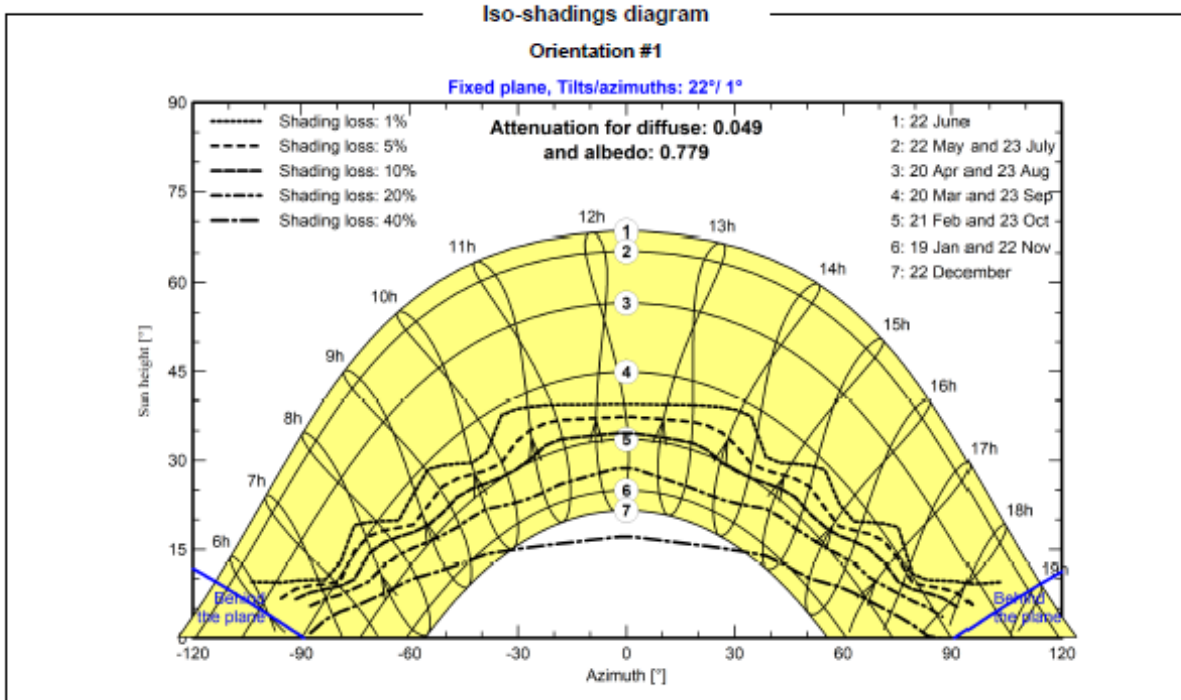
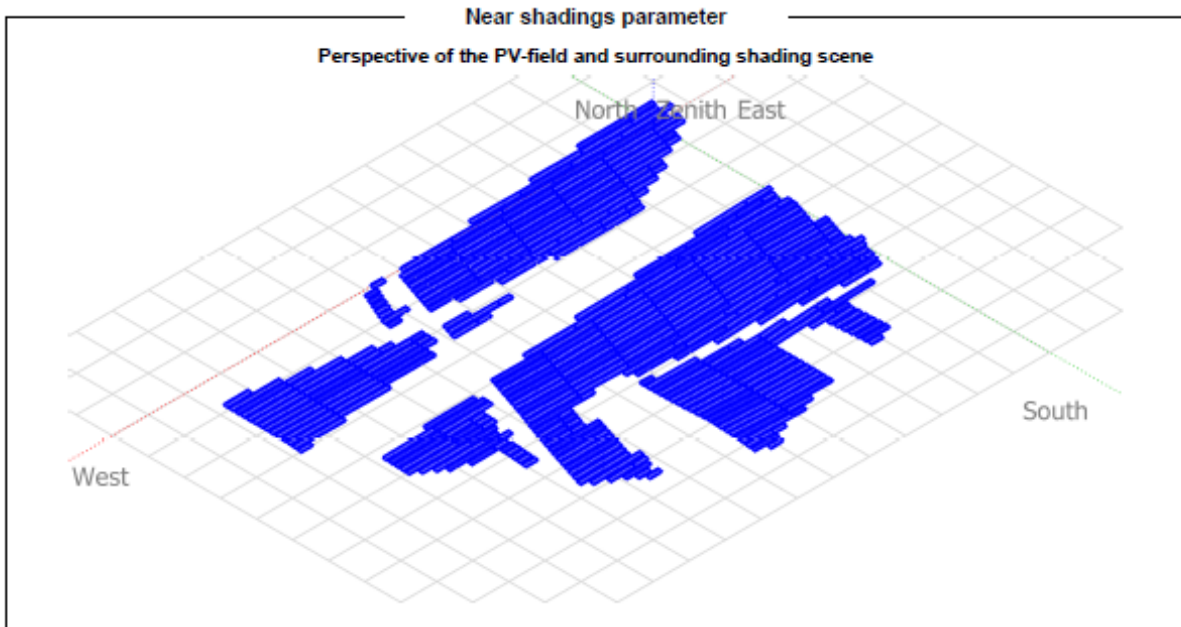
Auxiliaries loss	
Proportional to Power	4.0 W/kW
20.0 kW from Power thresh.	
Night aux. cons.	5.00 kW

AC wiring losses

Inv. output line up to MV transfo	
Inverter voltage	800 Vac tri
Loss Fraction	1.85 % at STC
Inverter: SUN2000-215KTL-H0	
Wire section (86 Inv.)	Copper 86 x 3 x 70 mm ²
Average wires length	194 m
MV line up to Injection	
MV Voltage	30 kV
Wires	Alu 3 x 240 mm ²
Length	4500 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	19531 kVA
Iron loss (24/24 Connexion)	29.30 kW
Loss Fraction	0.15 % at STC
Coils equivalent resistance	3 x 0.54 mΩ
Loss Fraction	1.65 % at STC

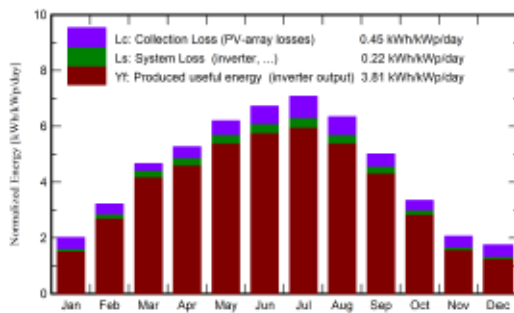


Main results

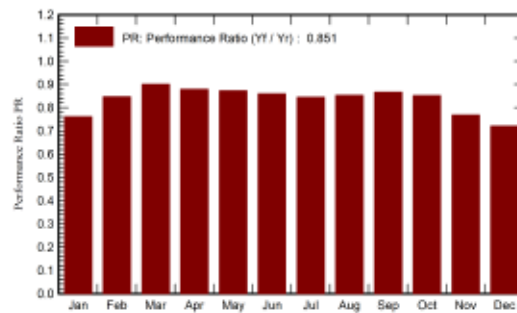
System Production

Produced Energy (P50)	28 GWh/year	Specific production (P50)	1390 kWh/kWp/year	Performance Ratio PR	85.12 %
Produced Energy (P90)	27.0 GWh/year	Specific production (P90)	1358 kWh/kWp/year		
Produced Energy (P95)	26.8 GWh/year	Specific production (P95)	1349 kWh/kWp/year		
Apparent energy	27688 MVAh				

Normalized productions (per installed kWp)



Performance Ratio PR

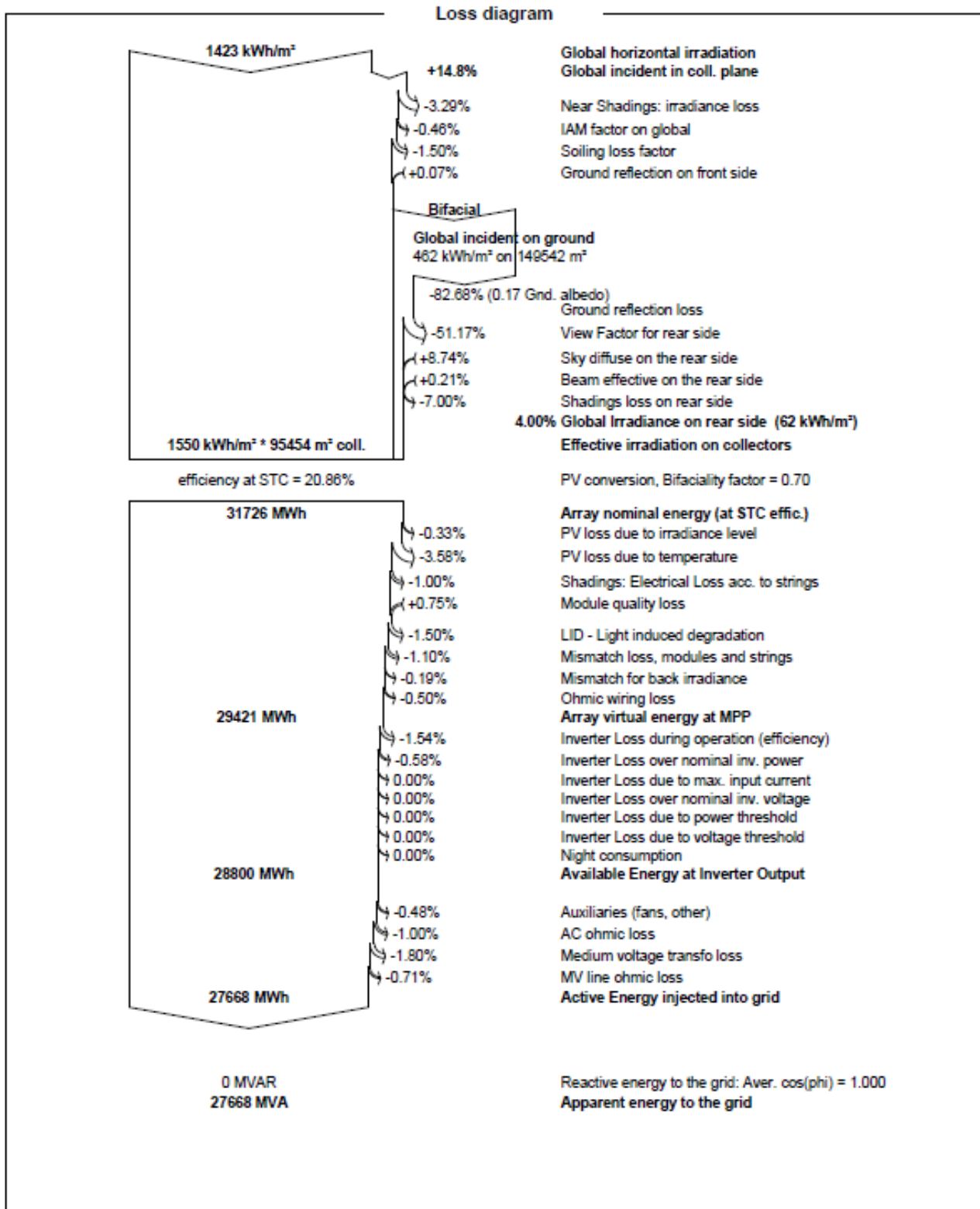


Balances and main results

	GlobHor kWh/m ²	DiffHor kWh/m ²	T_Amb °C	GlobInc kWh/m ²	GlobEff kWh/m ²	EArray GWh	E_Grid GWh	PR ratio
January	41.0	22.00	4.10	62.4	53.2	1.002	0.944	0.760
February	64.0	30.00	5.70	89.7	83.4	1.596	1.512	0.847
March	115.0	50.00	10.20	144.6	139.1	2.734	2.590	0.900
April	142.0	63.00	14.40	157.7	152.0	2.914	2.758	0.879
May	185.0	79.00	19.40	191.9	185.1	3.521	3.333	0.873
June	200.0	83.00	23.80	201.6	194.6	3.645	3.448	0.859
July	214.0	78.00	26.10	219.3	212.0	3.900	3.684	0.844
August	180.0	71.00	25.60	196.4	189.7	3.523	3.332	0.853
September	126.0	55.00	20.60	150.1	144.7	2.733	2.586	0.866
October	79.0	41.00	15.50	103.7	97.7	1.855	1.750	0.852
November	43.0	24.00	9.90	61.9	54.3	1.004	0.945	0.768
December	34.0	18.00	4.60	54.2	44.2	0.828	0.777	0.721
Year	1423.0	614.00	15.04	1633.5	1550.1	29.255	27.668	0.851

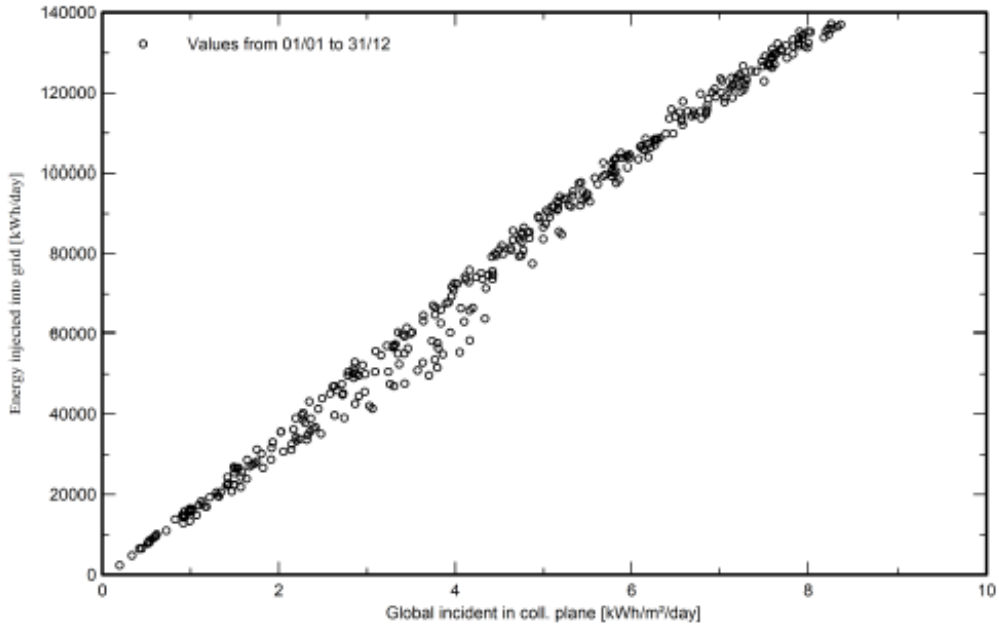
Legends

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		

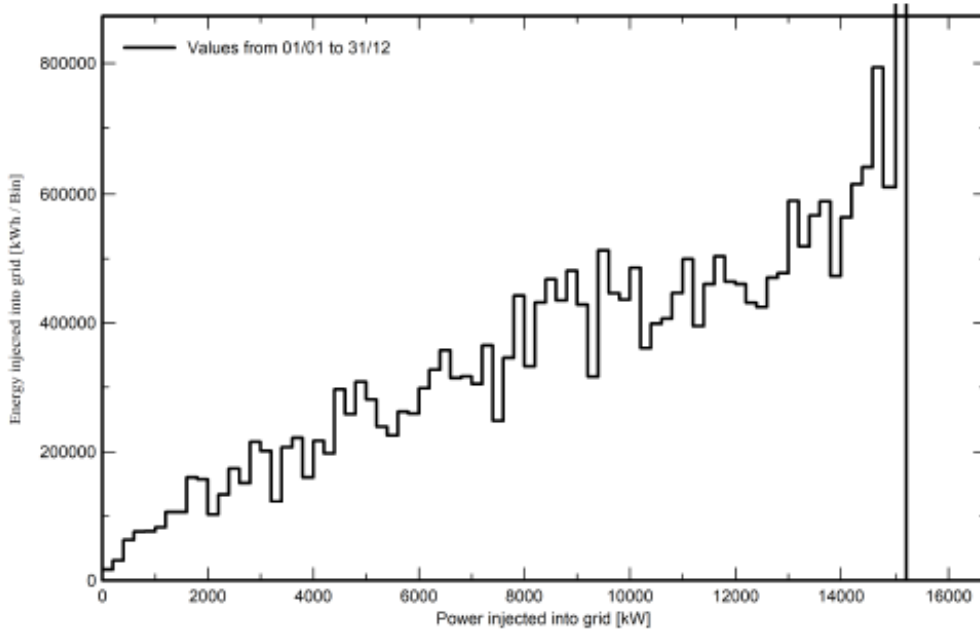


Special graphs

Daily Input/Output diagram



System Output Power Distribution



P50 - P90 evaluation

Meteo data

Source SolarGIS Monthly aver. , period not spec.
 Kind Not defined
 Year-to-year variability(Variance) 0.0 %
 Specified Deviation

Global variability (meteo + system)

Variability (Quadratic sum) 1.8 %

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 0.50 GWh
 P50 27.67 GWh
 P90 27.03 GWh
 P95 26.85 GWh

Probability distribution

