Version 7.2.13

# PVsyst - Simulation report

## Grid-Connected System

### Project: Altamura

Variant: Central Inverter Fixed South No Topo No Tree without windmills

Sheds on ground

System power: 1573 kWp

Altamura - Italy

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**PVsyst V7.2.13**
VC1, Simulation date:
26/04/22 10:04
with v7.2.13

wpd onshore GmbH & Co KG (Germany)

## Project summary

**Geographical Site**
**Altamura**
Italy

**Situation**

| | |
|---|---|
| Latitude | 40.78 °N |
| Longitude | 16.52 °E |
| Altitude | 369 m |
| Time zone | UTC+1 |

**Project settings**
Albedo 0.20

**Meteo data**
Altamura
Meteonorm 8.0 (1986-2005), Sat=100% - Synthetic

## System summary

**Grid-Connected System**
Simulation for year no 1

**Sheds on ground**

**PV Field Orientation**
Fixed plane
Tilt/Azimuth 30 / 0 °

**Near Shadings**
Linear shadings

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

**System information**

| PV Array | | Inverters | |
|---|---|---|---|
| Nb. of modules | 13680 units | Nb. of units | 2 units |
| Pnom total | 1573 kWp | Pnom total | 1600 kWac |
| | | Pnom ratio | 0.983 |

## Results summary

| | | | | | |
|---|---|---|---|---|---|
| Produced Energy | 2258 MWh/year | Specific production | 1436 kWh/kWp/year | Perf. Ratio PR | 84.52 % |

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## General parameters

**Grid-Connected System**

**Sheds on ground**

**PV Field Orientation**

| Orientation | |
|---|---|
| Fixed plane | |
| Tilt/Azimuth | 30 / 0 ° |

| Sheds configuration | |
|---|---|
| Nb. of sheds | 760 units |
| **Sizes** | |
| Sheds spacing | 10.00 m |
| Collector width | 2.40 m |
| Ground Cov. Ratio (GCR) | 24.0 % |
| **Shading limit angle** | |
| Limit profile angle | 8.6 ° |

| Models used | |
|---|---|
| Transposition | Perez |
| Diffuse | Perez, Meteonorm |
| Circumsolar | separate |

**Horizon**

Average Height 1.5 °

**Near Shadings**

Linear shadings

**User's needs**

Unlimited load (grid)

## PV Array Characteristics

**PV module**

| | |
|---|---|
| Manufacturer | Q-Cells SE |
| Model | Q.SMART UF L 115 (G1) |
| (Original PVsyst database) | |
| Unit Nom. Power | 115 Wp |
| Number of PV modules | 13680 units |
| Nominal (STC) | 1573 kWp |
| Modules | 1520 Strings x 9 In series |
| **At operating cond. (50°C)** | |
| Pmpp | 1424 kWp |
| U mpp | 613 V |
| I mpp | 2322 A |

**Inverter**

| | |
|---|---|
| Manufacturer | SMA |
| Model | Sunny Central 800CP-JP |
| (Original PVsyst database) | |
| Unit Nom. Power | 800 kWac |
| Number of inverters | 2 units |
| Total power | 1600 kWac |
| Operating voltage | 530-950 V |
| Max. power (=>25°C) | 880 kWac |
| Pnom ratio (DC:AC) | 0.98 |

**Total PV power**

| | |
|---|---|
| Nominal (STC) | 1573 kWp |
| Total | 13680 modules |
| Module area | 12861 m² |

**Total inverter power**

| | |
|---|---|
| Total power | 1600 kWac |
| Number of inverters | 2 units |
| Pnom ratio | 0.98 |

## Array losses

**Array Soiling Losses**

Loss Fraction 2.0 %

**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. | 1.1 mΩ |
| Loss Fraction | 0.4 % at STC |

**Module Quality Loss**

Loss Fraction -0.4 %

**Module mismatch losses**

Loss Fraction 1.0 % at MPP

**Strings Mismatch loss**

Loss Fraction 0.1 %

**Module average degradation**

| | |
|---|---|
| Year no | 1 |
| Loss factor | 0.45 %/year |
| **Mismatch due to degradation** | |
| Imp RMS dispersion | 0 %/year |
| Vmp RMS dispersion | 0 %/year |

**IAM loss factor**

ASHRAE Param: IAM = 1 - bo(1/cosi -1)

bo Param. 0.05

## System losses

**Auxiliaries loss**

Proportionnal to Power 3.0 W/kW

0.0 kW from Power thresh.

## AC wiring losses

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

| | | |
|---|---|---|
| Inverter voltage | 360 | Vac tri |
| Loss Fraction | 0.00 | % at STC |

**Inverter: Sunny Central 800CP-JP**

| | | |
|---|---|---|
| Wire section (2 Inv.) | Copper 2 x 3 x 4000 | mm² |
| Average wires length | 1 | m |

**MV line up to Injection**

| | | |
|---|---|---|
| MV Voltage | 20 | kV |
| Wires | Alu 3 x 95 | mm² |
| Length | 1311 | m |
| Loss Fraction | 0.17 | % at STC |

## AC losses in transformers

**MV transfo**

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

**Operating losses at STC**

| | | |
|---|---|---|
| Nominal power at STC | 1545 | kVA |
| Iron loss (24/24 Connexion) | 1.31 | kW |
| Loss Fraction | 0.08 | % at STC |
| Coils equivalent resistance | 3 x 0.98 | mΩ |
| Loss Fraction | 1.17 | % at STC |

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## Horizon definition

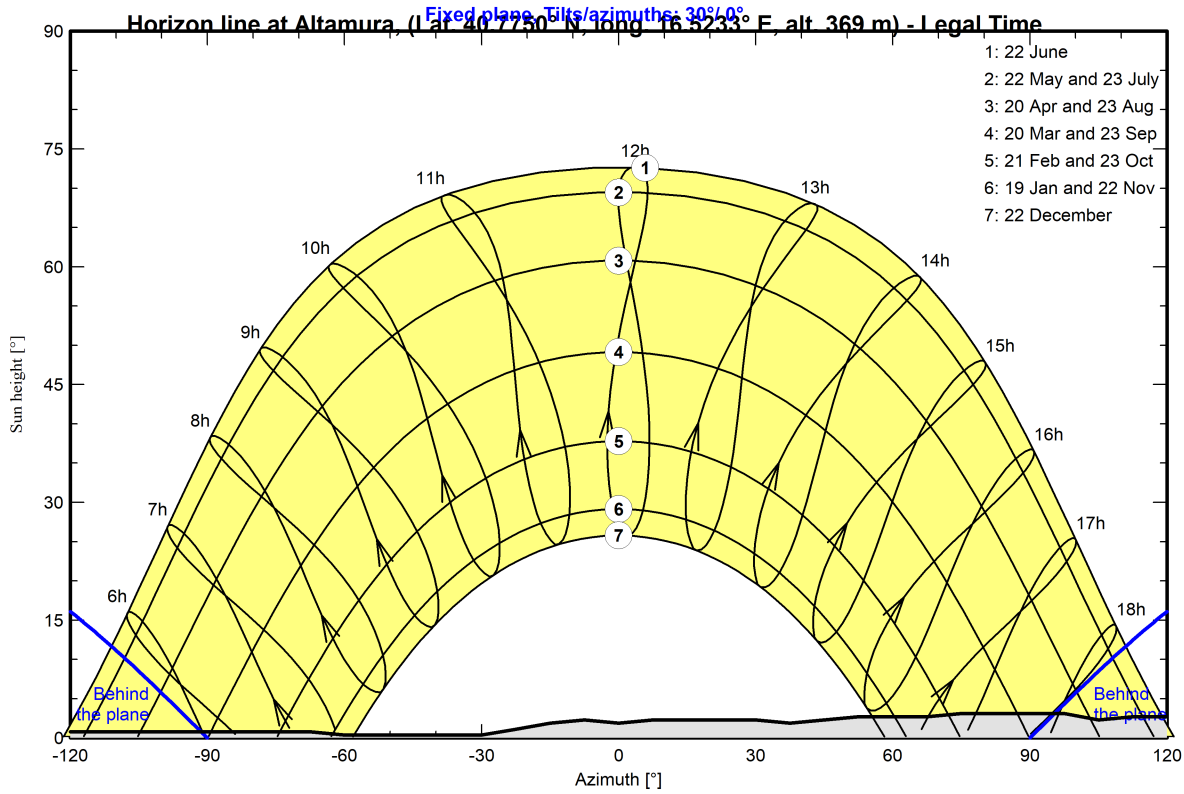
**Horizon from PVGIS website API, Lat=40°46'30', Long=16°31'23', Alt=m**

| | | | |
|---|---|---|---|
| Average Height | 1.5 ° | Albedo Factor | 0.91 |
| Diffuse Factor | 0.99 | Albedo Fraction | 100 % |

**Horizon profile**

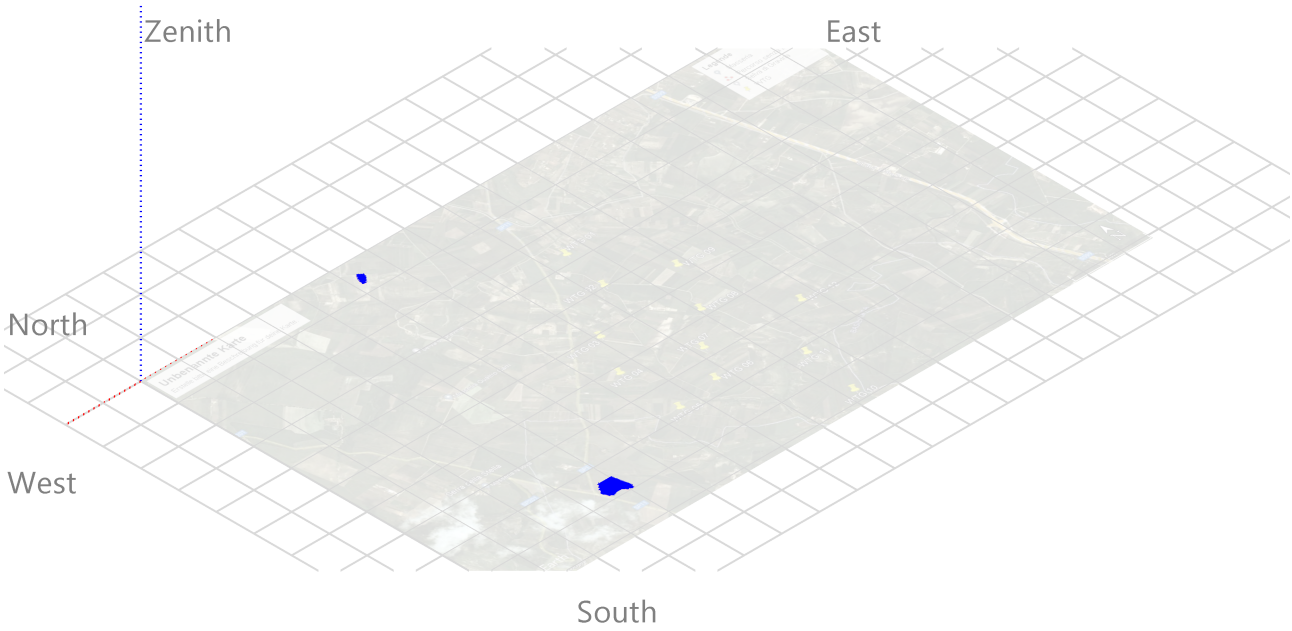
| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Azimuth [°] | -180 | -165 | -158 | -128 | -120 | -68 | -60 | -30 | -23 | -15 |
| Height [°] | 0.8 | 0.8 | 1.1 | 1.1 | 0.8 | 0.8 | 0.4 | 0.4 | 1.1 | 1.9 |
| Azimuth [°] | -8 | 0 | 8 | 30 | 38 | 45 | 53 | 68 | 75 | 98 |
| Height [°] | 2.3 | 1.9 | 2.3 | 2.3 | 1.9 | 2.3 | 2.7 | 2.7 | 3.1 | 3.1 |
| Azimuth [°] | 105 | 113 | 120 | 128 | 135 | 143 | 158 | 165 | 173 | 180 |
| Height [°] | 2.3 | 2.7 | 2.7 | 1.5 | 1.5 | 1.1 | 1.1 | 0.4 | 0.4 | 0.8 |

**Sun Paths (Height / Azimuth diagram)**



## Near shadings parameter

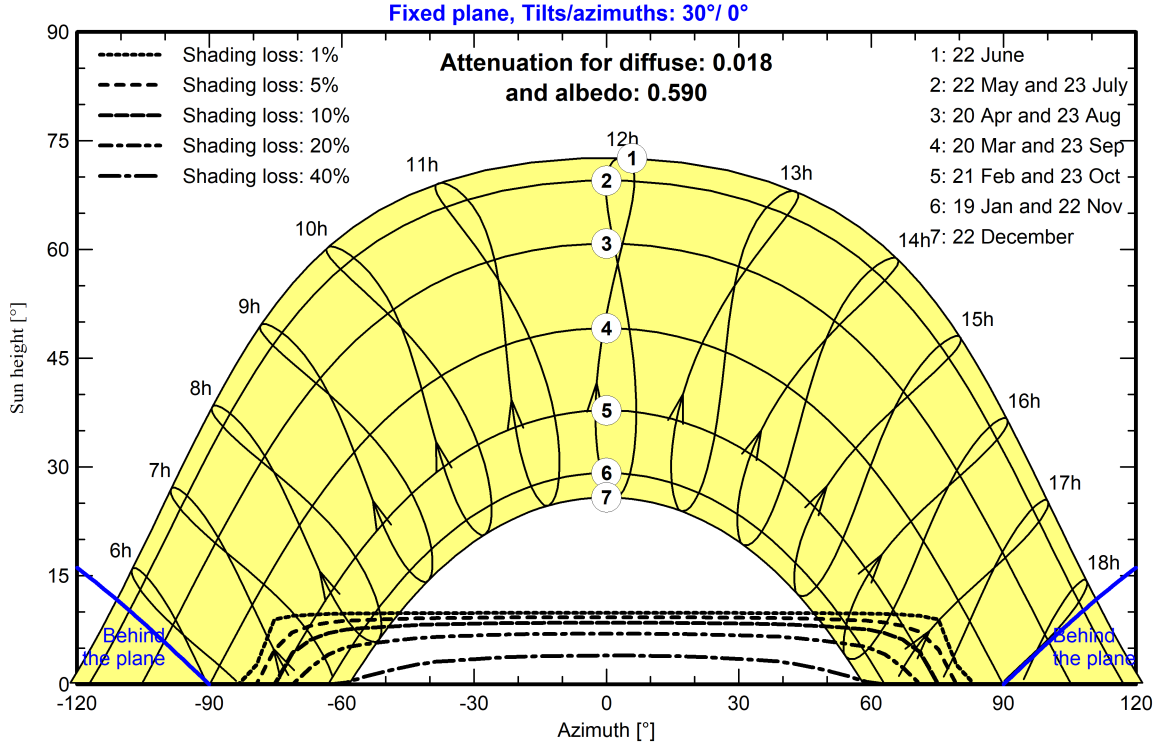
**Perspective of the PV-field and surrounding shading scene**




## Iso-shadings diagram

**Orientation #1**

**Fixed plane, Tilts/azimuths: 30°/ 0°**

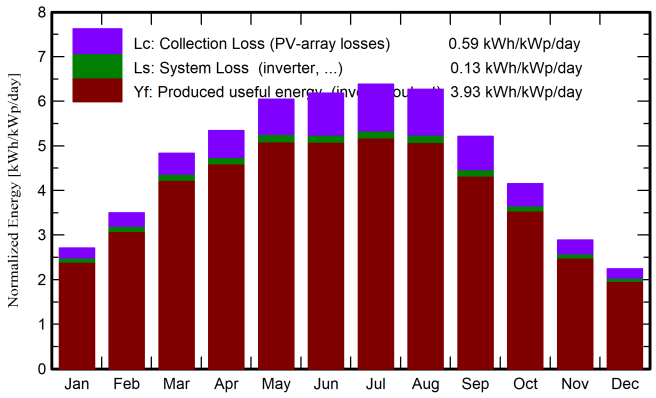


## Main results

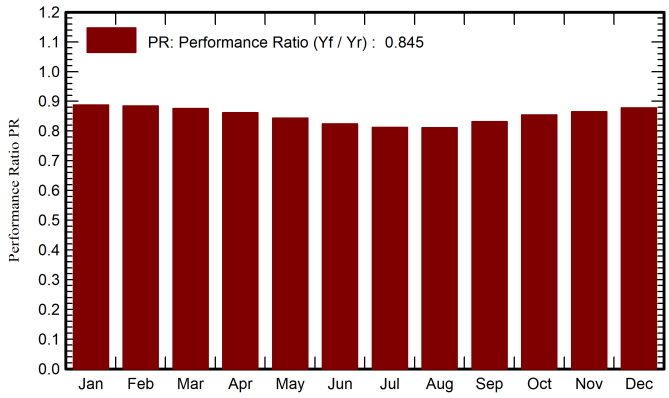
### System Production

| | | | |
|---|---|---|---|
| Produced Energy | 2258 MWh/year | Specific production | 1436 kWh/kWp/year |
| | | Performance Ratio PR | 84.52 % |

**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** | 53.1 | 26.21 | 5.74 | 83.9 | 79.2 | 121.5 | 117.2 | 0.888 |
| **February** | 69.9 | 32.88 | 6.15 | 98.0 | 92.4 | 141.0 | 136.2 | 0.884 |
| **March** | 121.9 | 57.59 | 9.08 | 150.0 | 141.6 | 213.4 | 206.6 | 0.876 |
| **April** | 146.1 | 67.98 | 12.13 | 160.3 | 150.8 | 224.2 | 217.3 | 0.862 |
| **May** | 188.6 | 88.87 | 16.89 | 187.5 | 176.1 | 256.6 | 248.7 | 0.843 |
| **June** | 194.9 | 81.66 | 21.95 | 185.4 | 174.1 | 247.9 | 240.3 | 0.824 |
| **July** | 203.5 | 80.45 | 25.50 | 197.9 | 186.1 | 260.7 | 252.8 | 0.812 |
| **August** | 183.8 | 68.39 | 25.23 | 194.4 | 183.2 | 256.0 | 248.1 | 0.811 |
| **September** | 133.6 | 50.79 | 19.54 | 156.3 | 147.4 | 211.2 | 204.5 | 0.831 |
| **October** | 96.6 | 48.28 | 15.73 | 128.7 | 121.5 | 178.6 | 172.9 | 0.854 |
| **November** | 57.5 | 27.42 | 11.28 | 86.6 | 81.6 | 122.1 | 117.8 | 0.865 |
| **December** | 45.4 | 27.82 | 7.25 | 69.5 | 65.1 | 99.6 | 96.0 | 0.878 |
| **Year** | 1494.9 | 658.35 | 14.76 | 1698.5 | 1599.2 | 2332.9 | 2258.4 | 0.845 |

### 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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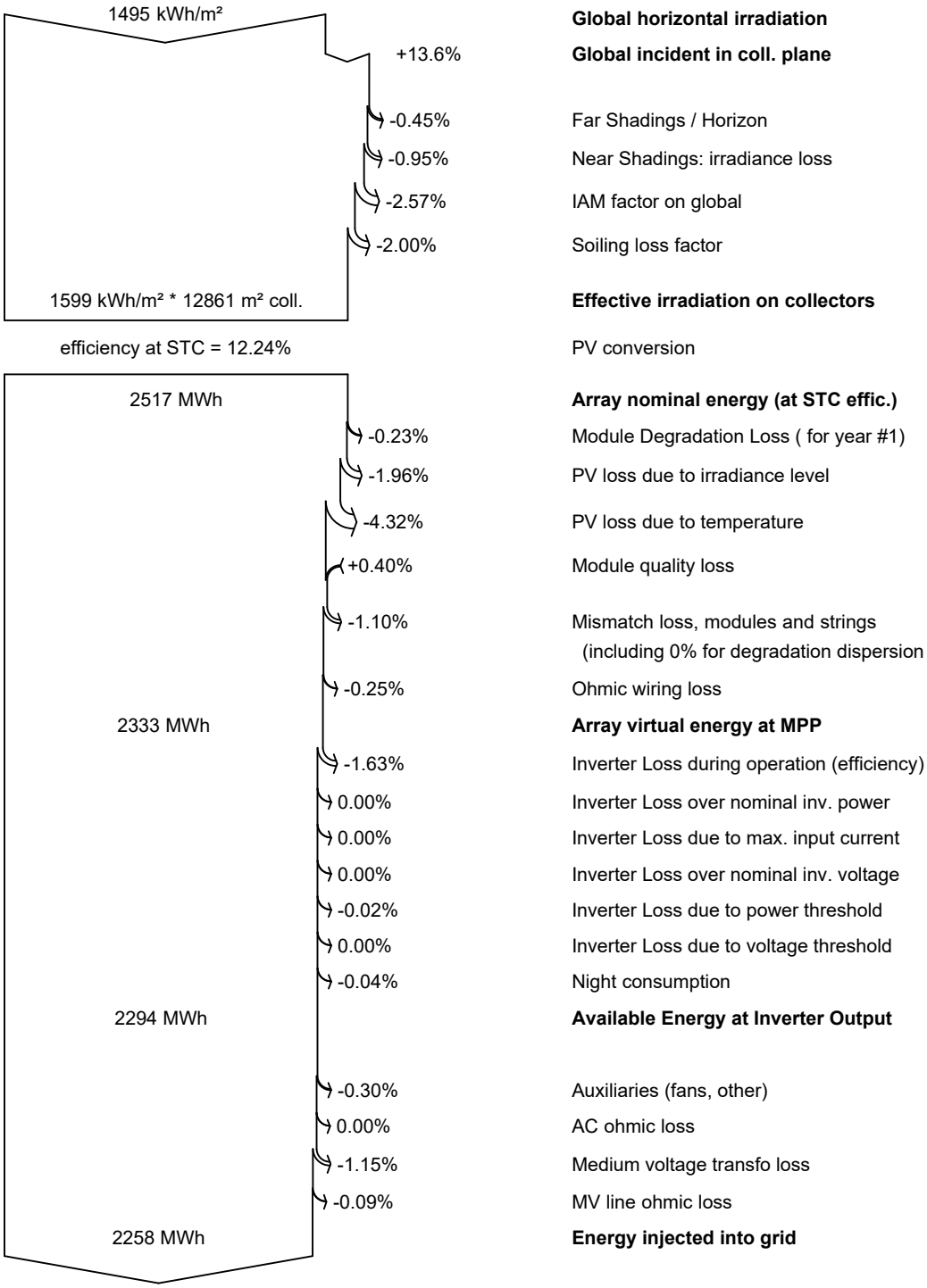
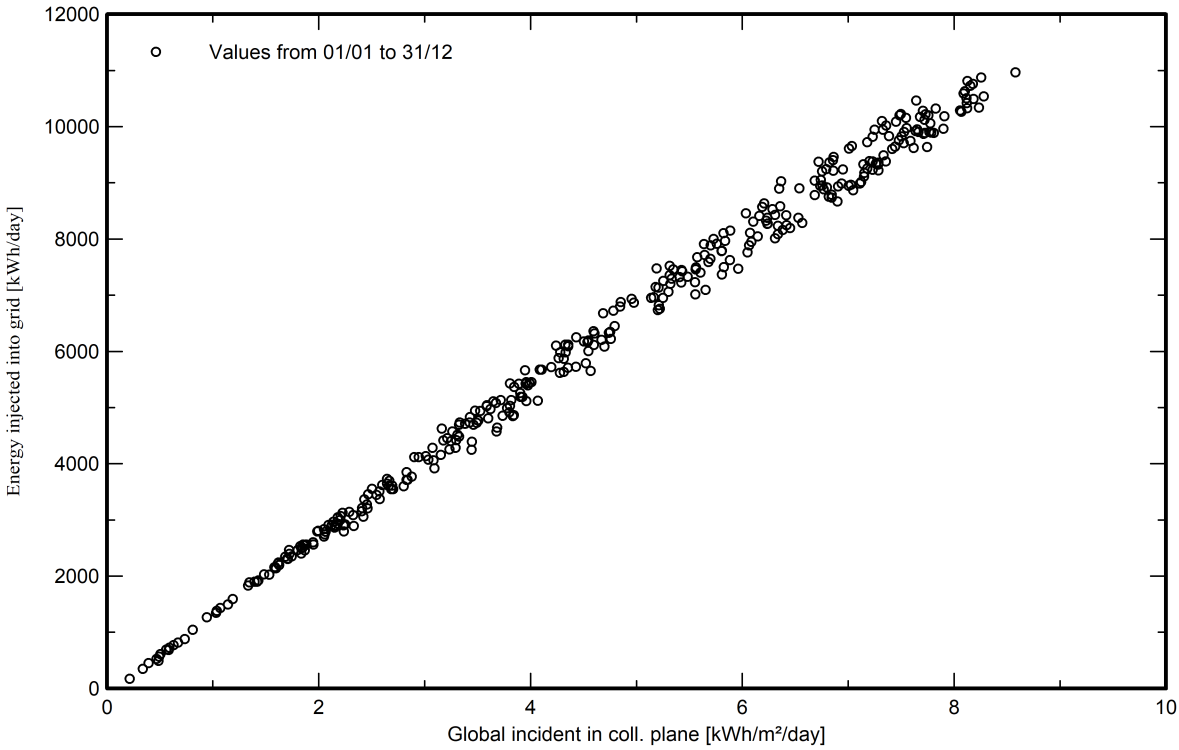
## Loss diagram



## Special graphs

### Daily Input/Output diagram




### System-Ausgangsleistungsverteilung