Version 7.2.16

# PVsyst - Simulation report

## Grid-Connected System

Project: Kopellis_ 1 Axis

Variant: 1 axis Vertical 9*3 pitch 30m

Trackers single array

System power: 114 kWp

Thessaloniki/Livadákion - Greece

**Author**

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## Project summary

**Geographical Site**
**Thessaloniki/Livadákion**
Greece

**Situation**

| | |
|---|---|
| Latitude | 40.52 °N |
| Longitude | 22.97 °E |
| Altitude | 4 m |
| Time zone | UTC+2 |

**Project settings**
Albedo 0.20

**Meteo data**
Thessaloniki/Livadákion
Meteonorm 8.0 (1994-2006), Sat=14% - Synthetic

## System summary

**Grid-Connected System**

**Trackers single array**

**PV Field Orientation**
**Orientation**
Tracking plane, vertical axis
Plane tilt 25 °

**Tracking algorithm**
Astronomic calculation

**Near Shadings**
Linear shadings

**System information**

**PV Array**

| | |
|---|---|
| Nb. of modules | 216 units |
| Pnom total | 114 kWp |

**Inverters**

| | |
|---|---|
| Nb. of units | 1 unit |
| Pnom total | 111 kWac |
| Pnom ratio | 1.031 |

**User's needs**
Unlimited load (grid)

## Results summary

| | | | | | |
|---|---|---|---|---|---|
| Produced Energy | 202.2 MWh/year | Specific production | 1766 kWh/kWp/year | Perf. Ratio PR | 84.92 % |

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## General parameters

**Grid-Connected System**

**Trackers single array**

**PV Field Orientation**

**Orientation**
Tracking plane, vertical axis
Plane tilt 25 °

**Tracking algorithm**
Astronomic calculation

**Trackers configuration**
Nb. of trackers 4 units

**Sizes**
Tracker Spacing 0.00 m
Collector width 10.4 m
Azimut min / max. -/+ 120.0 °

**Models used**
Transposition Perez
Diffuse Perez, Meteonorm
Circumsolar separate

**Horizon**
Average Height 7.4 °

**Near Shadings**
Linear shadings

**User's needs**
Unlimited load (grid)

## PV Array Characteristics

**PV module**
Manufacturer Generic
Model JKM-530M-72HL4-V
(Custom parameters definition)
Unit Nom. Power 530 Wp
Number of PV modules 216 units
Nominal (STC) 114 kWp
Modules 8 Strings x 27 In series
**At operating cond. (50°C)**
Pmpp 104 kWp
U mpp 1002 V
I mpp 104 A

**Inverter**
Manufacturer Generic
Model SG111-HV
(Original PVsyst database)
Unit Nom. Power 111 kWac
Number of inverters 1 unit
Total power 111 kWac
Operating voltage 780-1450 V
Pnom ratio (DC:AC) 1.03

**Total PV power**
Nominal (STC) 114 kWp
Total 216 modules
Module area 557 m²

**Total inverter power**
Total power 111 kWac
Number of inverters 1 unit
Pnom ratio 1.03

## Array losses

**Array Soiling Losses**
Loss Fraction 1.5 %

**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. 106 mΩ
Loss Fraction 1.0 % at STC

**Module Quality Loss**
Loss Fraction 0.0 %

**Module mismatch losses**
Loss Fraction 0.6 % 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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## System losses

**Auxiliaries loss**
Proportionnal to Power 4.0 W/kW
0.0 kW from Power thresh.

## AC wiring losses

**Inv. output line up to MV transfo**

| | |
|---|---|
| Inverter voltage | 540 Vac tri |
| Loss Fraction | 0.21 % at STC |

**Inverter: SG111-HV**

| | |
|---|---|
| Wire section (1 Inv.) | Copper 1 x 3 x 240 mm² |
| Wires length | 70 m |

## AC losses in transformers

**MV transfo**

| | |
|---|---|
| Grid voltage | 20 kV |

**Operating losses at STC**

| | |
|---|---|
| Nominal power at STC | 113 kVA |
| Iron loss (24/24 Connexion) | 0.11 kW |
| Loss Fraction | 0.10 % at STC |
| Coils equivalent resistance | 3 x 25.76 mΩ |
| Loss Fraction | 1.00 % at STC |

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## Horizon definition

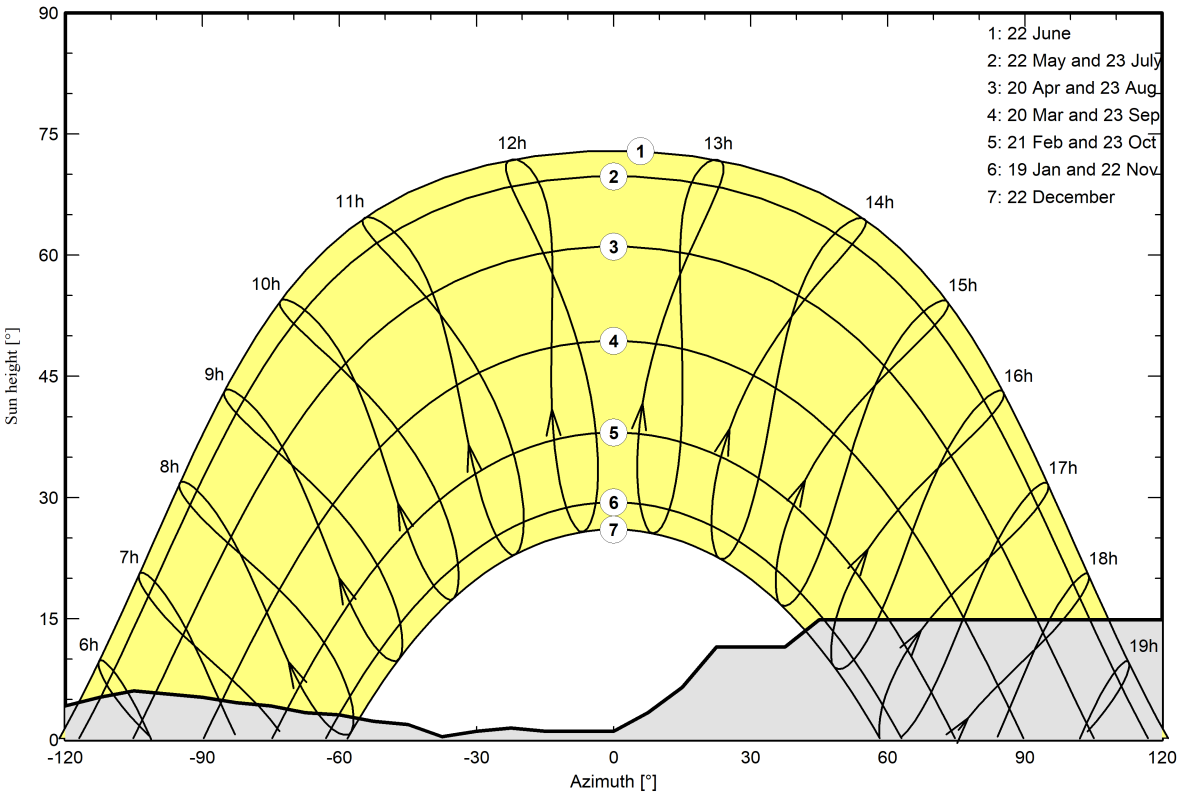
**Horizon from PVGIS website API, Lat=39°37"58', Long=22°13"41', Alt=153m**

| | | | |
|---|---|---|---|
| Average Height | 7.4 ° | Albedo Factor | 0.40 |
| Diffuse Factor | 0.92 | Albedo Fraction | 100 % |

### Horizon profile

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Azimuth [°] | -180 | -173 | -165 | -158 | -143 | -135 | -128 | -120 | -113 | -105 | -98 | -90 |
| Height [°] | 1.9 | 3.4 | 4.6 | 5.7 | 7.3 | 6.5 | 4.6 | 4.2 | 5.3 | 6.1 | 5.7 | 5.3 |
| Azimuth [°] | -83 | -75 | -68 | -60 | -53 | -45 | -38 | -30 | -23 | -15 | 0 | 8 |
| Height [°] | 4.6 | 4.2 | 3.4 | 3.1 | 2.3 | 1.9 | 0.4 | 1.1 | 1.5 | 1.1 | 1.1 | 3.4 |
| Azimuth [°] | 15 | 23 | 38 | 45 | 135 | 143 | 150 | 158 | 165 | 173 | 180 | |
| Height [°] | 6.5 | 11.5 | 11.5 | 14.9 | 14.9 | 8.0 | 8.0 | 5.3 | 1.9 | 1.5 | 1.9 | |

### Sun Paths (Height / Azimuth diagram)



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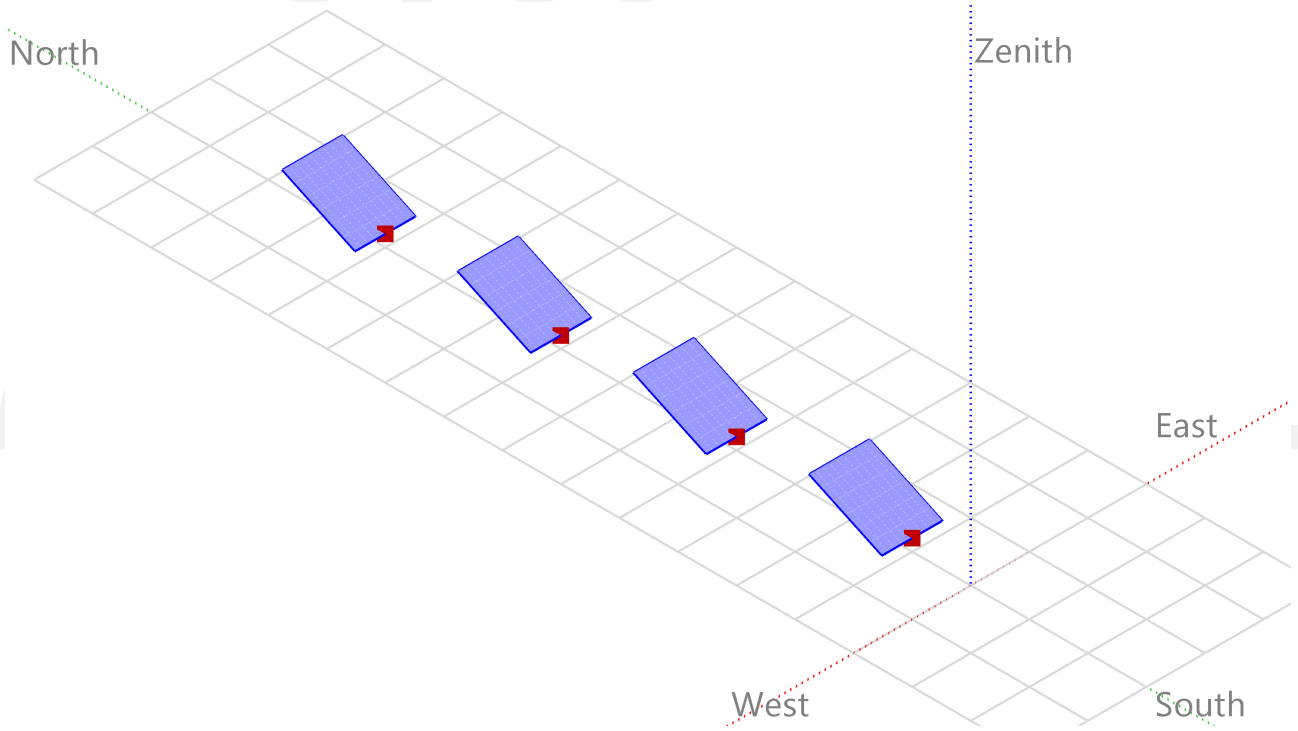
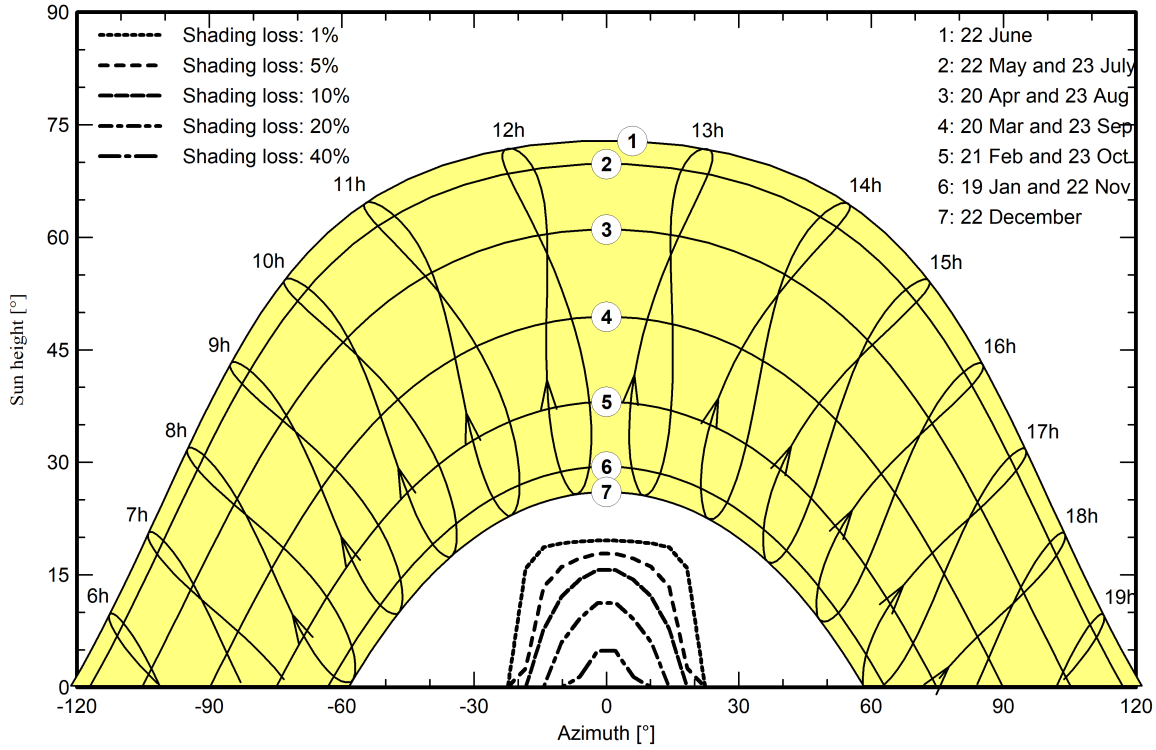
## Near shadings parameter

**Perspective of the PV-field and surrounding shading scene**




## Iso-shadings diagram

**Orientation #1**



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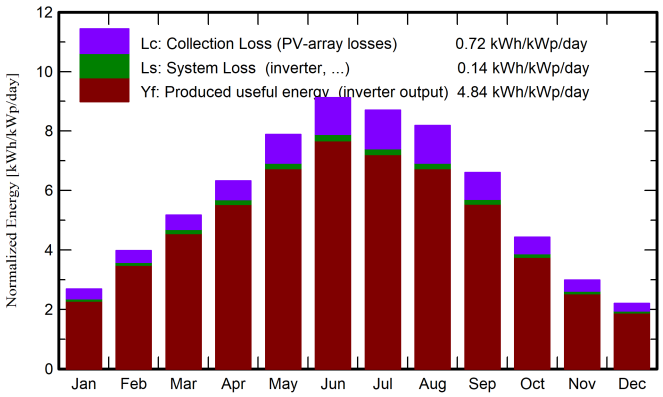
## Main results

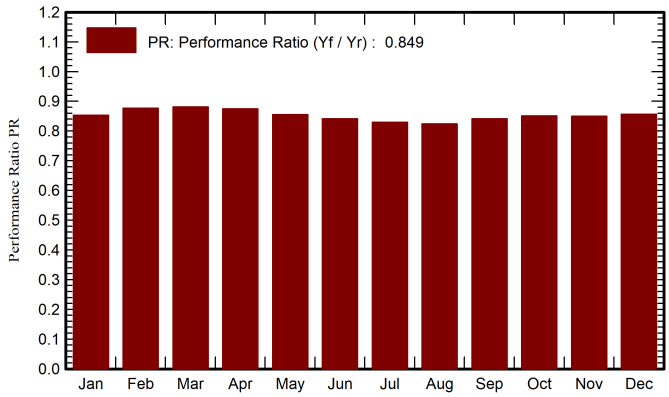
### System Production

| | | | |
|---|---|---|---|
| Produced Energy | 202.2 MWh/year | Specific production | 1766 kWh/kWp/year |
| | | Performance Ratio PR | 84.92 % |

**Normalized productions (per installed kWp)**




**Performance Ratio PR**




### Balances and main results

| | GlobHor kWh/m² | DiffHor kWh/m² | T_Amb °C | GlobInc kWh/m² | GlobEff kWh/m² | EArray MWh | E_Grid MWh | PR ratio |
|---|---|---|---|---|---|---|---|---|
| **January** | 52.6 | 29.21 | 4.95 | 83.1 | 73.6 | 8.40 | 8.11 | 0.853 |
| **February** | 76.4 | 39.36 | 6.71 | 111.4 | 102.0 | 11.53 | 11.18 | 0.877 |
| **March** | 118.0 | 57.36 | 9.91 | 160.5 | 149.9 | 16.67 | 16.20 | 0.882 |
| **April** | 150.3 | 77.02 | 13.73 | 189.9 | 178.7 | 19.56 | 19.02 | 0.875 |
| **May** | 195.0 | 84.41 | 19.52 | 244.4 | 230.7 | 24.58 | 23.92 | 0.855 |
| **June** | 218.4 | 75.24 | 24.54 | 273.8 | 261.0 | 27.12 | 26.38 | 0.842 |
| **July** | 214.7 | 82.15 | 27.83 | 269.7 | 256.1 | 26.32 | 25.61 | 0.829 |
| **August** | 194.0 | 76.29 | 27.71 | 253.8 | 238.5 | 24.58 | 23.93 | 0.824 |
| **September** | 144.2 | 53.93 | 21.67 | 198.1 | 185.6 | 19.62 | 19.07 | 0.841 |
| **October** | 94.1 | 43.87 | 16.53 | 137.2 | 126.3 | 13.77 | 13.36 | 0.850 |
| **November** | 57.9 | 29.79 | 11.46 | 89.6 | 81.0 | 9.02 | 8.72 | 0.850 |
| **December** | 43.4 | 24.96 | 6.66 | 68.2 | 61.3 | 6.95 | 6.69 | 0.857 |
| **Year** | 1559.1 | 673.58 | 15.99 | 2079.7 | 1944.7 | 208.11 | 202.18 | 0.849 |

### 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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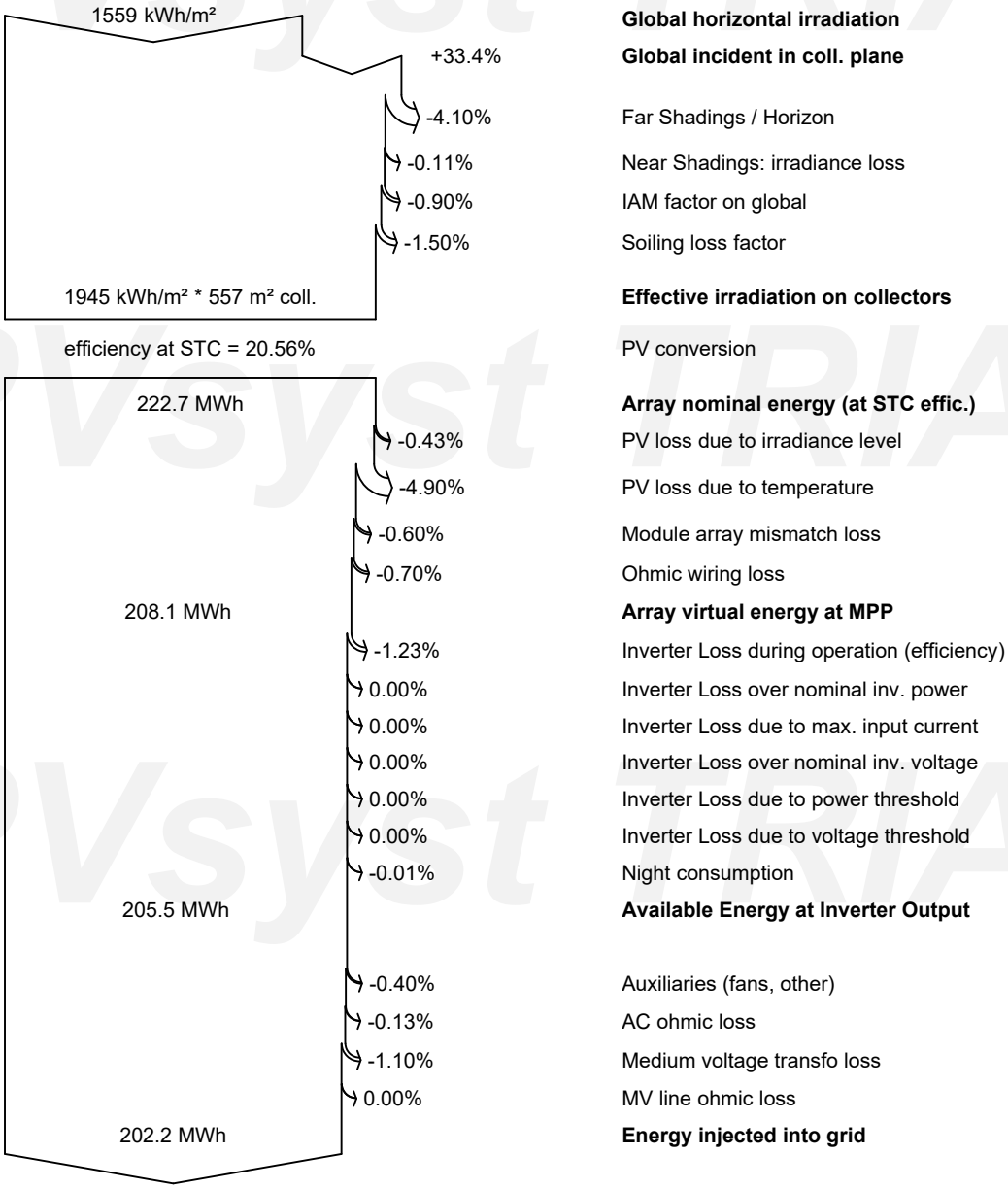
## Loss diagram



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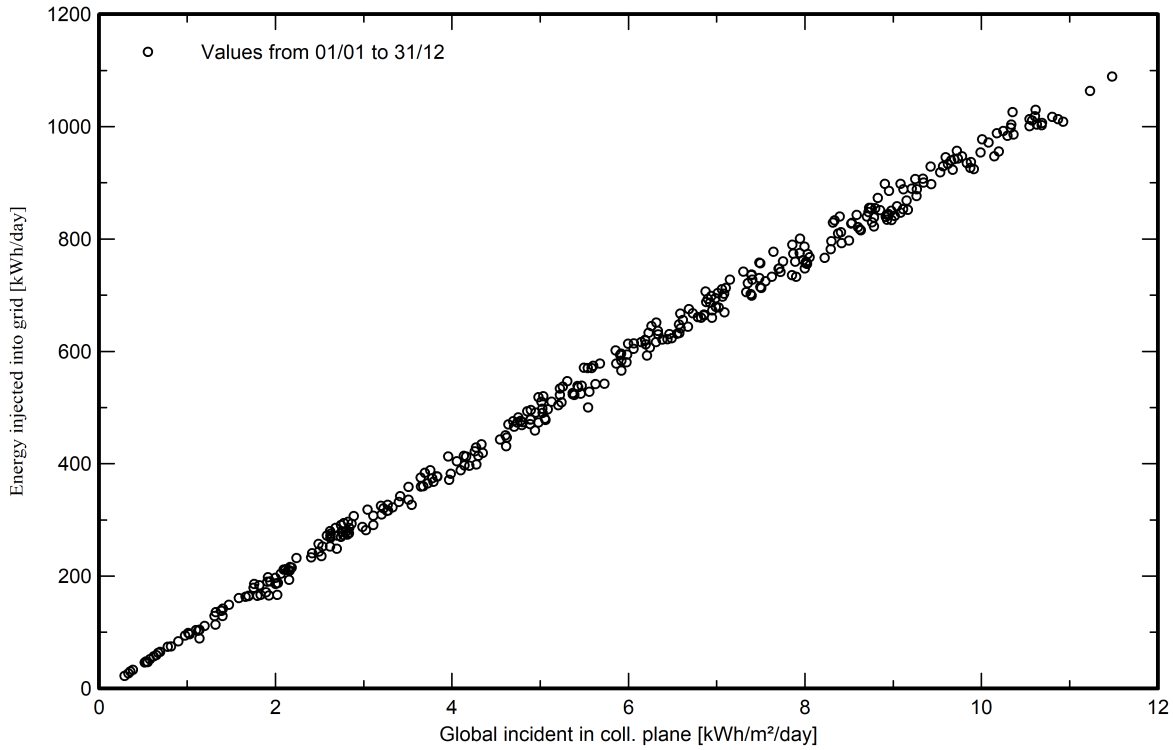
## Special graphs

### Daily Input/Output diagram




### System Output Power Distribution