QUICK GUIDE – SOLAR OPTIMIZE

Purpose:

The purpose of this document is to help you perform an optimization of Solar PV Area parameters using the Solar Optimize tool. The parameters, which can be optimized with the tool are:

- Tilt angle
- Vertical table panels
- Row distribution
- Azimuth
- AC/DC ratio

Outline of Guide:

1. **Requirements**

2. **Start Solar Optimize Session**

3. **Defining a Site**

4. **Area Selection**

5. **Panel and Inverter Selection**

6. **Setup & Run the Optimization**

7. **Results of the Optimization**

1.   REQUIREMENTS

The steps in this quick guide require the installation of windPRO 4.0 with license to the SOLAR PV module. The first release of windPRO 4.0 also requires PARK and OPTIMIZE, but this requirement will be removed in SP1.

Before proceeding with this quick guide, you should have a windPRO project with a Solar PV object with at least one area defined on the map.

For guidance on establishing Solar PV areas see Quick guide - Solar PV energy calculation.

More information about the Solar PV module can be found in the windPRO manual: windPRO_SOLAR_PV manual.

2.   START SOLAR OPTIMIZE SESSION

To start a Solar Optimize session open it from the Solar tab:
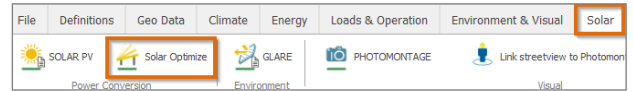
This will open the Session list. To open an existing session simply double click it, to start a new session click New. Change the name by clicking the Name field. Click Open to open selected session or double click it.
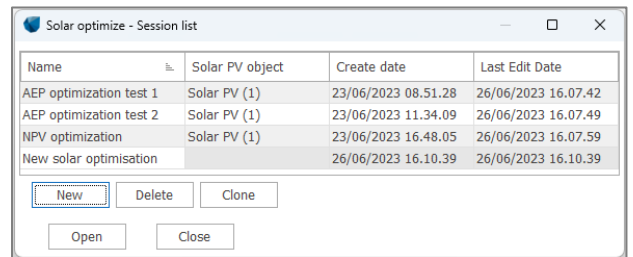
The session list holds information about which Solar PV object is optimized, creation date and last update day.
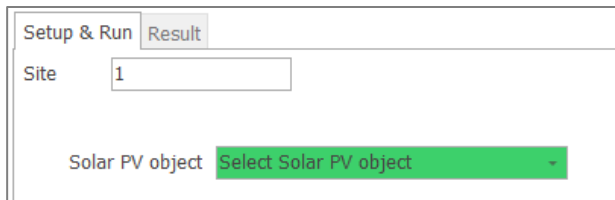
3.   DEFINING A SITE

The first step of working with the optimizer is to define a Site. By default, the first Site is already added.
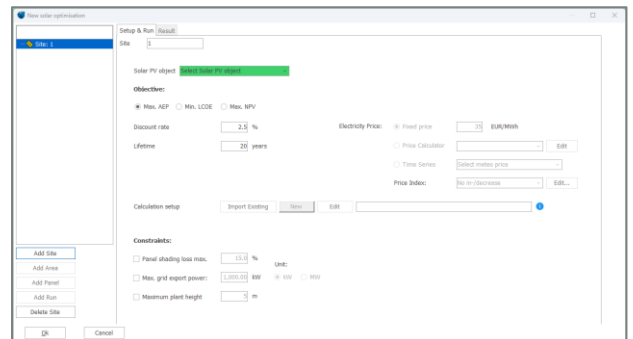
The necessary steps are marked in green, which will help you to go through the setup.
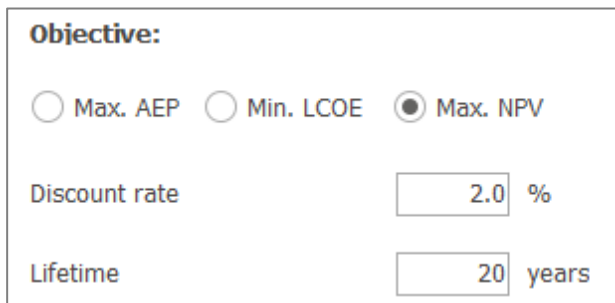
First, decide which Solar PV object you want to consider in your optimization by choosing it from the dropdown list.

Second step, define the Objective of the optimization. You can choose to optimize the PV plant layout for:

- Maximum Annual Energy Production (Max. AEP)
- Minimum Levelized Cost of Electricity (Min. LCOE)
- Maximum Net Present Value (Max. NPV)

No matter the objective, you need to specify the Lifetime of your project. If you select LCOE or NPV the discount rate is required.
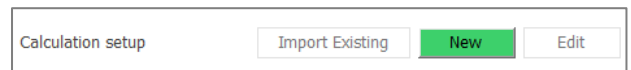

Finally, if you choose to optimize for Max. NPV the electricity price needs to be specified. Here, multiple options are available:

- Fixed price – the same price will be used for all hours.
- Price calculator – you can create an annual table, where different prices can be defined for specific times of the day, days in the week and months.
- Time Series – a time series of prices loaded through the Meteo Object can be used.

Additionally, it is possible to define a Price Index, which will increase or decrease the price for the following years.
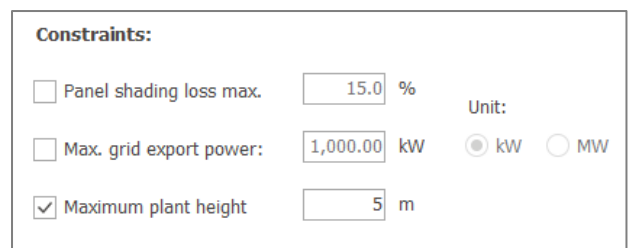

The third step is to define the Calculation Setup, which will be used for the optimization calculation. If you created a Solar PV Calculation report beforehand, it is possible to import the same Calculation Setup to the Solar Optimizer. Changes made to the Imported Setup will not be applied to your original calculation. If no report is available, you need to define a New Calculation Setup. You can find details about setting up a calculation in the user manual: windPRO SOLAR PV manual.


The final step in the Site setup is to choose if any constraints should be applied to the optimization. You can choose from:

- Panel shading loss max. – maximum shading loss from other panels allowed in your layout
- Max. grid export power – the maximum allowed export power from your plant.
- Maximum plant height – the maximum total height of the plant from the ground
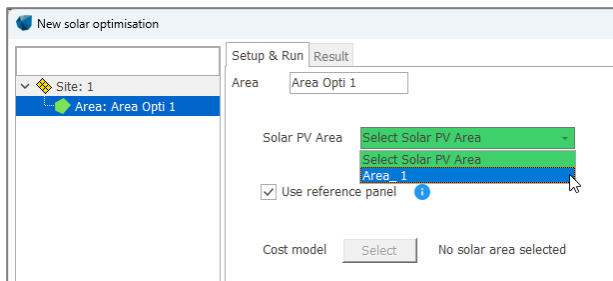

After all settings are chosen for the Site, the next step is to add an Area.
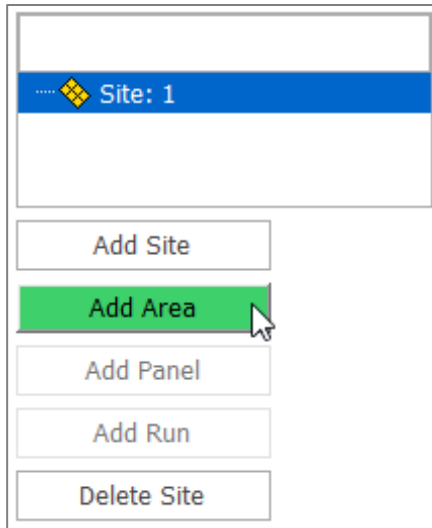
4. AREA SELECTION

In the Area part of the tree structure, you can select the Area of the Solar PV object, for which the optimization will be done. The complete list of Areas from the selected Solar PV object is available in a dropdown list.


By default, "Use reference panel" is selected. It is advised to keep this selection to reduce computation time.
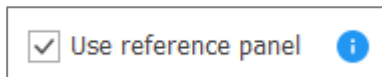

If Min. LCOE or Max. NPV is selected as the objective, a cost model must be selected. If you selected a cost model in the Calculation Setup in the previous step this will automatically be selected here. Otherwise, you will be required to select a cost model for the Area in this step.

By clicking Select a new window will open, where a cost model for the Area can be selected.
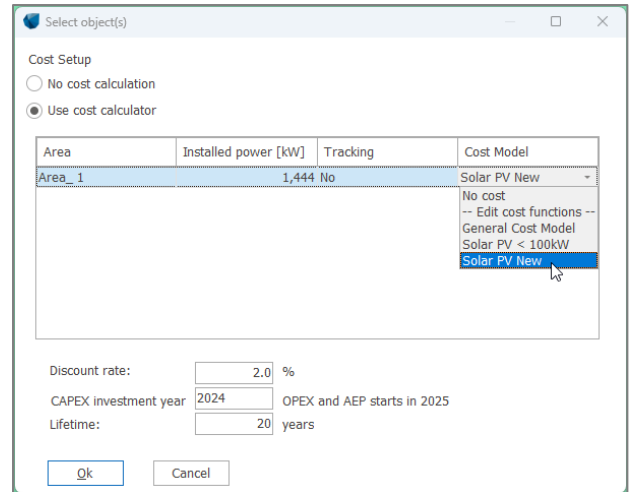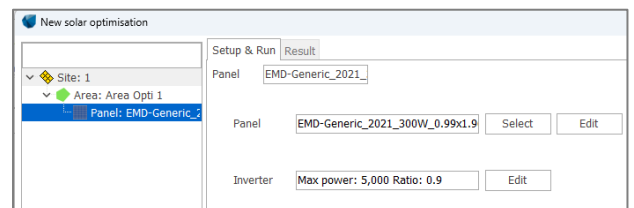

After the cost model is selected, the next step is to add a panel as marked with the green selection.
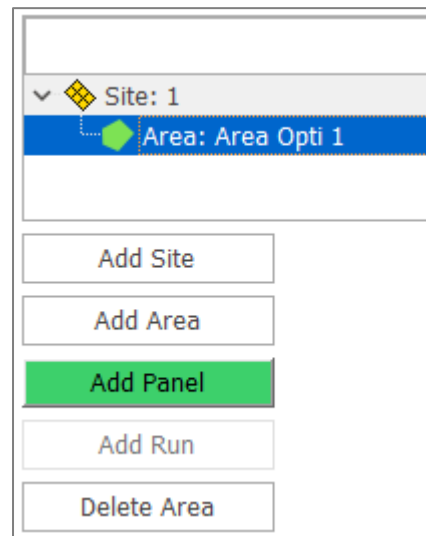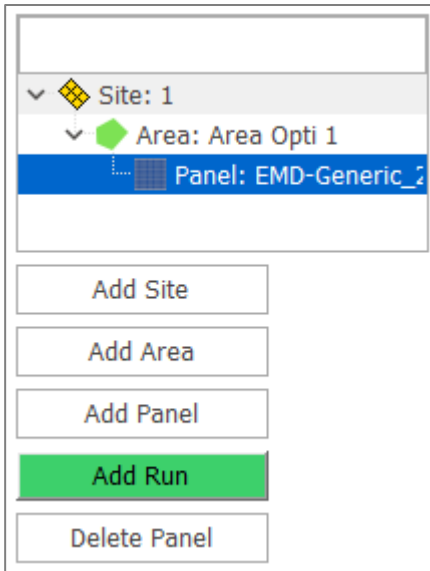

5. PANEL AND INVERTER SELECTION

In the Panel part of the tree structure, it is possible to select a PV panel and inverter to be used in the optimization. By default, the same equipment as selected for the existing Area is chosen. Here it is possible to select other or edit the selected.


After selecting the Panel and Inverter the next step is to add a Run.

Default	Min	Max	Step	Optimal
36.8	16.8	56.8	5.0	
2	1	3	1	
2.0	1.5	2.0	0.2	
180.0	90.0	270.0	90.0	
0.90	0.80	1.00	0.10	

The Row Distribution can be optimized considering two different parameters:

- Row spacing [TH] – distance between the end of one row and the end of the next, expressed in the table heights [TH] (number of vertical table panels multiplied with a height of one panel)
- Free space between rows [m] – distance between the end of one row and the beginning of the next row, expressed in meters.
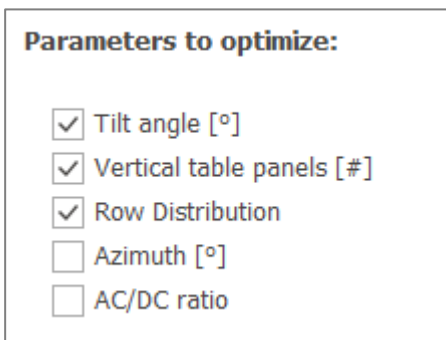
6.   SETUP & RUN THE OPTIMIZATION

In the Run part of the tree structure it is possible to select which parameters should be optimized.
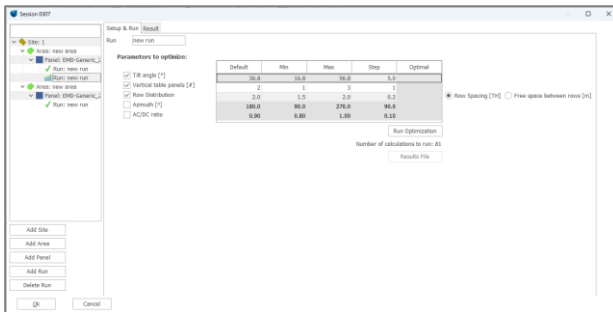
Select the parameters to optimize by checking the checkbox next to the name of the parameter.
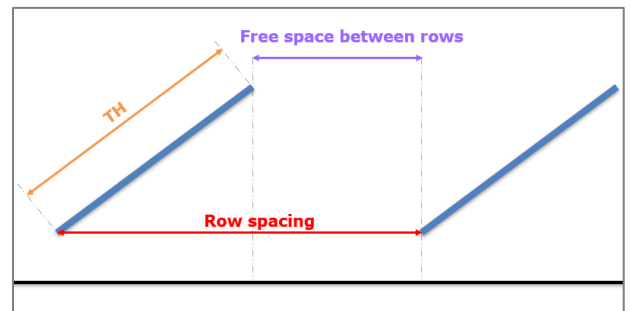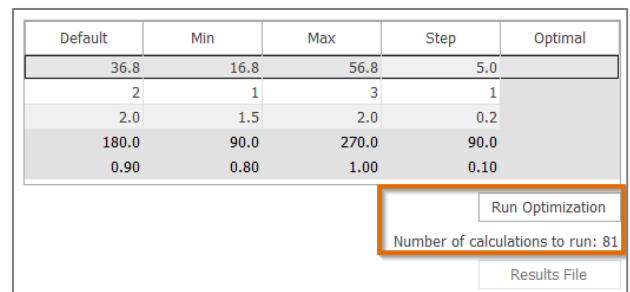

The default values in the table are taken from the current setup of the object. Based on these, the minimum (Min) and maximum (Max) values are proposed. The step defines for which values between Min and Max the calculations will be done. All the values in the table can be modified for the parameters selected to be optimized.

Choose the parameter in the radio button next to the table row.

After deciding on all parameters, you can see how many calculations will be performed in the note below the table, and run the optimization by clicking on Run Optimization.

Default	Min	Max	Step	Optimal
36.8	16.8	56.8	5.0	
2	1	3	1	
2.0	1.5	2.0	0.2	
180.0	90.0	270.0	90.0	
0.90	0.80	1.00	0.10	

Run Optimization
Number of calculations to run: 81
Results File

7.   RESULTS OF THE OPTIMIZATION

After the optimization is finished, the found optimal values from all the combinations created based on the inputs, are displayed in the Optimal column in the table.

Default	Min	Max	Step	Optimal
36.8	10.0	50.0	5.0	20
2	1	3	1	2
2.5	1.5	2.0	0.2	1.9
180.0	90.0	270.0	90.0	180
0.90	0.80	1.00	0.10	0.9

The results of all the runs can be saved by clicking on Results File button (active only after the calculations are finished). The results can be saved to a file or copied to clipboard and simply pasted to a spreadsheet.
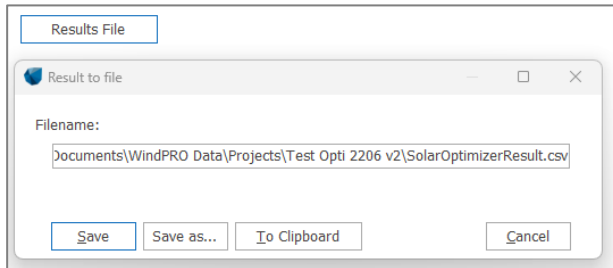
Detailed results analysis can be found in the Results tab.
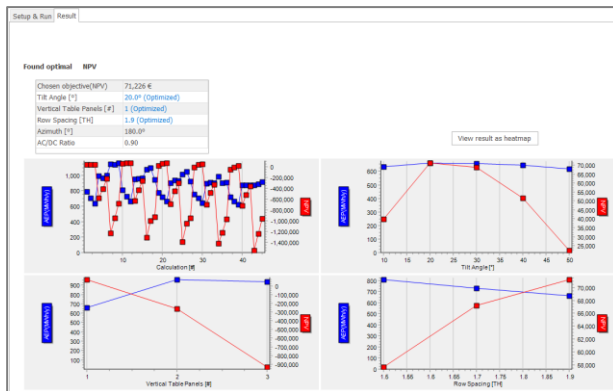
In the table on top of the page you can see the objective value and setup for the best-found plant configuration.

Found optimal   NPV

Chosen objective(NPV)	71,226 €
Tilt Angle [°]	20.0° (Optimized)
Vertical Table Panels [#]	1 (Optimized)
Row Spacing [TH]	1.9 (Optimized)
Azimuth [°]	180.0°
AC/DC Ratio	0.90

Also, graphs illustrating the impact of the parameters on the objective function are included. This way you can analyze if further investigation of the plant's parameters is needed. If LCOE or NPV is chosen as the objective, AEP will also be plotted on the graph to provide a better overview.
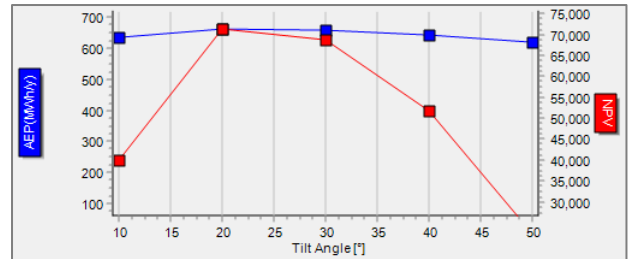
When selecting View results as heat map, you can view the results in a table.

The table has one parameter value as a column and another parameter value as a row. The values shown in the cells are the objective function value for this combination of the parameters. By default, the remaining parameters are set to optimum values, but you can view the table for other values by selecting it in the drop-down menu below the table. The parameters in the rows and columns can be changed. This way you can have a full overview of all the results. The values in the table are color coded with a gradient from red to green – green marks the best objective value, whereas red, the worst.