



TRANSIZIONE ECOLOGICA



REGIONE SICILIA



COMUNE DI RAMACCA



COMUNE DI CASTEL DI IUDICA

NOME PROGETTO:

Costruzione ed esercizio di un impianto agrovoltaico avente potenza in immissione pari a ~~240,500~~ 205,490MW, con relativo collegamento alla rete elettrica, sito nei comuni di Castel di Iudica e Ramacca (CT) - Impianto "FICURINIA".

ID. PROGETTO DEL MITE: ID_VIP 8434

PROCEDURA:

Valutazione di impatto ambientale ai sensi dell'art. 23 c. 1 del D.Lgs. 152/06 e ss.mm.ii..

PROPONENTE:



INE Ficurinia Srl

A Company of ILOS New Energy Italy

INE FICURINIA S.R.L.
Piazza Walther Von Vogelweide 8,
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RESPONSABILE PROGETTO:
Ing. Jury Mancinelli



INE FICURINIA S.R.L.
a company of ILOS New Energy Italy
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Legale rappresentante: Ing. Sergio Chiericoni

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RS06REL067A0_rev.01

CARTELLA:

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Dott. Ing. Giada Stella BOLIGNANO
Iscrizione all'Albo n° A 2508
alla Sezione degli Ingegneri (Sez. A)
- Settore civile e ambientale
- Settore industriale
- Settore dell'informazione



ORDINE DEGLI INGEGNERI
DELLA PROVINCIA DI REGGIO CALABRIA

TITOLO ELABORATO:

Analisi della risorsa solare e stima di produzione energia lotto 3684

SCALA:

-

PROGETTAZIONE E COORDINAMENTO



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STRUTTURE ED OPERE CIVILI



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N. REV.	DATA	REVISIONE
0	apr-22	Emissione
1	setl-23	Integrazioni con modifica sostanziale del progetto in riscontro a richiesta MASE prot. m_ame-CTVA. RFCISTRO UFFICIAI F.U.0006731.08-06-2023

ELABORATO	VERIFICATO	VALIDATO
Ing. Baldacconi/Ing. D'Elia/Ing. Vizzarro Ing. Baldacconi/Ing. D'Elia	Ing. Bolignano Ing. Bolignano	INE FICURINIA S.R.L. INE FICURINIA S.R.L.

PVsyst - Simulation report

Grid-Connected System

Project: Ficurinia lotto #3684

Variant: New simulation variant

Ground system (tables) on a hill

System power: 86.10 MWp

Cavalera - Italy

Author

ARATO SRL (Italy)



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Project summary

Geographical Site	Situation	Project settings
Cavalera	Latitude 37.51 °N	Albedo 0.20
Italy	Longitude 14.61 °E	
	Altitude 358 m	
	Time zone UTC+1	
Meteo data		
Cavalera		
PVGIS api TMY		

System summary

Grid-Connected System	Ground system (tables) on a hill	
Simulation for year no 1		
PV Field Orientation	Near Shadings	User's needs
Fixed plane	Linear shadings : Fast (table)	Unlimited load (grid)
Tilt/Azimuth 31.1 / 3.2 °		
System information		
PV Array	Inverters	
Nb. of modules 141144 units	Nb. of units 39 units	
Pnom total 86.10 MWp	Pnom total 76.42 MWac	
	Pnom ratio 1.127	

Results summary

Produced Energy 137.59 GWh/year	Specific production 1598 kWh/kWp/year	Perf. Ratio PR 77.60 %
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General parameters

Grid-Connected System		Ground system (tables) on a hill	
PV Field Orientation		Sheds configuration	
Orientation		Nb. of sheds	6063 units
Fixed plane		Sizes	
Tilt/Azimuth	31.1 / 3.2 °	Sheds spacing	10.1 m
		Collector width	4.60 m
		Ground Cov. Ratio (GCR)	45.4 %
		Shading limit angle	
		Limit profile angle	21.0 °
Horizon		Near Shadings	
Average Height	5.7 °	Linear shadings : Fast (table)	
		Models used	
		Transposition	Perez
		Diffuse	Imported
		Circumsolar	separate
		User's needs	
		Unlimited load (grid)	

PV Array Characteristics

PV module		Inverter	
Manufacturer	JA Solar	Manufacturer	Santerno
Model	JAM78S30-610/MR	Model	Sunway TG 1800 1500V TE - 600
(Custom parameters definition)		(Custom parameters definition)	
Unit Nom. Power	610 Wp	Unit Nom. Power	1662 kWac
Number of PV modules	20472 units	Number of inverters	7 units
Nominal (STC)	12.49 MWp	Total power	11634 kWac
Array #1 - Sub-array #1			
Number of PV modules	2928 units	Number of inverters	1 unit
Nominal (STC)	1786 kWp	Total power	1662 kWac
Modules	122 Strings x 24 In series		
At operating cond. (50°C)		Operating voltage	860-1200 V
Pmpp	1617 kWp	Pnom ratio (DC:AC)	1.07
U mpp	982 V	Power sharing within this inverter	
I mpp	1646 A		
Array #2 - Sub-array #2			
Number of PV modules	2928 units	Number of inverters	1 unit
Nominal (STC)	1786 kWp	Total power	1662 kWac
Modules	122 Strings x 24 In series		
At operating cond. (50°C)		Operating voltage	860-1200 V
Pmpp	1617 kWp	Pnom ratio (DC:AC)	1.07
U mpp	982 V	Power sharing within this inverter	
I mpp	1646 A		
Array #3 - Sub-array #3			
Number of PV modules	2928 units	Number of inverters	1 unit
Nominal (STC)	1786 kWp	Total power	1662 kWac
Modules	122 Strings x 24 In series		
At operating cond. (50°C)		Operating voltage	860-1200 V
Pmpp	1617 kWp	Pnom ratio (DC:AC)	1.07
U mpp	982 V	Power sharing within this inverter	
I mpp	1646 A		



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PV Array Characteristics

Array #4 - Sub-array #4

Number of PV modules	2928 units	Number of inverters	1 unit
Nominal (STC)	1786 kWp	Total power	1662 kWac
Modules	122 Strings x 24 In series		
At operating cond. (50°C)		Operating voltage	860-1200 V
Pmpp	1617 kWp	Pnom ratio (DC:AC)	1.07
U mpp	982 V	Power sharing within this inverter	
I mpp	1646 A		

Array #5 - Sub-array #5

Number of PV modules	2904 units	Number of inverters	1 unit
Nominal (STC)	1771 kWp	Total power	1662 kWac
Modules	121 Strings x 24 In series		
At operating cond. (50°C)		Operating voltage	860-1200 V
Pmpp	1604 kWp	Pnom ratio (DC:AC)	1.07
U mpp	982 V	Power sharing within this inverter	
I mpp	1633 A		

Array #27 - Sub-array #27

Number of PV modules	2736 units	Number of inverters	1 unit
Nominal (STC)	1669 kWp	Total power	1662 kWac
Modules	114 Strings x 24 In series		
At operating cond. (50°C)		Operating voltage	860-1200 V
Pmpp	1511 kWp	Pnom ratio (DC:AC)	1.00
U mpp	982 V	Power sharing within this inverter	
I mpp	1538 A		

Array #33 - Sub-array #33

Number of PV modules	3120 units	Number of inverters	1 unit
Nominal (STC)	1903 kWp	Total power	1662 kWac
Modules	130 Strings x 24 In series		
At operating cond. (50°C)		Operating voltage	860-1200 V
Pmpp	1723 kWp	Pnom ratio (DC:AC)	1.15
U mpp	982 V	Power sharing within this inverter	
I mpp	1754 A		

PV module

Manufacturer	JA Solar
Model	JAM78S30-610/MR
(Custom parameters definition)	
Unit Nom. Power	610 Wp
Number of PV modules	68112 units
Nominal (STC)	41.55 MWp

Inverter

Manufacturer	Santerno
Model	Sunway TG 1800 1500V TE - 690
(Custom parameters definition)	
Unit Nom. Power	1912 kWac
Number of inverters	19 units
Total power	36328 kWac

Array #6 - Sub-array #6

Number of PV modules	3552 units	Number of inverters	1 unit
Nominal (STC)	2167 kWp	Total power	1912 kWac
Modules	148 Strings x 24 In series		
At operating cond. (50°C)		Operating voltage	690-1200 V
Pmpp	1962 kWp	Max. power (=>25°C)	2151 kWac
U mpp	982 V	Pnom ratio (DC:AC)	1.13
I mpp	1997 A	Power sharing within this inverter	



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PV Array Characteristics

Array #7 - Sub-array #7

Number of PV modules	3552 units	Number of inverters	1 unit
Nominal (STC)	2167 kWp	Total power	1912 kWac
Modules	148 Strings x 24 In series		
At operating cond. (50°C)		Operating voltage	690-1200 V
Pmpp	1962 kWp	Max. power (=>25°C)	2151 kWac
U mpp	982 V	Pnom ratio (DC:AC)	1.13
I mpp	1997 A	Power sharing within this inverter	

Array #8 - Sub-array #8

Number of PV modules	3552 units	Number of inverters	1 unit
Nominal (STC)	2167 kWp	Total power	1912 kWac
Modules	148 Strings x 24 In series		
At operating cond. (50°C)		Operating voltage	690-1200 V
Pmpp	1962 kWp	Max. power (=>25°C)	2151 kWac
U mpp	982 V	Pnom ratio (DC:AC)	1.13
I mpp	1997 A	Power sharing within this inverter	

Array #9 - Sub-array #9

Number of PV modules	3552 units	Number of inverters	1 unit
Nominal (STC)	2167 kWp	Total power	1912 kWac
Modules	148 Strings x 24 In series		
At operating cond. (50°C)		Operating voltage	690-1200 V
Pmpp	1962 kWp	Max. power (=>25°C)	2151 kWac
U mpp	982 V	Pnom ratio (DC:AC)	1.13
I mpp	1997 A	Power sharing within this inverter	

Array #10 - Sub-array #10

Number of PV modules	3552 units	Number of inverters	1 unit
Nominal (STC)	2167 kWp	Total power	1912 kWac
Modules	148 Strings x 24 In series		
At operating cond. (50°C)		Operating voltage	690-1200 V
Pmpp	1962 kWp	Max. power (=>25°C)	2151 kWac
U mpp	982 V	Pnom ratio (DC:AC)	1.13
I mpp	1997 A	Power sharing within this inverter	

Array #11 - Sub-array #11

Number of PV modules	3504 units	Number of inverters	1 unit
Nominal (STC)	2137 kWp	Total power	1912 kWac
Modules	146 Strings x 24 In series		
At operating cond. (50°C)		Operating voltage	690-1200 V
Pmpp	1936 kWp	Max. power (=>25°C)	2151 kWac
U mpp	982 V	Pnom ratio (DC:AC)	1.12
I mpp	1970 A	Power sharing within this inverter	

Array #12 - Sub-array #12

Number of PV modules	3504 units	Number of inverters	1 unit
Nominal (STC)	2137 kWp	Total power	1912 kWac
Modules	146 Strings x 24 In series		
At operating cond. (50°C)		Operating voltage	690-1200 V
Pmpp	1936 kWp	Max. power (=>25°C)	2151 kWac
U mpp	982 V	Pnom ratio (DC:AC)	1.12
I mpp	1970 A	Power sharing within this inverter	



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PV Array Characteristics

Array #13 - Sub-array #13

Number of PV modules	3480 units	Number of inverters	1 unit
Nominal (STC)	2123 kWp	Total power	1912 kWac
Modules	145 Strings x 24 In series		
At operating cond. (50°C)			
Pmpp	1922 kWp	Operating voltage	690-1200 V
U mpp	982 V	Max. power (=>25°C)	2151 kWac
I mpp	1957 A	Pnom ratio (DC:AC)	1.11
		Power sharing within this inverter	

Array #15 - Sub-array #15

Number of PV modules	3432 units	Number of inverters	1 unit
Nominal (STC)	2094 kWp	Total power	1912 kWac
Modules	143 Strings x 24 In series		
At operating cond. (50°C)			
Pmpp	1896 kWp	Operating voltage	690-1200 V
U mpp	982 V	Max. power (=>25°C)	2151 kWac
I mpp	1930 A	Pnom ratio (DC:AC)	1.09
		Power sharing within this inverter	

Array #16 - Sub-array #16

Number of PV modules	3432 units	Number of inverters	1 unit
Nominal (STC)	2094 kWp	Total power	1912 kWac
Modules	143 Strings x 24 In series		
At operating cond. (50°C)			
Pmpp	1896 kWp	Operating voltage	690-1200 V
U mpp	982 V	Max. power (=>25°C)	2151 kWac
I mpp	1930 A	Pnom ratio (DC:AC)	1.09
		Power sharing within this inverter	

Array #17 - Sub-array #17

Number of PV modules	3432 units	Number of inverters	1 unit
Nominal (STC)	2094 kWp	Total power	1912 kWac
Modules	143 Strings x 24 In series		
At operating cond. (50°C)			
Pmpp	1896 kWp	Operating voltage	690-1200 V
U mpp	982 V	Max. power (=>25°C)	2151 kWac
I mpp	1930 A	Pnom ratio (DC:AC)	1.09
		Power sharing within this inverter	

Array #18 - Sub-array #18

Number of PV modules	4008 units	Number of inverters	1 unit
Nominal (STC)	2445 kWp	Total power	1912 kWac
Modules	167 Strings x 24 In series		
At operating cond. (50°C)			
Pmpp	2214 kWp	Operating voltage	690-1200 V
U mpp	982 V	Max. power (=>25°C)	2151 kWac
I mpp	2254 A	Pnom ratio (DC:AC)	1.28
		Power sharing within this inverter	

Array #19 - Sub-array #19

Number of PV modules	3984 units	Number of inverters	1 unit
Nominal (STC)	2430 kWp	Total power	1912 kWac
Modules	166 Strings x 24 In series		
At operating cond. (50°C)			
Pmpp	2201 kWp	Operating voltage	690-1200 V
U mpp	982 V	Max. power (=>25°C)	2151 kWac
I mpp	2240 A	Pnom ratio (DC:AC)	1.27
		Power sharing within this inverter	



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PV Array Characteristics

Array #20 - Sub-array #20

Number of PV modules	3984 units	Number of inverters	1 unit
Nominal (STC)	2430 kWp	Total power	1912 kWac
Modules	166 Strings x 24 In series		
At operating cond. (50°C)			
Pmpp	2201 kWp	Operating voltage	690-1200 V
U mpp	982 V	Max. power (=>25°C)	2151 kWac
I mpp	2240 A	Pnom ratio (DC:AC)	1.27
		Power sharing within this inverter	

Array #29 - Sub-array #29

Number of PV modules	3192 units	Number of inverters	1 unit
Nominal (STC)	1947 kWp	Total power	1912 kWac
Modules	133 Strings x 24 In series		
At operating cond. (50°C)			
Pmpp	1763 kWp	Operating voltage	690-1200 V
U mpp	982 V	Max. power (=>25°C)	2151 kWac
I mpp	1795 A	Pnom ratio (DC:AC)	1.02
		Power sharing within this inverter	

Array #30 - Sub-array #30

Number of PV modules	3192 units	Number of inverters	1 unit
Nominal (STC)	1947 kWp	Total power	1912 kWac
Modules	133 Strings x 24 In series		
At operating cond. (50°C)			
Pmpp	1763 kWp	Operating voltage	690-1200 V
U mpp	982 V	Max. power (=>25°C)	2151 kWac
I mpp	1795 A	Pnom ratio (DC:AC)	1.02
		Power sharing within this inverter	

Array #31 - Sub-array #31

Number of PV modules	3192 units	Number of inverters	1 unit
Nominal (STC)	1947 kWp	Total power	1912 kWac
Modules	133 Strings x 24 In series		
At operating cond. (50°C)			
Pmpp	1763 kWp	Operating voltage	690-1200 V
U mpp	982 V	Max. power (=>25°C)	2151 kWac
I mpp	1795 A	Pnom ratio (DC:AC)	1.02
		Power sharing within this inverter	

Array #34 - Sub-array #34

Number of PV modules	4008 units	Number of inverters	1 unit
Nominal (STC)	2445 kWp	Total power	1912 kWac
Modules	167 Strings x 24 In series		
At operating cond. (50°C)			
Pmpp	2214 kWp	Operating voltage	690-1200 V
U mpp	982 V	Max. power (=>25°C)	2151 kWac
I mpp	2254 A	Pnom ratio (DC:AC)	1.28
		Power sharing within this inverter	

Array #35 - Sub-array #35

Number of PV modules	4008 units	Number of inverters	1 unit
Nominal (STC)	2445 kWp	Total power	1912 kWac
Modules	167 Strings x 24 In series		
At operating cond. (50°C)			
Pmpp	2214 kWp	Operating voltage	690-1200 V
U mpp	982 V	Max. power (=>25°C)	2151 kWac
I mpp	2254 A	Pnom ratio (DC:AC)	1.28
		Power sharing within this inverter	



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PV Array Characteristics

PV module

Manufacturer JA Solar
Model JAM78S30-610/MR
(Custom parameters definition)
Unit Nom. Power 610 Wp
Number of PV modules 23040 units
Nominal (STC) 14.05 MWp

Inverter

Manufacturer Santerno
Model SUNWAY STATION TG1800&900-1500V-TE 600 (2493kW)
(Custom parameters definition)
Unit Nom. Power 2493 kWac
Number of inverters 5 units
Total power 12465 kWac

Array #14 - Sub-array #14

Number of PV modules 4416 units
Nominal (STC) 2694 kWp
Modules 184 Strings x 24 In series

Number of inverters 1 unit
Total power 2493 kWac

At operating cond. (50°C)

Pmpp 2439 kWp
U mpp 982 V
I mpp 2483 A

Operating voltage 860-1200 V
Max. power (=>25°C) 2494 kWac
Pnom ratio (DC:AC) 1.08
Power sharing within this inverter

Array #36 - Sub-array #36

Number of PV modules 4680 units
Nominal (STC) 2855 kWp
Modules 195 Strings x 24 In series

Number of inverters 1 unit
Total power 2493 kWac

At operating cond. (50°C)

Pmpp 2585 kWp
U mpp 982 V
I mpp 2631 A

Operating voltage 860-1200 V
Max. power (=>25°C) 2494 kWac
Pnom ratio (DC:AC) 1.15
Power sharing within this inverter

Array #37 - Sub-array #37

Number of PV modules 4656 units
Nominal (STC) 2840 kWp
Modules 194 Strings x 24 In series

Number of inverters 1 unit
Total power 2493 kWac

At operating cond. (50°C)

Pmpp 2572 kWp
U mpp 982 V
I mpp 2618 A

Operating voltage 860-1200 V
Max. power (=>25°C) 2494 kWac
Pnom ratio (DC:AC) 1.14
Power sharing within this inverter

Array #38 - Sub-array #38

Number of PV modules 4656 units
Nominal (STC) 2840 kWp
Modules 194 Strings x 24 In series

Number of inverters 1 unit
Total power 2493 kWac

At operating cond. (50°C)

Pmpp 2572 kWp
U mpp 982 V
I mpp 2618 A

Operating voltage 860-1200 V
Max. power (=>25°C) 2494 kWac
Pnom ratio (DC:AC) 1.14
Power sharing within this inverter

Array #39 - Sub-array #39

Number of PV modules 4632 units
Nominal (STC) 2826 kWp
Modules 193 Strings x 24 In series

Number of inverters 1 unit
Total power 2493 kWac

At operating cond. (50°C)

Pmpp 2559 kWp
U mpp 982 V
I mpp 2604 A

Operating voltage 860-1200 V
Max. power (=>25°C) 2494 kWac
Pnom ratio (DC:AC) 1.13
Power sharing within this inverter



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PV Array Characteristics

PV module

Manufacturer JA Solar
Model JAM78S30-610/MR
(Custom parameters definition)
Unit Nom. Power 610 Wp
Number of PV modules 23952 units
Nominal (STC) 14.61 MWp

Inverter

Manufacturer Santerno
Model SUNWAY STATION TG1800&900-1500V-TE 610 (2535kW)
(Custom parameters definition)
Unit Nom. Power 2535 kWac
Number of inverters 5 units
Total power 12675 kWac

Array #21 - Sub-array #21

Number of PV modules 4800 units
Nominal (STC) 2928 kWp
Modules 200 Strings x 24 In series

Number of inverters 1 unit
Total power 2535 kWac

At operating cond. (50°C)

Pmpp 2652 kWp
U mpp 982 V
I mpp 2699 A

Operating voltage 860-1200 V
Max. power (=>25°C) 2535 kWac
Pnom ratio (DC:AC) 1.16
Power sharing within this inverter

Array #22 - Sub-array #22

Number of PV modules 4800 units
Nominal (STC) 2928 kWp
Modules 200 Strings x 24 In series

Number of inverters 1 unit
Total power 2535 kWac

At operating cond. (50°C)

Pmpp 2652 kWp
U mpp 982 V
I mpp 2699 A

Operating voltage 860-1200 V
Max. power (=>25°C) 2535 kWac
Pnom ratio (DC:AC) 1.16
Power sharing within this inverter

Array #23 - Sub-array #23

Number of PV modules 4800 units
Nominal (STC) 2928 kWp
Modules 200 Strings x 24 In series

Number of inverters 1 unit
Total power 2535 kWac

At operating cond. (50°C)

Pmpp 2652 kWp
U mpp 982 V
I mpp 2699 A

Operating voltage 860-1200 V
Max. power (=>25°C) 2535 kWac
Pnom ratio (DC:AC) 1.16
Power sharing within this inverter

Array #24 - Sub-array #24

Number of PV modules 4776 units
Nominal (STC) 2913 kWp
Modules 199 Strings x 24 In series

Number of inverters 1 unit
Total power 2535 kWac

At operating cond. (50°C)

Pmpp 2638 kWp
U mpp 982 V
I mpp 2685 A

Operating voltage 860-1200 V
Max. power (=>25°C) 2535 kWac
Pnom ratio (DC:AC) 1.15
Power sharing within this inverter

Array #25 - Sub-array #25

Number of PV modules 4776 units
Nominal (STC) 2913 kWp
Modules 199 Strings x 24 In series

Number of inverters 1 unit
Total power 2535 kWac

At operating cond. (50°C)

Pmpp 2638 kWp
U mpp 982 V
I mpp 2685 A

Operating voltage 860-1200 V
Max. power (=>25°C) 2535 kWac
Pnom ratio (DC:AC) 1.15
Power sharing within this inverter



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PV Array Characteristics

PV module		Inverter	
Manufacturer	JA Solar	Manufacturer	Santerno
Model	JAM78S30-610/MR	Model	Sunway TG 900 1500V TE - 600 (831kW)
(Custom parameters definition)		(Custom parameters definition)	
Unit Nom. Power	610 Wp	Unit Nom. Power	831 kWac
Number of PV modules	2856 units	Number of inverters	2 units
Nominal (STC)	1742 kWp	Total power	1662 kWac
Array #26 - Sub-array #26			
Number of PV modules	1368 units	Number of inverters	1 unit
Nominal (STC)	834 kWp	Total power	831 kWac
Modules	57 Strings x 24 In series		
At operating cond. (50°C)		Operating voltage	860-1200 V
Pmpp	756 kWp	Max. power (=>25°C)	936 kWac
U mpp	982 V	Pnom ratio (DC:AC)	1.00
I mpp	769 A		
Array #32 - Sub-array #32			
Number of PV modules	1488 units	Number of inverters	1 unit
Nominal (STC)	908 kWp	Total power	831 kWac
Modules	62 Strings x 24 In series		
At operating cond. (50°C)		Operating voltage	860-1200 V
Pmpp	822 kWp	Max. power (=>25°C)	936 kWac
U mpp	982 V	Pnom ratio (DC:AC)	1.09
I mpp	837 A		
Array #28 - Sub-array #28			
PV module		Inverter	
Manufacturer	JA Solar	Manufacturer	Santerno
Model	JAM78S30-610/MR	Model	Sunway TG 1800 1500V TE - 600 (1654kVA)
(Custom parameters definition)		(Custom parameters definition)	
Unit Nom. Power	610 Wp	Unit Nom. Power	1654 kWac
Number of PV modules	2712 units	Number of inverters	1 unit
Nominal (STC)	1654 kWp	Total power	1654 kWac
Modules	113 Strings x 24 In series		
At operating cond. (50°C)		Operating voltage	860-1200 V
Pmpp	1498 kWp	Pnom ratio (DC:AC)	1.00
U mpp	982 V	Power sharing within this inverter	
I mpp	1525 A		
Total PV power		Total inverter power	
Nominal (STC)	86098 kWp	Total power	76418 kWac
Total	141144 modules	Max. power	81174 kWac
Module area	394541 m²	Number of inverters	39 units
Cell area	363745 m²	Pnom ratio	1.13

Array losses

Array Soiling Losses		Thermal Loss factor		Serie Diode Loss	
Loss Fraction	3.0 %	Module temperature according to irradiance		Voltage drop	0.7 V
		Uc (const)	29.0 W/m²K	Loss Fraction	0.1 % at STC
		Uv (wind)	0.0 W/m²K/m/s		
LID - Light Induced Degradation		Module Quality Loss		Module mismatch losses	
Loss Fraction	2.0 %	Loss Fraction	-0.3 %	Loss Fraction	0.8 % at MPP



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Array losses

Strings Mismatch loss

Loss Fraction 0.1 %

Module average degradation

Year no 1
Loss factor 0.4 %/year

Mismatch due to degradation

Imp RMS dispersion 0.4 %/year
Vmp RMS dispersion 0.4 %/year

IAM loss factor

Incidence effect (IAM): User defined profile

0°	30°	50°	60°	70°	75°	80°	85°	90°
1.000	1.000	1.000	1.000	1.000	0.985	0.943	0.840	0.000

DC wiring losses

Global wiring resistance 0.21 mΩ
Loss Fraction 1.5 % at STC

Array #1 - Sub-array #1

Global array res. 9.9 mΩ
Loss Fraction 1.5 % at STC

Array #3 - Sub-array #3

Global array res. 9.9 mΩ
Loss Fraction 1.5 % at STC

Array #5 - Sub-array #5

Global array res. 10.0 mΩ
Loss Fraction 1.5 % at STC

Array #7 - Sub-array #7

Global array res. 8.2 mΩ
Loss Fraction 1.5 % at STC

Array #9 - Sub-array #9

Global array res. 8.2 mΩ
Loss Fraction 1.5 % at STC

Array #11 - Sub-array #11

Global array res. 8.3 mΩ
Loss Fraction 1.5 % at STC

Array #13 - Sub-array #13

Global array res. 8.3 mΩ
Loss Fraction 1.5 % at STC

Array #15 - Sub-array #15

Global array res. 8.4 mΩ
Loss Fraction 1.5 % at STC

Array #17 - Sub-array #17

Global array res. 8.4 mΩ
Loss Fraction 1.5 % at STC

Array #19 - Sub-array #19

Global array res. 7.3 mΩ
Loss Fraction 1.5 % at STC

Array #21 - Sub-array #21

Global array res. 6.0 mΩ
Loss Fraction 1.5 % at STC

Array #23 - Sub-array #23

Global array res. 6.0 mΩ
Loss Fraction 1.5 % at STC

Array #2 - Sub-array #2

Global array res. 9.9 mΩ
Loss Fraction 1.5 % at STC

Array #4 - Sub-array #4

Global array res. 9.9 mΩ
Loss Fraction 1.5 % at STC

Array #6 - Sub-array #6

Global array res. 8.2 mΩ
Loss Fraction 1.5 % at STC

Array #8 - Sub-array #8

Global array res. 8.2 mΩ
Loss Fraction 1.5 % at STC

Array #10 - Sub-array #10

Global array res. 8.2 mΩ
Loss Fraction 1.5 % at STC

Array #12 - Sub-array #12

Global array res. 8.3 mΩ
Loss Fraction 1.5 % at STC

Array #14 - Sub-array #14

Global array res. 6.6 mΩ
Loss Fraction 1.5 % at STC

Array #16 - Sub-array #16

Global array res. 8.4 mΩ
Loss Fraction 1.5 % at STC

Array #18 - Sub-array #18

Global array res. 7.2 mΩ
Loss Fraction 1.5 % at STC

Array #20 - Sub-array #20

Global array res. 7.3 mΩ
Loss Fraction 1.5 % at STC

Array #22 - Sub-array #22

Global array res. 6.0 mΩ
Loss Fraction 1.5 % at STC

Array #24 - Sub-array #24

Global array res. 6.1 mΩ
Loss Fraction 1.5 % at STC



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DC wiring losses

Array #25 - Sub-array #25		Array #26 - Sub-array #26	
Global array res.	6.1 mΩ	Global array res.	21 mΩ
Loss Fraction	1.5 % at STC	Loss Fraction	1.5 % at STC
Array #27 - Sub-array #27		Array #28 - Sub-array #28	
Global array res.	11 mΩ	Global array res.	11 mΩ
Loss Fraction	1.5 % at STC	Loss Fraction	1.5 % at STC
Array #29 - Sub-array #29		Array #30 - Sub-array #30	
Global array res.	9.1 mΩ	Global array res.	9.1 mΩ
Loss Fraction	1.5 % at STC	Loss Fraction	1.5 % at STC
Array #31 - Sub-array #31		Array #32 - Sub-array #32	
Global array res.	9.1 mΩ	Global array res.	19 mΩ
Loss Fraction	1.5 % at STC	Loss Fraction	1.5 % at STC
Array #33 - Sub-array #33		Array #34 - Sub-array #34	
Global array res.	9.3 mΩ	Global array res.	7.2 mΩ
Loss Fraction	1.5 % at STC	Loss Fraction	1.5 % at STC
Array #35 - Sub-array #35		Array #36 - Sub-array #36	
Global array res.	7.2 mΩ	Global array res.	6.2 mΩ
Loss Fraction	1.5 % at STC	Loss Fraction	1.5 % at STC
Array #37 - Sub-array #37		Array #38 - Sub-array #38	
Global array res.	6.2 mΩ	Global array res.	6.2 mΩ
Loss Fraction	1.5 % at STC	Loss Fraction	1.5 % at STC
Array #39 - Sub-array #39			
Global array res.	6.3 mΩ		
Loss Fraction	1.5 % at STC		

System losses

Auxiliaries loss	
constant (fans)	10.00 kW
2.2 kW from Power thresh.	

AC wiring losses

Inv. output line up to MV transfo	
Inverter voltage	600 Vac tri
Loss Fraction	2.00 % at STC
Inverters: Sunway TG 1800 1500V TE - 600, Sunway TG 1800 1500V TE - 690, SUNWAY STATION TG1800&900-1500V-TE 600 (2493kW), SUNWAY S	
Wire section (39 Inv.)	Copper 39 x 3 x 1500 mm ²
Average wires length	327 m
MV line up to Injection	
MV Voltage	20 kV
Average each inverter	
Wires	Copper 3 x 50 mm ²
Length	10038 m
Loss Fraction	2.00 % at STC



AC losses in transformers

MV transfo

Medium voltage 20 kV

One transfo parameters

Nominal power at STC 2.12 MVA
Iron Loss (24/24 Connexion) 2.12 kVA
Iron loss fraction 0.10 % at STC
Copper loss 42.39 kVA
Copper loss fraction 2.00 % at STC
Coils equivalent resistance 3 x 3.40 mΩ

Operating losses at STC (full system)

Nb. identical MV transfos 40
Nominal power at STC 84.78 MVA
Iron loss (24/24 Connexion) 84.78 kVA
Copper loss 1695.64 kVA



Horizon definition

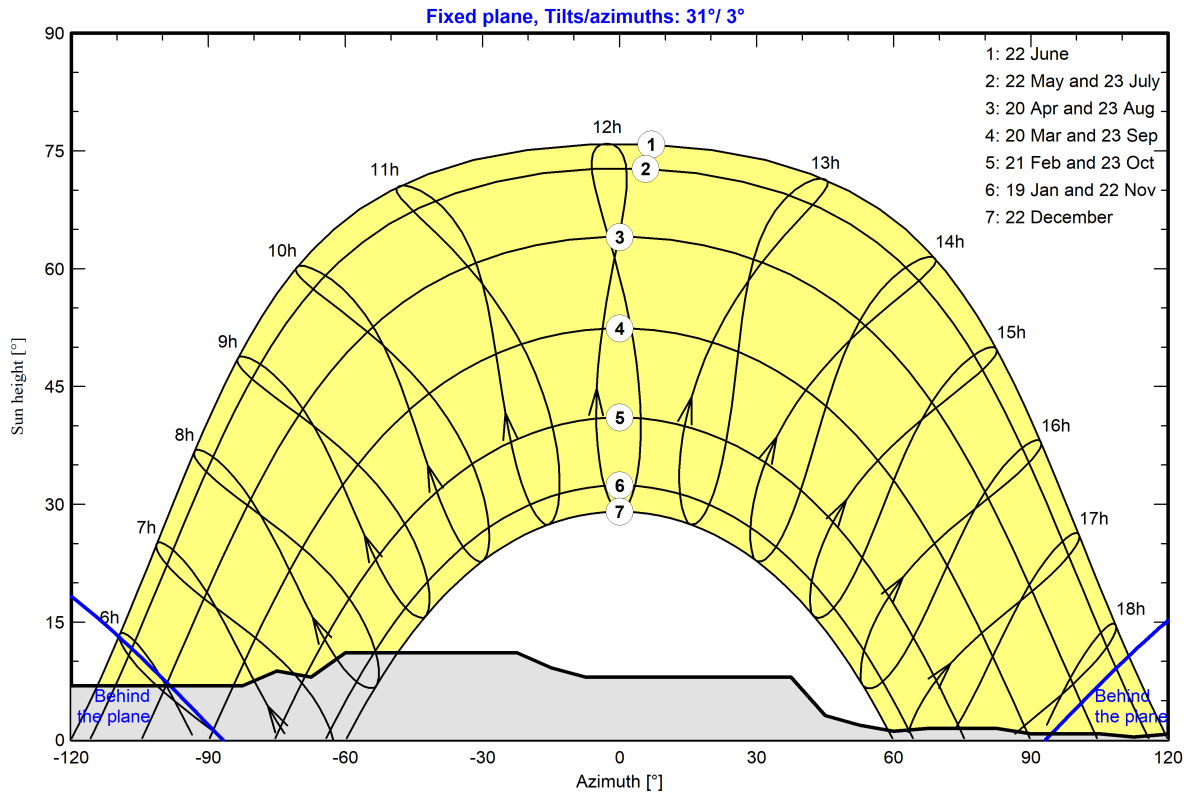
Horizon from PVGIS website API, Lat=37°30'36", Long=14°36'46", Alt=358m

Average Height	5.7 °	Albedo Factor	0.60
Diffuse Factor	0.94	Albedo Fraction	100 %

Horizon profile

Azimuth [°]	-180	-173	-165	-158	-143	-135	-83	-75	-68	-60
Height [°]	5.3	6.1	6.9	7.3	6.5	6.9	6.9	8.8	8.0	11.1
Azimuth [°]	-23	-15	-8	38	45	53	60	68	83	90
Height [°]	11.1	9.2	8.0	8.0	3.1	1.9	1.1	1.5	1.5	0.8
Azimuth [°]	105	113	128	135	143	150	158	165	173	180
Height [°]	0.8	0.4	1.1	1.1	1.5	1.9	2.7	3.8	4.6	5.3

Sun Paths (Height / Azimuth diagram)





Main results

System Production

Produced Energy 137.59 GWh/year

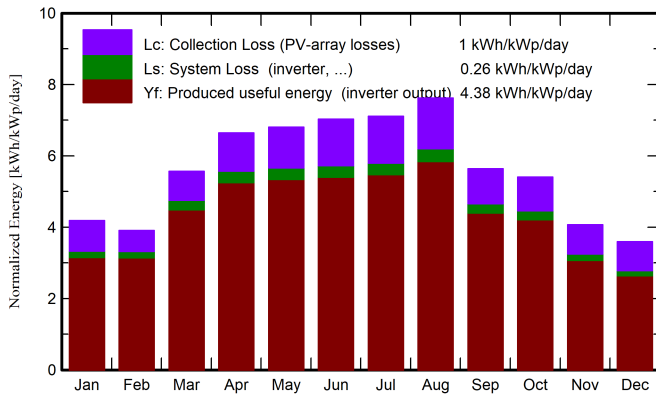
Specific production

1598 kWh/kWp/year

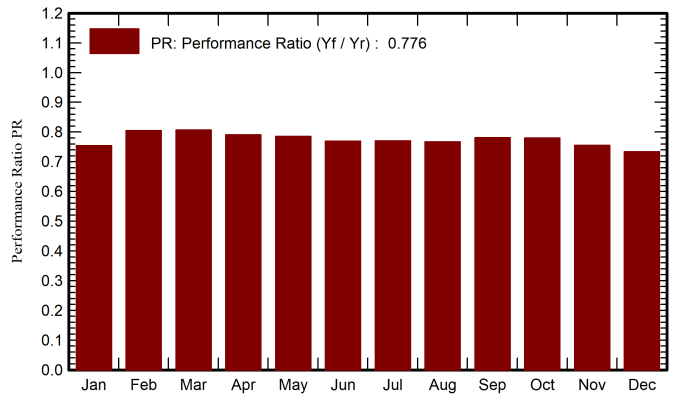
Perf. Ratio PR

77.60 %

Normalized productions (per installed kWp)



Performance Ratio PR



Balances and main results

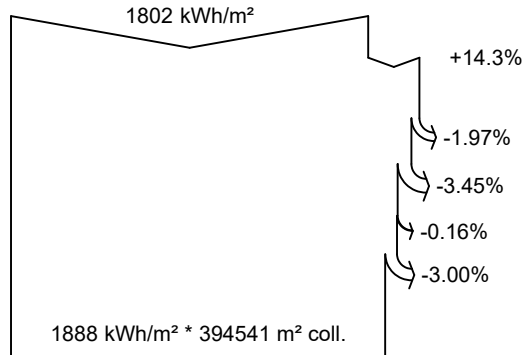
	GlobHor	DiffHor	T_Amb	GlobInc	GlobEff	EArray	E_Grid	PR
	kWh/m ²	kWh/m ²	°C	kWh/m ²	kWh/m ²	GWh	GWh	ratio
January	80.2	32.26	8.57	129.6	109.2	8.89	8.41	0.754
February	80.2	39.47	6.34	109.5	97.8	8.02	7.58	0.804
March	140.2	49.96	11.89	172.4	160.8	12.71	11.97	0.806
April	184.9	62.10	17.22	199.2	186.8	14.41	13.57	0.791
May	214.9	68.57	20.23	210.9	197.6	15.12	14.25	0.785
June	226.4	66.87	25.16	210.7	197.3	14.79	13.96	0.770
July	232.3	61.52	26.44	220.4	207.0	15.49	14.62	0.771
August	226.8	55.16	27.51	236.2	222.9	16.55	15.61	0.767
September	146.3	55.78	22.54	169.1	157.8	12.04	11.36	0.781
October	122.7	45.82	19.84	167.7	153.8	11.91	11.25	0.780
November	79.8	33.82	14.66	122.1	105.3	8.40	7.94	0.755
December	67.2	29.64	10.07	111.5	91.3	7.44	7.05	0.734
Year	1802.0	600.99	17.61	2059.4	1887.7	145.77	137.59	0.776

Legends

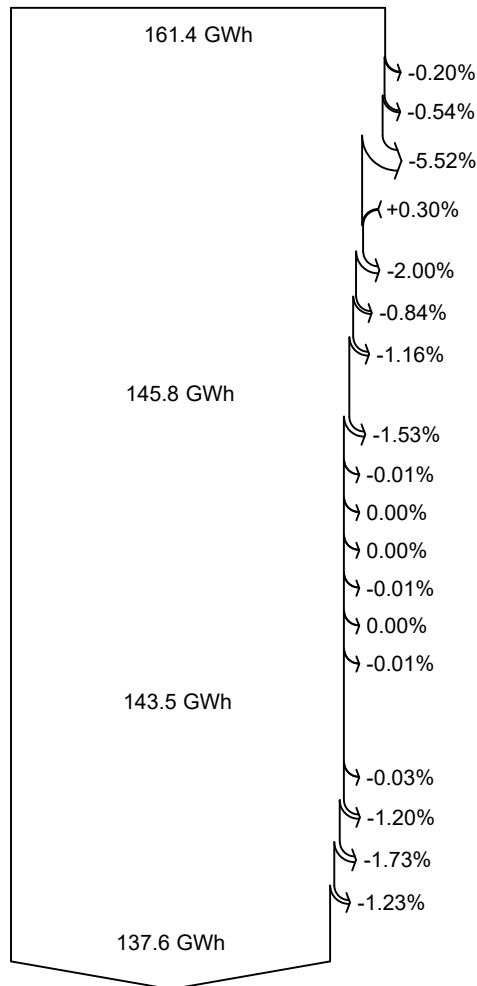
- GlobHor Global horizontal irradiation
- DiffHor Horizontal diffuse irradiation
- T_Amb Ambient Temperature
- GlobInc Global incident in coll. plane
- GlobEff Effective Global, corr. for IAM and shadings
- EArray Effective energy at the output of the array
- E_Grid Energy injected into grid
- PR Performance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



Loss diagram



efficiency at STC = 21.66%



Global horizontal irradiation

Global incident in coll. plane

Far Shadings / Horizon

Near Shadings: irradiance loss

IAM factor on global

Soiling loss factor

Effective irradiation on collectors

PV conversion

Array nominal energy (at STC effic.)

Module Degradation Loss (for year #1)

PV loss due to irradiance level

PV loss due to temperature

Module quality loss

LID - Light induced degradation

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

Auxiliaries (fans, other)

AC ohmic loss

Medium voltage transfo loss

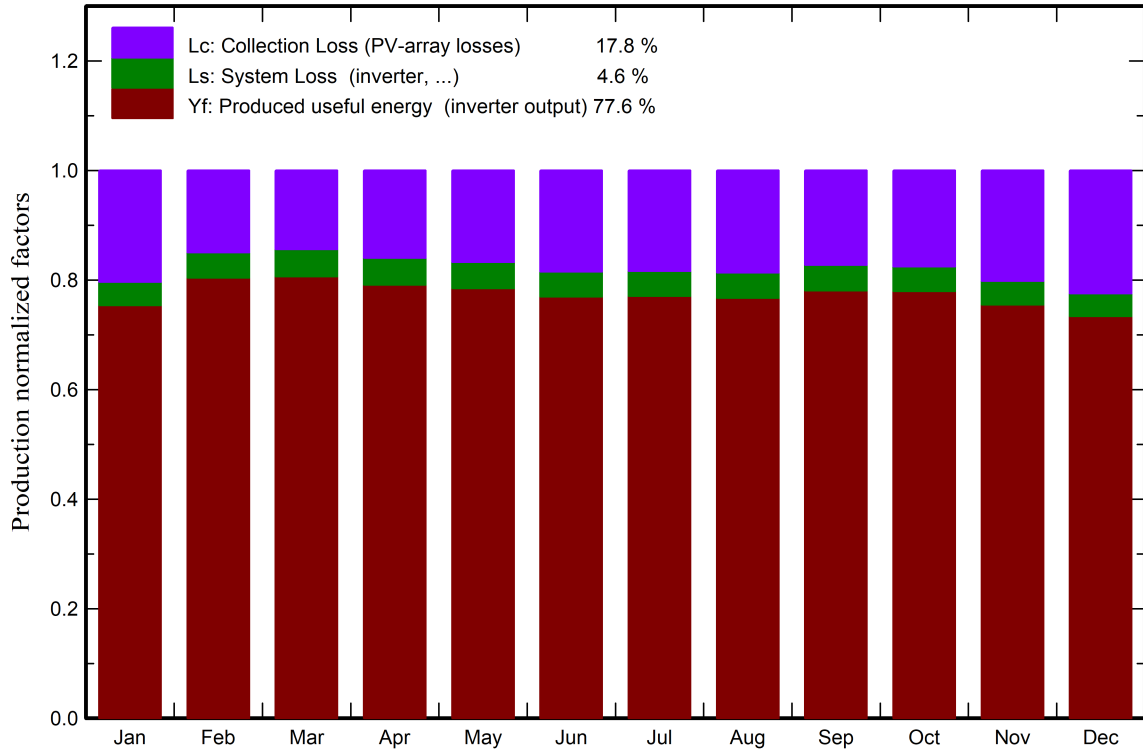
MV line ohmic loss

Energy injected into grid

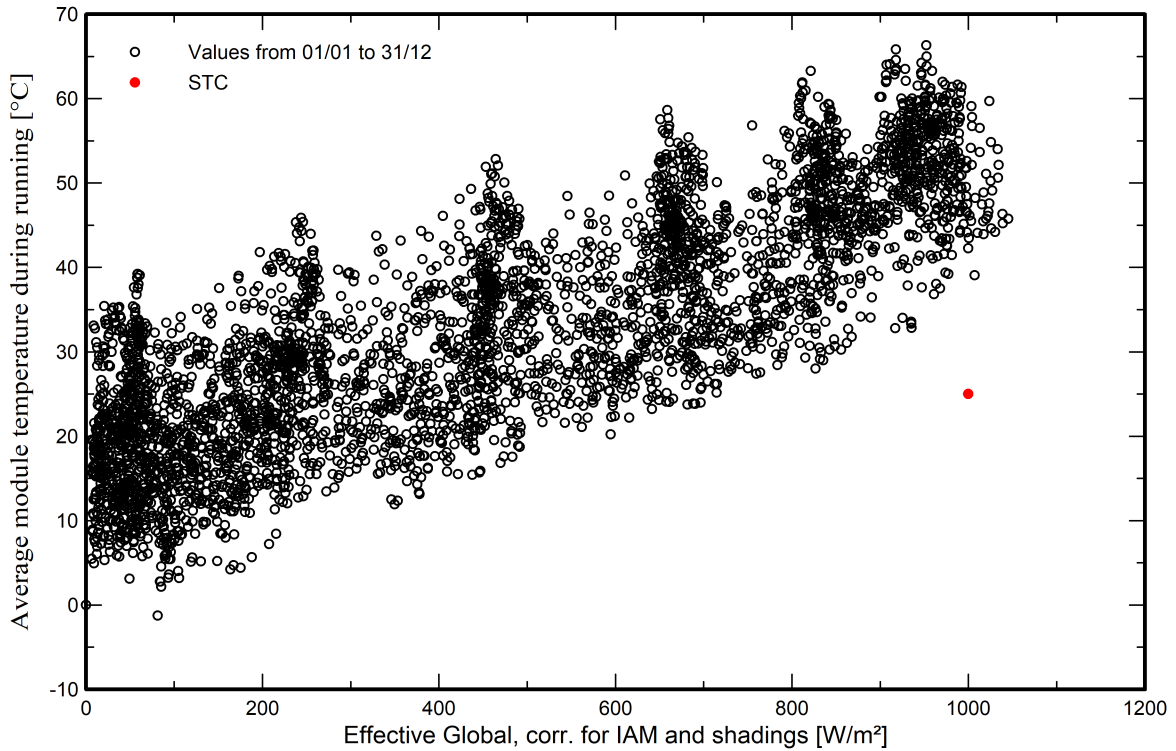


Predef. graphs

Normalized Production and Loss Factors



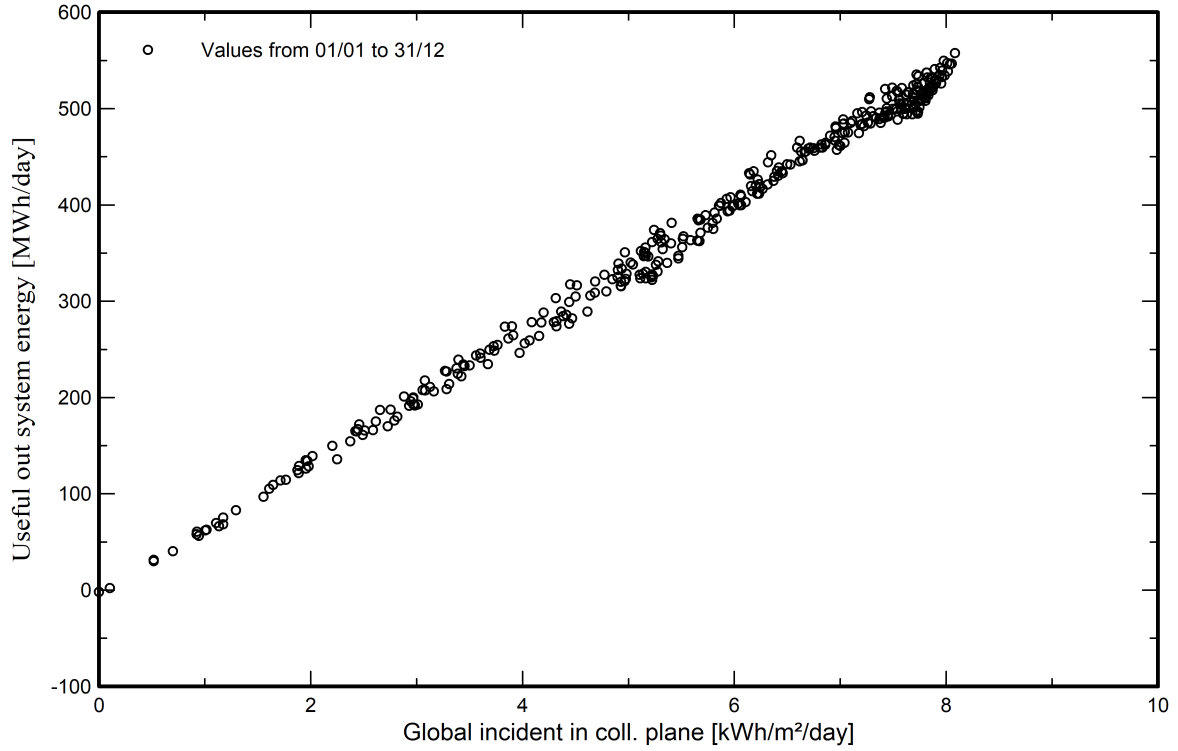
Array Temperature vs. Effective Irradiance



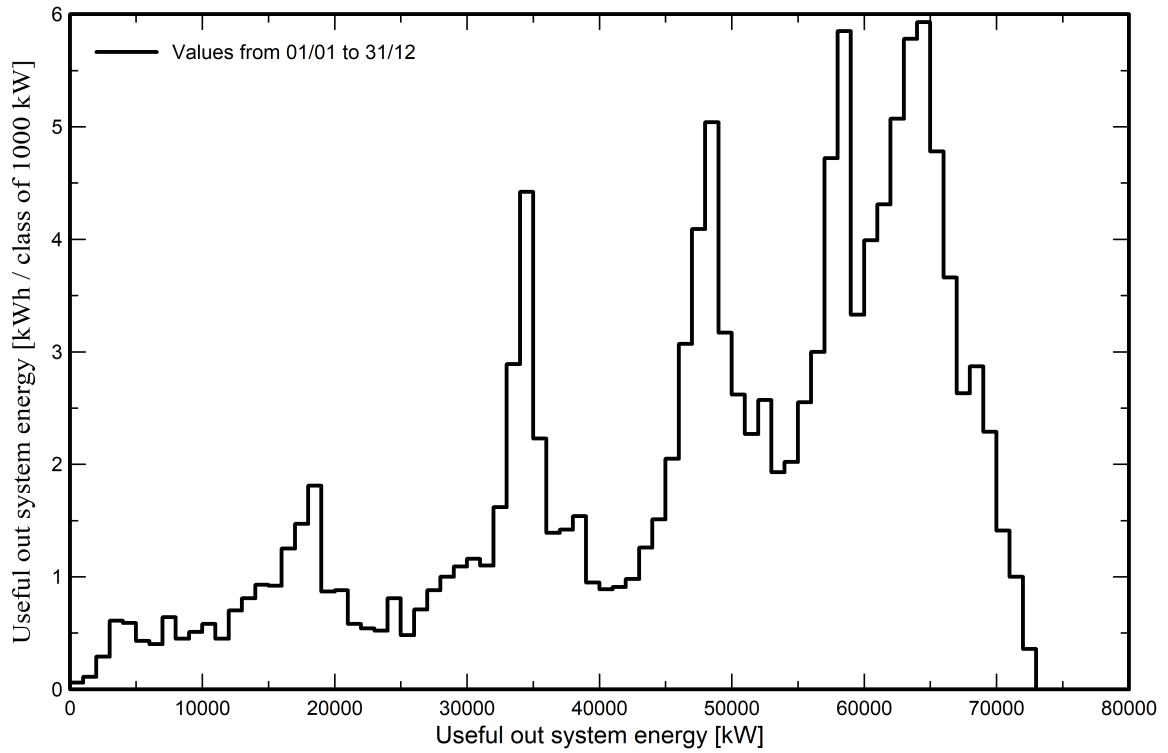


Predef. graphs

Daily Input/Output diagram



System Output Power Distribution





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Aging Tool

Aging Parameters

Time span of simulation 30 years

Module average degradation

Loss factor 0.4 %/year

Mismatch due to degradation

Imp RMS dispersion 0.4 %/year

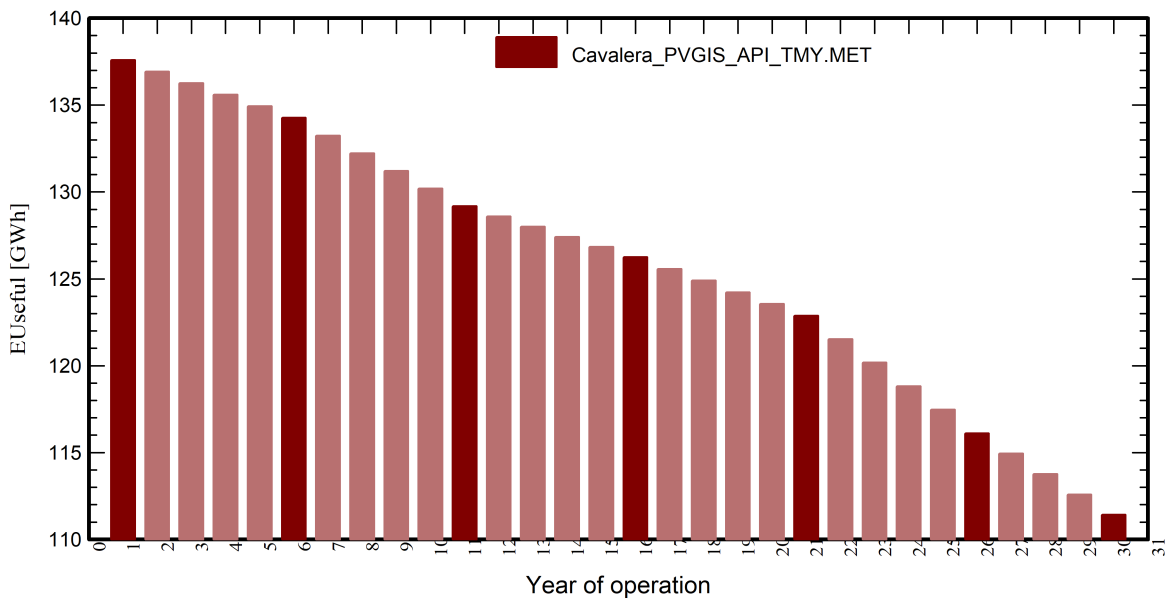
Vmp RMS dispersion 0.4 %/year

Meteo used in the simulation

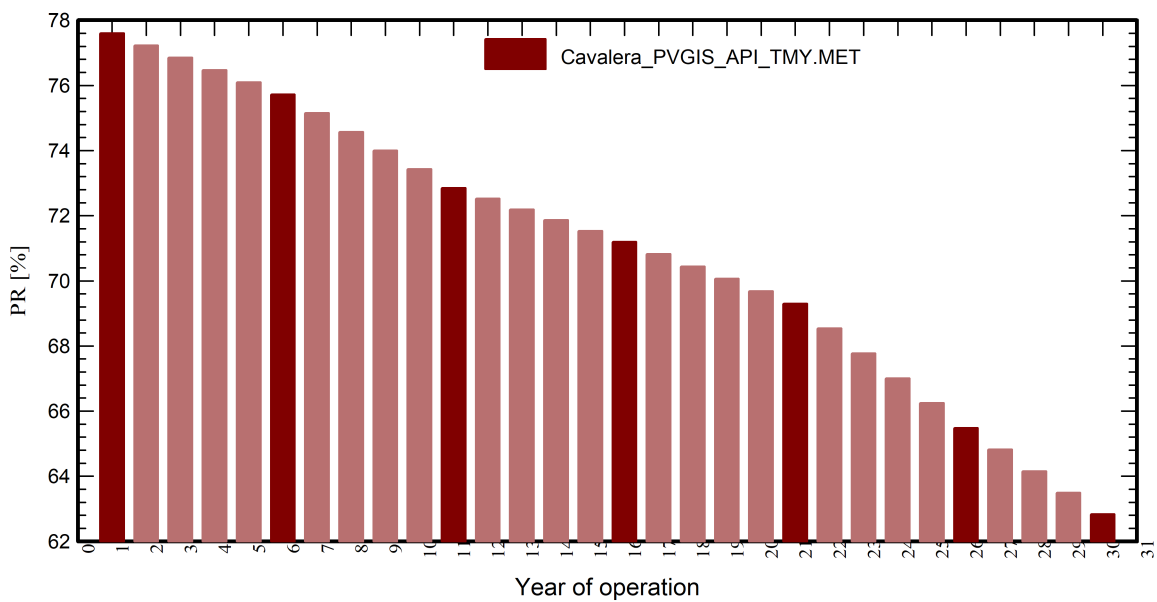
Cavalera PVGIS API TMY

Years reference year

Useful out system energy



Performance Ratio





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with v7.4.2

ARATO SRL (Italy)

Aging Tool

Aging Parameters

Time span of simulation 30 years

Module average degradation

Loss factor 0.4 %/year

Mismatch due to degradation

Imp RMS dispersion 0.4 %/year

Vmp RMS dispersion 0.4 %/year

Meteo used in the simulation

Cavalera PVGIS API TMY

Years reference year

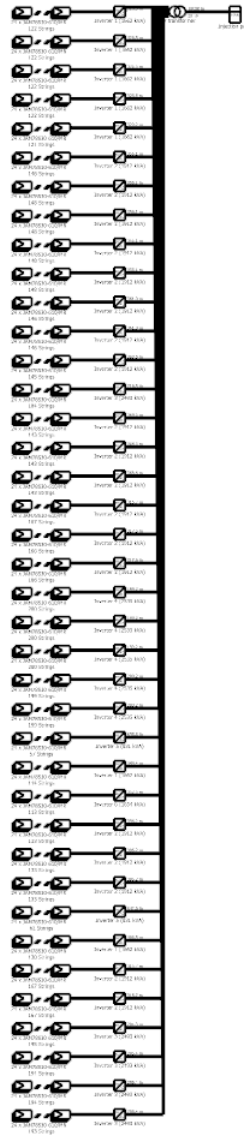
	EUseful	PR	PR loss
Year	GWh	%	%
1	137.59	77.60	-0.24
2	136.92	77.22	-0.73
3	136.26	76.85	-1.21
4	135.59	76.47	-1.69
5	134.93	76.10	-2.18
6	134.26	75.72	-2.66
7	133.24	75.15	-3.40
8	132.22	74.57	-4.13
9	131.21	74.00	-4.87
10	130.19	73.42	-5.61
11	129.17	72.85	-6.35
12	128.58	72.52	-6.77
13	128.00	72.19	-7.20
14	127.41	71.86	-7.62
15	126.83	71.53	-8.04
16	126.25	71.20	-8.47
17	125.57	70.82	-8.96
18	124.90	70.44	-9.45
19	124.23	70.06	-9.93
20	123.55	69.68	-10.42
21	122.88	69.30	-10.91
22	121.52	68.54	-11.89
23	120.17	67.77	-12.88
24	118.81	67.01	-13.86
25	117.46	66.24	-14.84
26	116.10	65.48	-15.82
27	114.93	64.82	-16.67
28	113.76	64.16	-17.53
29	112.58	63.49	-18.38
30	111.41	62.83	-19.23



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Single-line diagram



PV module	JAM78S30-610/MR
Inverter 1	Sunway TG 1800 1500V TE - 600
Inverter 2	Sunway TG 1800 1500V TE - 690
Inverter 3	SUNWAY STATION TG1800&900-1500V-TE 600 (2493kW)
Inverter 4	SUNWAY STATION TG1800&900-1500V-TE 610 (2535kW)
Inverter 5	Sunway TG 900 1500V TE - 600 (831kW)
Inverter 6	Sunway TG 1800 1500V TE - 600 (1654kVA)
String	24 x JAM78S30-610/MR

Ficurinia lotto #3684

ARATO SRL (Italy)

VCO : New simulation variant

10/10/23



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CO₂ Emission Balance

Total: 1385769.3 tCO₂

Generated emissions

Total: 129169.09 tCO₂

Source: Detailed calculation from table below

Replaced Emissions

Total: 1745993.8 tCO₂

System production: 137588.16 MWh/yr

Grid Lifecycle Emissions: 423 gCO₂/kWh

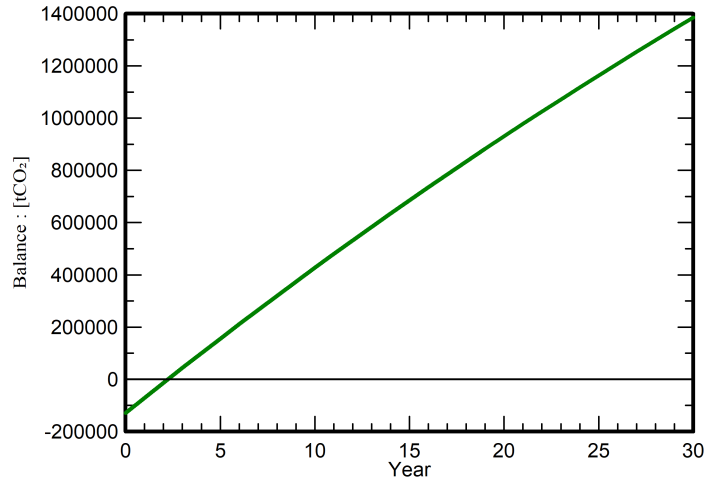
Source: IEA List

Country: Italy

Lifetime: 30 years

Annual degradation: 1.0 %

Saved CO₂ Emission vs. Time



System Lifecycle Emissions Details

Item	LCE	Quantity	Subtotal [kgCO ₂]
Modules	915 kgCO ₂ /modules	141144 modules	129146760
Supports	2.36 kgCO ₂ /units	6063 units	14309
Inverters	206 kgCO ₂ /units	39.0 units	8022