

greenius User Day

30. October 2014

Simulation Example for a PV Power Plant



Knowledge for Tomorrow

Objectives

- Setup of small grid connected PV system
- PV system optimizer
- Add new PV module
- Shading Editor
- MeteoTool: Tilted Plane
- Economics in **greenius**



Input: Meteo

The screenshot shows the 'View' menu with 'Data Table' selected. Below it is a data table for Almeria (Spain) showing solar radiation data from Jan 03 to Jan 11. The table has columns for time intervals (01:00 to 09:00) and rows for each day. The data values represent solar radiation in W/m².

| | 01:00 | 02:00 | 03:00 | 04:00 | 05:00 | 06:00 | 07:00 | 08:00 | 09:00 |
|--------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| Jan 03 | 12.9 | 12.9 | 12.7 | 12.3 | 11.8 | 10.4 | 9.2 | 8.6 | 8.6 |
| Jan 04 | 11.0 | 10.3 | 10.2 | 10.3 | 10.2 | 9.6 | 9.4 | 9.4 | 9.4 |
| Jan 05 | 10.8 | 8.8 | 7.8 | 8.3 | 8.6 | 8.5 | 9.2 | 9.3 | 8.8 |
| Jan 06 | 11.2 | 9.6 | 8.9 | 8.9 | 9.3 | 9.5 | 9.9 | 10.0 | 12.0 |
| Jan 07 | 10.6 | 9.4 | 9.3 | 9.2 | 9.4 | 9.1 | 9.0 | 8.9 | 8.8 |
| Jan 08 | 11.4 | 11.6 | 11.6 | 11.6 | 11.6 | 12.0 | 12.2 | 12.3 | 12.0 |
| Jan 09 | 9.3 | 9.5 | 9.7 | 9.7 | 8.4 | 6.1 | 6.1 | 6.8 | 8.9 |
| Jan 10 | 10.2 | 10.4 | 9.5 | 8.6 | 8.4 | 7.7 | 6.3 | 7.6 | 9.9 |
| Jan 11 | 7.9 | 6.7 | 7.6 | 9.4 | 8.5 | 6.9 | 6.4 | 5.4 | 8.8 |

The screenshot shows the 'Meteorological Data' window for Almeria (Spain). The site parameters are: Name: Almeria (Spain), Latitude: 36.83° N, Longitude: -2.45° E, Altitude: 5 m, Timezone: +1 (Middle European Time). The graph shows DNI (red line) and Diffuse Irradiation (green line) in W/m² over a 24-hour period. The DNI peaks at approximately 900 W/m² around 14:00.

Warning

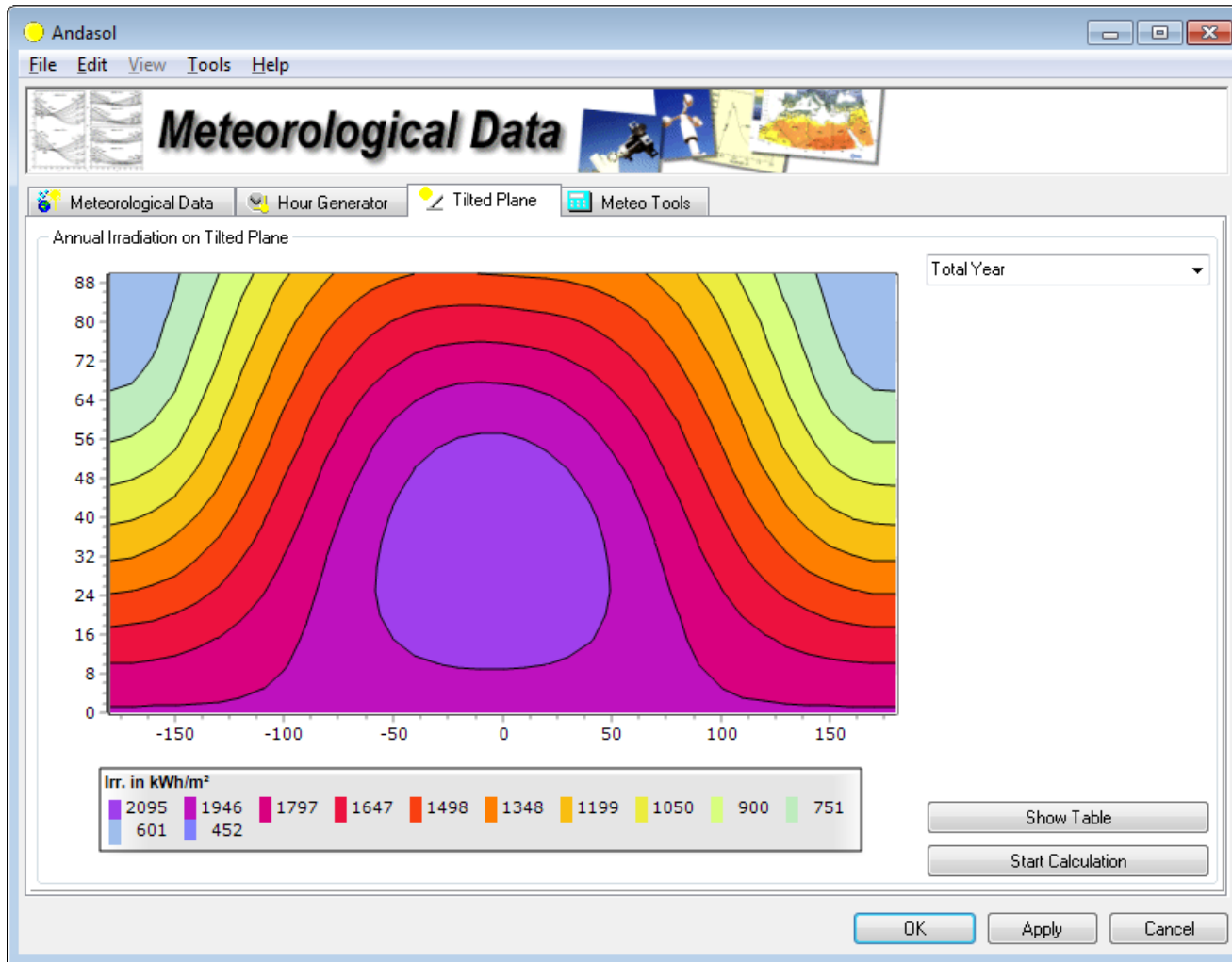
The meteo site is 146 km away from the project site that is defined in the location form. The data of the project site are used for the further simulations.

The following project site data differ(s) from the meteo data:
 latitude, longitude, height over sea level.
 Copy these data from the meteo site to project site?

Yes No



Meteo Tool: Tilted Plane



About Costs

Costs

€ Investment Costs

General

Name: Default *) given at start of construction
2) escalated to start of construction

Major Equipment Costs (EPC)

| | |
|------------------------------------------|----------------------|
| Non-conventional components *) | 163 238 400 € |
| Conventional components *) | 39 975 840 € |
| Storage *) | 37 600 000 € |
| Total major equipment costs (EPC) | 240 814 240 € |

Other Costs

| | | |
|-------------------------------------|----------------------|--------------|
| Land Costs *) | 3 835 000 € | |
| Infrastructure Requirement Costs *) | 0 € | |
| Project Development | 5.0 % of I. | 12 040 712 € |
| Insurance during Construction | 1.0 % of I. | 2 408 142 € |
| Supervision and Startup | 3.0 % of I. | 7 224 427 € |
| Total Other Costs | 25 508 281 € | |
| Contingencies | 5.0 of I+II | 13 316 126 € |
| Total Investment Costs | 279 638 647 € | |

OK Apply Cancel

Technology Specific Costs

General

Field Data 1

*) Reference year: 2014

Land Use *) : 1 900 000 m²

Investment Costs *)

Field Size: 510 120 m²

Specific costs: 320.0 €/m²

Total investment costs: 163 238 400 € 2) given at start of construction

O&M Costs *)

| | |
|----------------------------|---------------------------|
| Specific O&M costs | 4.00 €/m ² -yr |
| Total O&M costs | 2 040 480 €/a |
| Specific replacement costs | 0.20 %/a |
| Total replacement costs | 326 477 €/a |
| Guarantee period | 0.00 yr |
| Specific insurance costs | 1.00 %/a |
| Total insurance costs | 1 632 384 €/a |

Costs allocation for LEC calculation of co-generation systems

Annual efficiency ratio: [dropdown] Electricity: [input] % Heat: 100.0 %

OK Apply Cancel

- All specific costs given in greenius are just estimates and may considerably differ from project to project!
- Component costs belong to the component
- Only surcharges are saved to cost structure

System specifications

- Site: Spain, Andasol
- PV module: Yingli Solar 250Wp
- Inverter: SMA Sunny Mini Central 6000A, 6.3kW

- Cell degradation **not** included in the model
- Small and large scale



New PV module: Yingli Solar Panda YL250P-29b

YGE 60 CELL SERIES 2

ELECTRICAL PERFORMANCE

Electrical parameters at Standard Test Conditions (STC)

| Module type | YL250P-29b (YGE-60) | | | | | | | |
|-------------------------|---------------------|---|------|------|--------|------|------|--|
| | | | 260 | 255 | 250 | 245 | 240 | |
| Power output | P_{max} | W | 260 | 255 | 250 | 245 | 240 | |
| Power output tolerances | ΔP_{max} | W | | | 0 / +5 | | | |
| Module efficiency | η_m | % | 16.0 | 15.7 | 15.4 | 15.1 | 14.8 | |
| Voltage at P_{max} | V_{mpp} | V | 30.3 | 30.0 | 29.8 | 29.6 | 29.3 | |
| Current at P_{max} | I_{mpp} | A | 8.59 | 8.49 | 8.39 | 8.28 | 8.18 | |
| Open-circuit voltage | V_{oc} | V | 37.7 | 37.7 | 37.6 | 37.5 | 37.5 | |
| Short-circuit current | I_{sc} | A | 9.09 | 9.01 | 8.92 | 8.83 | 8.75 | |

STC: 1000W/m² irradiance, 25°C cell temperature, AM1.5g spectrum according to EN 60904-3.

Average relative efficiency reduction of 3.3% at 200W/m² according to EN 60904-1.

THERMAL CHARACTERISTICS

| Nominal operating cell temperature | NOCT | °C | 46 +/- 2 |
|--------------------------------------|-------------------|------|----------|
| Temperature coefficient of P_{max} | γ | %/°C | -0.42 |
| Temperature coefficient of V_{oc} | $\beta_{V_{oc}}$ | %/°C | -0.32 |
| Temperature coefficient of I_{sc} | $\alpha_{I_{sc}}$ | %/°C | 0.05 |
| Temperature coefficient of V_{mpp} | $\beta_{V_{mpp}}$ | %/°C | -0.42 |

GENERAL CHARACTERISTICS

| | |
|------------------------|-----------------------|
| Dimensions (L / W / H) | 1640mm / 990mm / 35mm |
| Weight | 18.5kg |



Source: Yingli Solar

