

## QUICK GUIDE –CREATING AND VISUALIZING SOLAR PV LAYOUTS

### Purpose:

The purpose of this quick guide is to help you create solar PV layouts and use Photomontage to visualize it.

### Outline of Guide:

1. Requirements
2. Defining areas for solar PV
3. Modifying panel characteristics
4. Creating Photomontage with solar PV farm
5. Miscellaneous

#### 1. REQUIREMENTS

The steps in this quick guide require windPRO 3.4 with license to the Solar PV module and Photomontage module.

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: [Start using windPRO](#), or visit the [BASIS manual](#).

#### 2. DEFINING AREAS FOR SOLAR PV

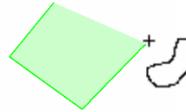
Start by inserting a  Solar PV object in the map window:



Place the Solar PV object in the area you want to establish solar panels. The exact position is not

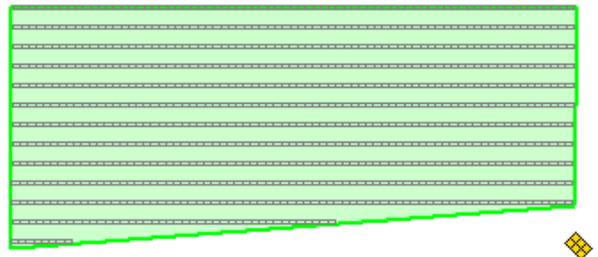
important, but the map will automatically zoom into the area where the object is placed.

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”:

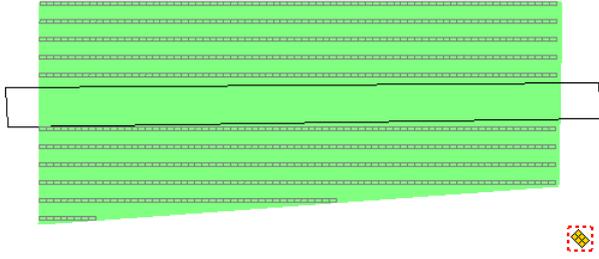


Then define the area as an Exclusion Area:



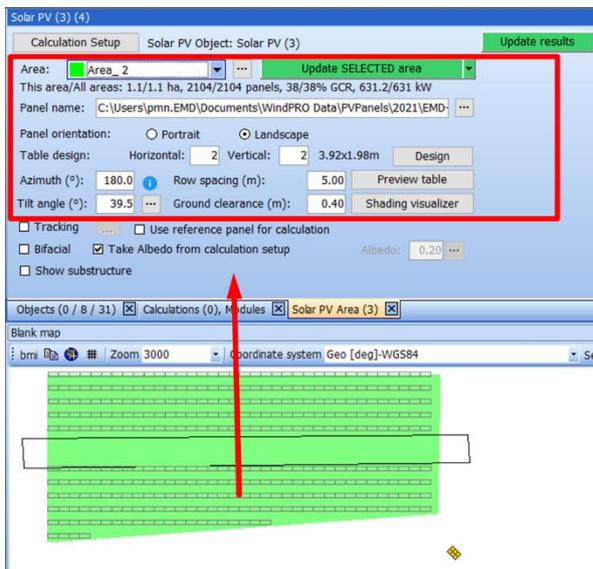
Click Ok, and start digitizing the exclusion area:

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Multiple PV areas and Exclusion areas can be created within the same Solar PV object. Each area can have different properties to the panel layout and visual design.

The properties of each area can be seen in the status window which appears above the map when inserting the Solar PV object:



The azimuth follows the general conventions in windPRO: 0 degree is north, 90 degrees is east, 180 south etc. Thus, on the northern hemisphere, 180 degree will make the panels face towards Equator and on the southern hemisphere, 0 degrees will make panels face Equator:

Azimuth (°):	180.0	Row spacing (m):	5.00
Tilt angle (°):	40.0	Ground clearance (m):	0.40

Row spacing is a fixed value (but changeable) regardless of the size of the panels.

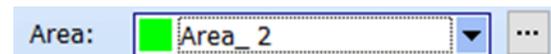
The tilt angle of the PV array can be adjusted (where 0° is horizontally flat), along with the azimuth of the rows. The default tilt angle is the “optimal” for the location, giving highest production for a panel free of shading.

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



If all design parameters shall be used for all areas, the drop down can change the button to “Update ALL areas”.

You can switch between the areas from the dropdown:



### 3. MODIFYING PANEL CHARACTERISTICS

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

windPRO comes with a set of default panel presets:

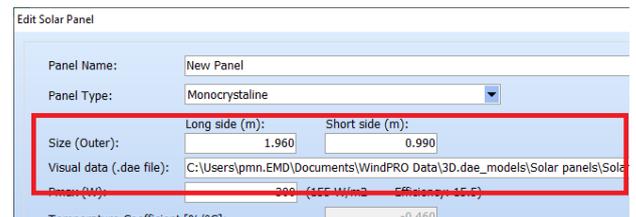
- EMD-Generic\_2021\_250W\_0.99x1.96Poly\_3xBypass.PVPanel
- EMD-Generic\_2021\_300W\_0.99x1.96Mono\_3xBypass.PVPanel
- EMD-Generic\_2021\_330W\_0.99x1.96Mono\_3xBypass.PVPanel

Each panel dataset contains information about the individual panel’s width, height, 3D model, cell type, power etc.

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



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.

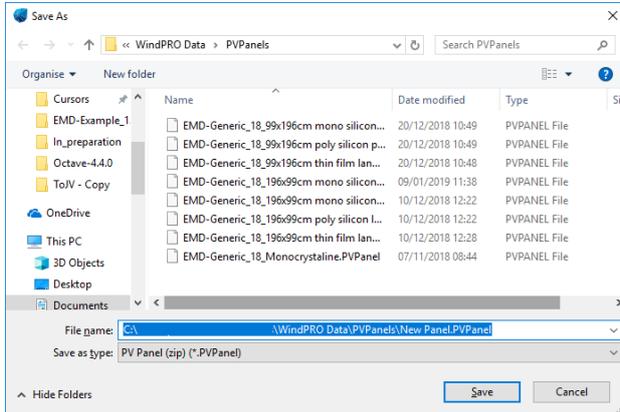


The selected .dae file will be scaled to the width and height properties given above.

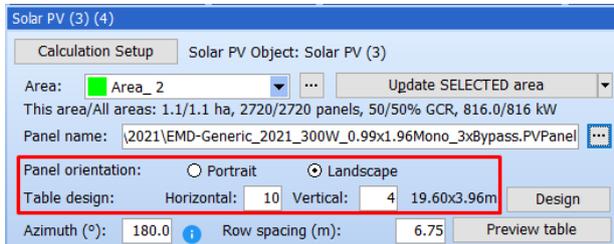
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Information about the power characteristics of the panel can be ignored for visualization purposes.

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



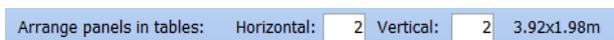
Once saved, you can define how many panels fit into each undividable table in both horizontal and vertical direction:



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



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

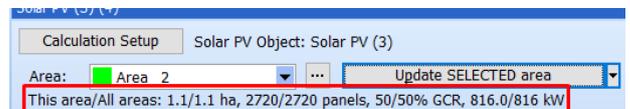


And the 3D model is updated:



These undividable tables are used to fill out the digitized solar PV area. Increasing the table size naturally decreases the number of tables fitted to the area. Adding more vertical panels usually requires more row spacing.

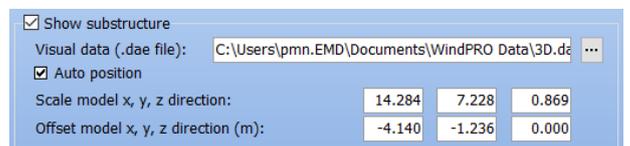
The number of panels fitted to the selected area and also all areas can be viewed below, along with Ground-coverage ratio (GCR) and the peak capacity:



### 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 table” to see the table with a substructure:

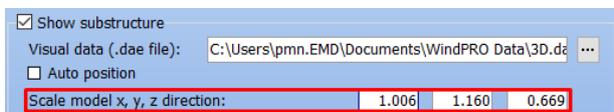


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The substructure and panel are two independent components. If we lower the tilt angle of the panel, the substructure does not automatically adjust:



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

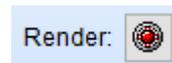


### 5. CREATING PHOTOMONTAGE

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



Click render:

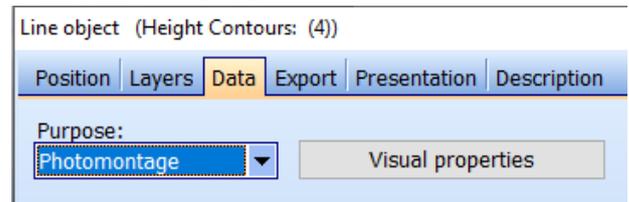


And now you are done:

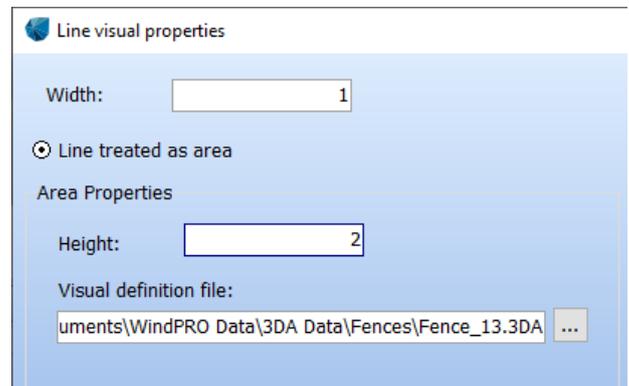


### 6. ADDING FENCES

To visualize access roads and surrounding fences, add a new Line object  on the map, and set the purpose to “Photomontage” and open “Visual properties”:

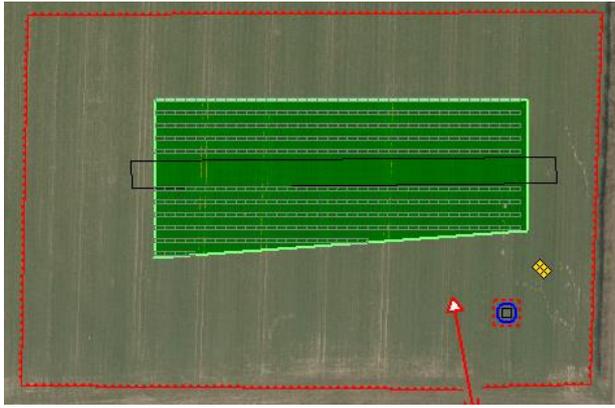


For a single row chain fence, select “Line treated as area” and set the width 1 (meter), and the Height to e.g. 2 meters. In this visualization example we use the “Fence\_13.3DA” file found in the “3DA Data” folder.

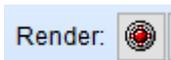


Click OK two times, right click on the map and select “Create new contour” to start digitizing the fence as a line:

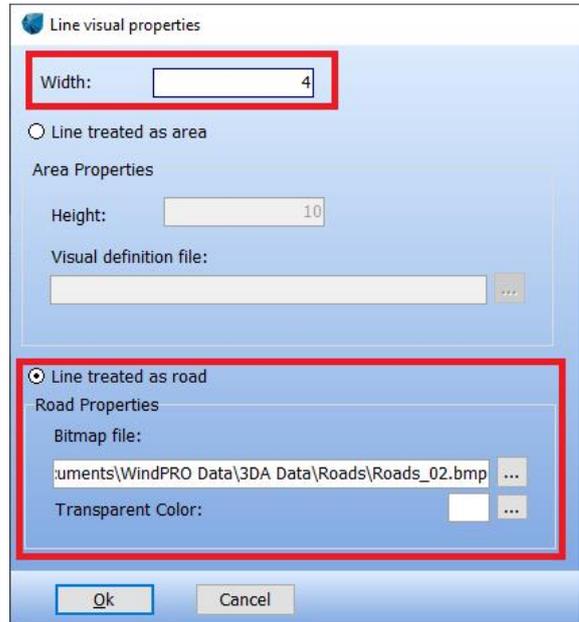
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In the Photomontage tool window, click render:



And now there is also a chain fence:



Click OK twice and start digitizing the access road (red):

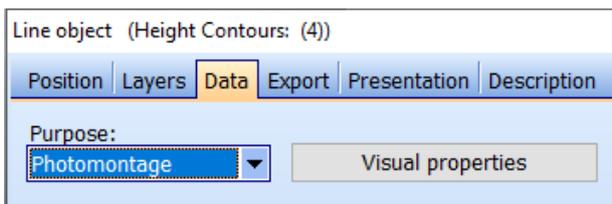


### 7. ADDING ACCESS ROADS

Adding an access road is very similar to adding a fence.

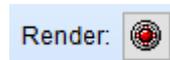
Insert a new Line object  on the map.

Set the purpose to “Photomontage” and open “Visual Properties”:



This time select “Line treated as road”, and select a desired bitmap and road width:

In the Photomontage tool window, click render:



And now there is also an access road:



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### 8. MISCELLANEOUS

#### How do I calculate the AEP of a solar PV farm?

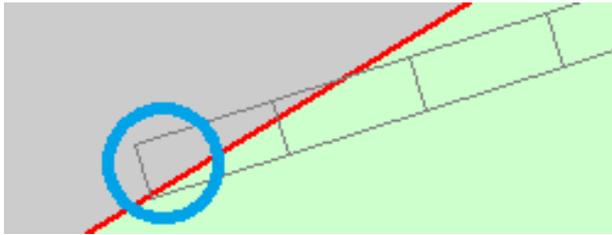
Visit the “Quick guide – Solar PV energy calculation”

#### 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?

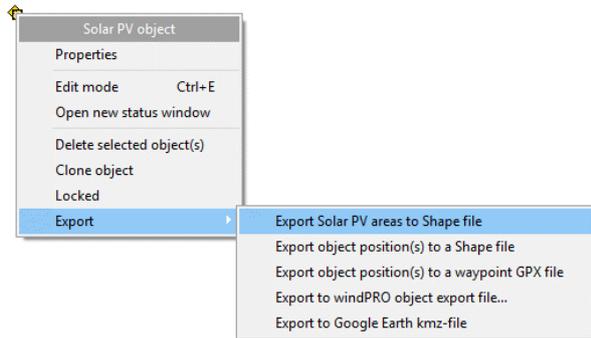
Sometimes the solar panels will extend past the defined Solar PV area:



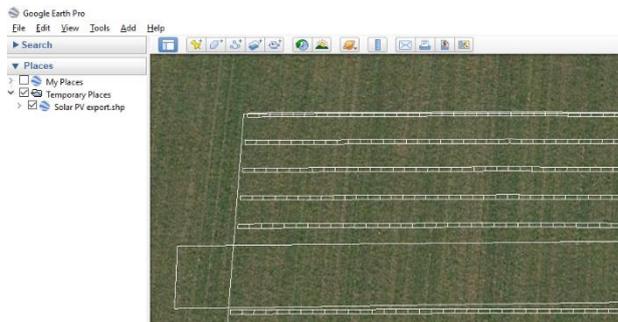
Unfortunately, this cannot yet be avoided. The only option is to move the boundary of the PV area or to insert an exclusion area

#### How do I export my layout?

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



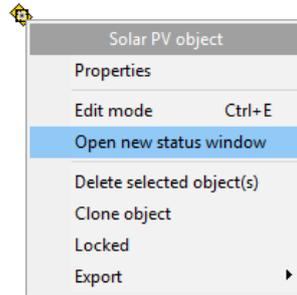
The lines (not renditions) of the areas and panels can then be imported to Google Earth Pro, QGIS, etc.



Note that both panels and design areas are shown on e.g. Google Earth. But these are in separate layers, and it is possible to switch off one of them to get a nicer view.

#### How do I re-open the solar PV status window?

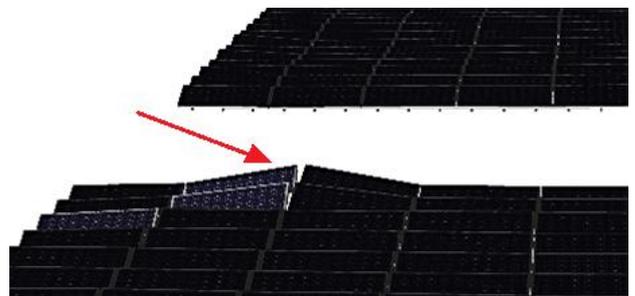
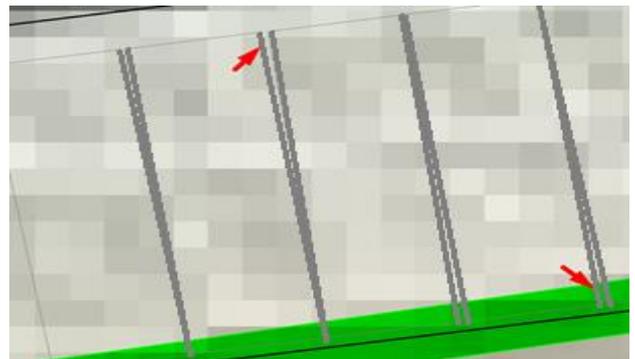
Right-click on the Solar PV object and select “Open new status window”



If an Energy calculation has been performed, the setup for that calculation can be accessed from the Properties menu in the Calculation list.

#### Why are my panels not mounted straight?

Panels may be placed in a skew layout on the map and in a photomontage:



This can occur when using very high resolution elevation data (0.4m) with some noise. Since the panels follow the terrain, any bump in the elevation data will result in a bump in the panel layout. A solution is to post-process the elevation data and remove the noise. For typical low resolution elevation data, this problem will be rare.