

**MÁSTER UNIVERSITARIO EN
INGENIERÍA INDUSTRIAL**

ANEXO VI.V

INSTALACIÓN FOTOVOLTAICA: PVSYST

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Curso académico	<i>2020-2021</i>

Bilbao, 21/09/2021

PVsyst - Simulation report

Grid-Connected System

Project: Carretillas

Variant: Carretillas_Final

Tables on a building

System power: 958 kWp

Tudela - Spain

PVsyst TRIAL

PVsyst TRIAL

PVsyst TRIAL

PVsyst TRIAL



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VC1, Simulation date:
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Project summary

Geographical Site	Situation	Project settings
Tudela	Latitude 42.08 °N	Albedo 0.20
Spain	Longitude -1.65 °W	
	Altitude 322 m	
	Time zone UTC+1	
Meteo data		
Tudela		
PVGIS api TMY		

System summary

Grid-Connected System	Tables on a building	
Simulation for year no 1		
PV Field Orientation	Near Shadings	User's needs
Fixed plane	According to strings	Monthly values
Tilt/Azimuth 36 / 0 °	Electrical effect 100 %	
System information		
PV Array	Inverters	
Nb. of modules 2128 units	Nb. of units 9 units	
Pnom total 958 kWp	Pnom total 900 kWac	
	Pnom ratio 1.064	

Results summary

Produced Energy 1571 MWh/year	Specific production 1641 kWh/kWp/year	Perf. Ratio PR 82.90 %
Apparent energy 1571 MVAh		Solar Fraction SF 28.28 %

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General parameters

Grid-Connected System

PV Field Orientation

Orientation

Fixed plane
Tilt/Azimuth 36 / 0 °

Horizon

Free Horizon

Tables on a building

Sheds configuration

Nb. of sheds 56 units

Sizes

Sheds spacing 14.0 m
Collector width 4.24 m
Ground Cov. Ratio (GCR) 30.3 %

Shading limit angle

Limit profile angle 13.3 °

Near Shadings

According to strings
Electrical effect 100 %

Models used

Transposition Perez
Diffuse Imported
Circumsolar separate

User's needs

Monthly values

Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.	Year	
12.5	12.5	12.5	12.5	12.5	15.6	15.6	15.6	12.5	12.5	12.5	12.5	13.3	MWh/day

Grid injection point

Power factor

Cos(phi) (leading) 1.000

PV Array Characteristics

PV module

Manufacturer Generic
Model CS3W-450MS
(Original PVsyst database)

Unit Nom. Power 450 Wp
Number of PV modules 2128 units
Nominal (STC) 958 kWp
Modules 112 Strings x 19 In series

At operating cond. (50°C)

Pmpp 875 kWp
U mpp 703 V
I mpp 1244 A

Total PV power

Nominal (STC) 958 kWp
Total 2128 modules
Module area 4701 m²

Inverter

Manufacturer Generic
Model Ingecon Sun 100TL 400V
(Original PVsyst database)

Unit Nom. Power 100 kWac
Number of inverters 9 units
Total power 900 kWac
Operating voltage 570-850 V
Pnom ratio (DC:AC) 1.06

Total inverter power

Total power 900 kWac
Nb. of inverters 9 units
Pnom ratio 1.06

Array losses

Array Soiling Losses

Loss Fraction 2.5 %

Thermal Loss factor

Module temperature according to irradiance
Uc (const) 29.0 W/m²K
Uv (wind) 0.0 W/m²K/m/s

DC wiring losses

Global array res. 7.5 mΩ
Loss Fraction 1.2 % at STC

LID - Light Induced Degradation

Loss Fraction 2.0 %

Module Quality Loss

Loss Fraction -0.6 %

Module mismatch losses

Loss Fraction 2.0 % 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

10°	20°	30°	40°	50°	60°	70°	80°	90°
0.998	0.998	0.995	0.992	0.986	0.970	0.917	0.763	0.000



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System losses

Unavailability of the system

Time fraction 1.5 %
5.5 days,
3 periods

AC wiring losses

Inv. output line up to injection point

Inverter voltage 400 Vac tri
Loss Fraction 1.2 % at STC

Inverter: Ingecon Sun 100TL 400V

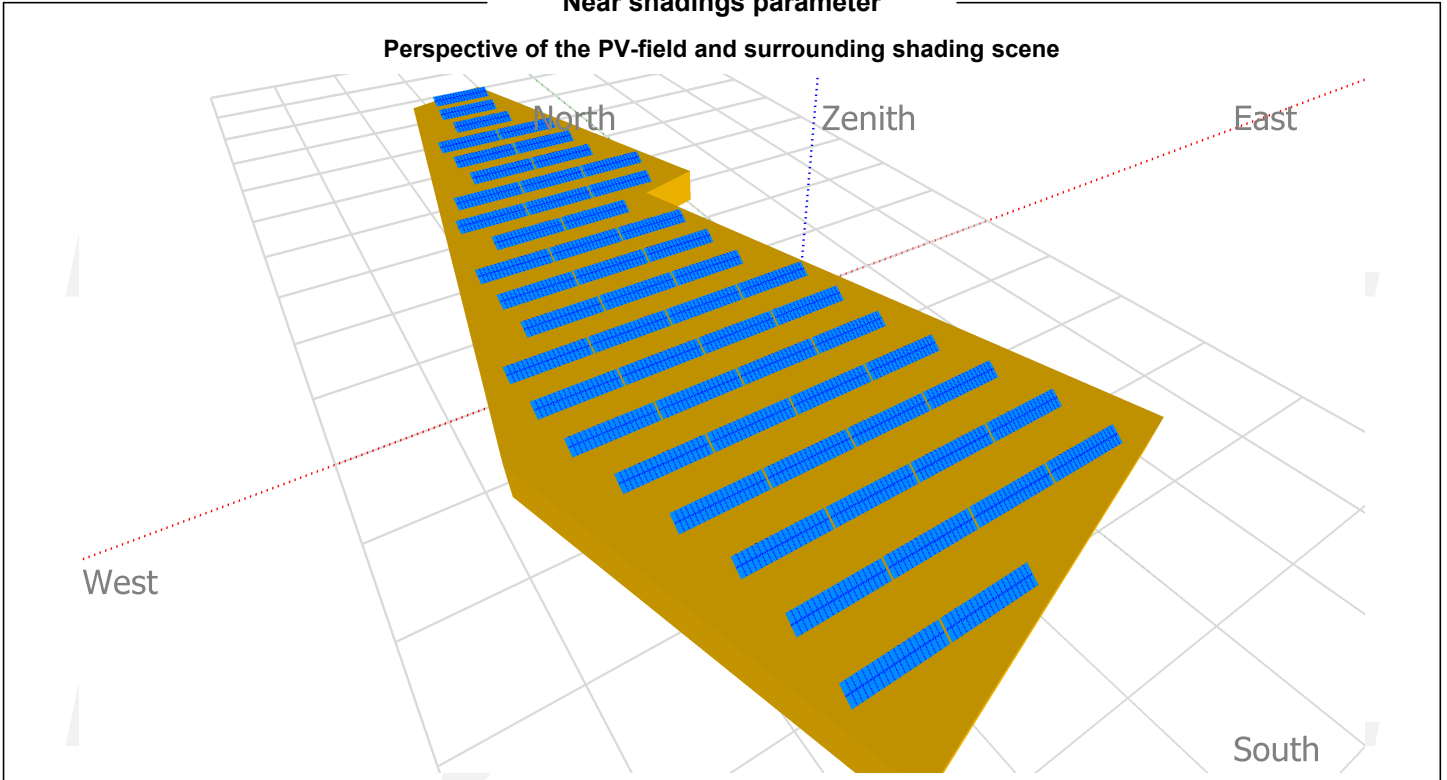
Wire section (9 Inv.) Copper 9 x 3 x 1000 mm²
Average wires length 975 m



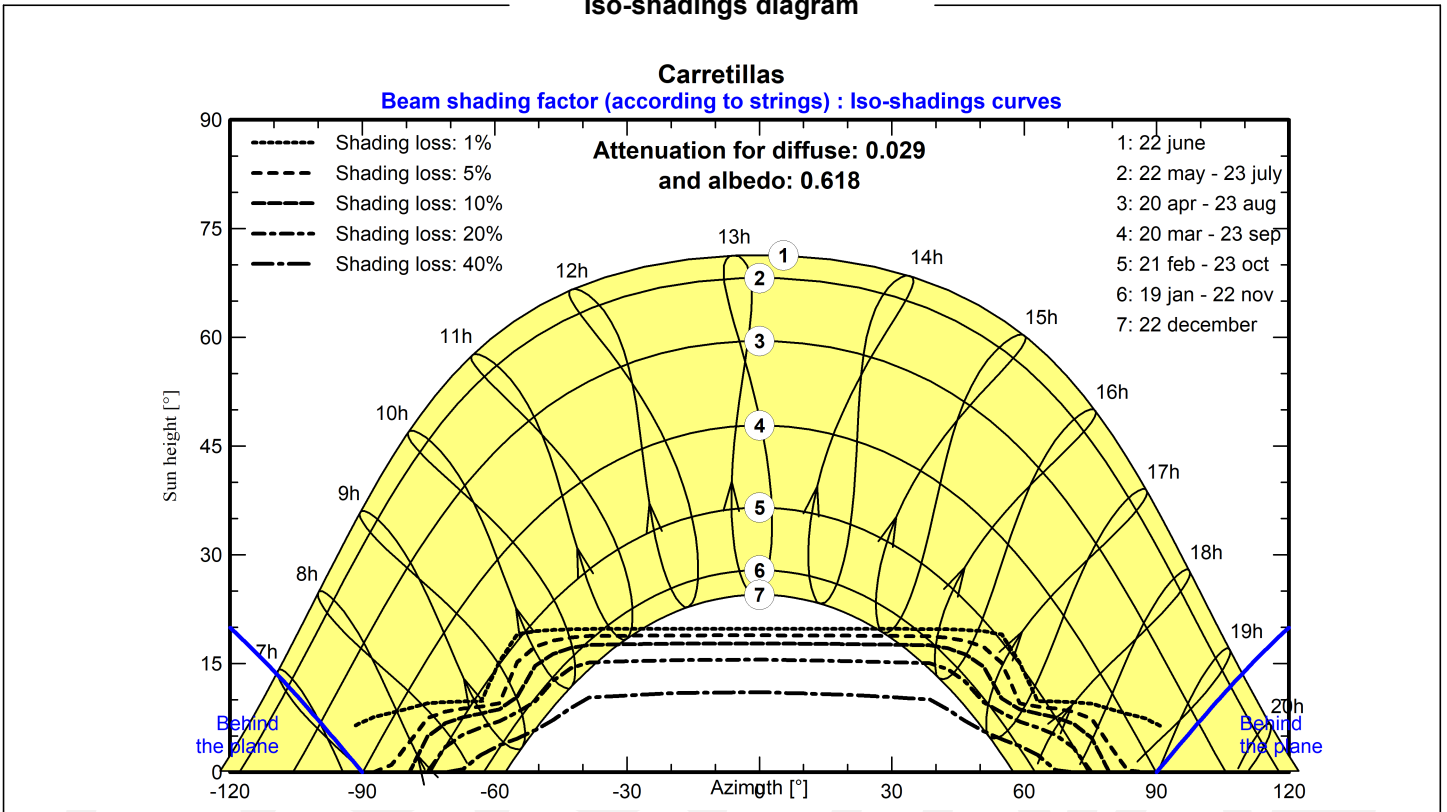
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Near shadings parameter



Iso-shadings diagram





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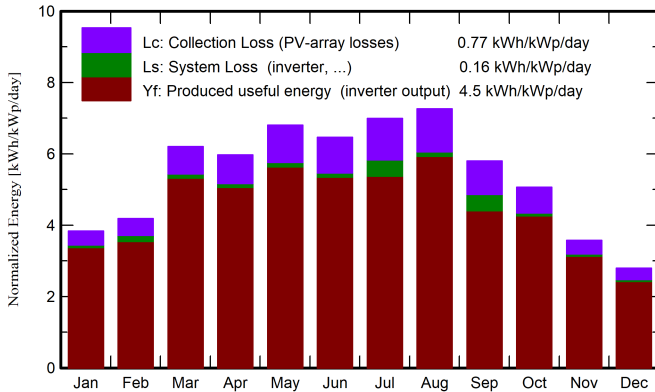
Main results

System Production

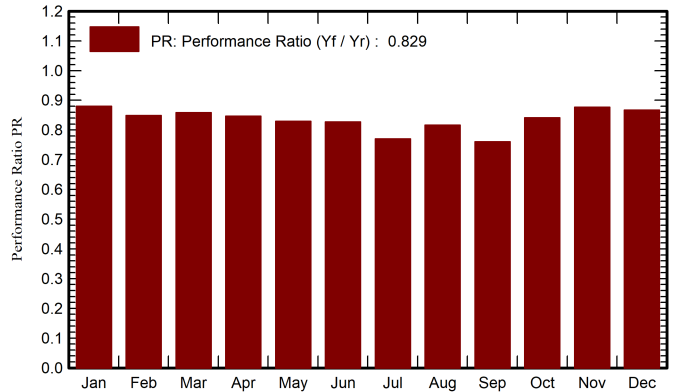
Produced Energy 1571 MWh/year
Apparent energy 1571 MVAh

Specific production 1641 kWh/kWp/year
Performance Ratio PR 82.90 %
Solar Fraction SF 28.28 %

Normalized productions (per installed kWp)



Performance Ratio PR



Balances and main results

	GlobHor	DiffHor	T_Amb	GlobInc	GlobEff	EArray	E_User	E_Solar	E_Grid	EFrGrid
	kWh/m ²	kWh/m ²	°C	kWh/m ²	kWh/m ²	MWh	MWh	MWh	MWh	MWh
January	64.7	24.84	7.48	119.0	112.8	102.4	387.2	87.2	13.17	300.0
February	75.8	30.03	9.58	117.1	111.2	99.7	349.7	79.7	15.47	270.0
March	145.1	45.64	10.30	192.2	182.2	161.4	387.2	125.9	32.22	261.3
April	162.9	62.18	13.60	179.2	168.8	148.5	374.7	118.6	26.71	256.1
May	212.7	71.51	18.80	210.9	198.3	171.1	387.2	137.5	29.96	249.7
June	206.7	74.01	20.10	194.0	181.9	157.0	468.8	147.5	6.14	321.3
July	226.3	70.03	22.32	216.7	203.4	173.2	484.5	150.7	9.03	333.7
August	211.1	55.15	23.53	225.2	212.6	179.8	484.5	163.6	12.44	320.8
September	142.9	52.02	22.57	174.0	164.4	139.7	374.7	107.7	19.09	267.0
October	108.2	40.88	18.95	157.0	148.9	129.1	387.2	108.0	18.49	279.2
November	63.7	28.51	9.69	107.1	101.5	91.9	374.7	79.0	10.93	295.7
December	49.0	24.91	9.14	86.7	81.7	73.7	387.2	65.3	6.77	321.9
Year	1669.0	579.71	15.54	1979.3	1867.4	1627.5	4847.5	1370.9	200.43	3476.7

Legends

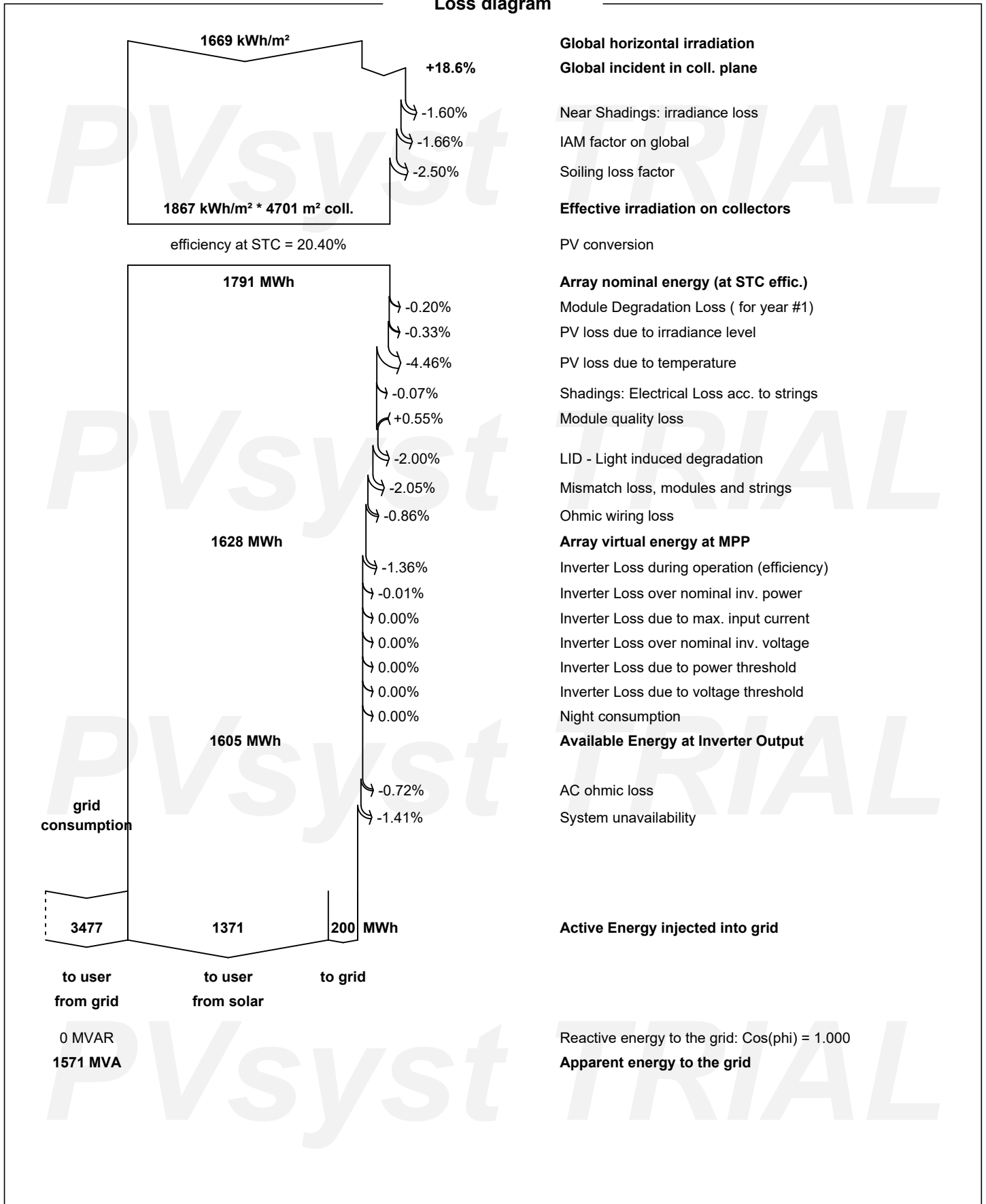
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|---------|--|---------|---|
| GlobHor | Global horizontal irradiation | EArray | Effective energy at the output of the array |
| DiffHor | Horizontal diffuse irradiation | E_User | Energy supplied to the user |
| T_Amb | Ambient Temperature | E_Solar | Energy from the sun |
| GlobInc | Global incident in coll. plane | E_Grid | Energy injected into grid |
| GlobEff | Effective Global, corr. for IAM and shadings | EFrGrid | Energy from the grid |



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Loss diagram



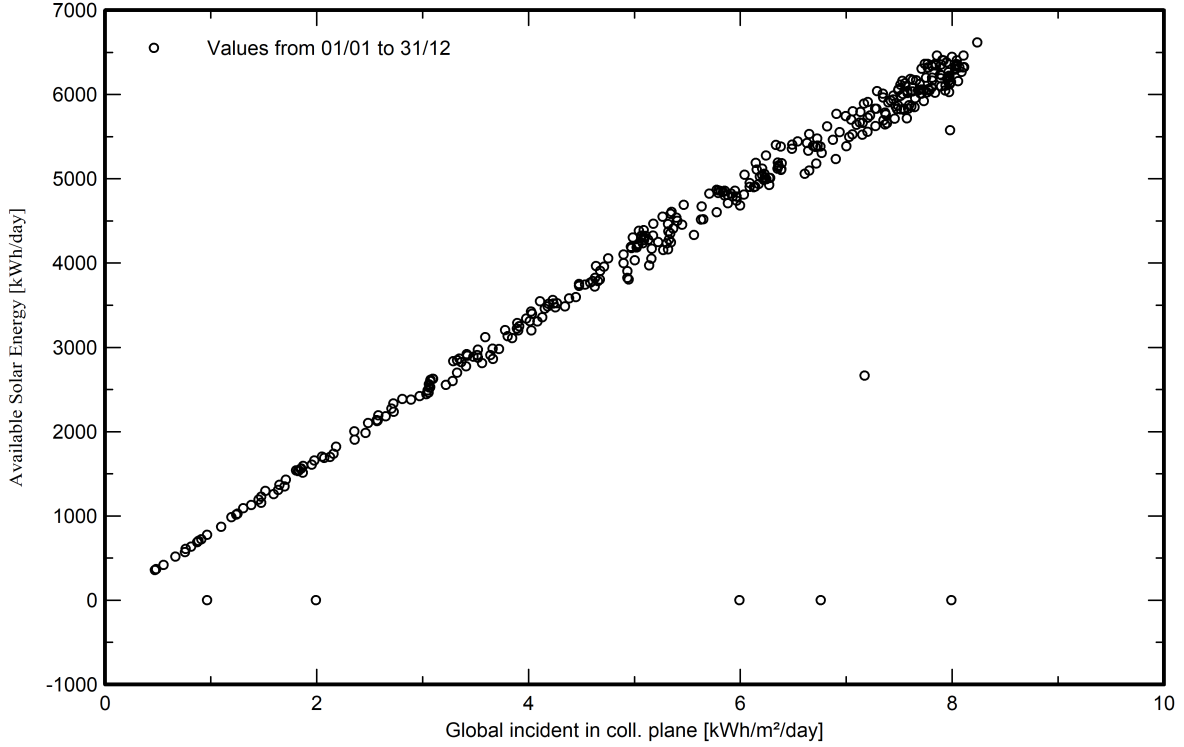


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Special graphs

Daily Input/Output diagram



System Output Power Distribution

