

ISTANZA VIA
Presentata al
Ministero dell'Ambiente e della Sicurezza Energetica
e al Ministero della Cultura
(Art. 23 del D. Lgs 152/2006 e ss. mm. ii
Art. 12 del D. Lgs. 387/03 e ss. mm. ii.)

PROGETTO

IMPIANTO AGRIVOLTAICO

POTENZA DI GENERAZIONE (DC) 58,905 MWp
POTENZA NOMINALE E IN IMMISSIONE (AC) 56,1 MW

Comune di Cavarzere (VE) -
Comune di Adria (RO)

CALCOLO DI PRODUCIBILITA'

23-00178-IT-CVZ_PI-R02

PROPONENTE:

TEP RENEWABLES (CAVARZERE 4) SRL
Piazzale Giulio Douhet, 25 – 00143 – Roma (RM)
P. IVA e C.F. 17374271009 – REA RM – 1714161

PROGETTISTI:

ING. GIULIA GIOMBINI
Iscritto all' Ordine degli Ingegneri della Provincia di Viterbo al n. A-1009

Data	Rev.	Tipo revisione	Redatto	Verificato	Approvato
19/12/2023	0	Prima Emissione	M.Valentini	G.Giombini	F. Rapicavoli

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1 CALCOLO DI PRODUCIBILITA'

PVsyst - Simulation report

Grid-Connected System

Project: CAVARZERE 4

Variant: CAVARZERE 4 - DEFINITIVO

Tracking system

System power: 58.91 MWp

Passetto - Italy

Author

TEP Renewables (Italia) S.r.l (Italy)



Project: CAVARZERE 4

Variant: CAVARZERE 4 - DEFINITIVO

PVsyst V7.3.4

VC5, Simulation date:
13/12/23 11:31
with v7.3.4

TEP Renewables (Italia) S.r.l (Italy)

Project summary

Geographical Site

Passetto

Italy

Situation

Latitude 45.11 °N
Longitude 12.05 °E
Altitude 8 m
Time zone UTC+1

Project settings

Albedo 0.20

Meteo data

Passetto

Meteonorm 8.1 (1991-2012), Sat=100% - Synthetic

System summary

Grid-Connected System

PV Field Orientation

Orientation

Tracking plane, horizontal N-S axis
Avg axis azim. 0 °

Tracking system

Tracking algorithm

Irradiance optimization

Near Shadings

Linear shadings
Diffuse shading Automatic

System information

PV Array

Nb. of modules 94248 units
Pnom total 58.91 MWp

Inverters

Nb. of units 187 units
Pnom total 56.10 MWac
Pnom ratio 1.050

User's needs

Unlimited load (grid)

Results summary

Produced Energy 83113787 kWh/year Specific production 1411 kWh/kWp/year Perf. Ratio PR 78.81 %

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Project: CAVARZERE 4

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TEP Renewables (Italia) S.r.l (Italy)

General parameters

Grid-Connected System

PV Field Orientation

Orientation

Tracking plane, horizontal N-S axis
Avg axis azim. 0 °

Models used

Transposition Perez
Diffuse Perez, Meteonorm
Circumsolar separate

Horizon

Free Horizon

Bifacial system

Model 2D Calculation
unlimited trackers

Bifacial model geometry

Tracker Spacing 9.00 m
Tracker width 4.95 m
GCR 55.0 %
Axis height above ground 2.30 m

Tracking system

Tracking algorithm

Irradiance optimization

Near Shadings

Linear shadings
Diffuse shading Automatic

Trackers configuration

Nb. of trackers 2052 units

Sizes

Tracker Spacing 9.00 m
Collector width 4.95 m
Ground Cov. Ratio (GCR) 55.0 %
Phi min / max. -/+ 55.0 °

Shading limit angles

Phi limits for BT -/+ 56.5 °

User's needs

Unlimited load (grid)

PV Array Characteristics

PV module

Manufacturer Jinkosolar
Model Tiger Neo N-type 78HL4-BDV_JKM625N-78HL4-BDV
(Custom parameters definition)
Unit Nom. Power 625 Wp
Number of PV modules 94248 units
Nominal (STC) 58.91 MWp

Array #1 - PS1

Number of PV modules 4512 units
Nominal (STC) 2820 kWp
Modules 188 Strings x 24 In series

At operating cond. (50°C)

Pmpp 2609 kWp
U mpp 1021 V
I mpp 2554 A

Array #2 - PS2

Number of PV modules 4320 units
Nominal (STC) 2700 kWp
Modules 180 Strings x 24 In series

Inverter

Manufacturer Huawei technologies
Model Sun2000-330KTL-H1
(Custom parameters definition)
Unit Nom. Power 300 kWac
Number of inverters 187 units
Total power 56100 kWac

Number of inverters 9 units
Total power 2700 kWac

Operating voltage 550-1500 V
Max. power (=>25°C) 330 kWac
Pnom ratio (DC:AC) 1.04
Power sharing within this inverter

Number of inverters 9 units
Total power 2700 kWac



PV Array Characteristics

Array #2 - PS2**At operating cond. (50°C)**

Pmpp	2498 kWp
U mpp	1021 V
I mpp	2445 A

Operating voltage	550-1500 V
Max. power (=>25°C)	330 kWac
Pnom ratio (DC:AC)	1.00
Power sharing within this inverter	

Array #3 - PS3

Number of PV modules	4320 units
Nominal (STC)	2700 kWp
Modules	180 Strings x 24 In series

Number of inverters	9 units
Total power	2700 kWac

At operating cond. (50°C)

Pmpp	2498 kWp
U mpp	1021 V
I mpp	2445 A

Operating voltage	550-1500 V
Max. power (=>25°C)	330 kWac
Pnom ratio (DC:AC)	1.00
Power sharing within this inverter	

Array #4 - PS4

Number of PV modules	4320 units
Nominal (STC)	2700 kWp
Modules	180 Strings x 24 In series

Number of inverters	9 units
Total power	2700 kWac

At operating cond. (50°C)

Pmpp	2498 kWp
U mpp	1021 V
I mpp	2445 A

Operating voltage	550-1500 V
Max. power (=>25°C)	330 kWac
Pnom ratio (DC:AC)	1.00
Power sharing within this inverter	

Array #5 - PS5

Number of PV modules	4320 units
Nominal (STC)	2700 kWp
Modules	180 Strings x 24 In series

Number of inverters	9 units
Total power	2700 kWac

At operating cond. (50°C)

Pmpp	2498 kWp
U mpp	1021 V
I mpp	2445 A

Operating voltage	550-1500 V
Max. power (=>25°C)	330 kWac
Pnom ratio (DC:AC)	1.00
Power sharing within this inverter	

Array #6 - PS6

Number of PV modules	4728 units
Nominal (STC)	2955 kWp
Modules	197 Strings x 24 In series

Number of inverters	9 units
Total power	2700 kWac

At operating cond. (50°C)

Pmpp	2733 kWp
U mpp	1021 V
I mpp	2676 A

Operating voltage	550-1500 V
Max. power (=>25°C)	330 kWac
Pnom ratio (DC:AC)	1.09
Power sharing within this inverter	

Array #7 - PS7

Number of PV modules	4680 units
Nominal (STC)	2925 kWp
Modules	195 Strings x 24 In series

Number of inverters	9 units
Total power	2700 kWac

At operating cond. (50°C)

Pmpp	2706 kWp
U mpp	1021 V
I mpp	2649 A

Operating voltage	550-1500 V
Max. power (=>25°C)	330 kWac
Pnom ratio (DC:AC)	1.08
Power sharing within this inverter	

Array #8 - PS8

Number of PV modules	4536 units
Nominal (STC)	2835 kWp
Modules	189 Strings x 24 In series

Number of inverters	9 units
Total power	2700 kWac



PV Array Characteristics

Array #8 - PS8**At operating cond. (50°C)**

Pmpp	2622 kWp	Operating voltage	550-1500 V
U mpp	1021 V	Max. power (=>25°C)	330 kWac
I mpp	2567 A	Pnom ratio (DC:AC)	1.05
		Power sharing within this inverter	

Array #9 - PS9

Number of PV modules	4944 units	Number of inverters	9 units
Nominal (STC)	3090 kWp	Total power	2700 kWac
Modules	206 Strings x 24 In series		

At operating cond. (50°C)

Pmpp	2858 kWp	Operating voltage	550-1500 V
U mpp	1021 V	Max. power (=>25°C)	330 kWac
I mpp	2798 A	Pnom ratio (DC:AC)	1.14
		Power sharing within this inverter	

Array #10 - PS10

Number of PV modules	4968 units	Number of inverters	9 units
Nominal (STC)	3105 kWp	Total power	2700 kWac
Modules	207 Strings x 24 In series		

At operating cond. (50°C)

Pmpp	2872 kWp	Operating voltage	550-1500 V
U mpp	1021 V	Max. power (=>25°C)	330 kWac
I mpp	2812 A	Pnom ratio (DC:AC)	1.15
		Power sharing within this inverter	

Array #11 - PS11

Number of PV modules	4536 units	Number of inverters	9 units
Nominal (STC)	2835 kWp	Total power	2700 kWac
Modules	189 Strings x 24 In series		

At operating cond. (50°C)

Pmpp	2622 kWp	Operating voltage	550-1500 V
U mpp	1021 V	Max. power (=>25°C)	330 kWac
I mpp	2567 A	Pnom ratio (DC:AC)	1.05
		Power sharing within this inverter	

Array #12 - PS12

Number of PV modules	4536 units	Number of inverters	9 units
Nominal (STC)	2835 kWp	Total power	2700 kWac
Modules	189 Strings x 24 In series		

At operating cond. (50°C)

Pmpp	2622 kWp	Operating voltage	550-1500 V
U mpp	1021 V	Max. power (=>25°C)	330 kWac
I mpp	2567 A	Pnom ratio (DC:AC)	1.05
		Power sharing within this inverter	

Array #13 - PS13

Number of PV modules	4320 units	Number of inverters	9 units
Nominal (STC)	2700 kWp	Total power	2700 kWac
Modules	180 Strings x 24 In series		

At operating cond. (50°C)

Pmpp	2498 kWp	Operating voltage	550-1500 V
U mpp	1021 V	Max. power (=>25°C)	330 kWac
I mpp	2445 A	Pnom ratio (DC:AC)	1.00
		Power sharing within this inverter	

Array #14 - PS14

Number of PV modules	4320 units	Number of inverters	9 units
Nominal (STC)	2700 kWp	Total power	2700 kWac
Modules	180 Strings x 24 In series		



PV Array Characteristics

Array #14 - PS14**At operating cond. (50°C)**

Pmpp	2498 kWp	Operating voltage	550-1500 V
U mpp	1021 V	Max. power (=>25°C)	330 kWac
I mpp	2445 A	Pnom ratio (DC:AC)	1.00
		Power sharing within this inverter	

Array #15 - PS15

Number of PV modules	3840 units	Number of inverters	8 units
Nominal (STC)	2400 kWp	Total power	2400 kWac
Modules	160 Strings x 24 In series		

At operating cond. (50°C)

Pmpp	2220 kWp	Operating voltage	550-1500 V
U mpp	1021 V	Max. power (=>25°C)	330 kWac
I mpp	2174 A	Pnom ratio (DC:AC)	1.00
		Power sharing within this inverter	

Array #16 - PS16

Number of PV modules	3840 units	Number of inverters	8 units
Nominal (STC)	2400 kWp	Total power	2400 kWac
Modules	160 Strings x 24 In series		

At operating cond. (50°C)

Pmpp	2220 kWp	Operating voltage	550-1500 V
U mpp	1021 V	Max. power (=>25°C)	330 kWac
I mpp	2174 A	Pnom ratio (DC:AC)	1.00
		Power sharing within this inverter	

Array #17 - PS17

Number of PV modules	4752 units	Number of inverters	9 units
Nominal (STC)	2970 kWp	Total power	2700 kWac
Modules	198 Strings x 24 In series		

At operating cond. (50°C)

Pmpp	2747 kWp	Operating voltage	550-1500 V
U mpp	1021 V	Max. power (=>25°C)	330 kWac
I mpp	2690 A	Pnom ratio (DC:AC)	1.10
		Power sharing within this inverter	

Array #18 - PS18

Number of PV modules	4752 units	Number of inverters	9 units
Nominal (STC)	2970 kWp	Total power	2700 kWac
Modules	198 Strings x 24 In series		

At operating cond. (50°C)

Pmpp	2747 kWp	Operating voltage	550-1500 V
U mpp	1021 V	Max. power (=>25°C)	330 kWac
I mpp	2690 A	Pnom ratio (DC:AC)	1.10
		Power sharing within this inverter	

Array #19 - PS19

Number of PV modules	4632 units	Number of inverters	9 units
Nominal (STC)	2895 kWp	Total power	2700 kWac
Modules	193 Strings x 24 In series		

At operating cond. (50°C)

Pmpp	2678 kWp	Operating voltage	550-1500 V
U mpp	1021 V	Max. power (=>25°C)	330 kWac
I mpp	2622 A	Pnom ratio (DC:AC)	1.07
		Power sharing within this inverter	

Array #20 - PS20

Number of PV modules	4536 units	Number of inverters	9 units
Nominal (STC)	2835 kWp	Total power	2700 kWac
Modules	189 Strings x 24 In series		



PV Array Characteristics

Array #20 - PS20

At operating cond. (50°C)

Pmpp	2622 kWp
U mpp	1021 V
I mpp	2567 A

Operating voltage	550-1500 V
Max. power (=>25°C)	330 kWac
Pnom ratio (DC:AC)	1.05
Power sharing within this inverter	

Array #21 - PS21

Number of PV modules	4536 units
Nominal (STC)	2835 kWp
Modules	189 Strings x 24 In series

Number of inverters	9 units
Total power	2700 kWac

At operating cond. (50°C)

Pmpp	2622 kWp
U mpp	1021 V
I mpp	2567 A

Operating voltage	550-1500 V
Max. power (=>25°C)	330 kWac
Pnom ratio (DC:AC)	1.05
Power sharing within this inverter	

Total PV power

Nominal (STC)	58905 kWp
Total	94248 modules
Module area	263452 m²

Total inverter power

Total power	56100 kWac
Max. power	61710 kWac
Number of inverters	187 units
Pnom ratio	1.05

Array losses

Array Soiling Losses

Loss Fraction	4.0 %
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Thermal Loss factor

Module temperature according to irradiance	
Uc (const)	31.3 W/m²K
Uv (wind)	2.3 W/m²K/m/s

LID - Light Induced Degradation

Loss Fraction	0.5 %
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Module Quality Loss

Loss Fraction	-0.8 %
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Module mismatch losses

Loss Fraction	2.0 % at MPP
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Strings Mismatch loss

Loss Fraction	0.1 %
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IAM loss factor

ASHRAE Param.: IAM = 1 - bo (1/cosi -1)	
bo Param.	0.05

DC wiring losses

Global wiring resistance	0.31 mΩ
Loss Fraction	1.5 % at STC

Array #1 - PS1

Global array res.	6.5 mΩ
Loss Fraction	1.5 % at STC

Array #3 - PS3

Global array res.	6.8 mΩ
Loss Fraction	1.5 % at STC

Array #5 - PS5

Global array res.	6.8 mΩ
Loss Fraction	1.5 % at STC

Array #7 - PS7

Global array res.	6.3 mΩ
Loss Fraction	1.5 % at STC

Array #9 - PS9

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

Array #11 - PS11

Global array res.	6.5 mΩ
Loss Fraction	1.5 % at STC

Array #2 - PS2

Global array res.	6.8 mΩ
Loss Fraction	1.5 % at STC

Array #4 - PS4

Global array res.	6.8 mΩ
Loss Fraction	1.5 % at STC

Array #6 - PS6

Global array res.	6.2 mΩ
Loss Fraction	1.5 % at STC

Array #8 - PS8

Global array res.	6.5 mΩ
Loss Fraction	1.5 % at STC

Array #10 - PS10

Global array res.	5.9 mΩ
Loss Fraction	1.5 % at STC

Array #12 - PS12

Global array res.	6.5 mΩ
Loss Fraction	1.5 % at STC

**PVsyst V7.3.4**

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DC wiring losses**Array #13 - PS13**

Global array res. 6.8 mΩ
Loss Fraction 1.5 % at STC

Array #15 - PS15

Global array res. 7.7 mΩ
Loss Fraction 1.5 % at STC

Array #17 - PS17

Global array res. 6.2 mΩ
Loss Fraction 1.5 % at STC

Array #19 - PS19

Global array res. 6.4 mΩ
Loss Fraction 1.5 % at STC

Array #21 - PS21

Global array res. 6.5 mΩ
Loss Fraction 1.5 % at STC

Array #14 - PS14

Global array res. 6.8 mΩ
Loss Fraction 1.5 % at STC

Array #16 - PS16

Global array res. 7.7 mΩ
Loss Fraction 1.5 % at STC

Array #18 - PS18

Global array res. 6.2 mΩ
Loss Fraction 1.5 % at STC

Array #20 - PS20

Global array res. 6.5 mΩ
Loss Fraction 1.5 % at STC

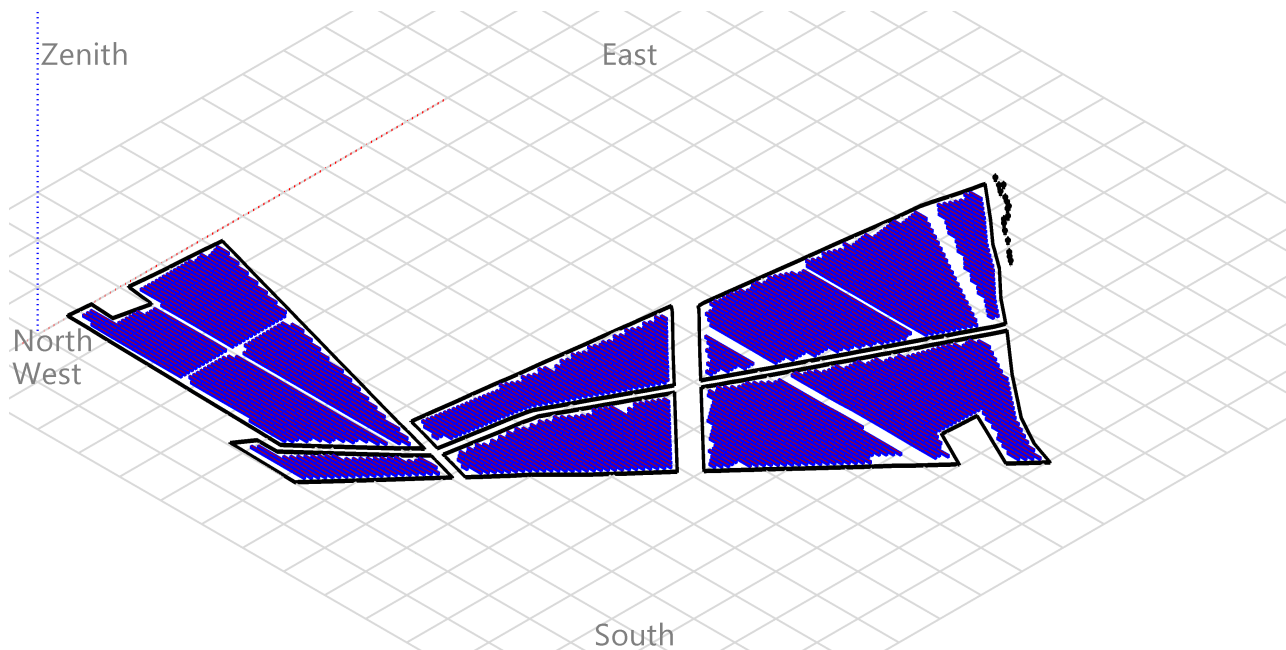
System losses**Unavailability of the system**

Time fraction 2.0 %
7.3 days,
3 periods



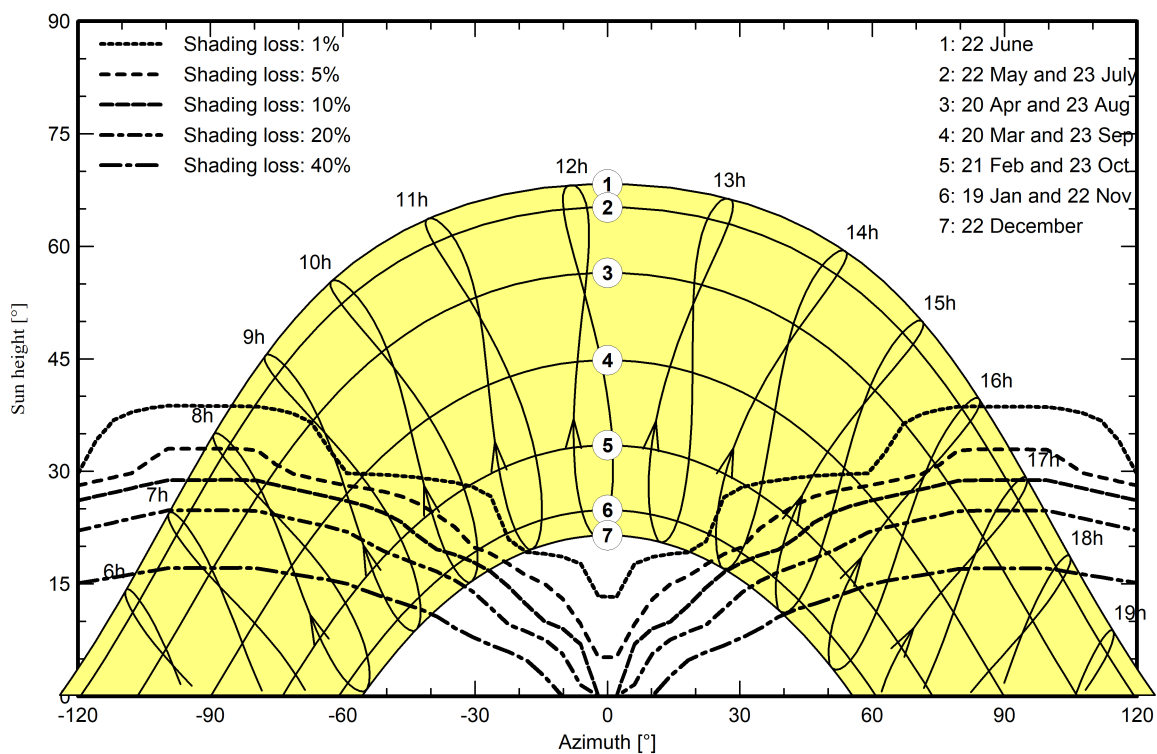
Near shadings parameter

Perspective of the PV-field and surrounding shading scene



Iso-shadings diagram

Orientation #1





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Main results

System Production

Produced Energy

83113787 kWh/year

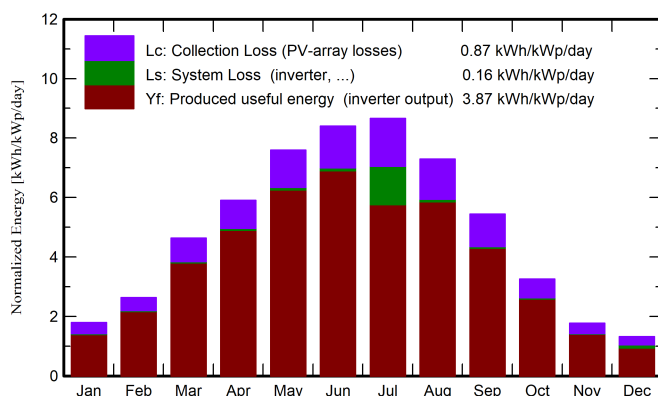
Specific production

1411 kWh/kWp/year

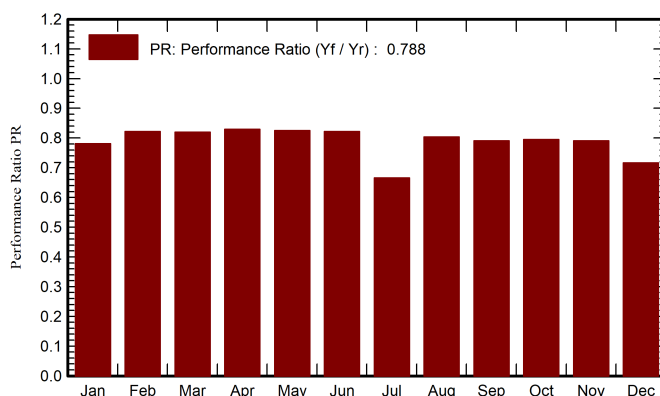
Perf. Ratio PR

78.81 %

Normalized productions (per installed kWp)



Performance Ratio PR



Balances and main results

	GlobHor	DiffHor	T_Amb	GlobInc	GlobEff	EArray	E_Grid	PR
	kWh/m²	kWh/m²	°C	kWh/m²	kWh/m²	kWh	kWh	ratio
January	39.3	22.84	2.22	55.4	42.7	2602943	2550100	0.781
February	55.0	31.31	4.34	73.8	59.8	3632987	3575377	0.822
March	103.9	50.69	9.33	143.6	118.4	7031298	6939925	0.820
April	133.2	66.85	14.01	177.3	149.9	8771776	8661610	0.829
May	176.9	85.26	19.05	235.3	201.7	11578963	11430573	0.825
June	191.3	84.69	23.28	252.0	219.0	12368452	12198249	0.822
July	197.8	80.49	25.38	268.3	230.3	12883613	10524851	0.666
August	168.3	75.21	24.80	226.1	192.9	10853898	10703265	0.804
September	115.0	50.74	19.28	163.1	134.2	7695351	7593901	0.790
October	73.5	40.12	14.56	101.1	81.6	4798113	4732188	0.795
November	39.5	24.61	9.01	53.2	42.2	2521047	2476375	0.790
December	30.4	21.30	3.60	40.9	31.3	1908428	1727373	0.716
Year	1324.2	634.10	14.13	1790.3	1503.8	86646868	83113787	0.788

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



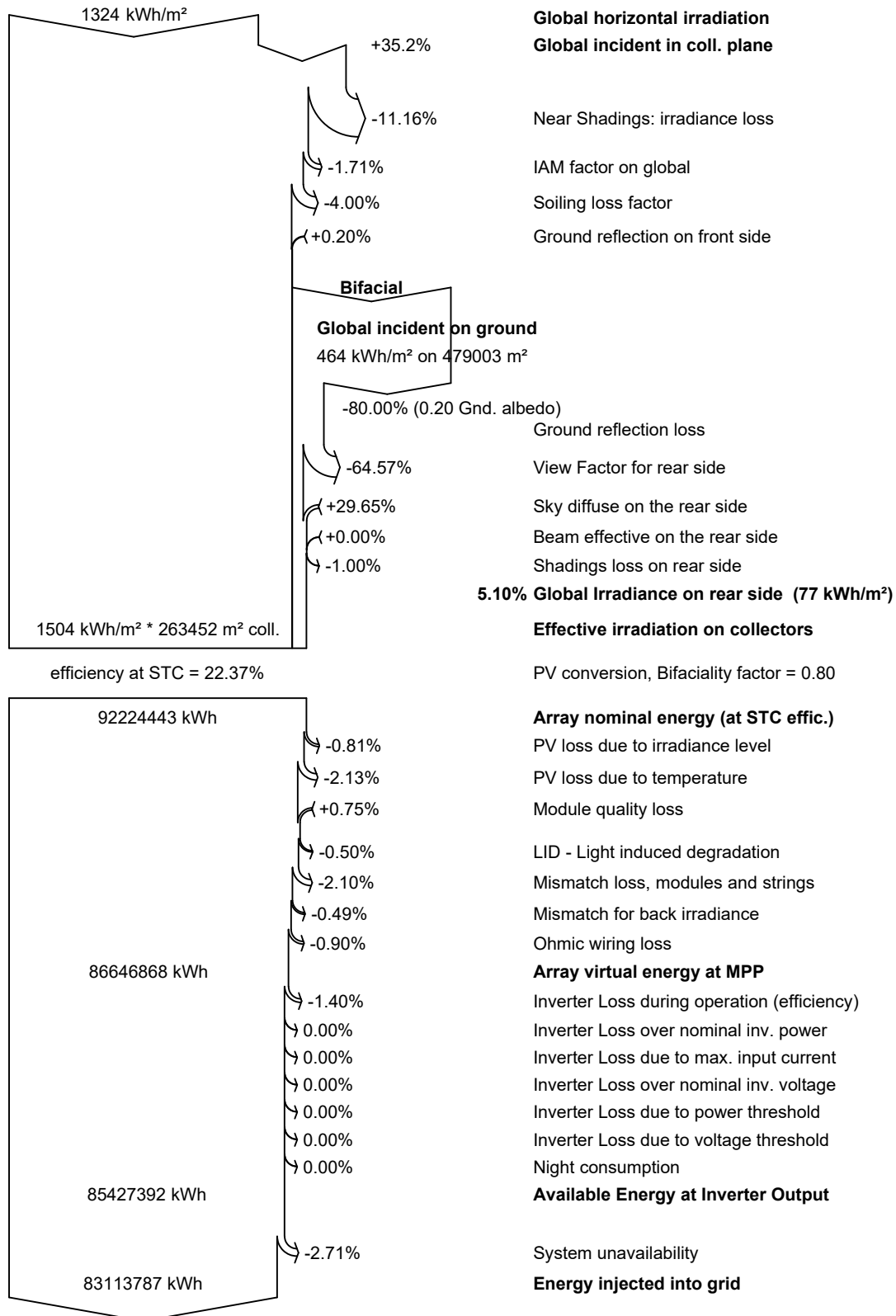
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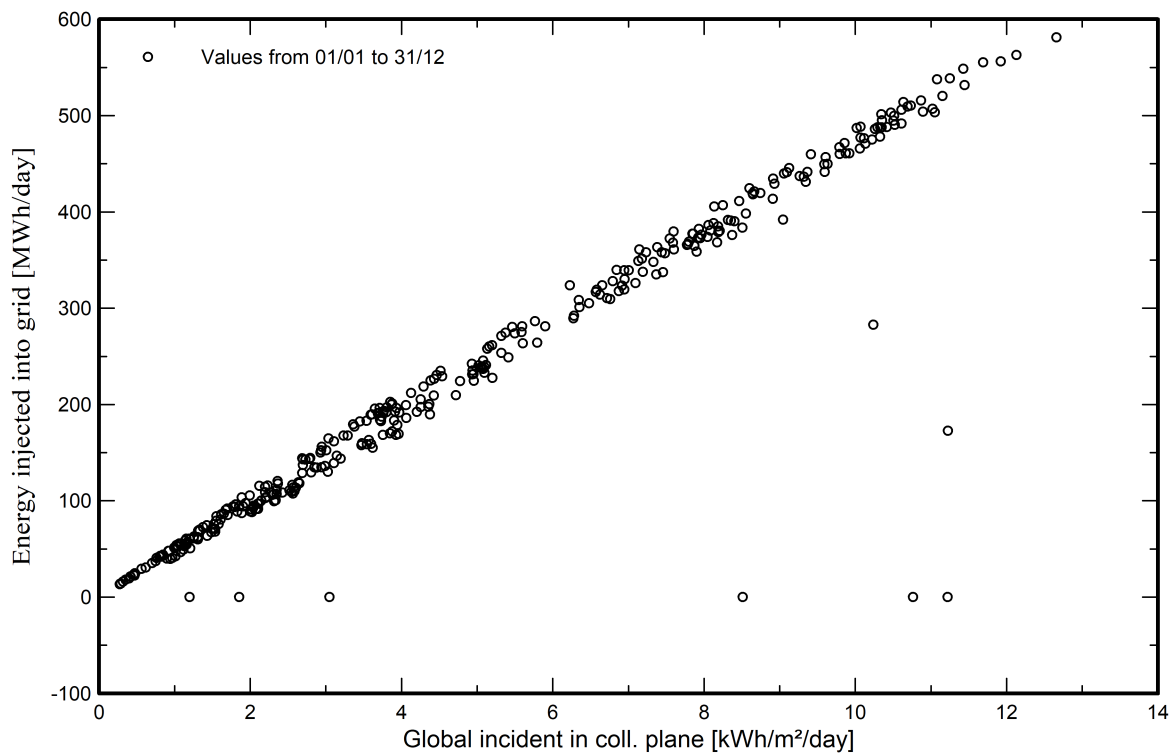
Loss diagram



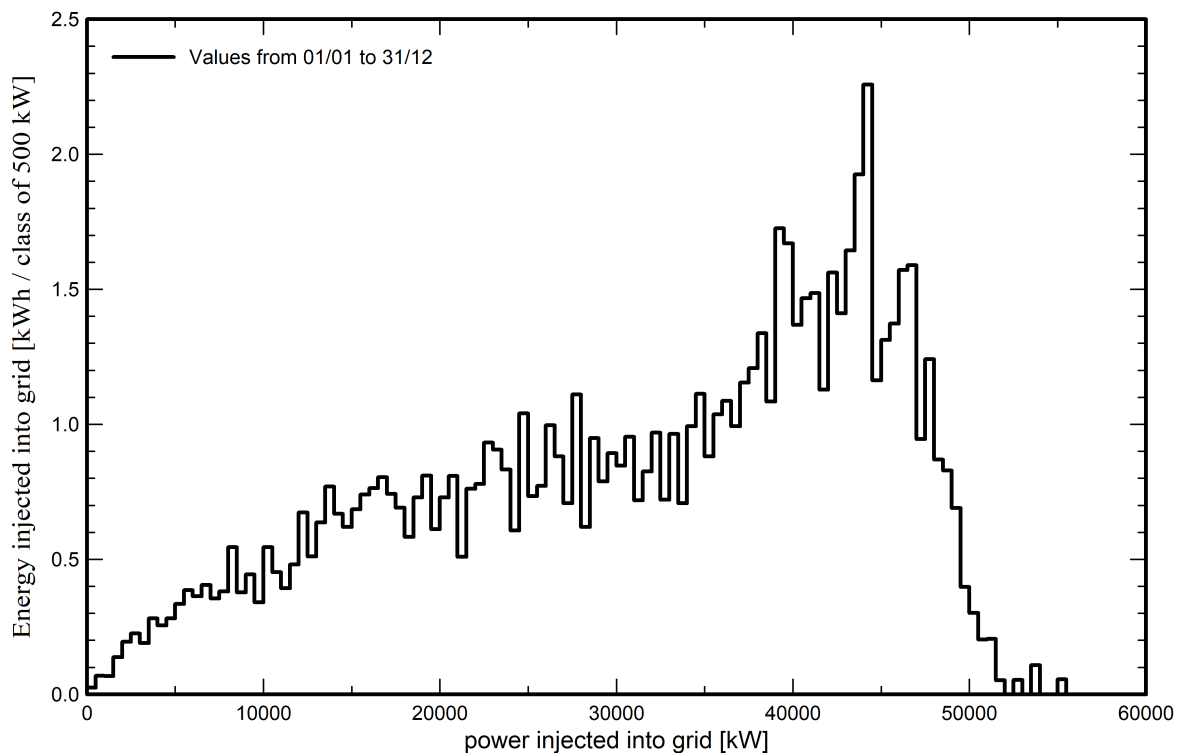


Predef. graphs

Daily Input/Output diagram



System Output Power Distribution





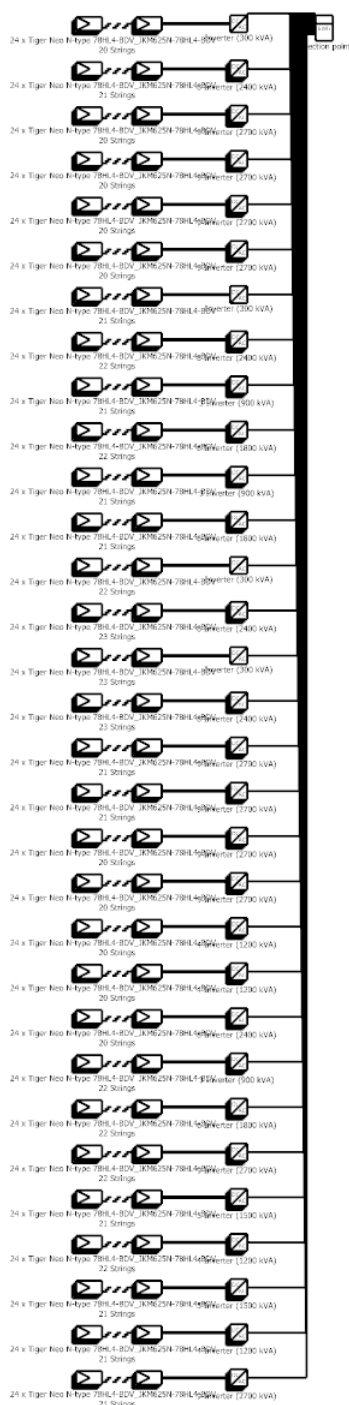
PVsyst V7.3.4

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with v7.3.4

Single-line diagram



PV module	Tiger Neo N-type 78HL4-BDV_JKM625N-78HL4-BDV	
Inverter	Sun2000-330KTL-H1	
String	24 x Tiger Neo N-type 78HL4-BDV_JKM625N-78HL4-BDV	

CAVARZERE 4

**TEP Renewables (I
talia) S.r.l (Italy)**

VC5 : CAVARZERE 4 - DEFINITIVO

13/12/23