

**Máster Universitario en Energías Renovables**  
**Escuela de Arquitectura**

**TRABAJO FIN DE MÁSTER**

**Estudio de Prefactibilidad para el Aprovechamiento del Recurso Eólico y Solar en la  
Cobertura de la Demanda Eléctrica en Islas de San Andrés**

Tutor:	José Miguel Márquez Martinon
Autores:	Harold Enrique Arroyo Barros
	Diego Alberto López Osorio
	Alejandro Castro Álzate
	Sergio Augusto Beltrán Gómez
	Fabián Miguel Contreras García

Abril 2025

# **ANEXO 6: REPORTE PVSYST PARQUE SOLAR 3.500 KW<sub>p</sub>**

# PVsyst - Simulation report

## Grid-Connected System

Project: TFM

Variant: 3.500 kWp ON-SHORE / TRINA\_DELTA-WING / INV\_SUNGROW

Rows as domes east-west

System power: 3885 kWp

5. San Andrés - PVGIS TMY V5.3 - ONSHORE - Colombia

Author

Universidad Europea (Spain)



## Project: TFM

Variant: 3.500 KWp ON-SHORE / TRINA\_DELTA-WING / INV\_SUNGROW

PVsyst V8.0.7

VCA, Simulation date:  
12/04/25 13:50  
with V8.0.7

Universidad Europea (Spain)

### Project summary

Geographical Site	Situation	Project settings
5. San Andrés - PVGIS TMY V5.3 - ONSHORE	Latitude 12.55 °N	Albedo 0.10
Colombia	Longitude -81.73 °W	
	Altitude 0 m	
	Time zone UTC-5	
Weather data		
5. San Andrés - PVGIS TMY V5.3 - ONSHORE		
PVGIS api TMY		

### System summary

Grid-Connected System	Rows as domes east-west	
Simulation for year no 10		
Orientation #1	Orientation #2	Near Shadings
Dome front face	Dome backface	Linear shadings : Fast (table)
Tilt/Azimuth 12 / 90 °	Tilt/Azimuth 12 / -90 °	
System information		
PV Array	Inverters	
Nb. of modules 7000 units	Nb. of units 10 units	
Pnom total 3885 kWp	Pnom total 3500 kWac	
	Pnom ratio 1.110	
User's needs		
Unlimited load (grid)		

### Results summary

Produced Energy 6141.9 MWh/year	Specific production 1581 kWh/kWp/year	Perf. Ratio PR 80.03 %
---------------------------------	---------------------------------------	------------------------

### 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	7
Loss diagram	8
Predef. graphs	9
Single-line diagram	10



## Project: TFM

Variant: 3.500 KWp ON-SHORE / TRINA\_DELTA-WING / INV\_SUNGROW

PVsyst V8.0.7

VCA, Simulation date:  
12/04/25 13:50  
with V8.0.7

Universidad Europea (Spain)

### General parameters

Grid-Connected System		Rows as domes east-west			
Orientation #1		Sheds configuration		Sizes	
Dome front face		Nb. of sheds		Sheds spacing	
Tilt/Azimuth	12 / 90 °	50 units		Collector width	0.00 m
		Set of tables		Average GCR	2.21 m
		Shading limit angle		%	
		Limit profile angle		Top inactive band	0.02 m
				Bottom inactive band	0.02 m
Orientation #2		Sheds configuration		Sizes	
Dome backface		Nb. of sheds		Sheds spacing	
Tilt/Azimuth	12 / -90 °	50 units		Collector width	0.00 m
		Set of tables		Average GCR	2.21 m
		Shading limit angle		%	
		Limit profile angle		Top inactive band	0.02 m
				Bottom inactive band	0.02 m
Models used		Horizon		Near Shadings	
Transposition	Perez	Free Horizon		Linear shadings : Fast (table)	
Diffuse	Imported				
Circumsolar	separate				
User's needs					
Unlimited load (grid)					

### PV Array Characteristics

PV module		Inverter	
Manufacturer	Generic	Manufacturer	Generic
Model	TSM-DE19-555Wp Vertex	Model	SG350-HX
(Original PVsyst database)		(Original PVsyst database)	
Unit Nom. Power	555 Wp	Unit Nom. Power	350 kWac
Number of PV modules	7000 units	Number of inverters	10 units
Nominal (STC)	3885 kWp	Total power	3500 kWac
Modules	200 string x 35 In series	Operating voltage	500-1450 V
At operating cond. (50°C)		Pnom ratio (DC:AC)	1.11
Pmpp	3555 kWp	Power sharing within this inverter	
U mpp	1008 V		
I mpp	3525 A		
Total PV power		Total inverter power	
Nominal (STC)	3885 kWp	Total power	3500 kWac
Total	7000 modules	Number of inverters	10 units
Module area	18290 m²	Pnom ratio	1.11

### Array losses

Array Soiling Losses		Thermal Loss factor		DC wiring losses	
Loss Fraction	2.0 %	Module temperature according to irradiance		Global array res.	4.7 mΩ
		Uc (const)	27.0 W/m²K	Loss Fraction	1.5 % at STC
		Uv (wind)	0.0 W/m²K/m/s		
Serie Diode Loss		Module Quality Loss		Module mismatch losses	
Voltage drop	0.7 V	Loss Fraction	-0.4 %	Loss Fraction	2.0 % at MPP
Loss Fraction	0.1 % at STC				



## Project: TFM

Variant: 3.500 KWp ON-SHORE / TRINA\_DELTA-WING / INV\_SUNGROW

PVsyst V8.0.7

VCA, Simulation date:  
12/04/25 13:50  
with V8.0.7

Universidad Europea (Spain)

### Array losses

#### Strings Mismatch loss

Loss Fraction 0.1 %

#### Module average degradation

Year no 10  
Loss factor 0.4 %/year  
Imp / Vmp contributions 80% / 20%  
Mismatch due to degradation  
Imp RMS dispersion 0.4 %/year  
Vmp RMS dispersion 0.4 %/year

#### 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	0.963	0.892	0.814	0.679	0.438	0.000

### System losses

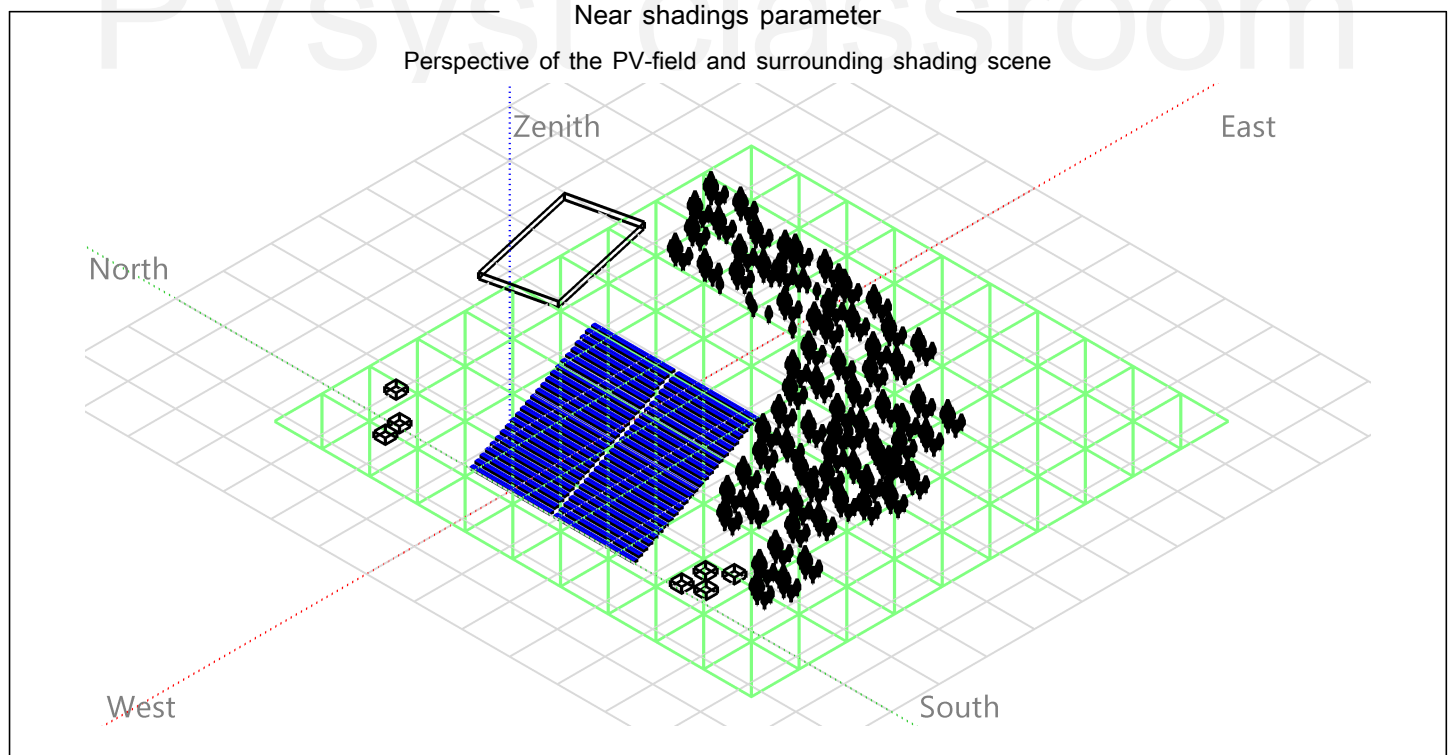
#### Auxiliaries loss

constant (fans) 10.00 kW  
0.0 kW from Power thresh.

### AC wiring losses

#### Inv. output line up to injection point

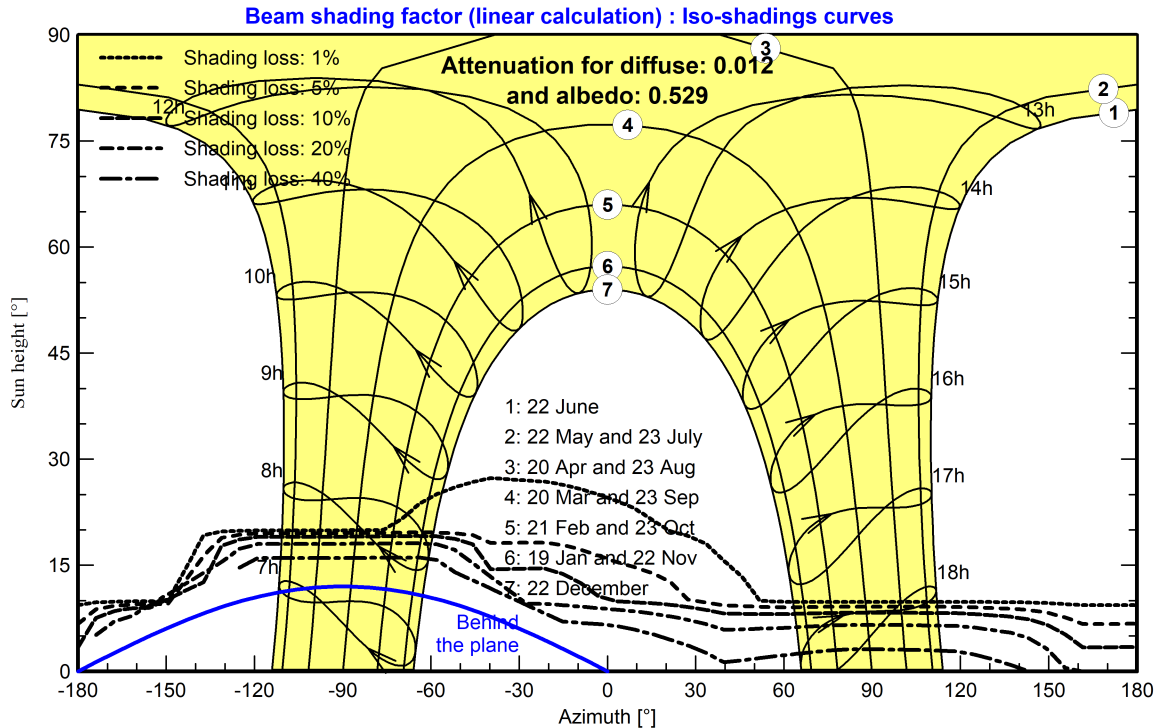
Inverter voltage 800 Vac tri  
Loss Fraction 1.42 % at STC  
Global System  
Wire section Copper 3 x 4000 mm<sup>2</sup>  
Wires length 500 m



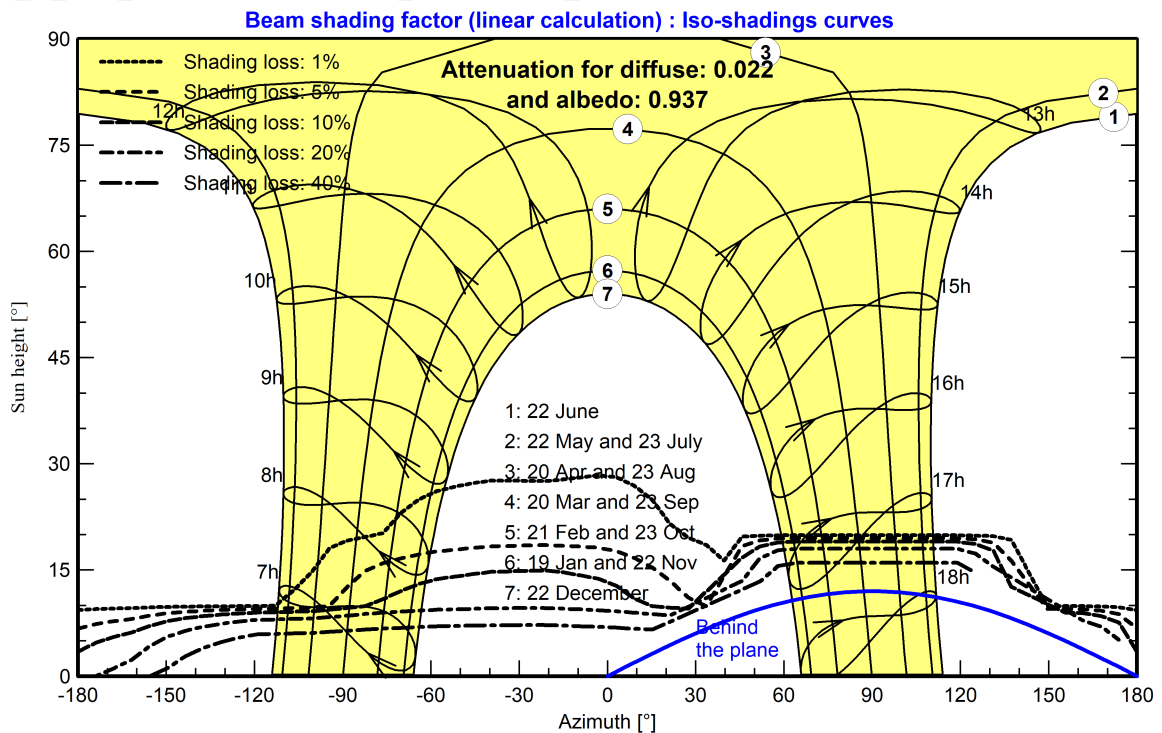


Iso-shadings diagram

Orientation #1 - Dome front face - Domes, Tilts/azimuths: 12°/ 90°



Orientation #2 - Dome backface - Domes, Tilts/azimuths: 12°/ -90°







## Project: TFM

Variant: 3.500 KWp ON-SHORE / TRINA\_DELTA-WING / INV\_SUNGROW

PVsyst V8.0.7

VCA, Simulation date:  
12/04/25 13:50  
with V8.0.7

Universidad Europea (Spain)

### Main results

#### System Production

Produced Energy 6141.9 MWh/year

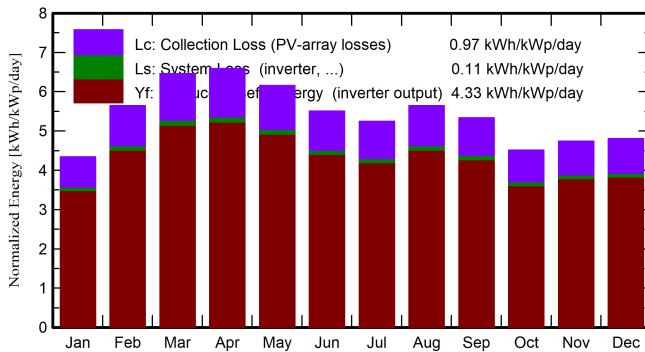
Specific production

1581 kWh/kWp/year

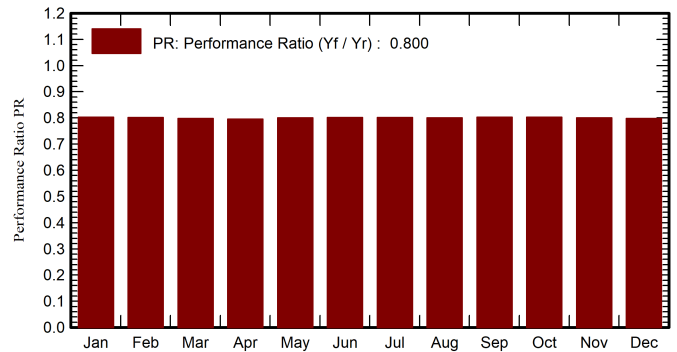
Perf. Ratio PR

80.03 %

Normalized productions (per installed kWp)



Performance Ratio PR



### Balances and main results

	GlobHor kWh/m <sup>2</sup>	DiffHor kWh/m <sup>2</sup>	T_Amb °C	GlobInc kWh/m <sup>2</sup>	GlobEff kWh/m <sup>2</sup>	EArray MWh	E_Grid MWh	PR ratio
January	136.0	46.51	25.99	134.7	128.2	432.0	420.5	0.803
February	159.5	40.40	26.15	158.0	151.0	504.2	491.8	0.801
March	202.4	44.92	26.13	200.3	191.9	636.2	620.9	0.798
April	199.7	45.89	27.35	197.6	189.5	625.8	610.8	0.796
May	192.7	56.01	26.88	190.9	183.0	608.6	593.9	0.801
June	166.7	61.25	27.16	165.1	158.0	527.2	514.2	0.802
July	164.2	63.92	27.10	162.7	155.5	519.4	506.4	0.801
August	176.8	59.16	27.14	175.1	167.8	558.1	544.4	0.800
September	161.5	58.62	27.24	160.0	153.4	511.5	498.8	0.803
October	141.1	58.41	26.62	139.8	133.3	447.6	436.0	0.803
November	143.3	42.80	26.73	142.3	135.2	453.6	442.2	0.800
December	150.0	37.57	26.13	149.0	141.0	473.9	461.9	0.798
Year	1993.6	615.46	26.72	1975.4	1887.9	6298.1	6141.9	0.800

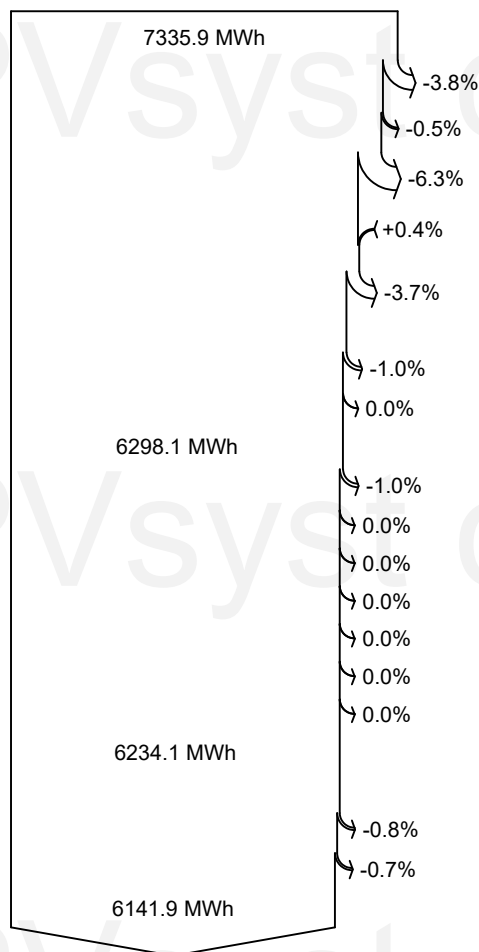
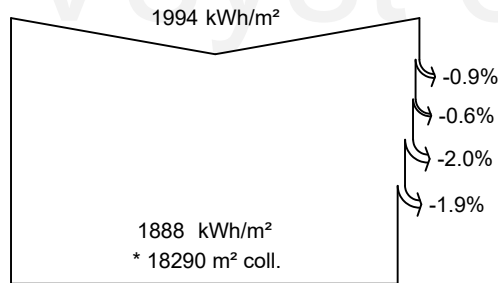
#### Legends

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



#### Global horizontal irradiation

#### Global incident in coll. plane

Near Shadings: irradiance loss

Soiling loss factor

IAM factor on global

#### Effective irradiation on collectors

PV conversion

#### Array nominal energy (at STC effic.)

Module Degradation Loss ( for year #10)

PV loss due to irradiance level

PV loss due to temperature

Module quality loss

Mismatch loss, modules and strings  
(including 1.6% for degradation dispersion)

Ohmic wiring loss

Mixed orientation mismatch 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)

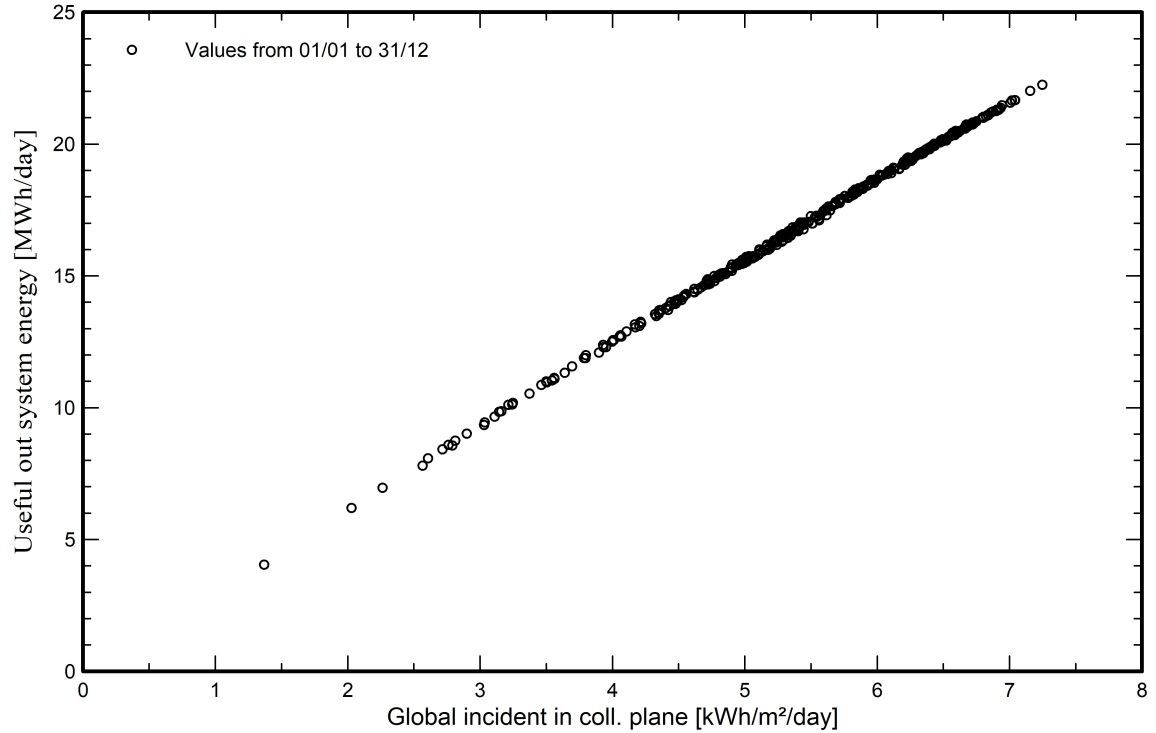
AC ohmic loss

#### Energy injected into grid

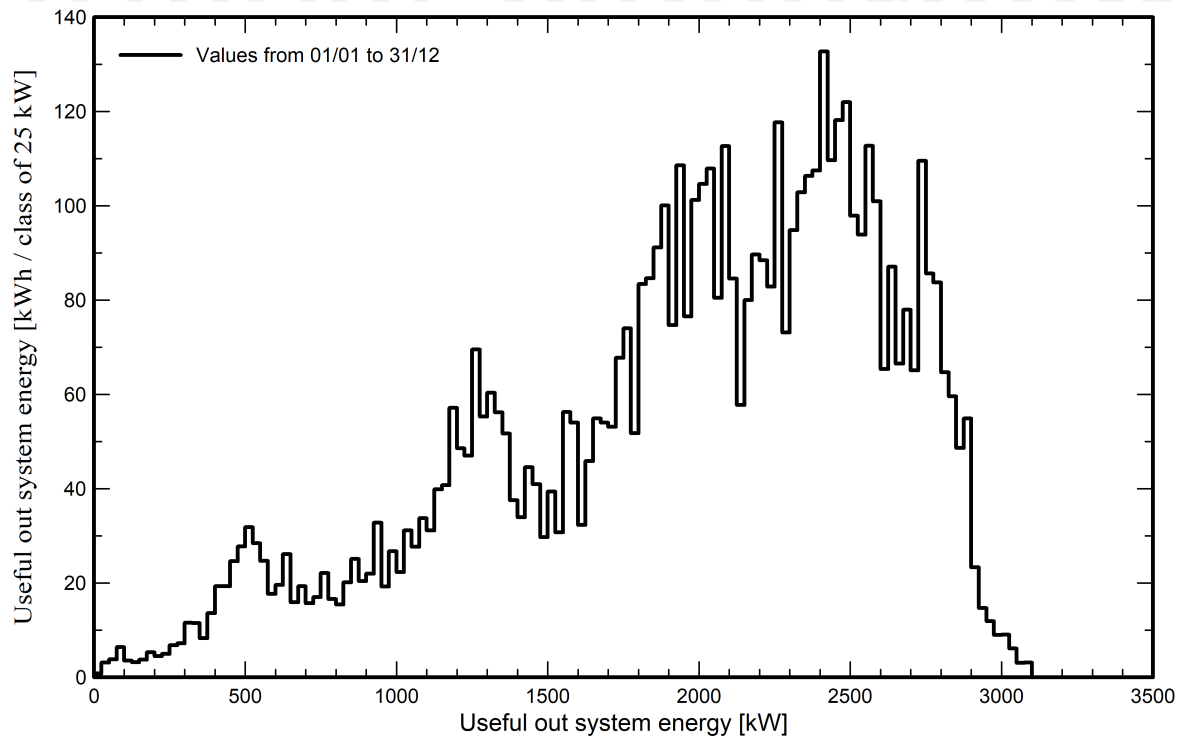


Predef. graphs

Diagrama entrada/salida diaria



Distribución de potencia de salida del sistema

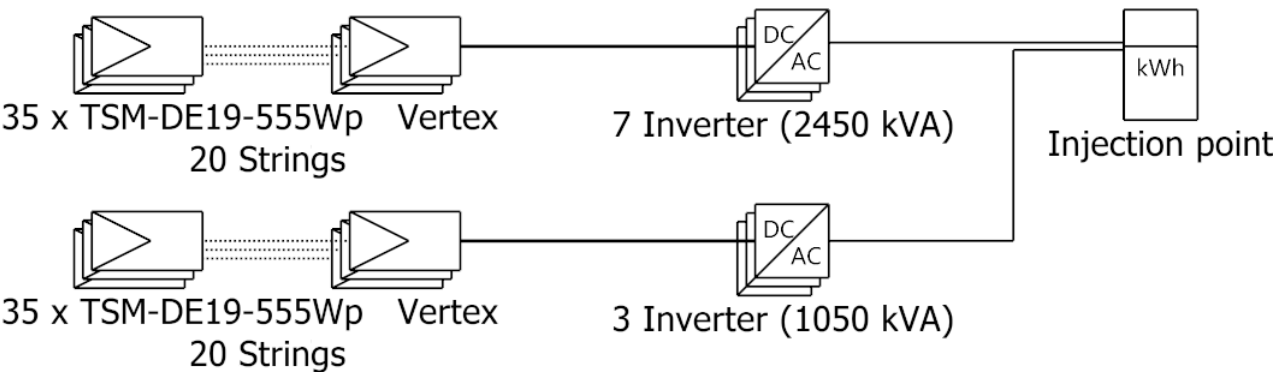




PVsyst V8.0.7

VCA, Simulation date:  
12/04/25 13:50  
with V8.0.7

# Single-line diagram



PV module	TSM-DE19-555Wp	Vertex
Inverter	SG350-HX	
String	35 x TSM-DE19-555Wp	Vertex

TFM

Universidad Europea  
(Spain)

VCA : 3.500 KWp ON-SHORE / TRINA\_  
DELTA-WING / INV\_SUNGROW

12/04/25