



GED115 - Sassari
Comune: Sassari
Provincia: Sassari
Regione: Sardegna

Nome Progetto:

GED115 - Sassari
Progetto di un impianto agrivoltaico sito nel comune di Sassari in località
"Mandra Ebbas" di potenza nominale pari a 34,04 MWp in DC

Proponente:

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PROGETTO DEFINITIVO

Nome documento:

Stima Producibilità Impianto

Commissa	Codice elaborato	Nome file
30200208	PRO_REL_11	PRO_REL_11 - Stima Producibilità FV

Rev.	Data	Oggetto revisione	Redatto	Verificato	Approvato
00	Mar. 24	Prima Emissione	MA	SDA	SDA

PVsyst - Simulation report

Grid-Connected System

Project: Sassari

Variant: New simulation variant

Unlimited sheds

System power: 34.04 MWp

Sassari - Italy



Project: Sassari

Variant: New simulation variant

ARCADIS (italy)

PVsyst V7.4.5

VC1, Simulation date:
17/04/24 21:53
with v7.4.5

Project summary

Geographical Site Sassari Italy	Situation Latitude 40.73 °N Longitude 8.56 °E Altitude 191 m Time zone UTC+1	Project settings Albedo 0.20
Meteo data Sassari PVGIS api TMY		

System summary

Grid-Connected System PV Field Orientation Sheds Tilt 25 ° Azimuth 0 °	Unlimited sheds Near Shadings Mutual shadings of sheds	User's needs Unlimited load (grid)
System information PV Array Nb. of modules 49336 units Pnom total 34.04 MWp	Inverters Nb. of units 7 units Pnom total 31.00 MWac Grid power limit 26.00 MWac Grid lim. Pnom ratio 1.309	Battery pack Storage strategy: Peak shaving Nb. of units 20130 units Voltage 732 V Capacity 66000 Ah

Results summary

Produced Energy 56090637 kWh/year	Specific production 1648 kWh/kWp/year	Perf. Ratio PR 85.64 %
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General parameters

Grid-Connected System		Unlimited sheds			
PV Field Orientation		Sheds configuration		Models used	
Orientation		Nb. of sheds	1846 units	Transposition	Perez
Sheds		Unlimited sheds		Diffuse	Imported
Tilt	25 °	Sizes		Circumsolar	separate
Azimuth	0 °	Sheds spacing	5.00 m		
		Collector width	2.38 m		
		Ground Cov. Ratio (GCR)	47.6 %		
		Top inactive band	0.02 m		
		Bottom inactive band	0.02 m		
		Shading limit angle			
		Limit profile angle	19.8 °		
Horizon		Near Shadings		User's needs	
Free Horizon		Mutual shadings of sheds		Unlimited load (grid)	
Bifacial system					
Model	2D Calculation				
	unlimited sheds				
Bifacial model geometry		Bifacial model definitions			
Sheds spacing	5.00 m	Ground albedo	0.20		
Sheds width	2.42 m	Bifaciality factor	72 %		
Limit profile angle	20.0 °	Rear shading factor	17.0 %		
GCR	48.4 %	Rear mismatch loss	10.0 %		
Height above ground	1.30 m	Shed transparent fraction	0.0 %		
Storage		Grid power limitation			
Kind	Peak shaving	Active power	26.00 MWac		
Charging strategy		Discharging strategy			
Available power over Grid	26000.0 kW	As soon as power is needed			
		Pnom ratio	1.309		

PV Array Characteristics

PV module		Inverter	
Manufacturer	Trina Solar	Manufacturer	SMA
Model	TSM-DEG21C-20-690Wp Vertex	Model	Sunny Central 4000 UP
	(Custom parameters definition)		(Original PVsyst database)
Unit Nom. Power	690 Wp	Unit Nom. Power	4000 kWac
Number of PV modules	12852 units	Number of inverters	2 units
Nominal (STC)	8868 kWp	Total power	8000 kWac
Array #1 - Array 1			
Number of PV modules	6468 units	Number of inverters	1 unit
Nominal (STC)	4463 kWp	Total power	4000 kWac
Modules	231 string x 28 In series		
At operating cond. (50°C)		Operating voltage	880-1325 V
Pmpp	4088 kWp	Pnom ratio (DC:AC)	1.12
U mpp	1017 V		
I mpp	4018 A		



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PV Array Characteristics

Array #2 - Array 2

Number of PV modules 6384 units
Nominal (STC) 4405 kWp
Modules 228 string x 28 In series

At operating cond. (50°C)

Pmpp 4035 kWp
U mpp 1017 V
I mpp 3966 A

PV module

Manufacturer Trina Solar
Model TSM-DEG21C-20-690Wp Vertex
(Custom parameters definition)

Unit Nom. Power 690 Wp
Number of PV modules 36484 units
Nominal (STC) 25.17 MWp

Array #3 - Array 3

Number of PV modules 7336 units
Nominal (STC) 5062 kWp
Modules 262 string x 28 In series

At operating cond. (50°C)

Pmpp 4637 kWp
U mpp 1017 V
I mpp 4558 A

Array #4 - Array 4

Number of PV modules 7364 units
Nominal (STC) 5081 kWp
Modules 263 string x 28 In series

At operating cond. (50°C)

Pmpp 4655 kWp
U mpp 1017 V
I mpp 4575 A

Array #5 - Array 5

Number of PV modules 7308 units
Nominal (STC) 5043 kWp
Modules 261 string x 28 In series

At operating cond. (50°C)

Pmpp 4619 kWp
U mpp 1017 V
I mpp 4540 A

Array #6 - Array 6

Number of PV modules 7336 units
Nominal (STC) 5062 kWp
Modules 262 string x 28 In series

At operating cond. (50°C)

Pmpp 4637 kWp
U mpp 1017 V
I mpp 4558 A

Number of inverters 1 unit
Total power 4000 kWac

Operating voltage 880-1325 V
Pnom ratio (DC:AC) 1.10

Inverter

Manufacturer SMA
Model Sunny Central 4600 UP
(Original PVsyst database)

Unit Nom. Power 4600 kWac
Number of inverters 5 units
Total power 23000 kWac

Number of inverters 1 unit
Total power 4600 kWac

Operating voltage 1003-1325 V
Pnom ratio (DC:AC) 1.10

Number of inverters 1 unit
Total power 4600 kWac

Operating voltage 1003-1325 V
Pnom ratio (DC:AC) 1.10

Number of inverters 1 unit
Total power 4600 kWac

Operating voltage 1003-1325 V
Pnom ratio (DC:AC) 1.10

Number of inverters 1 unit
Total power 4600 kWac

Operating voltage 1003-1325 V
Pnom ratio (DC:AC) 1.10



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PV Array Characteristics

Array #7 - Array 7

Number of PV modules	7140 units	Number of inverters	1 unit
Nominal (STC)	4927 kWp	Total power	4600 kWac
Modules	255 string x 28 In series		
At operating cond. (50°C)		Operating voltage	1003-1325 V
Pmpp	4513 kWp	Pnom ratio (DC:AC)	1.07
U mpp	1017 V		
I mpp	4436 A		

Total PV power

Nominal (STC)	34042 kWp
Total	49336 modules
Module area	153255 m ²

Total inverter power

Total power	31000 kWac
Number of inverters	7 units
Pnom ratio	1.10

Battery Storage

Battery

Manufacturer	Narada
Model	AcmeG 12V 200

Battery pack

Nb. of units	61 in series x 330 in parallel
Discharging min. SOC	20.0 %
Stored energy	39836.9 kWh

Battery Pack Characteristics

Voltage	732 V
Nominal Capacity	66000 Ah (C10)
Temperature	Fixed 20 °C

Battery input charger

Model	Generic
Max. charg. power	4200.0 kWdc
Max./Euro effic.	97.0/95.0 %

Battery to Grid inverter

Model	Generic
Max. disch. power	21.0 MWac
Max./Euro effic.	97.0/95.0 %

Array losses

Thermal Loss factor

Module temperature according to irradiance	
Uc (const)	20.0 W/m ² K
Uv (wind)	0.0 W/m ² K/m/s

LID - Light Induced Degradation

Loss Fraction	1.5 %
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Module Quality Loss

Loss Fraction	-0.3 %
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Module mismatch losses

Loss Fraction	0.4 % at MPP
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Strings Mismatch loss

Loss Fraction	0.2 %
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IAM loss factor

Incidence effect (IAM): Fresnel, AR coating, n(glass)=1.526, n(AR)=1.290

0°	30°	50°	60°	70°	75°	80°	85°	90°
1.000	0.999	0.987	0.962	0.892	0.816	0.681	0.440	0.000



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DC wiring losses

Global wiring resistance 0.73 mΩ
Loss Fraction 2.0 % at STC

Array #1 - Array 1

Global array res. 5.6 mΩ
Loss Fraction 2.0 % at STC

Array #3 - Array 3

Global array res. 4.9 mΩ
Loss Fraction 2.0 % at STC

Array #5 - Array 5

Global array res. 4.9 mΩ
Loss Fraction 2.0 % at STC

Array #7 - Array 7

Global array res. 5.0 mΩ
Loss Fraction 2.0 % at STC

Array #2 - Array 2

Global array res. 5.6 mΩ
Loss Fraction 2.0 % at STC

Array #4 - Array 4

Global array res. 4.9 mΩ
Loss Fraction 2.0 % at STC

Array #6 - Array 6

Global array res. 4.9 mΩ
Loss Fraction 2.0 % at STC

System losses

Unavailability of the system

Time fraction 2.0 %
7.3 days,
3 periods

Auxiliaries loss

constant (fans) 65.0 kW
0.0 kW from Power thresh.

AC wiring losses

Inv. output line up to MV transfo

Inverter voltage 600 Vac tri
Loss Fraction 0.03 % at STC

Global System

Wire section Copper 3 x 30000 mm²
Wires length 5 m

MV line up to Injection

MV Voltage 36 kV
Average loss Fraction 0.03 % at STC

Array #1 - Array 1

Wires Alu 3 x 500 mm²
Length 1000 m

Array #3 - Array 3

Wires Alu 3 x 500 mm²
Length 1010 m

Array #5 - Array 5

Wires Alu 3 x 500 mm²
Length 1075 m

Array #7 - Array 7

Wires Alu 3 x 500 mm²
Length 1132 m

Array #2 - Array 2

Wires Alu 3 x 500 mm²
Length 1370 m

Array #4 - Array 4

Wires Alu 3 x 500 mm²
Length 1300 m

Array #6 - Array 6

Wires Alu 3 x 500 mm²
Length 1700 m



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AC losses in transformers

MV transfo

Grid voltage 36 kV

One transfo in each sub-array

Array #1 - Array 1

Transformer parameters

Nominal power at STC 4.38 MVA
Iron Loss (24/24 Connexion) 4.00 kVA
Iron loss fraction 0.09 % at STC
Copper loss 47.86 kVA
Copper loss fraction 1.09 % at STC
Coils equivalent resistance 3 x 0.90 mΩ

Array #2 - Array 2

Transformer parameters

Nominal power at STC 4.32 MVA
Iron Loss (24/24 Connexion) 4.00 kVA
Iron loss fraction 0.09 % at STC
Copper loss 46.64 kVA
Copper loss fraction 1.08 % at STC
Coils equivalent resistance 3 x 0.90 mΩ

Array #3 - Array 3

Transformer parameters

Nominal power at STC 4.97 MVA
Iron Loss (24/24 Connexion) 4.60 kVA
Iron loss fraction 0.09 % at STC
Copper loss 53.78 kVA
Copper loss fraction 1.08 % at STC
Coils equivalent resistance 3 x 1.03 mΩ

Array #4 - Array 4

Transformer parameters

Nominal power at STC 4.99 MVA
Iron Loss (24/24 Connexion) 4.60 kVA
Iron loss fraction 0.09 % at STC
Copper loss 54.19 kVA
Copper loss fraction 1.09 % at STC
Coils equivalent resistance 3 x 1.03 mΩ

Array #5 - Array 5

Transformer parameters

Nominal power at STC 4.96 MVA
Iron Loss (24/24 Connexion) 4.60 kVA
Iron loss fraction 0.09 % at STC
Copper loss 53.38 kVA
Copper loss fraction 1.08 % at STC
Coils equivalent resistance 3 x 1.03 mΩ

Array #6 - Array 6

Transformer parameters

Nominal power at STC 4.97 MVA
Iron Loss (24/24 Connexion) 4.60 kVA
Iron loss fraction 0.09 % at STC
Copper loss 53.78 kVA
Copper loss fraction 1.08 % at STC
Coils equivalent resistance 3 x 1.03 mΩ



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AC losses in transformers

MV transfo

Grid voltage 36 kV

One transfo in each sub-array

Array #7 - Array 7

Transformer parameters

Nominal power at STC 4.84 MVA

Iron Loss (24/24 Connexion) 4.60 kVA

Iron loss fraction 0.09 % at STC

Copper loss 50.97 kVA

Copper loss fraction 1.05 % at STC

Coils equivalent resistance 3 x 1.03 mΩ



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Main results

System Production

Produced Energy 56090637 kWh/year

Specific production

1648 kWh/kWp/year

Battery aging (State of Wear)

Cycles SOW 98.0 %

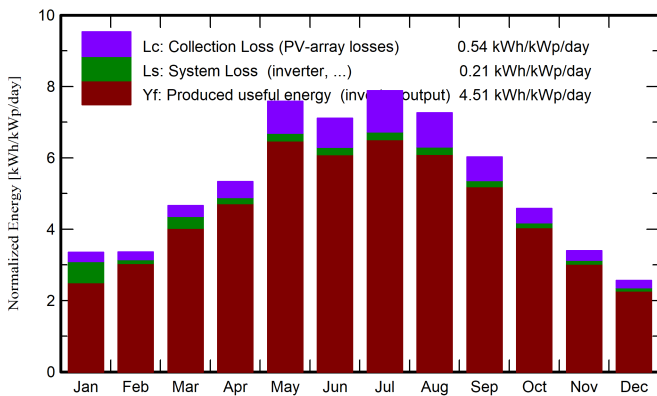
Static SOW 91.7 %

Battery lifetime 12.0 years

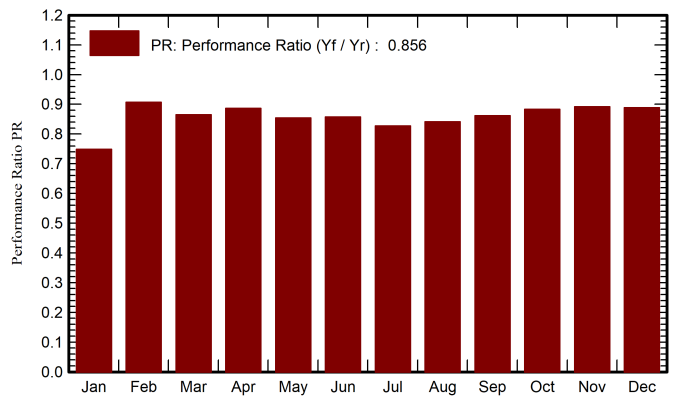
Perf. Ratio PR

85.64 %

Normalized productions (per installed kWp)



Performance Ratio PR



Balances and main results

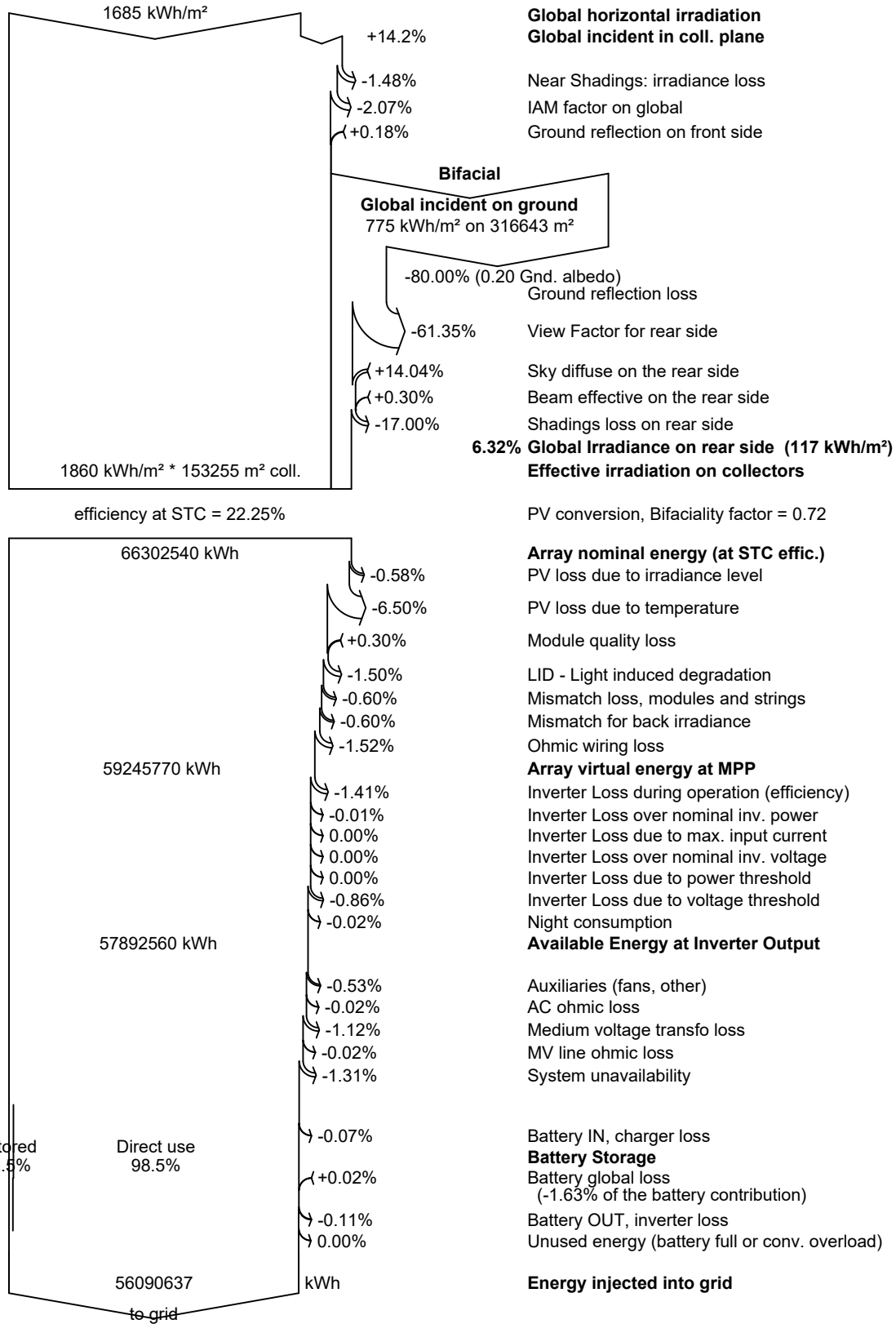
	GlobHor kWh/m ²	DiffHor kWh/m ²	T_Amb °C	GlobInc kWh/m ²	GlobEff kWh/m ²	EArray kWh	E_Grid kWh	PR ratio	PR ratio
January	66.7	29.58	10.30	103.8	99.5	3269876	2644268	0.749	0.749
February	70.5	37.45	9.93	94.0	90.4	3007170	2901535	0.906	0.906
March	118.8	56.07	9.90	144.4	139.5	4606399	4252396	0.865	0.865
April	147.5	61.52	11.84	160.0	154.5	4998996	4825381	0.886	0.886
May	230.2	65.02	18.29	235.0	227.9	7065871	6837434	0.855	0.855
June	218.4	69.70	20.08	213.3	206.3	6433912	6226449	0.857	0.857
July	244.7	59.10	24.01	244.3	237.3	7103562	6880840	0.827	0.827
August	209.1	59.51	22.23	225.1	218.6	6658412	6445079	0.841	0.841
September	153.1	54.43	19.58	180.8	175.4	5480612	5307441	0.862	0.862
October	106.8	44.72	16.08	142.1	137.5	4412998	4271612	0.883	0.883
November	68.3	31.26	11.90	101.9	98.0	3204021	3096059	0.892	0.892
December	50.7	26.55	8.62	79.4	74.9	2495019	2402143	0.889	0.889
Year	1685.0	594.92	15.27	1924.1	1859.7	58736848	56090637	0.856	0.856

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	PR	Performance Ratio
GlobEff	Effective Global, corr. for IAM and shadings		



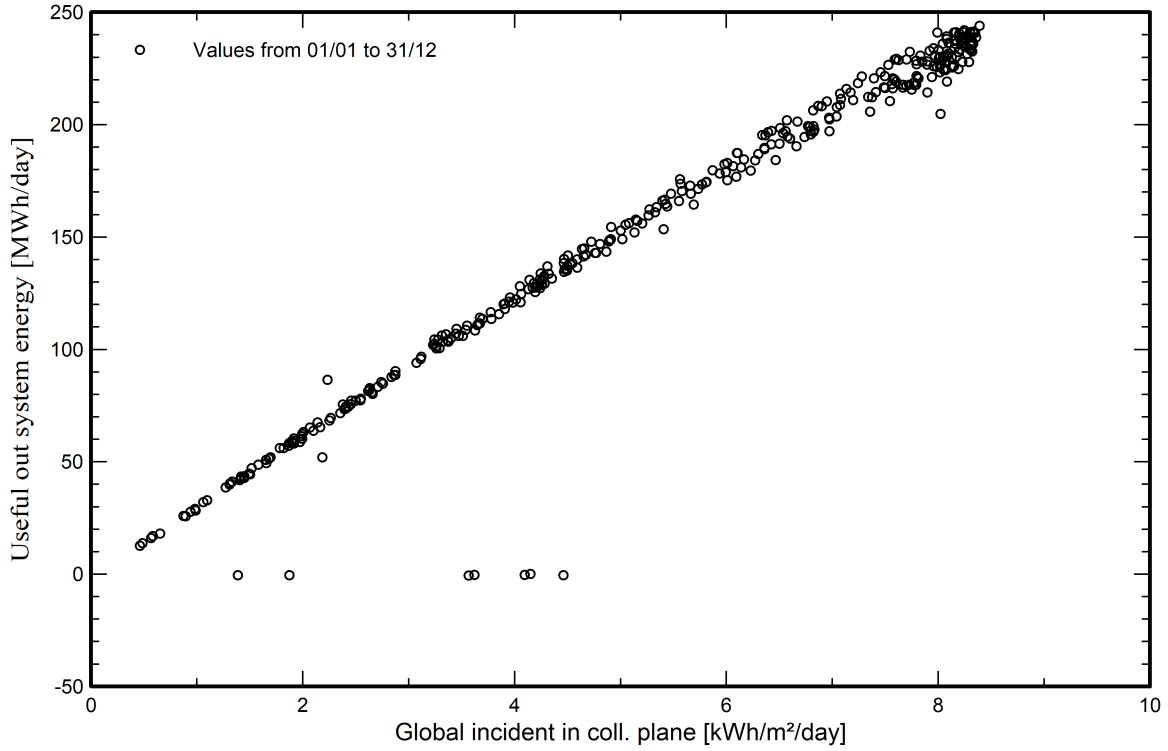
Loss diagram



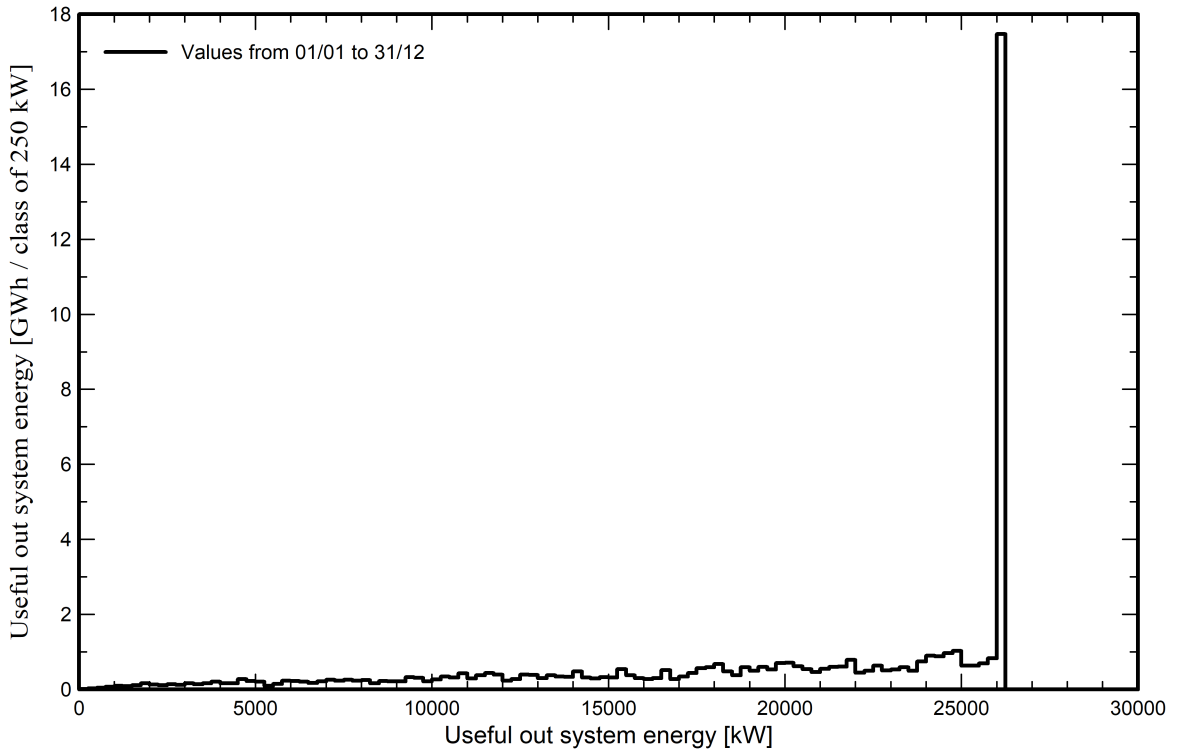


Predef. graphs

Daily Input/Output diagram



System Output Power Distribution

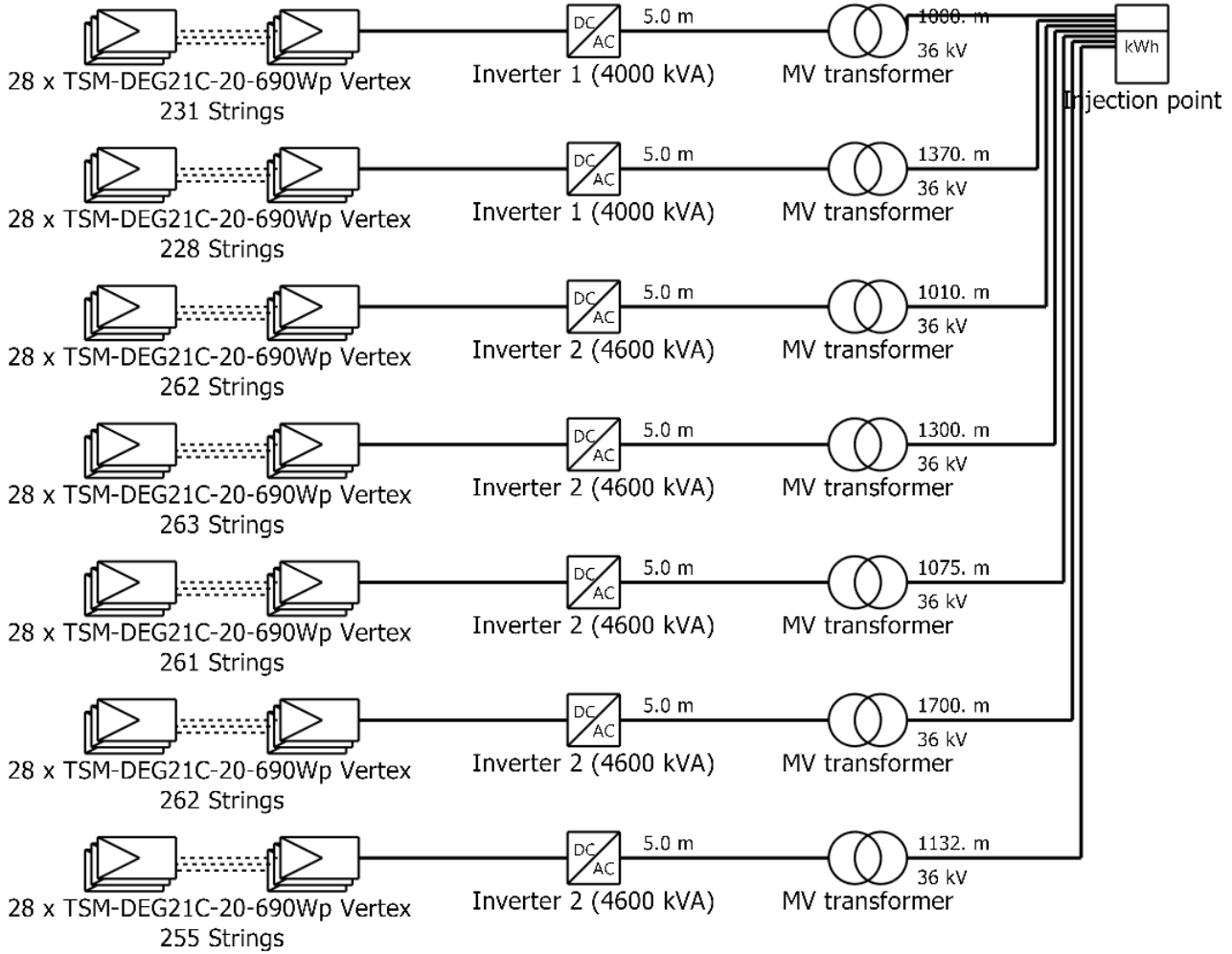




Single-line diagram

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PV module	TSM-DEG21C-20-690Wp Vertex
Inverter 1	Sunny Central 4000 UP
Inverter 2	Sunny Central 4600 UP
String	28 x TSM-DEG21C-20-690Wp Vertex

Sassari

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VC1 : New simulation variant

17/04/24