

# PVsyst - Simulation report

## Grid-Connected System

Project: Hohenholz

Variant: 90 MWp - grid limit\_Agri

Tracking system with backtracking

System power: 90.04 MWp

Hohenholz - Germany

**Author**

Safvi Energie UG (Germany)



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02/06/26 17:12  
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### Project summary

#### Geographical Site

Hohenholz  
Germany

#### Situation

Latitude 53.3416 °(N)  
Longitude 14.2933 °(E)  
Altitude 22 m  
Time zone UTC+1

#### Project settings

Albedo 0.20

#### Weather data

Hohenholz  
Meteonorm 8.2 (2001-2020), Sat=100% - Synthetic

### System summary

#### Grid-Connected System

##### Orientation #1

##### Tracking plane, horizontal N-S axis

Avg axis azim. 0 °  
Phi min / max. -/+ 41 °  
Diffuse shading all trackers

##### Tracking algorithm

Astronomic calculation  
Backtracking activated

#### System information

##### PV Array

Nb. of modules 125060 units  
Pnom total 90.04 MWp

#### Tracking system with backtracking

##### Near Shadings

Linear shadings : Fast (table)

##### User's needs

Unlimited load (grid)

##### Inverters

Nb. of units 216 units  
Total power 75600 kWac  
Pnom ratio 1.19

### Results summary

Simulation step Hourly

|                 |                    |                     |                   |                      |         |
|-----------------|--------------------|---------------------|-------------------|----------------------|---------|
| Produced Energy | 106779075 kWh/year | Specific production | 1186 kWh/kWp/year | Perf. Ratio PR       | 89.51 % |
|                 |                    |                     |                   | Bifacial perf. ratio | 85.19 % |

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### General parameters

#### Grid-Connected System

##### Simulation step

Hourly

##### Orientation #1

###### Tracking plane, horizontal N-S axis

Avg axis azim. 0 °  
Phi min / max. -/+ 41 °  
Diffuse shading all trackers

##### Tracking algorithm

Astronomic calculation  
Backtracking activated

#### Tracking system with backtracking

##### Field properties

Nb. of trackers 1270 units  
Tracking plane, horizontal N-S axis

##### Sizes

Tracker Spacing 10.00 m  
Sensitive width 4.79 m  
GCR Shading 47.9 %

##### Backtracking limit angle

Phi limits +/- 61.4 °

##### Backtracking parameters

Backtracking pitch 10.00 m  
Backtracking width 4.79 m  
Left inactive band 0.00 m  
Right inactive band 0.00 m  
GCR Backtracking 47.9 %  
Parameters choice Automatic

##### Models used

Transposition Perez  
Diffuse Perez, Meteonorm  
Circumsolar separate

##### Horizon

Free Horizon

##### Near Shadings

Linear shadings : Fast (table)

##### User's needs

Unlimited load (grid)

#### Bifacial system definition

##### Orientation #1

##### Bifacial system

Model Unlimited Trackers 2D model

##### Bifacial model geometry

Tracker Spacing 10.00 m  
Tracker width 4.79 m  
Axis height above ground 2.10 m  
Nb. of sheds 109 units

##### Bifacial model definitions

Ground albedo 0.30  
Bifaciality factor 80 %  
Rear shading factor 5.0 %  
Rear mismatch loss 10.0 %  
Shed transparent fraction 0.0 %

### PV Array Characteristics

#### PV module

Manufacturer Trina solar  
Model TSM-NEG-21C-20-720 Vertex  
(Original PVsyst database)  
Unit Nom. Power 720 Wp  
Number of PV modules 125060 units  
Nominal (STC) 90.04 MWp  
Modules 4810 units x 26 In series

##### At operating cond. (50°C)

Pmpp 83.57 MWp  
U mpp 984 V  
I mpp 84951 A

#### Inverter

Manufacturer Sungrow  
Model SG350-HX  
(Original PVsyst database)  
Unit Nom. Power 350 kWac  
Number of inverters 216 units  
Total power 75600 kWac  
Operating voltage 500-1450 V  
Pnom ratio (DC:AC) 1.19  
Power sharing within this inverter



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## PV Array Characteristics

## Total PV power

|               |                       |
|---------------|-----------------------|
| Nominal (STC) | 90043 kWp             |
| Total         | 125060 modules        |
| Module area   | 388480 m <sup>2</sup> |
| Cell area     | 364000 m <sup>2</sup> |

## Total inverter power

|                     |            |
|---------------------|------------|
| Total power         | 75600 kWac |
| Number of inverters | 216 units  |
| Pnom ratio          | 1.19       |

## Array losses

## Array Soiling Losses

|               |       |
|---------------|-------|
| Loss Fraction | 2.0 % |
|---------------|-------|

## Thermal Loss factor

|                                            |                            |
|--------------------------------------------|----------------------------|
| Module temperature according to irradiance |                            |
| Uc (const)                                 | 29.0 W/m <sup>2</sup> K    |
| Uv (wind)                                  | 0.0 W/m <sup>2</sup> K/m/s |

## DC wiring losses

|                   |               |
|-------------------|---------------|
| Global array res. | 0.19 mΩ       |
| Loss Fraction     | 1.50 % at STC |

## Module Quality Loss

|               |         |
|---------------|---------|
| Loss Fraction | -0.38 % |
|---------------|---------|

## Module mismatch losses

|               |               |
|---------------|---------------|
| Loss Fraction | 2.00 % at MPP |
|---------------|---------------|

## Strings Mismatch loss

|               |        |
|---------------|--------|
| Loss Fraction | 0.05 % |
|---------------|--------|

## 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

## Auxiliary losses

|                           |          |
|---------------------------|----------|
| Proportional to Power     | 5.0 W/kW |
| 0.0 kW from Power thresh. |          |

## AC wiring losses

## Inv. output line up to MV transfo

|                  |               |
|------------------|---------------|
| Inverter voltage | 800 Vac tri   |
| Loss Fraction    | 0.81 % at STC |

## Inverter: SG350-HX

|                         |                                      |
|-------------------------|--------------------------------------|
| Wire section (216 Inv.) | Copper 216 x 3 x 185 mm <sup>2</sup> |
| Average wires length    | 123 m                                |

## MV line up to Injection

|                          |                              |
|--------------------------|------------------------------|
| MV Voltage               | 30 kV                        |
| Average each transformer |                              |
| Wires                    | Alu 3 x 1200 mm <sup>2</sup> |
| Length                   | 17500 m                      |
| Loss Fraction            | 1.52 % at STC                |

## AC losses in transformers

## MV transfo

|                |       |
|----------------|-------|
| Medium voltage | 30 kV |
|----------------|-------|

## One transfo parameters

|                             |               |
|-----------------------------|---------------|
| Nominal power at STC        | 29.77 MVA     |
| Iron Loss (24/24 Connexion) | 25.20 kVA     |
| Iron loss fraction          | 0.08 % at STC |
| Copper loss                 | 351.79 kVA    |
| Copper loss fraction        | 1.18 % at STC |
| Coils equivalent resistance | 3 x 0.25 mΩ   |

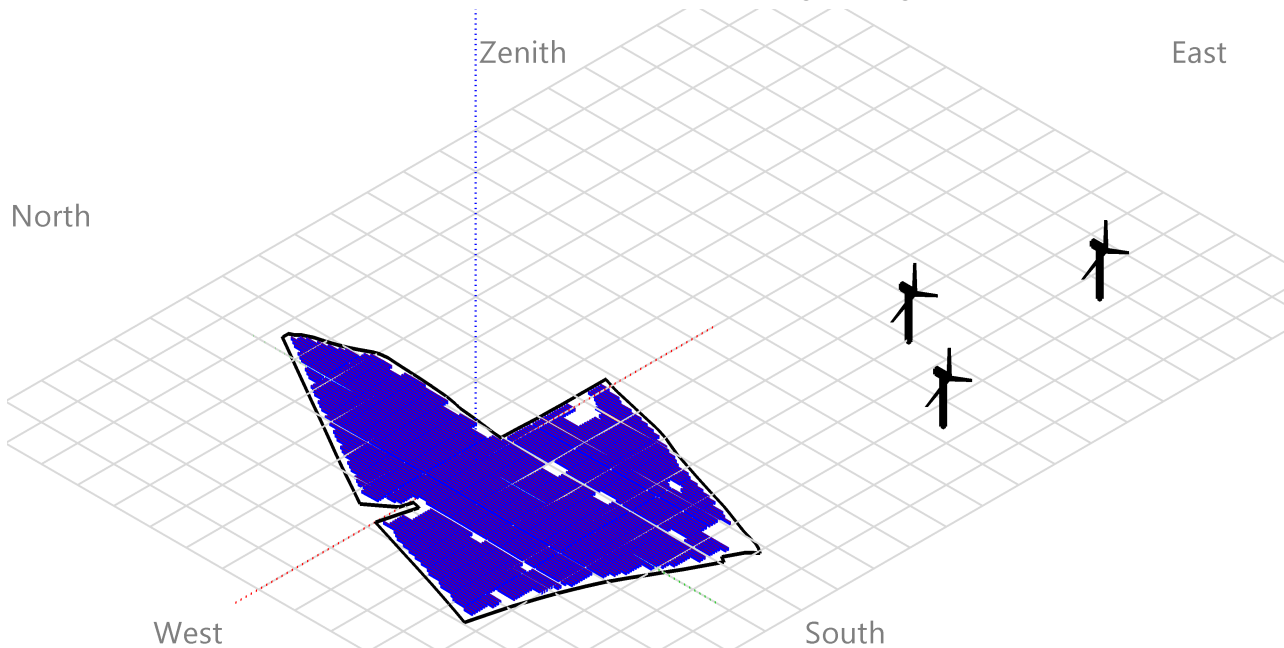
## Operating losses at STC (full system)

|                             |             |
|-----------------------------|-------------|
| Nb. identical MV transfos   | 3           |
| Nominal power at STC        | 89.32 MVA   |
| Iron loss (24/24 Connexion) | 75.60 kVA   |
| Copper loss                 | 1055.37 kVA |



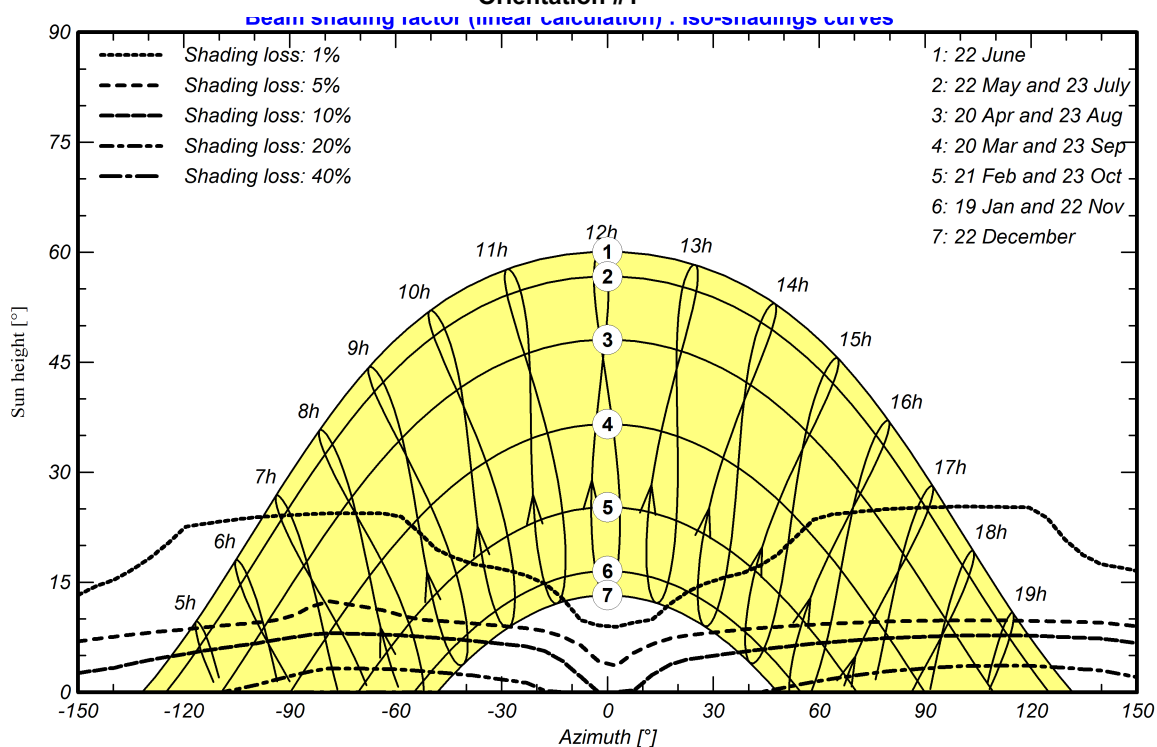
### Near shadings parameter

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



### Iso-shadings diagram

#### Orientation #1 -





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## Main results

### Simulation step

Hourly

### System Production

Produced Energy 106779075 kWh/year

Specific production

1186 kWh/kWp/year

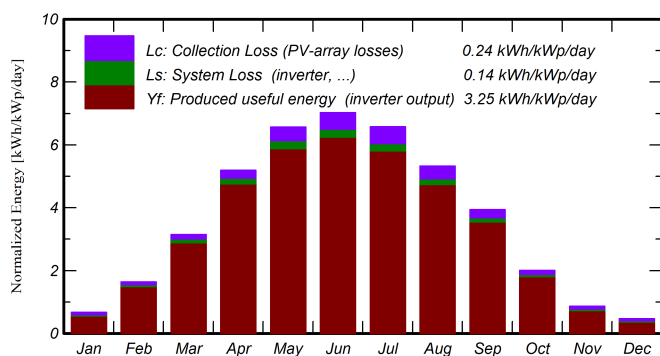
Perf. Ratio PR

89.51 %

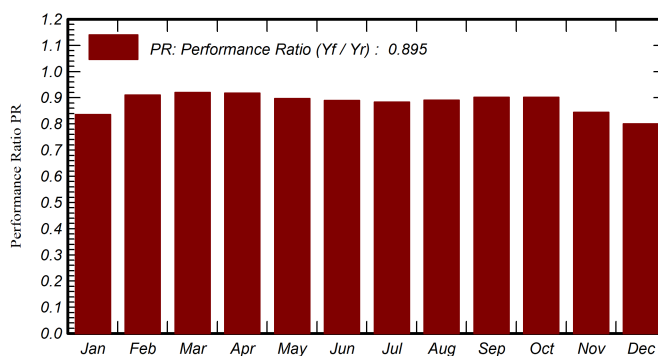
Bifacial perf. ratio

85.19 %

### Normalized productions (per installed kWp)



### Performance Ratio PR



## Balances and main results

|           | GlobHor            | DiffHor            | T_Amb | GlobInc            | GlobEff            | EArray    | E_Grid    | PR    | PRBifi |
|-----------|--------------------|--------------------|-------|--------------------|--------------------|-----------|-----------|-------|--------|
|           | kWh/m <sup>2</sup> | kWh/m <sup>2</sup> | °C    | kWh/m <sup>2</sup> | kWh/m <sup>2</sup> | kWh       | kWh       | ratio | ratio  |
| January   | 17.1               | 11.72              | -1.34 | 20.8               | 18.1               | 1692989   | 1567646   | 0.836 | 0.790  |
| February  | 36.1               | 20.05              | -0.19 | 46.0               | 41.7               | 3941001   | 3765597   | 0.910 | 0.866  |
| March     | 76.5               | 39.47              | 3.49  | 97.4               | 90.6               | 8403586   | 8073843   | 0.920 | 0.877  |
| April     | 124.5              | 66.63              | 9.14  | 155.8              | 146.2              | 13372391  | 12872568  | 0.918 | 0.873  |
| May       | 159.6              | 67.75              | 14.18 | 203.7              | 192.8              | 17126639  | 16439776  | 0.896 | 0.856  |
| June      | 167.8              | 78.70              | 17.32 | 210.8              | 199.3              | 17578804  | 16893168  | 0.890 | 0.848  |
| July      | 162.7              | 78.80              | 19.59 | 204.0              | 192.6              | 16890964  | 16232413  | 0.884 | 0.842  |
| August    | 134.9              | 74.70              | 18.92 | 165.2              | 155.0              | 13763843  | 13248611  | 0.891 | 0.846  |
| September | 93.9               | 51.72              | 13.59 | 118.2              | 109.9              | 9962592   | 9596378   | 0.902 | 0.858  |
| October   | 50.9               | 32.63              | 8.77  | 62.3               | 57.0               | 5276358   | 5060249   | 0.902 | 0.854  |
| November  | 20.8               | 12.35              | 4.07  | 26.2               | 23.2               | 2126639   | 1987694   | 0.844 | 0.802  |
| December  | 12.9               | 10.19              | 0.55  | 14.5               | 12.4               | 1150353   | 1041132   | 0.800 | 0.748  |
| Year      | 1057.6             | 544.70             | 9.06  | 1324.8             | 1238.8             | 111286160 | 106779075 | 0.895 | 0.852  |

### 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

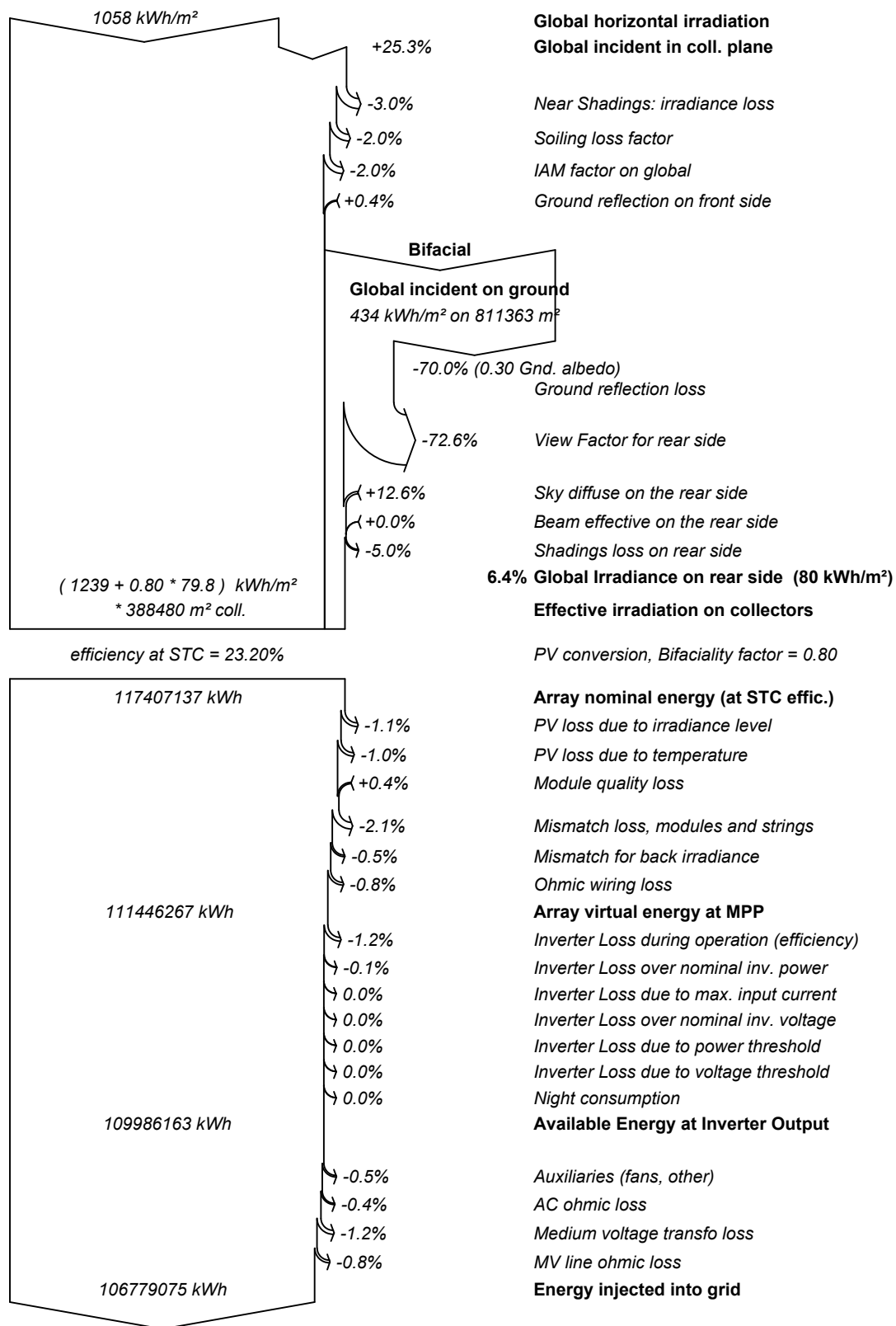
E\_Grid Energy injected into grid

PR Performance Ratio

PRBifi Bifacial Performance Ratio



### Loss diagram





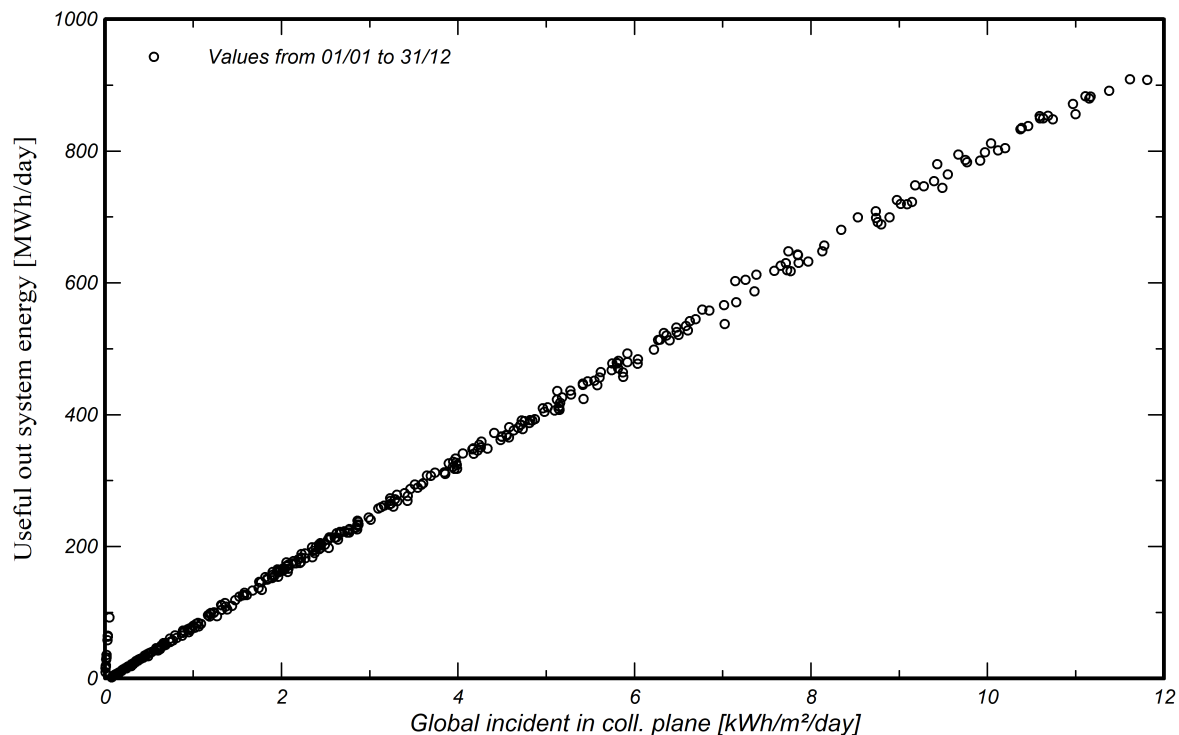
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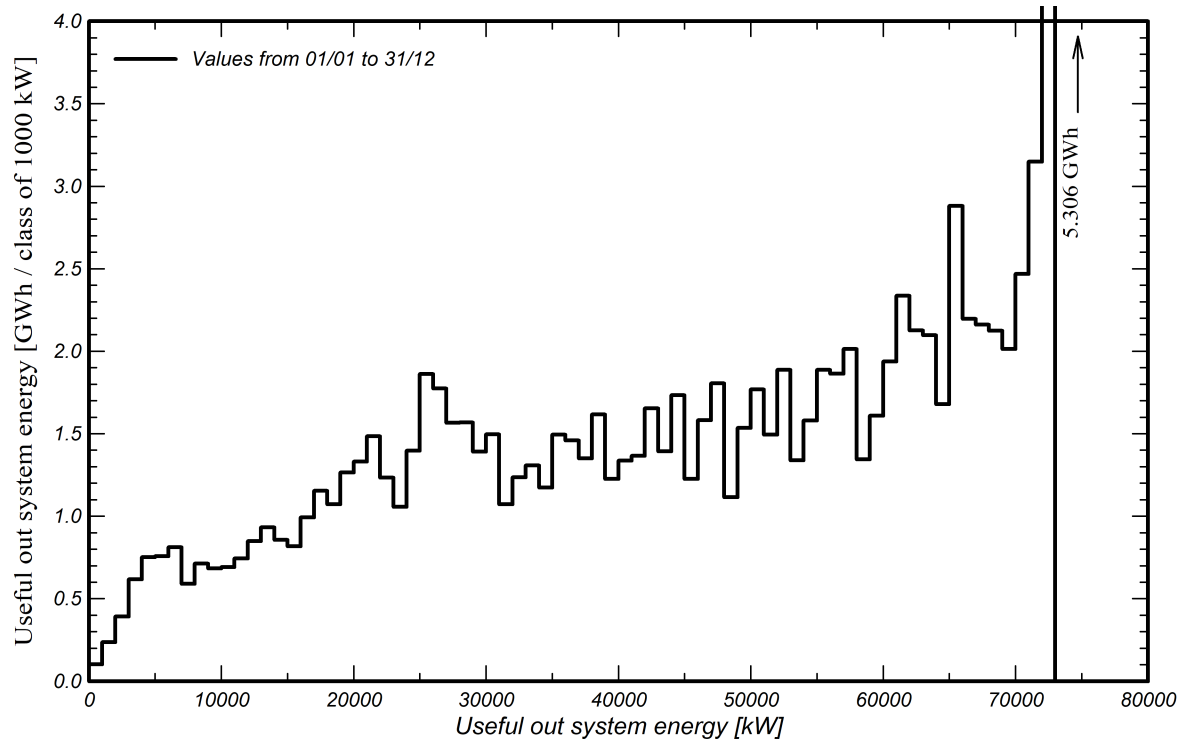
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**Predef. graphs**

**Daily Input/Output diagram**



**System Output Power Distribution**

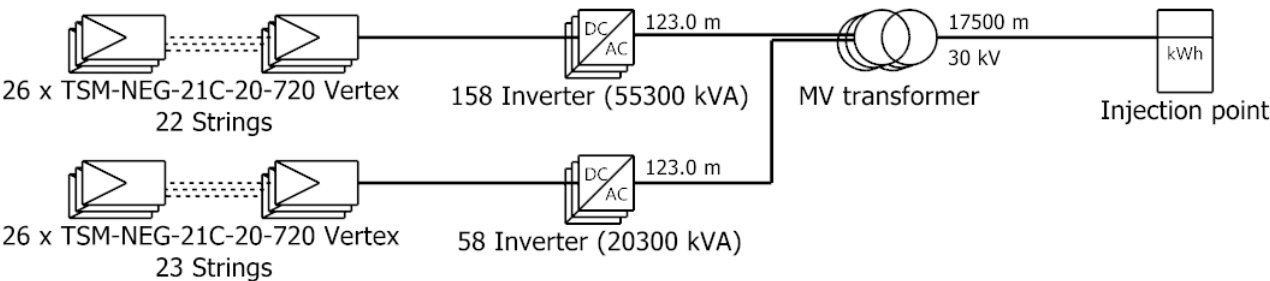




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# Single-line diagram



|           |                                |
|-----------|--------------------------------|
| PV module | TSM-NEG-21C-20-720 Vertex      |
| Inverter  | SG350-HX                       |
| String    | 26 x TSM-NEG-21C-20-720 Vertex |

Hohenholz

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