

PVsyst - Simulation report

Grid-Connected System

Project: LBH - Sports and Leisure Complex

Variant: New simulation variant

Rows as domes east-west

System power: 216 kWp

Hillingdon - United Kingdom

Author

Ameresco (USA)



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PVsyst V7.4.0

VC0, Simulation date:
29/07/23 18:36
with v7.4.0

Ameresco (USA)

Project summary

Geographical Site

Hillingdon
United Kingdom

Situation

Latitude 51.53 °N
Longitude -0.45 °W
Altitude 43 m
Time zone UTC

Project settings

Albedo 0.20

Meteo data

Hillingdon
Meteonorm 8.1 (1991-2006), Sat=35% - Synthetic

System summary

Grid-Connected System

PV Field Orientation

Fixed planes 2 orientations
Tilts/azimuths 10 / -90 °
10 / 90 °

Rows as domes east-west

Near Shadings

Linear shadings

User's needs

Unlimited load (grid)

System information

PV Array

Nb. of modules 526 units
Pnom total 216 kWp

Inverters

Nb. of units 2 units
Pnom total 160 kWac
Pnom ratio 1.348

Results summary

Produced Energy 178309 kWh/year Specific production 827 kWh/kWp/year Perf. Ratio PR 81.82 %

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General parameters

Grid-Connected System

PV Field Orientation

Orientation

Fixed planes 2 orientations
Tilts/azimuths 10 / -90 °
10 / 90 °

Horizon

Free Horizon

Rows as domes east-west

Sheds configuration

Nb. of sheds 198 units
Several orientations

Near Shadings

Linear shadings

Models used

Transposition Perez
Diffuse Perez, Meteonorm
Circumsolar separate

User's needs

Unlimited load (grid)

PV Array Characteristics

PV module

Manufacturer Hanwha Q Cells
Model Q.Peak-Duo-ML-G10-410

(Custom parameters definition)

Unit Nom. Power 410 Wp
Number of PV modules 526 units
Nominal (STC) 216 kWp

Array #1 - PV Array

Orientation #1
Tilt/Azimuth 10/-90 °
Number of PV modules 234 units
Nominal (STC) 95.9 kWp
Modules 13 Strings x 18 In series

At operating cond. (50°C)

Pmpp 87.5 kWp
U mpp 626 V
I mpp 140 A

Array #2 - Sub-array #2

Orientation #1
Tilt/Azimuth 10/-90 °
Number of PV modules 14 units
Nominal (STC) 5.74 kWp
Modules 1 String x 14 In series

At operating cond. (50°C)

Pmpp 5.24 kWp
U mpp 487 V
I mpp 11 A

Array #3 - Sub-array #3

Orientation #1
Tilt/Azimuth 10/-90 °
Number of PV modules 15 units
Nominal (STC) 6.15 kWp
Modules 1 String x 15 In series

At operating cond. (50°C)

Pmpp 5.61 kWp
U mpp 522 V
I mpp 11 A

Inverter

Manufacturer Ginlong Technologies
Model Solis-80K-5G

(Custom parameters definition)

Unit Nom. Power 80.0 kWac
Number of inverters 2 units
Total power 160 kWac

Number of inverters 7 * MPPT 11% 0.8 unit
Total power 62.2 kWac

Operating voltage 180-800 V
Pnom ratio (DC:AC) 1.54
No power sharing between MPPTs

Number of inverters 1 * MPPT 11% 0.1 unit
Total power 8.9 kWac

Operating voltage 180-800 V
Pnom ratio (DC:AC) 0.65

Number of inverters 1 * MPPT 11% 0.1 unit
Total power 8.9 kWac

Operating voltage 180-800 V
Pnom ratio (DC:AC) 0.69



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PV Array Characteristics

Array #4 - Sub-array #4

Orientation	#2		
Tilt/Azimuth	10/90 °		
Number of PV modules	234 units	Number of inverters	7 * MPPT 11% 0.8 unit
Nominal (STC)	95.9 kWp	Total power	62.2 kWac
Modules	13 Strings x 18 In series		
At operating cond. (50°C)		Operating voltage	180-800 V
Pmpp	87.5 kWp	Pnom ratio (DC:AC)	1.54
U mpp	626 V	No power sharing between MPPTs	
I mpp	140 A		

Array #5 - Sub-array #5

Orientation	#2		
Tilt/Azimuth	10/90 °		
Number of PV modules	14 units	Number of inverters	1 * MPPT 11% 0.1 unit
Nominal (STC)	5.74 kWp	Total power	8.9 kWac
Modules	1 String x 14 In series		
At operating cond. (50°C)		Operating voltage	180-800 V
Pmpp	5.24 kWp	Pnom ratio (DC:AC)	0.65
U mpp	487 V		
I mpp	11 A		

Array #6 - Sub-array #6

Orientation	#2		
Tilt/Azimuth	10/90 °		
Number of PV modules	15 units	Number of inverters	1 * MPPT 11% 0.1 unit
Nominal (STC)	6.15 kWp	Total power	8.9 kWac
Modules	1 String x 15 In series		
At operating cond. (50°C)		Operating voltage	180-800 V
Pmpp	5.61 kWp	Pnom ratio (DC:AC)	0.69
U mpp	522 V		
I mpp	11 A		

Total PV power

Nominal (STC)	216 kWp
Total	526 modules
Module area	1033 m²

Total inverter power

Total power	160 kWac
Number of inverters	2 units
Pnom ratio	1.35
No power sharing	

Array losses

Array Soiling Losses

Loss Fraction 2.5 %

Thermal Loss factor

Module temperature according to irradiance
Uc (const) 27.0 W/m²K
Uv (wind) 0.0 W/m²K/m/s

LID - Light Induced Degradation

Loss Fraction 2.5 %

Module Quality Loss

Loss Fraction -0.8 %

Module mismatch losses

Loss Fraction 2.0 % at MPP

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 10 mΩ
Loss Fraction 1.5 % at STC

Array #1 - PV Array

Global array res. 74 mΩ
Loss Fraction 1.5 % at STC

Array #3 - Sub-array #3

Global array res. 799 mΩ
Loss Fraction 1.5 % at STC

Array #5 - Sub-array #5

Global array res. 746 mΩ
Loss Fraction 1.5 % at STC

Array #2 - Sub-array #2

Global array res. 746 mΩ
Loss Fraction 1.5 % at STC

Array #4 - Sub-array #4

Global array res. 74 mΩ
Loss Fraction 1.5 % at STC

Array #6 - Sub-array #6

Global array res. 799 mΩ
Loss Fraction 1.5 % at STC

AC wiring losses

Inv. output line up to injection point

Inverter voltage 400 Vac tri
Loss Fraction 0.32 % at STC

Inverter: Solis-80K-5G

Wire section (2 Inv.) Copper 2 x 3 x 70 mm²
Average wires length 18 m

Inverter: Solis-80K-5G

Wire section (1 Inv.) Copper 1 x 3 x 25 mm²
Wires length 0 m

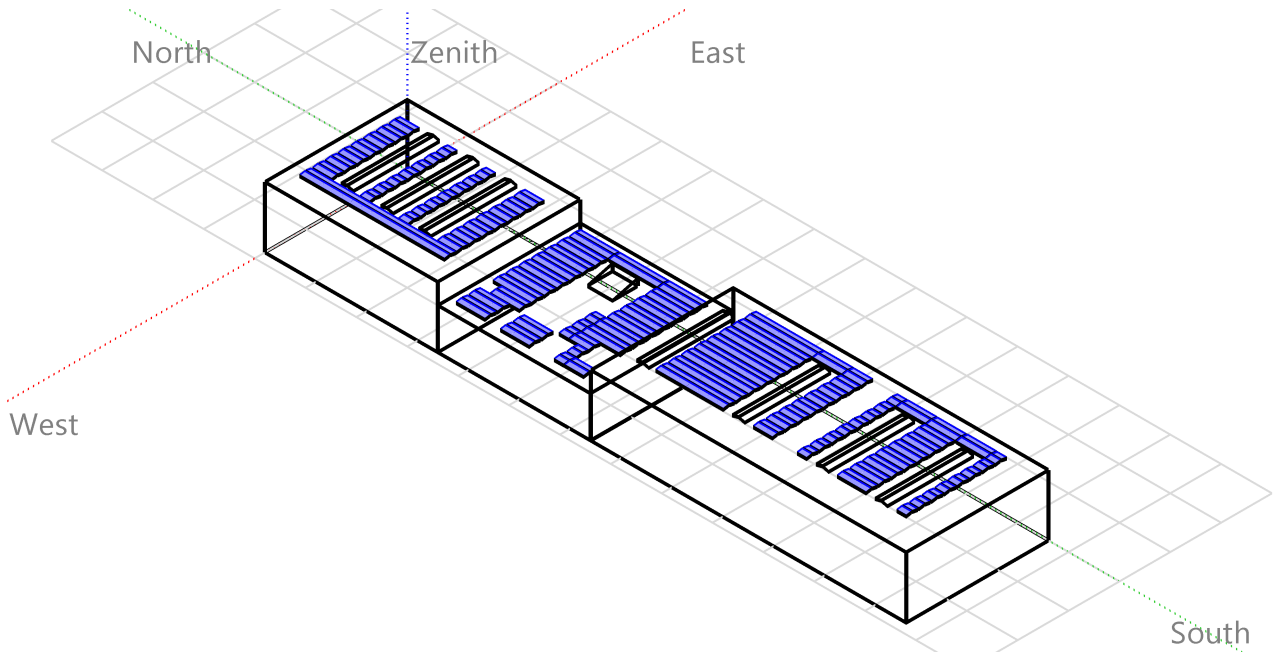
Inverter: Solis-80K-5G

Wire section (1 Inv.) Copper 1 x 3 x 16 mm²
Wires length 0 m



Near shadings parameter

Perspective of the PV-field and surrounding shading scene





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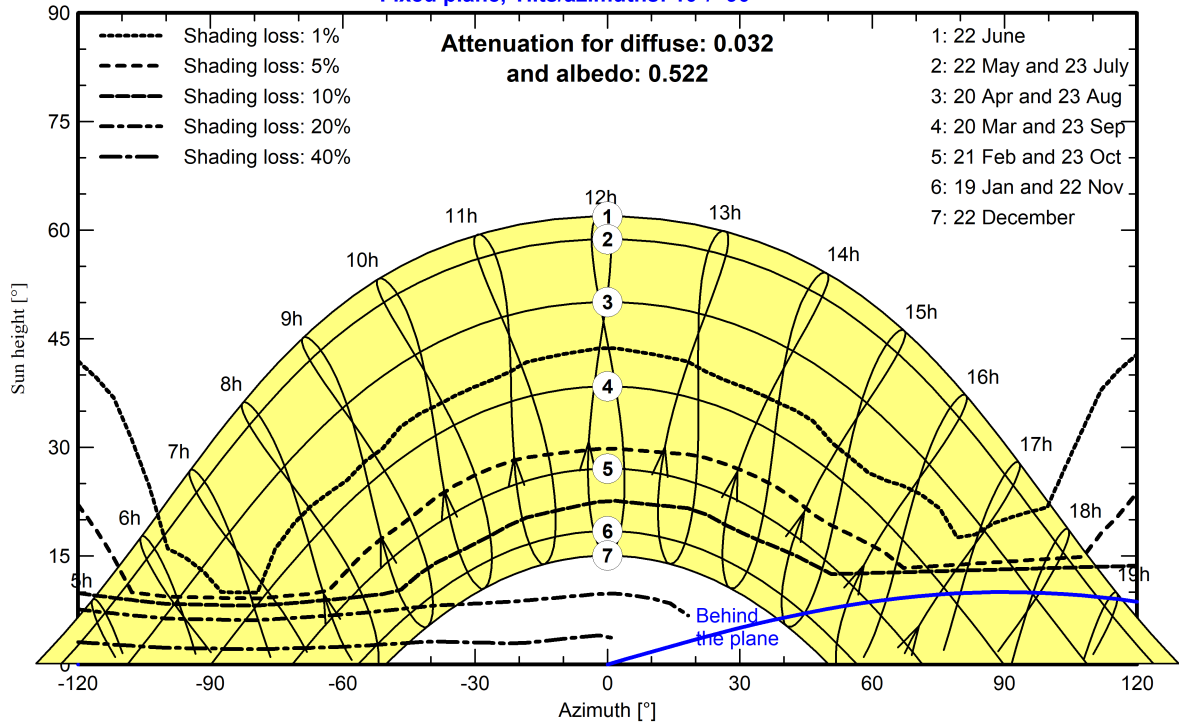
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Iso-shadings diagram

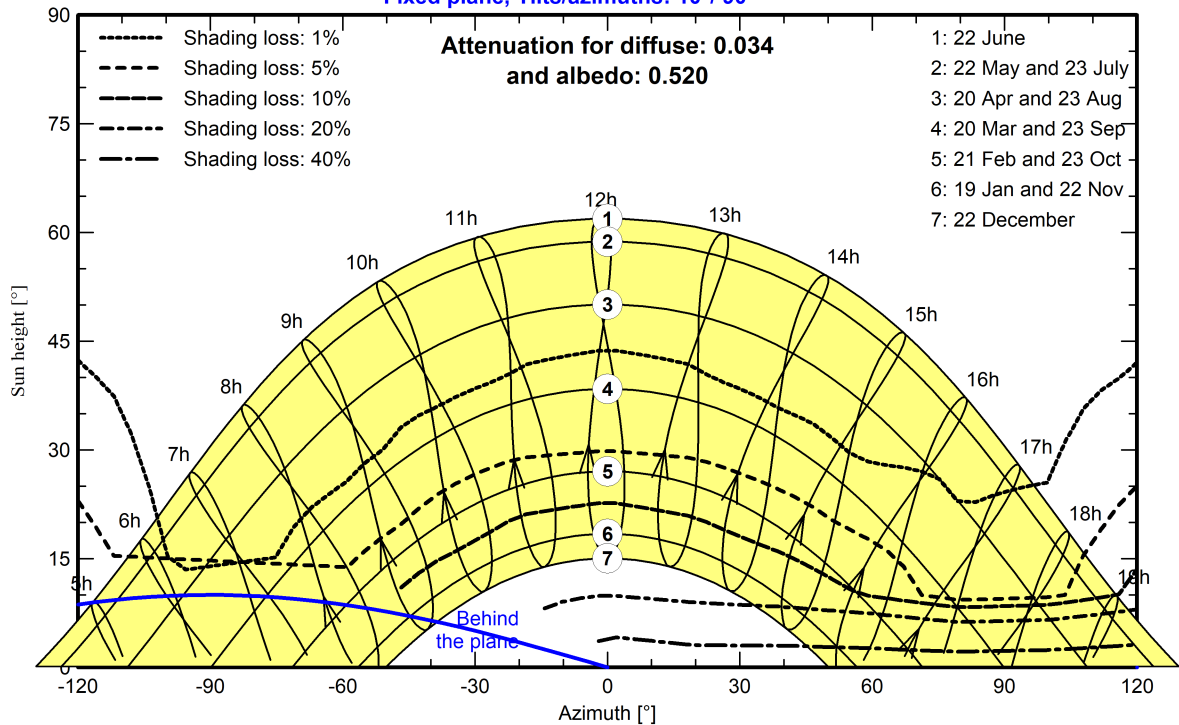
Orientation #1

Fixed plane, Tilts/azimuths: 10°/-90°



Orientation #2

Fixed plane, Tilts/azimuths: 10°/90°





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Main results

System Production

Produced Energy

178309 kWh/year

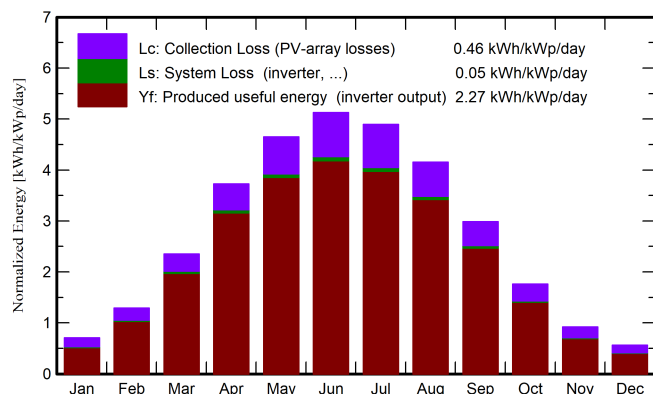
Specific production

827 kWh/kWp/year

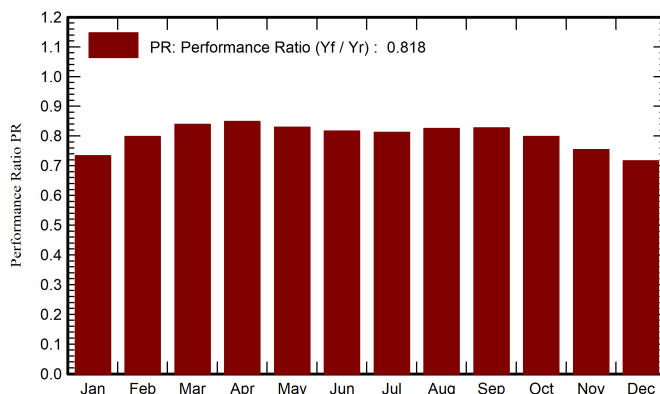
Perf. Ratio PR

81.82 %

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	kWh	kWh	ratio
January	22.1	14.33	5.33	21.9	17.5	3592	3473	0.734
February	36.4	21.70	5.42	36.1	30.8	6381	6227	0.799
March	73.5	41.09	7.34	73.0	65.6	13485	13211	0.839
April	112.7	62.73	9.89	111.7	103.5	20852	20461	0.849
May	145.3	77.31	13.27	144.2	134.2	26268	25779	0.829
June	154.8	84.88	16.49	153.8	143.0	27594	27082	0.817
July	152.8	79.66	18.84	151.7	141.1	27088	26583	0.813
August	129.6	72.02	18.10	128.7	119.3	23336	22905	0.825
September	90.2	47.41	15.20	89.6	82.0	16308	15991	0.828
October	55.1	32.30	12.05	54.7	47.7	9614	9412	0.798
November	27.8	18.19	8.01	27.6	22.7	4612	4483	0.754
December	17.7	11.85	5.96	17.5	13.8	2812	2702	0.717
Year	1018.1	563.46	11.36	1010.5	921.2	181943	178309	0.818

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

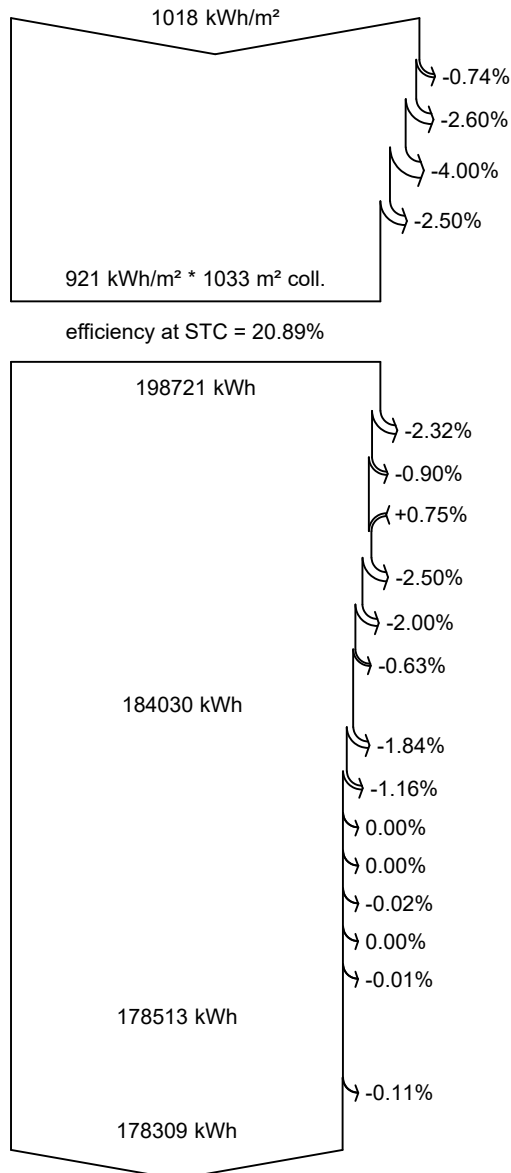
EArray Effective energy at the output of the array

E_Grid Energy injected into grid

PR Performance Ratio



Loss diagram



Global horizontal irradiation

Global incident in coll. plane

Near Shadings: irradiance loss

IAM factor on global

Soiling loss factor

Effective irradiation on collectors

PV conversion

Array nominal energy (at STC effic.)

PV loss due to irradiance level

PV loss due to temperature

Module quality loss

LID - Light induced degradation

Module array mismatch loss

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

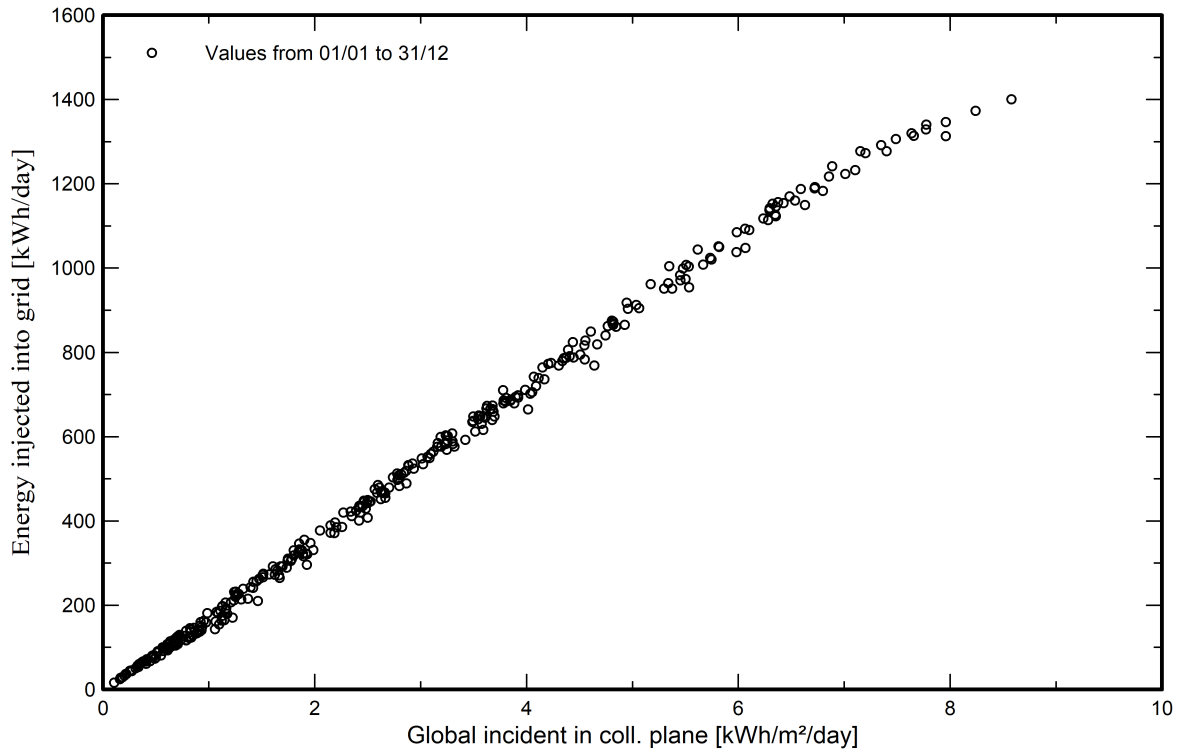
AC ohmic loss

Energy injected into grid



Predef. graphs

Daily Input/Output diagram



System Output Power Distribution

