

## QUICK GUIDE –CREATING SOLAR PV LAYOUTS

### Purpose:

The purpose of this quick guide is to help you investigate the feasibility of installing solar photovoltaic (PV) panels in conjunction with a wind farm.

AEP calculations for Solar PV are not yet available in windPRO. All windPRO 3.3 users will have free access to the module through 2019.

This guide also shows you how to make visualizations of a solar pv farm.

### Outline of Guide:

1. Requirements
2. Defining areas for solar pv
3. Modifying panel characteristics
4. Creating Photomontage with solar pv farm
5. Identifying WTG shadows
6. Miscellaneous

#### 1. REQUIREMENTS

The steps in this quick guide require windPRO 3.3 with license to the Solar PV module. Through 2019, this module is freely available to all windPRO users. Optionally, creating visualizations requires a license to Photomontage.

Before creating your solar PV farm, you should establish a digital elevation model either as height contour lines or as elevation grid. Also, ensure you have a background map with a satisfying resolution.

For more guidance on establishing background maps and a digital elevation model, read more here: [Quick Guide - Start using windPRO](#), or visit the [BASIS manual](#).

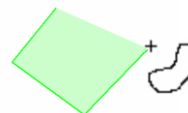
#### 2. DEFINING AREAS FOR SOLAR PV

Start by inserting a  Solar PV object in the map window:



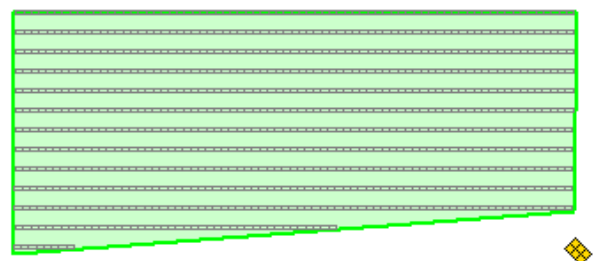
Place the Solar PV object in the area you want to establish solar panels. The exact position is not important, but the map will automatically zoom into the area where the object is placed.

Once placed, the cursor changes to a drawing cursor, so you can draw an area by left-clicking:



To stop digitizing the area, right-click and select “Stop”.

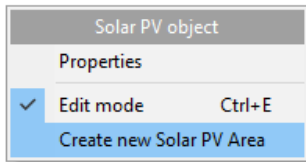
The area will automatically be filled with solar PV panels:



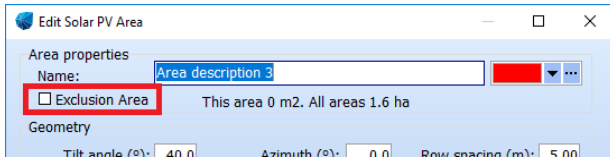
It's possible to define exclusion areas, where no panels are to be installed. This can be used to remove panels at substations, access roads, buildings etc.:

Right-click on the map and select “Create new Solar PV Area”:

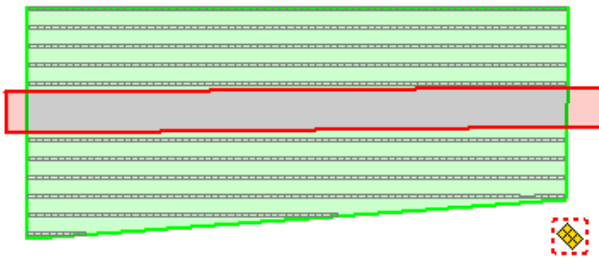
## QUICK GUIDE – CREATING SOLAR PANEL LAYOUTS



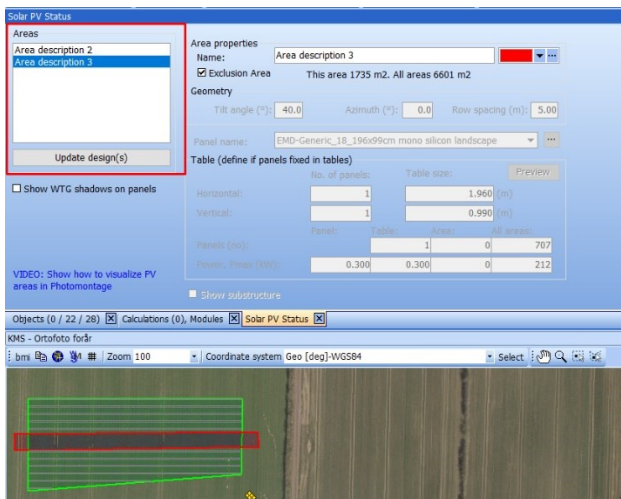
Then define the area as an Exclusion Area:



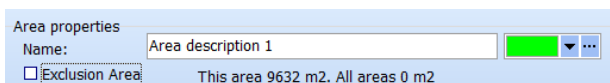
Click Ok, and start digitizing the exclusion area:



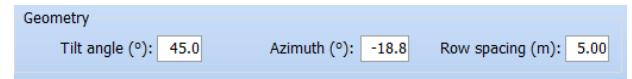
Multiple PV areas and Exclusion areas can be created within the same Solar PV object. The list of created areas can be seen in the status window which appears above the map when inserting the Solar PV object:



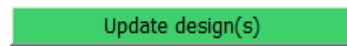
Each area can have different characteristics to the panel layout and visual design.



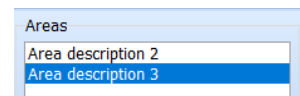
The tilt angle of the PV array can be adjusted (where 0° is horizontally flat), along with the Azimuth of the rows (where 0° is south in the northern hemisphere, and north in the southern hemisphere). Row spacing is a fixed value regardless of the size of the panels:



When changing any properties in the status window, the impact on the layout can be quickly seen on the map by clicking the Update design(s) button:



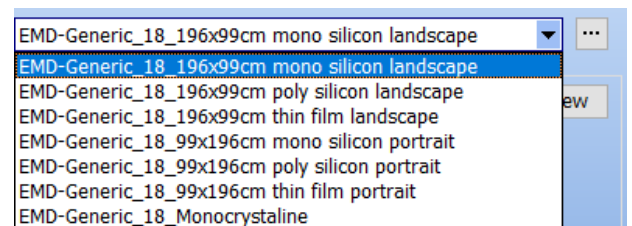
You can switch between the areas by clicking on the areas in the list:



### 3. MODIFYING PANEL CHARACTERISTICS

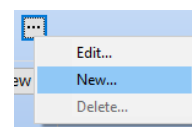
A PV layout consists of a number of undividable tables in each row. Each table can contain a number of panels.

windPRO comes with a set of default panel presets:

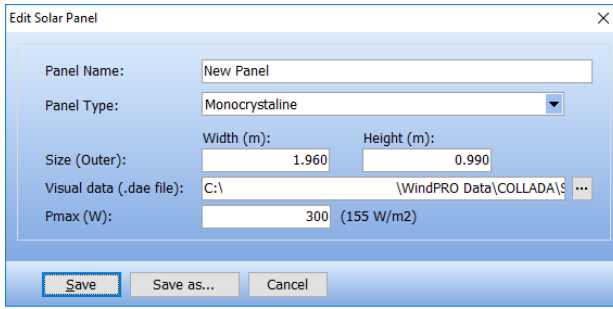


Each panel dataset contains information about the individual panel's width, height, 3D model, peak power and cell type.

You can also create your own panel presets by clicking the [...] button next to the panel preset and select "New":



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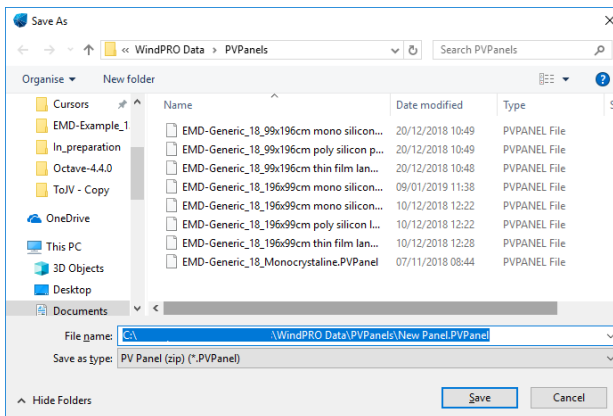


Input information about the panels outer size and select a visual 3D model from the windPRO Collada folder or create your own .dae file in, for example SketchUp.

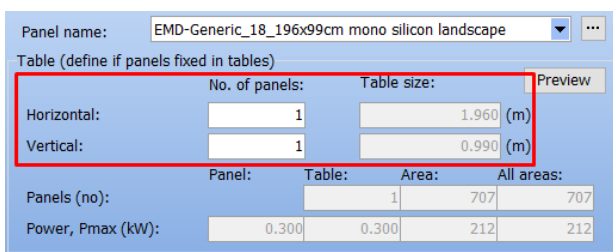
The selected .dae file will be scaled to the width and height properties given above.

Pmax is currently only used to calculate the peak power for the entire solar farm.

Click "Save as..." to save the new panel as a pre-set template:



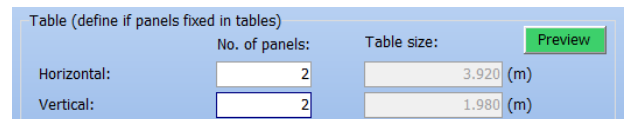
Once saved, you can define how many panels fit into each undividable table in both horizontal and vertical direction:



Click Preview, to see a 3D model of the table holding a single panel:



You can modify the table to hold, e.g. 2x2 panels:

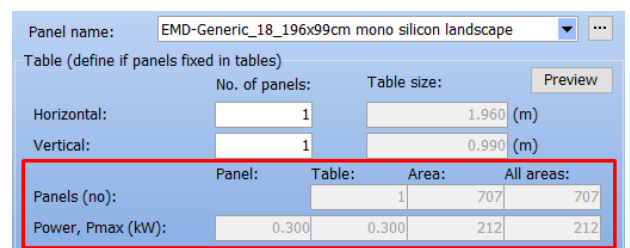


And the 3D model is updated:



These undividable tables are used to fill out the digitized solar PV area. Increasing the table size, naturally decreases the number of panels fitted to the area.

The number of tables fitted to the selected area and also all areas can be viewed below, along with the peak capacity:

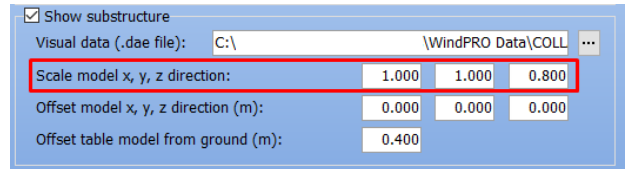
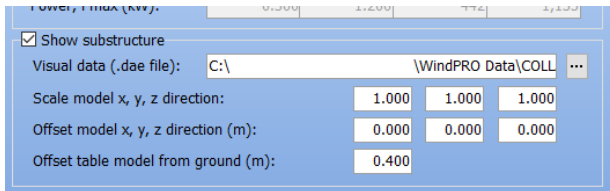


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### 4. ADDING A SUBSTRUCTURE

It is possible to add a mounting rack, or substructure to the table. However, the substructure requires a bit of manual adjustment to fit correctly with the table. Rendering a Photomontage will also take twice as long.

In this example we use a table with just one panel. Click the “Show substructure” checkbox to use the default substructure included in windPRO:



Click preview to see the table with a substructure:



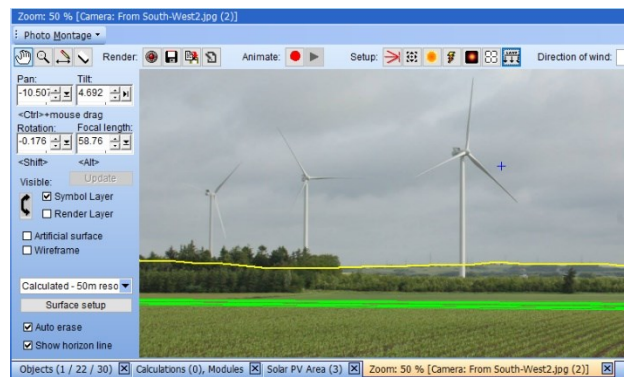
The substructure and panel are two independent components which unfortunately do not scale together. If we lower the tilt angle of the panel, the substructure does not automatically adjust:



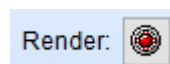
To fix this, either use a .dae model with the correct tilt or use the adjustment options for scale and offset:

### 5. CREATING PHOTOMONTAGE WITH SOLAR PV FARM

Open the Photomontage of a calibrated Camera object pointing towards the Solar PV area:



Click render:



And now you are done:



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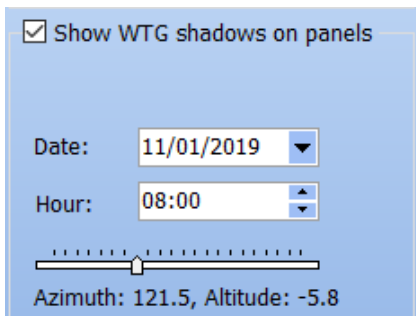
### 6. IDENTIFYING WTG SHADOWS

windPRO is capable of calculating the shadows cast by turbines onto the PV panels.

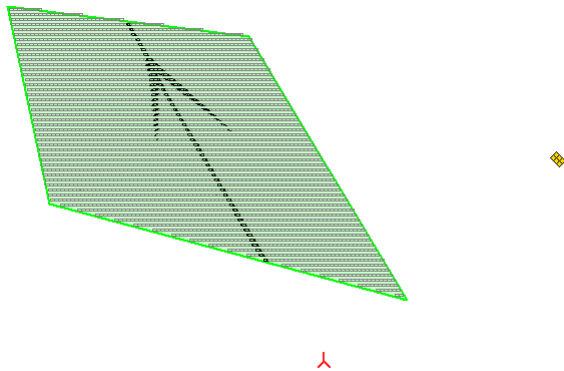
Click the “Show WTG shadows on panel”:

Show WTG shadows on panels

Here you can control the date and time you want to simulate:



This will change the shape of the shadow. Any panel falling in the shadow of a turbine will be coloured darker:



Currently, the shadow can only be displayed in a single timestep at a time, in 1-minute resolution. Accumulated shadow effect and loss are not yet available.

### 7. MISCELLANEOUS

#### Why can't I make an energy calculation?

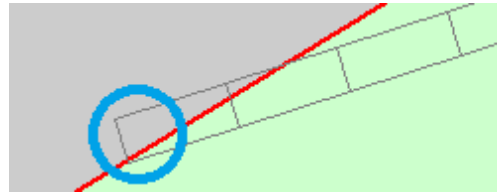
Energy calculations will be added to the Solar PV module over time. Stay tuned.

#### Why do I only see lines in my Solar PV area?

If there are too many panels, windPRO will reduce the drawing time by only displaying lines.

#### Why do some solar panels cross oblique sections of the Solar PV area?

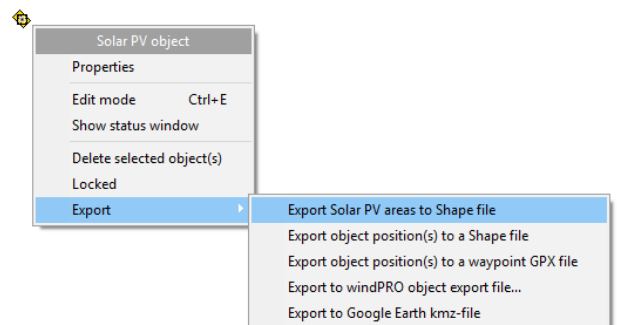
Sometimes the solar panels will extend past the defined Solar PV area:



Unfortunately, this cannot yet be avoided. The only option is to move the boundary of the PV area or to insert an exclusion area

#### How do I export my layout?

Right-click on the Solar PV object and select Export and Export Solar PV areas to Shape file:



The lines (not renditions) of the areas and panels can then be imported to Google Earth Pro, QGIS, etc.

