Solar Pathfinder™
ASSISTANT
RAISING THE STANDARD IN SOLAR SITE ANALYSIS

Assistant User's Guide

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1 Getting Started

Thank you for purchasing the SolarPathfinder Assistant application. We believe you will find this to be a worthwhile investment in assisting with your solar site analysis. The SolarPathfinder Assistant application is designed to remove the mundane calculation tasks that current users of the SolarPathfinder are forced to perform. By doing so, users can expect quicker and more accurate results in addition to having permanent reports regarding a prospective installation site.

To use this application, you will need access to a computer running Microsoft Windows (XP, Vista, 7, 8.1, 10) and a digital camera. Administrative privileges will be required to install the application. However, normal users can run the application without having administrative privileges.

One Time Steps for Getting Started

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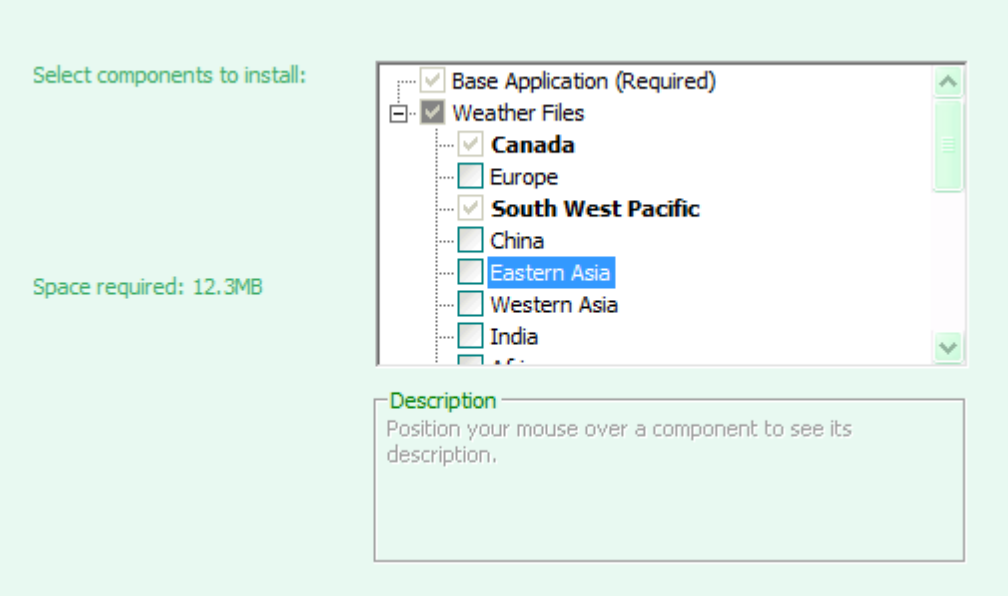
1.1 Installing Weather Data Files

Weather files can be added in the installer:



Weater File Selection List

The weather sizes are very large and are downloaded from the Internet.

Below is a listing of the weather data files. Where the contents of some of the files are counter intuitive, a partial list of the included countries is appended in parenthesis.

Africa (4 MB)

Canada (5 MB)

Central America (3 MB) (Cuba, U.S. Virgin Islands, Puerto Rico, Martinique)

China (25 MB)

Eastern Asia (3 MB)

Europe (16 MB) (Northern and Eastern Europe, Turkey, Syria, Israel)

India (5 MB)

South America (3 MB)

South Western Pacific (7 MB) (Australia, NZ, Guam, Fiji, Philippines, Singapore, Malaysia)

USA AK-AZ (8 MB)
USA CA-CT (8 MB)
USA DE-HI (8 MB)
USA IA-IN (6 MB)
USA KS-ME (6 MB)
USA MI-MT (9 MB)
USA NC-NJ (5 MB)
USA NM-OR (7 MB)
USA PA-TX (8 MB)
USA UT-WY (8 MB)

Western Asia (1.3 MB)

The weather data has been grouped according to the grouping given by the U.S. Department of Energy. Get more information at their website: http://apps1.eere.energy.gov/buildings/energyplus/weatherdata_about.cfm

1.2 License Validation

The first time that you run the application, you will be greeted by the License Validation form. If you purchased the Solar Pathfinder Assistant for download, a serial number was sent to you at your registered email address. If you purchased a physical CD, that serial number should be located on a sticker on the CD case. Either way, enter that serial number into the Serial Number text box. The value is case sensitive, so enter it exactly as it appears on the CD case label. If you copy your serial number from the email into your clipboard (using Ctrl-C) then the serial number will be automatically copied into the text boxes when this window opens.

If you want to register later, just click on the Evaluation button. You can always come back to this screen by using the Help|Register 92 menu command.

License Validation Form

Once the serial number has been entered, click the Validate button to validate your purchase and generate your license file. If you are simply evaluating the product before purchasing, click the Still Evaluating button. Note that some options in the program are disabled in evaluation mode. In addition, reports are generated with an evaluation mode watermark.

During license validation, you must have an active internet connection. Also note that you will only have to validate your license

once. After successful validation, you will not see this form again.

2 Create A Report

A report in the SolarPathfinder Assistant contains location information, panel and inverter configuration information as well as the sun traces for the analysis site. When you are at the analysis site, you need to determine how many pictures will be needed for your analysis site. Depending on your available rebate programs, you might be able to take a single picture, or maybe you have to take one picture per corner. Check with your rebate administrator to make sure. As an example, in order for a report to be considered "CSI" capable, you must provide at least four pictures - one for each corner of the array. After you have taken your pictures, you can create a new report and associate those traces with the report in one of two ways. First, from the QuickStart form, you can click on the "New Report" button. Second, you can choose "New Report" from the File main menu. Either way, you will be presented with the Create New Report form.

Steps for creating a PV report:

1. Capturing your image 9
2. Create a new report 11
3. Enter analysis data 15
4. Select panels and inverters 18
5. Set System Losses 21
6. Select array configuration 22
7. Exit the report editor 26
8. Create One Or More Traces 27

Other types of reports, such as Thermal, save similar steps, but those steps that are unique to a PV report will be different in the Report Wizard for non-PV reports.

2.1 Capturing Your Image

The SolarPathfinder Assistant application works off of one or more user-supplied digital picture(s) of the SolarPathfinder dome. There are several steps that need to be followed to get the best results.

STEP 1: At the prospective site, set up your SolarPathfinder so that it is facing magnetic south and adjust the unit for level.

STEP 2: Take a digital picture of the dome reflection. The application is relatively forgiving regarding the size and orientation of the picture.

There are several pointers that will help you take the best possible picture.

- Your body should be on the north side of the unit so that your reflection is not covering the tracing area. It is not necessary to have the Pathfinder exactly square in the picture. Just make sure that your body is not an obstruction.

- The camera should be looking straight down at the Pathfinder unit. If you are too far off, this will introduce skew into the picture and affect the calculations. One way to confirm your positioning is that the blue plastic housing should be equally wide on all sides of the dome. If it is wider on one side than the other, you are not looking straight down on the unit.

- The calibration step will take care of image normalization. When looking through your camera viewfinder, the Solar Pathfinder unit should fill as much of the viewing area as possible, yet include ALL of the blue (or green) plastic housing. Camera resolution does not matter.

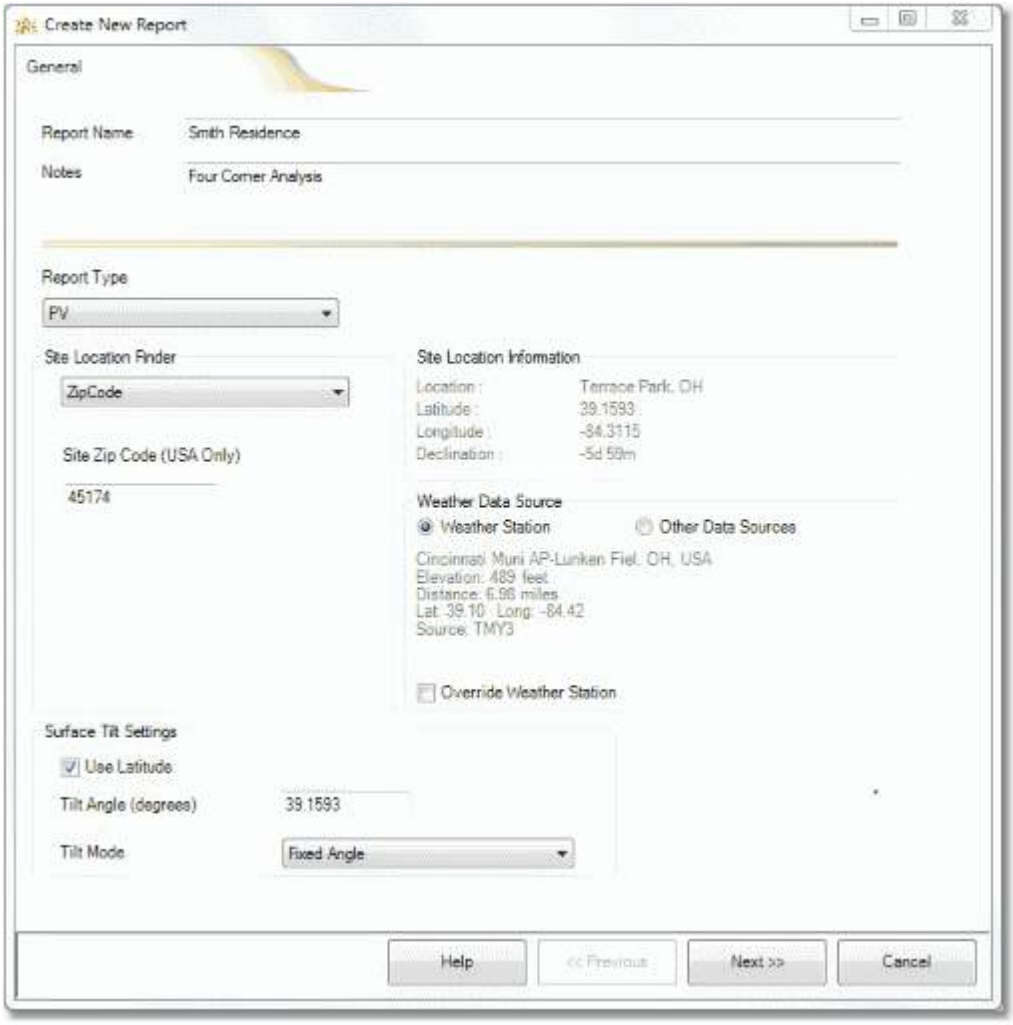
Note: that if you are unsure whether you obtained a good picture, it may be worthwhile to take several.

Capturing Your Image

STEP 3: Transfer the digital image that was just taken to your computer. There are many conventional methods for doing this, such as removing your flash memory card, transfer via USB cable, etc. Consult your digital camera user's manual for more information. At this point, we are ready to start the SolarPathfinder Assistant application.

2.2 General Report Editor

Start a new report by click on the File|New Report 83 menu command. Alternatively, you can also hit the Ctrl-N key sequence or click on the New Report Icon on the tool bar 94.



Report Name and Notes

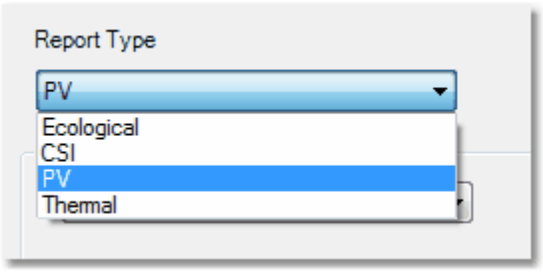
Use the Report Name field to give your report a title. This will appear at the top of each report page when printed. You can leave this blank, but it is not recommended.

If there are any notes that are applicable to the entire report, you can add these here. Or, you can leave this blank.

Report Type

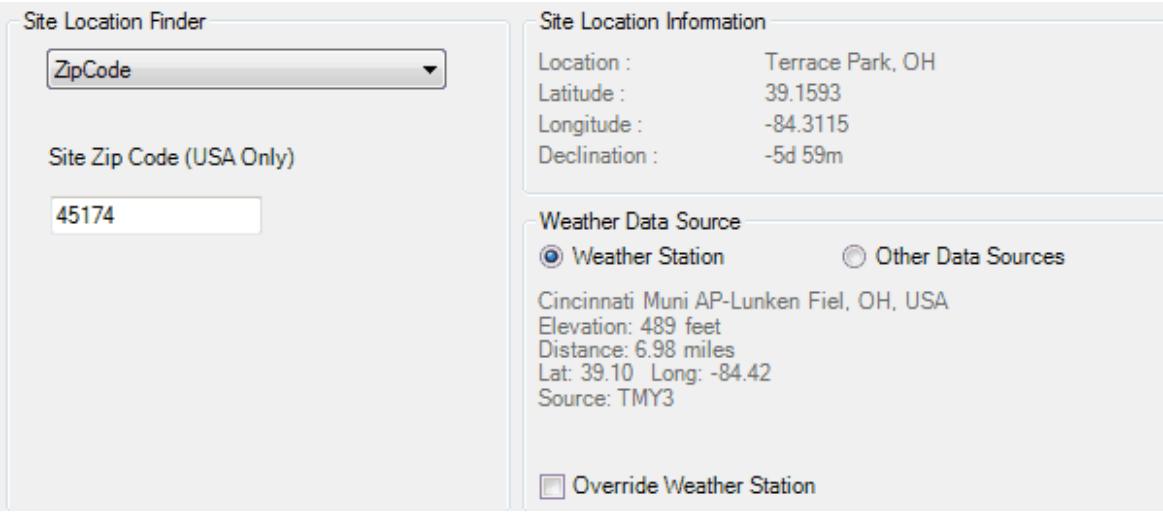
This dropdown box allows you to select among different report types:

- Ecological 76
- Photovoltaic (PV) 71,
- Thermal (Solar Hot Water) 79
- CSI (California Solar Initiative) 71

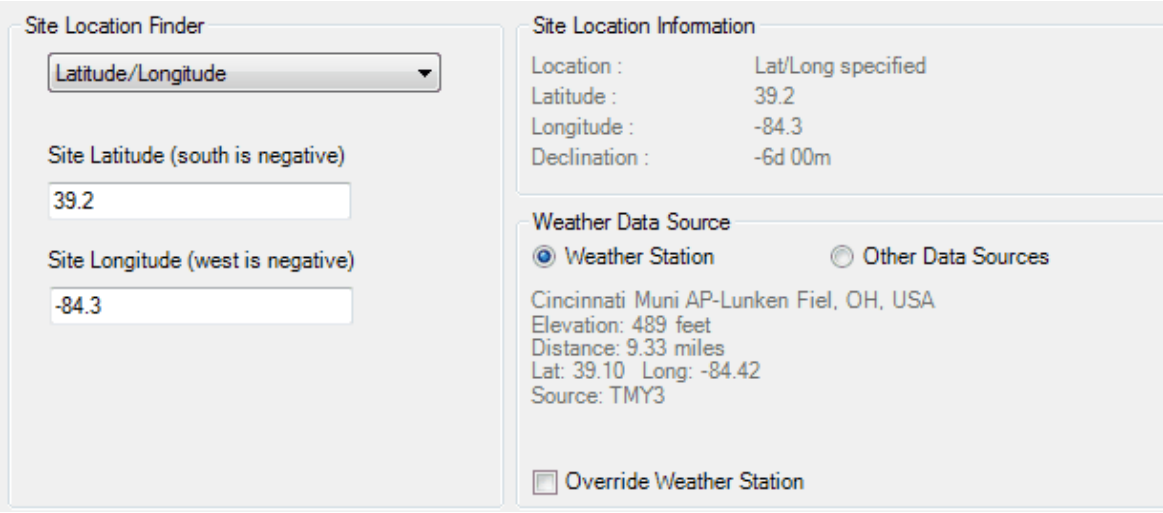


Report Type Dropdown Box

Choosing a location



Site/Location Information (Zip code)



Site/Location Information (lat/long)

When defining a report, you must enter the location information for the analysis site. You can either enter the zip code or the latitude/ longitude pair. To toggle between the two input modes, select an option in the location pulldown list.

The application uses the location information to determine latitude & longitude (in the case of zip code entry), what template to use, magnetic declination, and the weather station that is closest to the location in question.

For latitude/longitude entry, negative latitudes are south of the equator and negative longitudes are east of the prime meridian.

After successfully creating a report, the application remembers the last location you used. New report will start out with this information. Of course, you can override it simply by providing a new value for the zip code or lat/long pair.

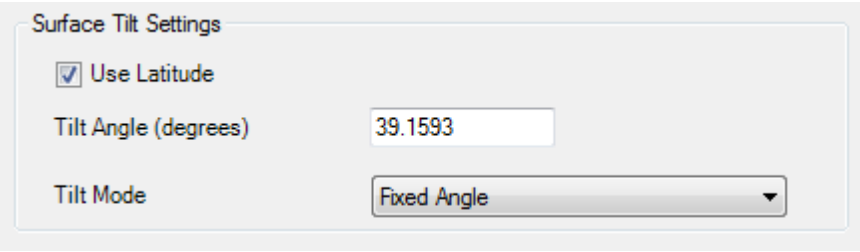
Select Weather Data

The default weather selection is Weather Stations which picks the closest weather station to your site. Selecting the "Override weather station selection" checkbox will display the Weather Station Selection Form 118.

If the weather station is too far away or from a different microclimate then you have the option of using alternate weather data 119 by selecting the "Other Data Sources" radio button.

Tilt Angle

The tilt angle represents the angle of the PV array with respect to horizontal. Note that tilt angle is not applicable for two-axis PV tracking arrays. By default, the tilt angle is set to the latitude for the current location. This generally gives the most solar exposure for the site. If you need to override this value for some reason, you can click in the "Using latitude" checkbox to remove the "check", which will enable the text box for manual entry.



Using Latitude

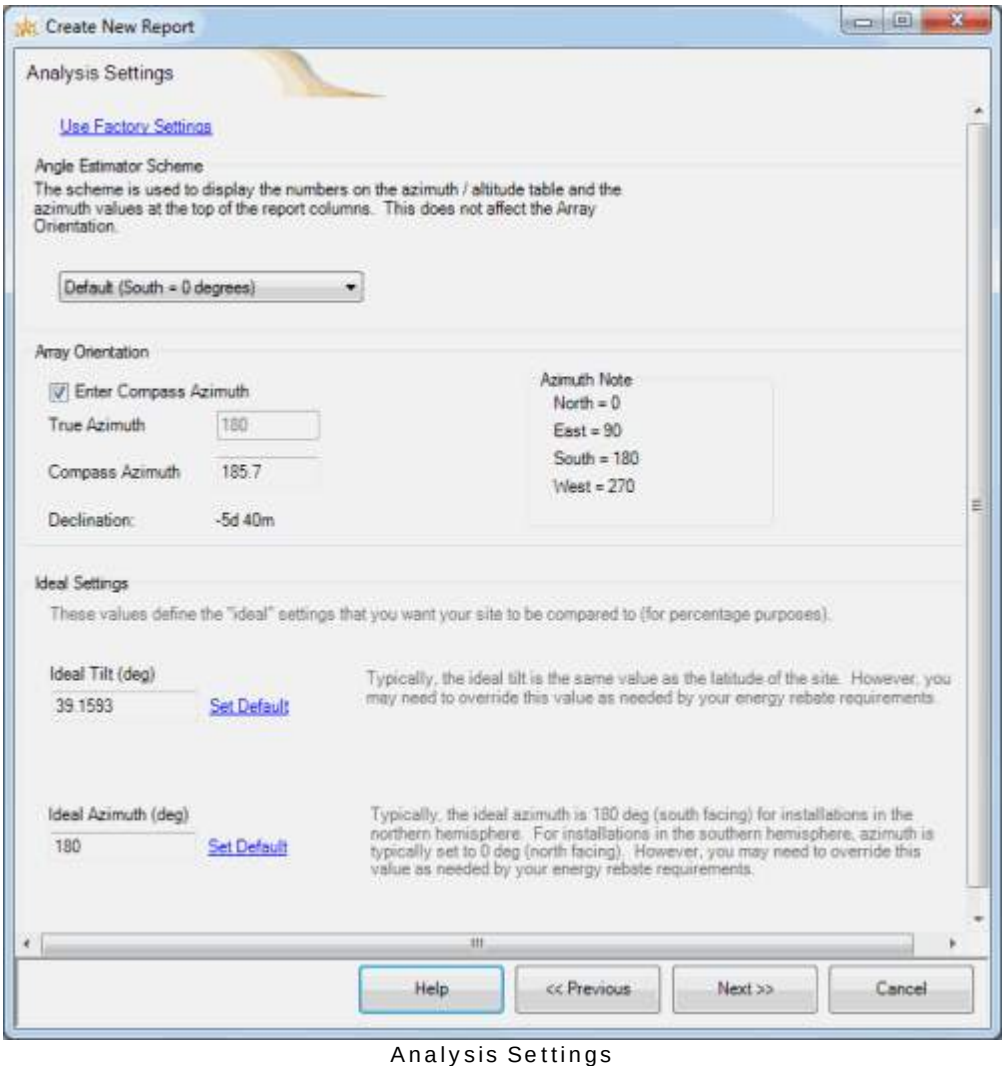
If you are performing ecological studies, the tilt will automatically be set to 0 degrees.

For the Southern hemisphere, latitude values will be negative.

Tilt Mode

The tilt mode represents the type of tracking used by the PV array. This can be fixed (no tracking), one axis, or two axis. One axis tracking is used to track on the azimuth, and two axis tracking affects both azimuth and tilt. Tracking arrays are not applicable for ecological studies.

2.3 Analysis Report Editor



Analysis Settings

Angle Estimator Scheme

When creating the angle estimator report, you can choose whether south represents zero degrees or 180 degrees. Both the template image as well as the analysis numbers at the top of the report will reflect the angle estimator scheme that you have chosen. Note that the two schemes can be easily converted by adding 180 degrees to the default scheme in order to generate the reverse scheme. Some government bodies require one scheme as opposed to the other. Check with your local jurisdiction to determine which scheme to use for your rebates and/or subsidies.

Azimuth

The NREL web site has a good description of azimuth as it relates to PV arrays. http://rredc.nrel.gov/solar/calculators/PVWATTS/system.html#azimuth

For a fixed PV array, the azimuth angle is the angle clockwise from true north of the direction that the PV array faces. For a sun-tracking PV array with one axis of rotation, the azimuth angle is the angle clockwise from true north of the direction of the axis of rotation. The azimuth angle is not applicable for sun tracking PV arrays with two axes of rotation.

The default value is an azimuth angle of 180° (south-facing). This normally maximizes energy production. Increasing the azimuth angle favors afternoon energy production, while decreasing the azimuth angle favors morning energy production.

The table below provides azimuth angles for various headings:

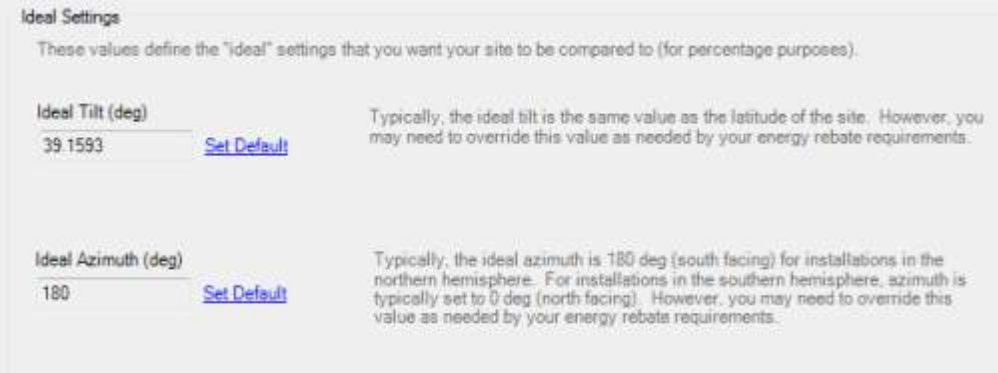
Heading	Azimuth Angle (°)
N	0 or 360
NE	45
E	90
SE	135
S	180
SW	225
W	270
NW	315

Compass Azimuth

This field converts a magnetic heading to the true direction. The value entered in this field should be the compass heading that your Arrays are facing. When the value is entered in this field, the True Azimuth field will be automatically adjusted to account for magnetic declination.

Ideal Tilt and Azimuth

At the bottom of the form you will see text boxes for "Ideal" tilt and azimuth values.

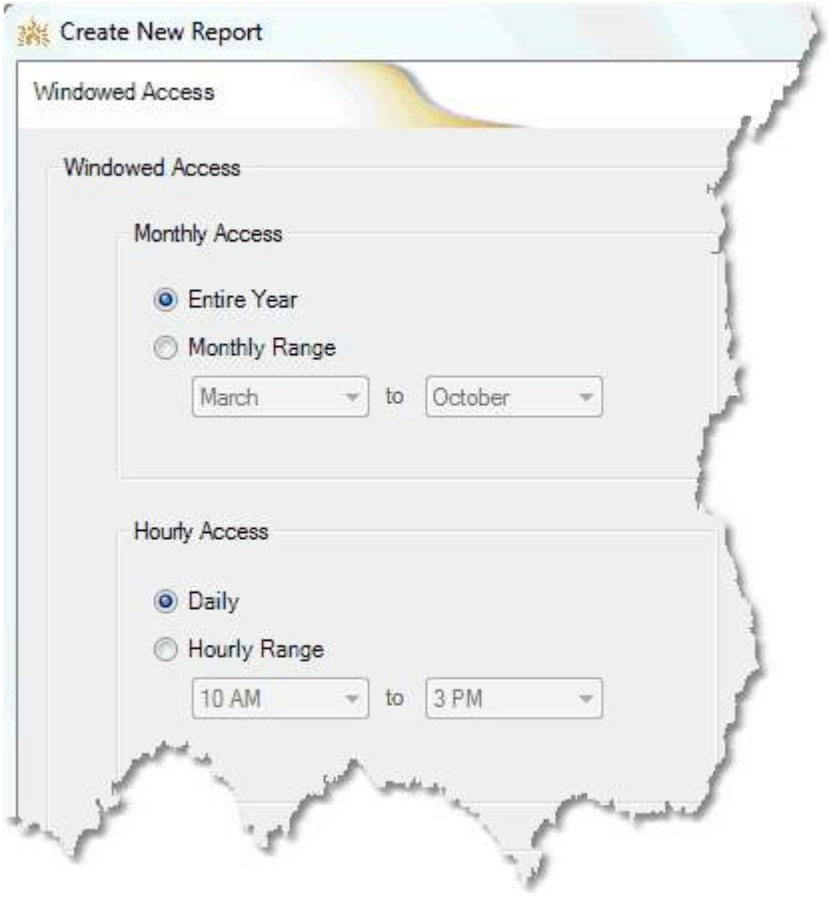


Ideal Tilt and Azimuth

Many of the calculations reference the ideal tilt and azimuth angles. Typically these values are set so that the Ideal Azimuth is 180 degrees for installations in the northern hemisphere and the Ideal Tilt is set to the latitude value for your site. However, there are rebate programs that require alternate values for the Ideal Tilt and Azimuth. These values will be pre-populated with the values set in the Ideal Settings Options 112 form. However, you can override those values on a report by report basis by setting them here.

2.4 Windowed Access

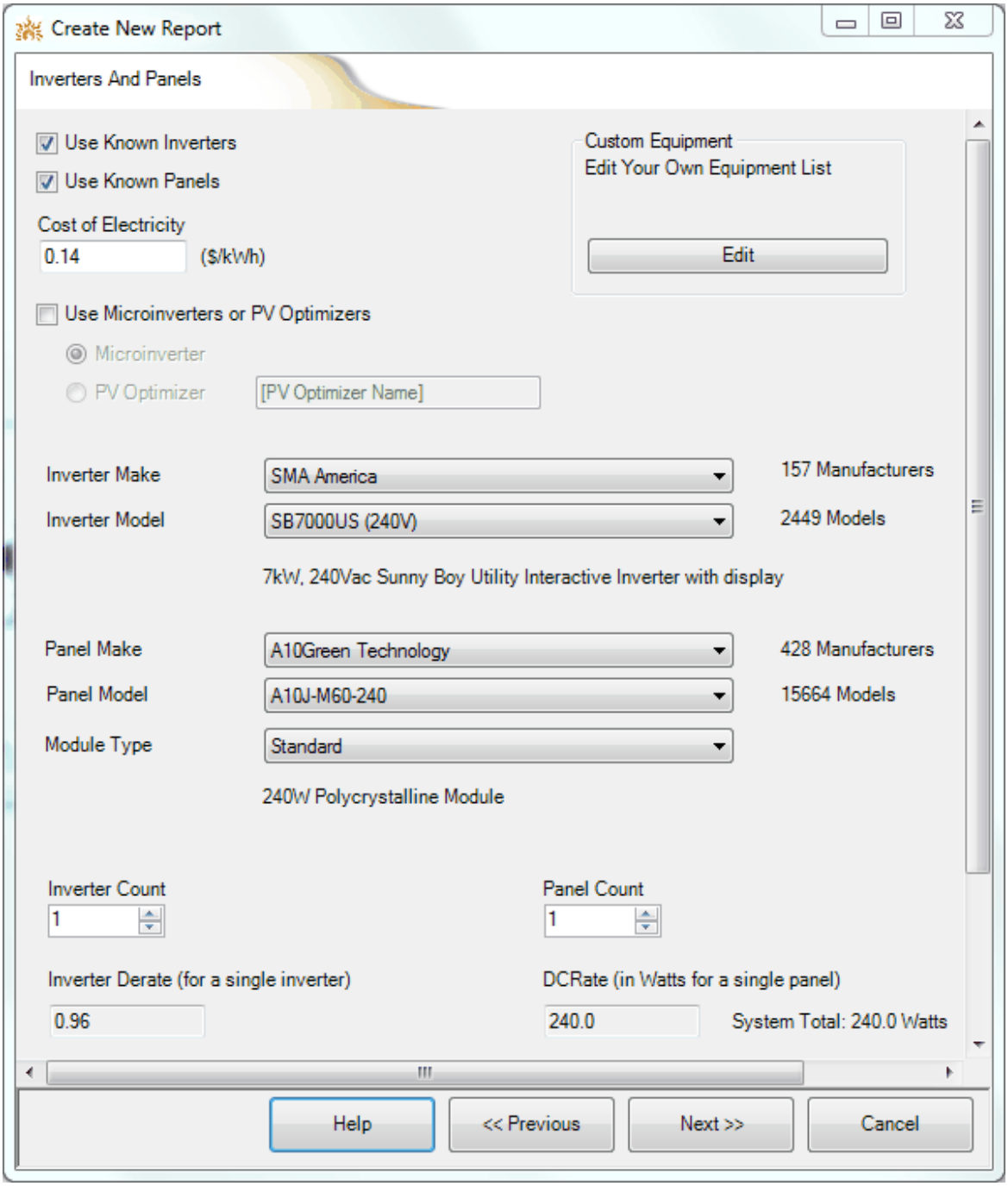
These settings allow you to set the time range during which the insolation and production calculations are considered. A narrow time range can improve the efficiency calculations.



The screenshot shows the default time range. It takes advantage of all available insolation. Reducing the monthly and/or hourly time ranges affects all of the report column data.

2.5 Panels And Inverters

On this page you can choose your equipment from a list of Inverters and Panels (modules).



Panels and Inverters Page

Custom Equipment

If your inverter and/or panel is not the program database, you can add your equipment by clicking on the edit button on the upper right part of this page. Once your return from the custom editor, you can find your custom equipment at the end of the drop-down list.

Use Known Inverter Checkbox

Unchecking this box will remove the Inverter selection list and enable the Inverter Derate text box near the bottom of the page. The Derate is the CEC efficiency of the inverter where 1.0 is 100%, so you should enter a number less than 1.

Use Known Panel Checkbox

Unchecking this box will remove the Panel selection list and enable the DCRate text box near the bottom of the page. The DCRate is the STC watts of the panel.

Use Microinverters or PV Optimizers

Selecting this option activates the shade mitigation algorithm for shaded modules. Your modules will produce more when they are shaded than modules that don't have a microinverter or PV optimizer. If you select the PV Optimizer option, you can also enter the name of the optimizer in the text box; the name of the optimizer will be printed on the report title page.

Module Type

(copied from the PV Watts documentation at pvwatts.nrel.gov)

The module type describes the photovoltaic modules in the array. If you do not have information about the modules in the system, use the default Standard module type. Otherwise, you can use the nominal module efficiency, cell material, and temperature coefficient from the module data sheet to choose the module type.

Module Type Options

Type	Approximate Efficiency	Module Cover	Temperature Coefficient of Power
Standard (crystalline Silicon)	15%	Glass	-0.47 %/°C
Premium (crystalline Silicon)	19%	Anti-reflective	-0.35 %/°C
Thin film	10%	Glass	-0.20 %/°C

Inverter Count

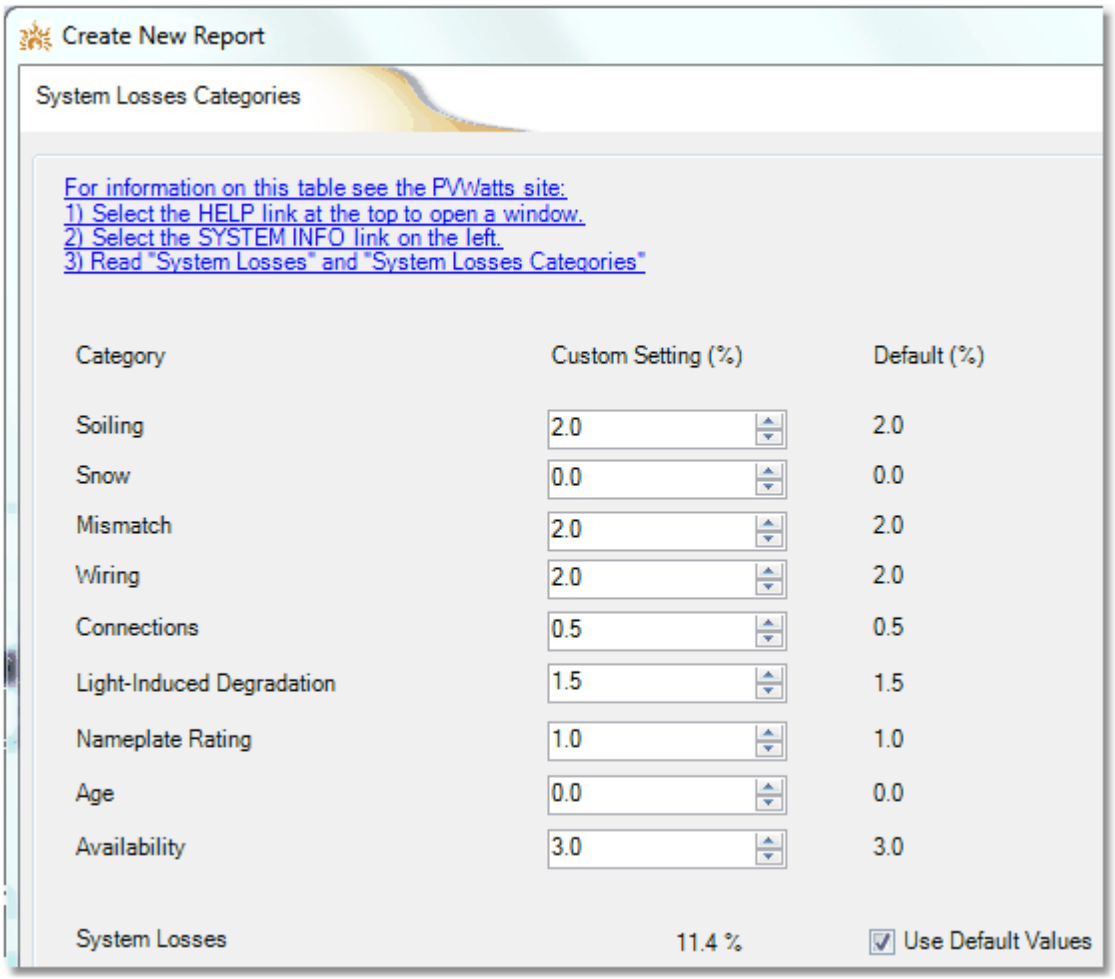
This number is here for documentation in your report but it does not affect any calculations. This software does no string or inverter capacity calculations.

Panel Count

This number is used to calculate the size and production capability of your array.

2.6 System Losses Categories

The system losses account for performance losses you would expect in a real system that are not explicitly calculated by the PVWatts® model equations.



The system losses categories have been defined by NREL(pvwatts.nrel.gov). The main difference in this program is the removal of the shading category since that is taken care of by other parts of this software.

You can adjust the the values of the separate categories and the total System Losses at the bottom of the form will be updated to

reflect the changed categories.

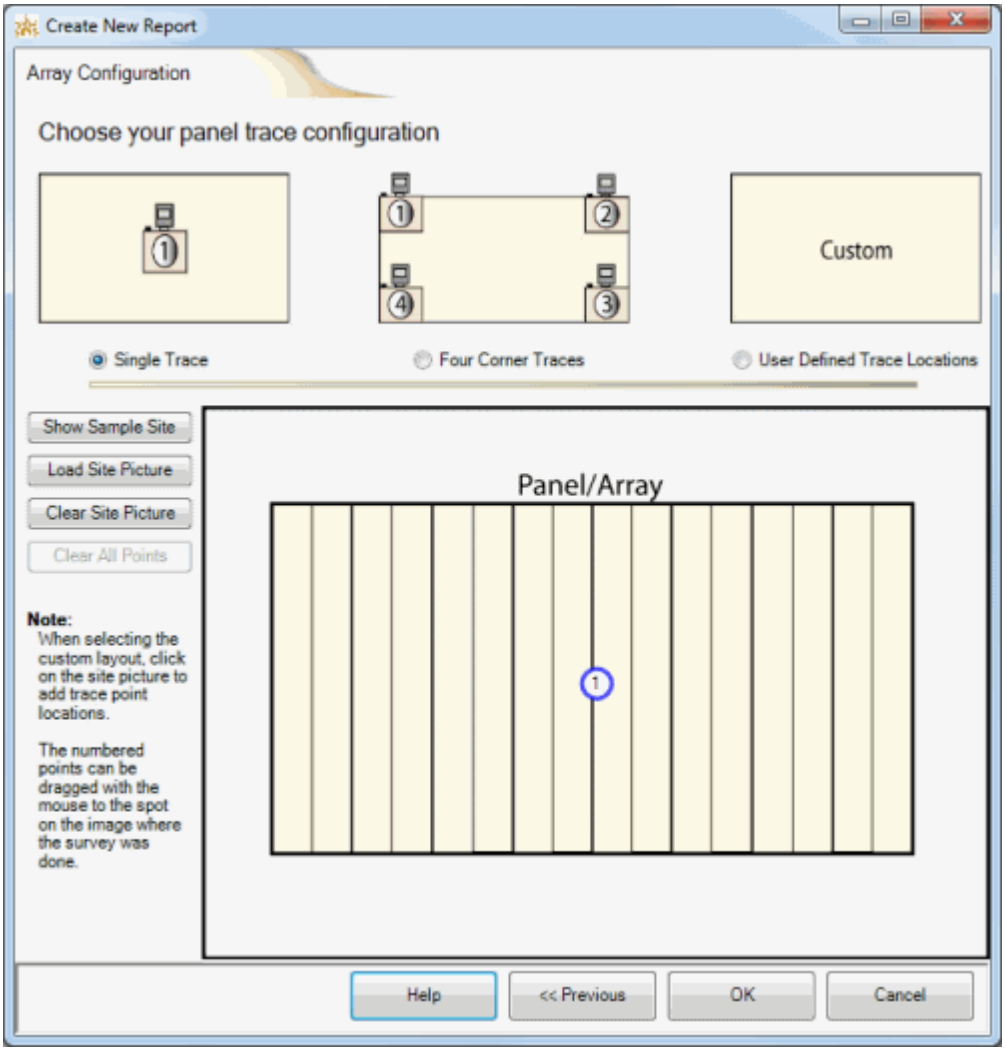
The "Use Default Values" checkbox will reset the custom categories to the default values.

Mismatch is automatically set to zero if you use microinveters or pv optimizers.

2.7 Array Configuration

The last page of the report editor is the Array Configuration page.

Here you log the exact place where each of the analysis photos (traces) were taken. If you are working on a roof mount, you take a picture of the roof and import it here ('Click' "Show Sample Site" button for an example). You can then mark on the photo how many analysis are included in the report. You can insert numbers that will correspond to the different tracings/photos of the dome you will include in your report. This System Picture Layout page is valuable for inspectors or anyone wanting to "duplicate" or verify your report.



Array Configuration

Single Trace or Four Traces

A report contains one or more site analysis photos. With Single Picture, there will be one traced photo in your report. The four corner option will define a report that requires a picture at the four corners of the proposed array. The custom option allows you to define whatever layout points are necessary.

With any of the layout options, you are free to move the point(s) around to suite your configuration. Simply drag the corresponding data point on the array to the position you desire and drop it there.

Custom Layouts

When you choose a custom layout, the array will initially have no layout points assigned. It is up to you to define those points. You must define at least one point, but there is no upper limit to the points you can define. The number of layout points that you define

here must be the same as the number of pictures that you have taken for the array. A layout point is associated with one and only one trace image. We will get to that association shortly.

To add layout points, simply click on the location you would like the point. A new point will be generated and be given a unique number which identifies that layout point. You can move them around by dragging an existing point to its destination and dropping it there. To delete an existing point, either right-click on the offending point or select the point and hit the delete key on the keyboard.

To clear all of the layout points, click the *Clear All Points* button on the left hand side of the form.

Custom Layout Picture

By default, a rectangle with vertical lines is used to represent your array. However, we suggest that you take a picture of the actual site so that your customers have a reference image of where the panel will go. You can load this custom image by clicking on the Load Picture link on the left hand side of the form. Simply navigate to and choose your image from the open file dialog box and the picture will be shown.

Custom Layout Picture

Note that you can use a custom layout picture with a single, four-corner or custom layout chosen. This image, along with the associated layout points will be available for printing the final report for your customers.

The Show Sample button will display the Solar Pathfinder Assistant Sample picture along with four analysis points as shown in the image above. This will give you an idea about how layout points should be placed on a layout picture. Note that the position of layout points on the picture does not affect how solar values are calculated. This is provided as a convenience so that people that read the report can get an idea of panel positioning as well as where each picture was taken.

When you are satisfied with your report, click *OK* to close the report editor.

2.8 Main Report View

After the Report Editor has closed, you will see the title page of your report. At this point, you can save your report, although there are currently no traces associated with your report.

Created Report

At any time you can edit your report settings by choosing File|Edit Current Report 87 from the file menu. However, once you have started adding traces to your report, some report options such as the location cannot be modified without first deleting your traces.

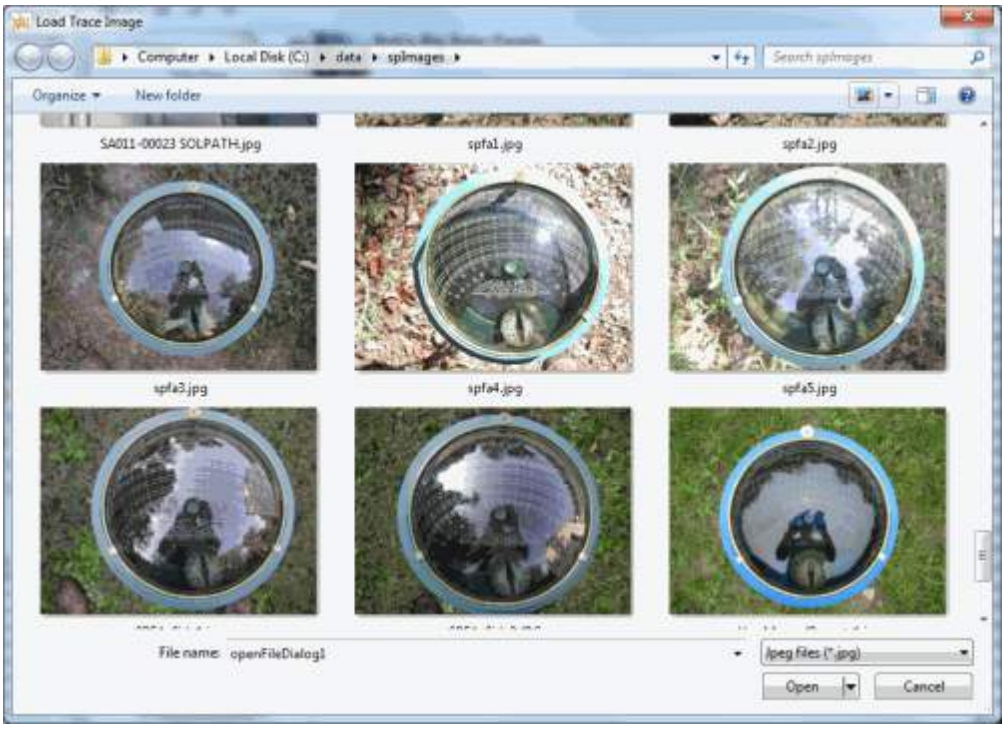
2.9 Create One Or More Traces

One you've entered the report information, you will be ready to enter one or more traces (images). The following steps are needed for each trace:

1. Creating A Trace 27
2. Trace Layout Point Association 28
3. Cropping the Image 31
4. Calibrating the Image 33
5. Fisheye Image Tracing 35 or Rectilinear Image Tracing 48
6. Deciduous Shade Tracing 48
7. Adjust Survey Position 52

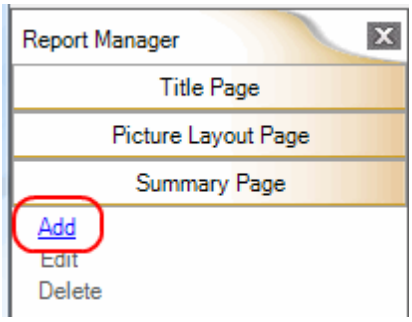
2.9.1 Creating Your First Trace

After you have clicked on the "Create Report" button in the Report Creation Wizard, you will see the "Load Trace Image" dialog box.



Load Trace Image

A second way to get to this input mode is to click the "Add" link on the Report Manager.



Add Image Through the Report Manager

The third way to get here is to choose the Trace|Add 87 Trace menu command.

Select one of the pictures that you took of your SolarPathfinder unit at the analysis site in question. If this is a multi-trace report, you are free to load these traces in any order, although we suggest that you both take and load the pictures in numerical order. Once you have found the file, select it and click "Open".

2.9.2 Trace Layout Point Association

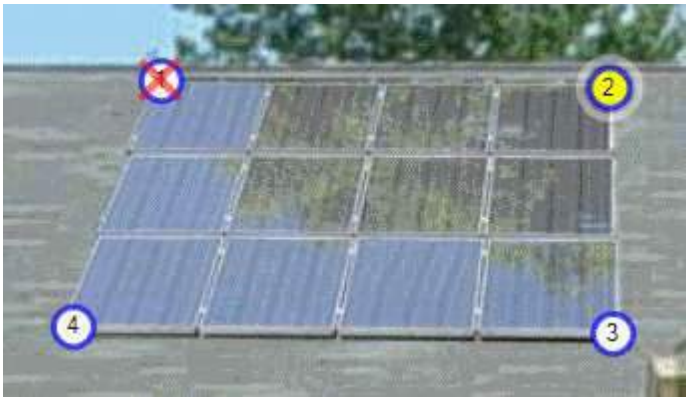
The first page you will see on the Sun Trace Wizard is the Point Association page. You may recognize this as the system layout that you defined when creating your report.

Choosing a point
Each layout point defined in your report must be associated with one and only one trace image. To associate your trace with a layout point, simply click on the layout point on the right hand side of the screen. The selected point will be highlighted.

Layout Point #1 Highlighted

If desired, you can navigate through the points by pressing the tab key to move to the next layout data point. Or, you can simply click on

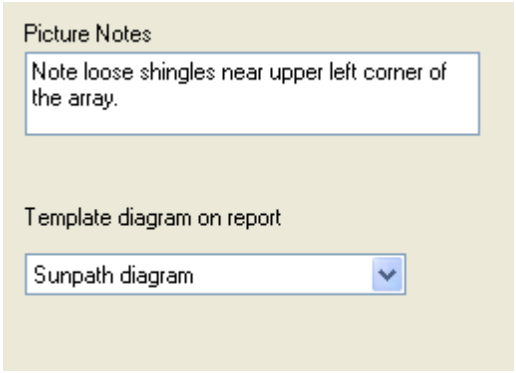
the layout point to use. Note that if there are other traces defined in the report, the associated layout points will not be available for use. Those points that have already been used will be shown with a red "X" through them as shown below.



Layout Point #1 Already Used

Picture Notes

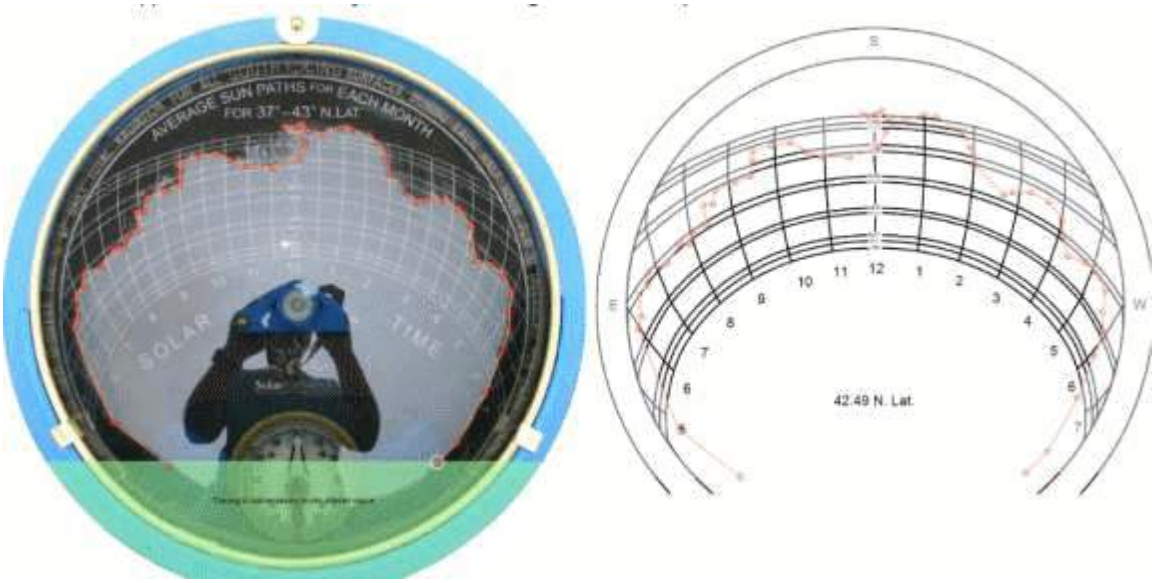
Any information you provide here will apply only to this particular trace and the text will appear on this trace's report page.



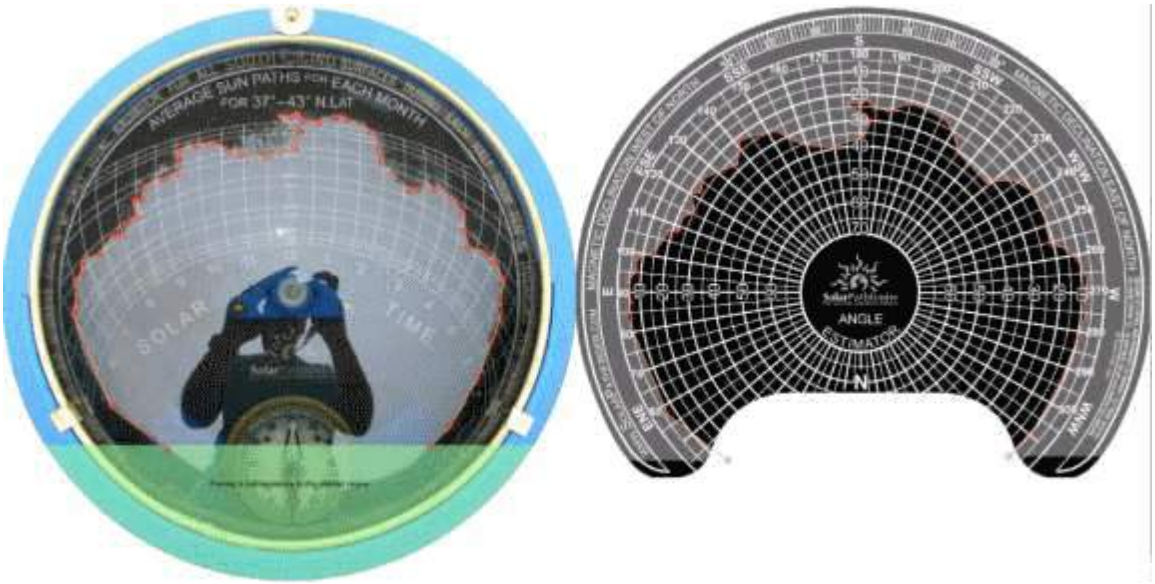
Picture Notes

Template Diagram on Report

The last option on this wizard page determines which stock template will appear on the final report. If "Sunpath diagram" is chosen, the report will contain a SolarPathfinder Sun Trace diagram for your exact location. If "Angle Estimator diagram" is chosen, the report will contain an angle estimator diagram. Note that in both cases, both the sun trace data columns will be shown on the report. This option simply determines which stock template image will be shown.



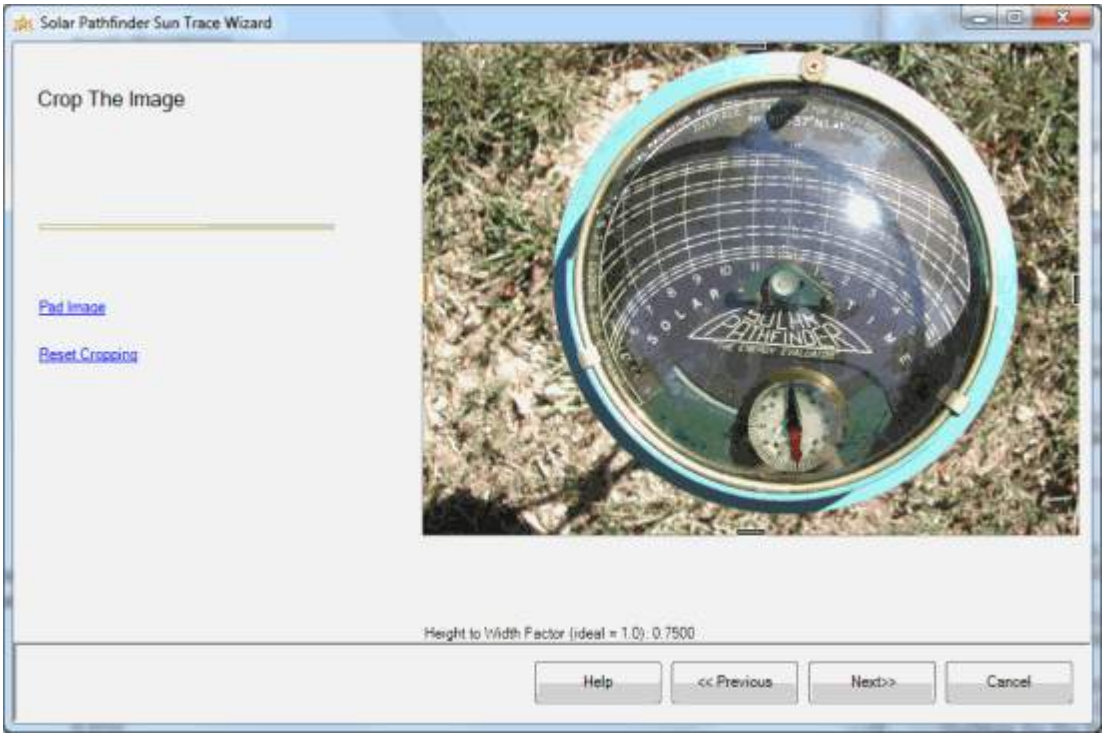
Final Report With SunPath Diagram



Final Report With Angle Estimator Diagram

Once you have completed this page click *Next* at the bottom of the form.

2.9.3 Cropping The Image



Uncropped Image

The application uses the cropping set to determine where your Pathfinder is in the image and how much skew has been introduced. It is very important to set these crop points as accurately as possible.

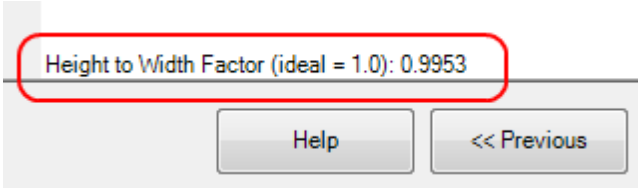
There are four crop handles (left, top, right, bottom). These handles should be dragged so that the translucent box frames the outside of the plastic Pathfinder housing.

Bad Crop #1 (leaves too much space outside the blue ring)

Bad Crop #2 (cuts off part of the blue ring)

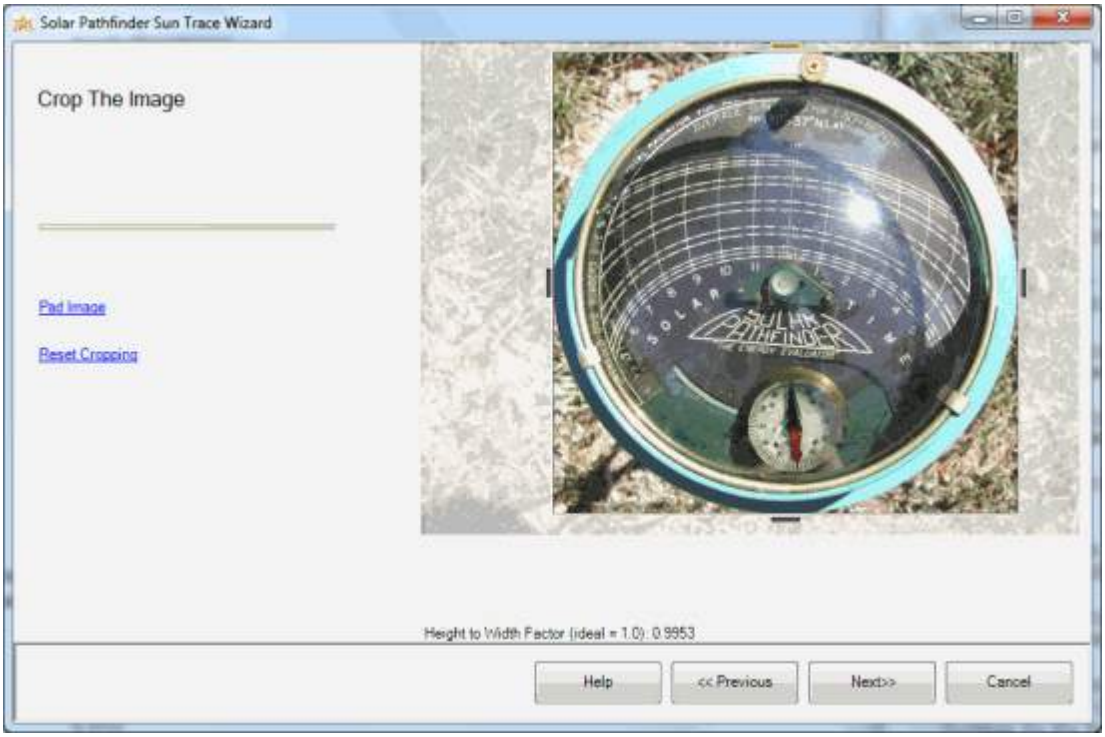
Good Crop

Once you have set your crop handles, you can determine your image skew by examining the "Height to Width Factor" on the bottom left of the cropping control.



Height to Width Factor

If there is no skew, the height to width factor will be 1.0, meaning that the Pathfinder is a perfect circle. Once you are within 0.99, do not attempt to adjust the cropping handles further to fix this. The software will adjust the picture to correct for this skew.



Cropped Image

After the crop handles have been set to your satisfaction, click the "Next" button to continue. This will take you to image calibration.

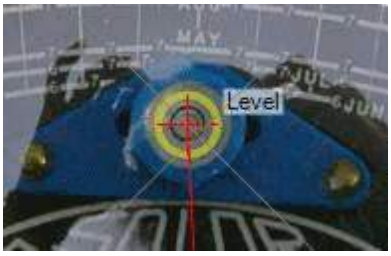
If you try to skip cropping, you will be notified that doing so is not recommended.

Pad Image Link
Possibly you have taken a picture that is missing a portion of the pathfinder, such as the bottom of the image. Using the pad image link you can simulate cropping to the "outer edge of the blue frame. Adding space will allow the image to be cropped as if the whole picture were present. However this is only an estimate for your convenience, to be used to continue the analysis. Your best course of action would be to go out to the field again and take new pictures.

2.9.4 Calibrating The Image

In order to properly analyze the Pathfinder image, the application needs you to indicate the position of the level its relationship to the North/South line.

Using your mouse, click and drag the reference point marked as "Level" to the center of the level. Click and drag the reference point marked as "Below Compass" so that the red line passes directly through the North/South lines on the compass.



Level Reference Point

Below-Compass Reference Point

The "below compass" line will always remain at a fixed distance from the level point. If you are using the keyboard to move the "below compass" marker, the up and right arrow keys will move the point counter-clockwise whereas the down and left arrow keys will move the point clockwise around the image. If you do not set either the level or compass reference points, you will be notified of your infraction with a dialog box.

You can bypass the setting of reference points if by some slight chance the picture was taken so perfectly that everything lines up by default, but most likely that is not the case. The reference point locations are crucial to the proper analysis of you image. It is recommended that you click "No" and set your reference points properly.

You will notice that there are gray lines drawn diagonally across the picture. The intersection of these lines gives a visual indication as to where the level should be. If the center of the level is offset from this, this indicates that parallax was introduced into the picture. If this difference is significant, it can have adverse effects on the outcome. The software will make a reasonable effort to try to correct this discrepancy. If the error is too great, you will be notified of this with a dialog box.

Should you need to reset the reference points to their default location, click the "Reset Reference Points" link on the bottom left of the form.

The closer you get these reference points to the indicated position, the more accurate the resulting analysis will be.

Both Reference Points in Context

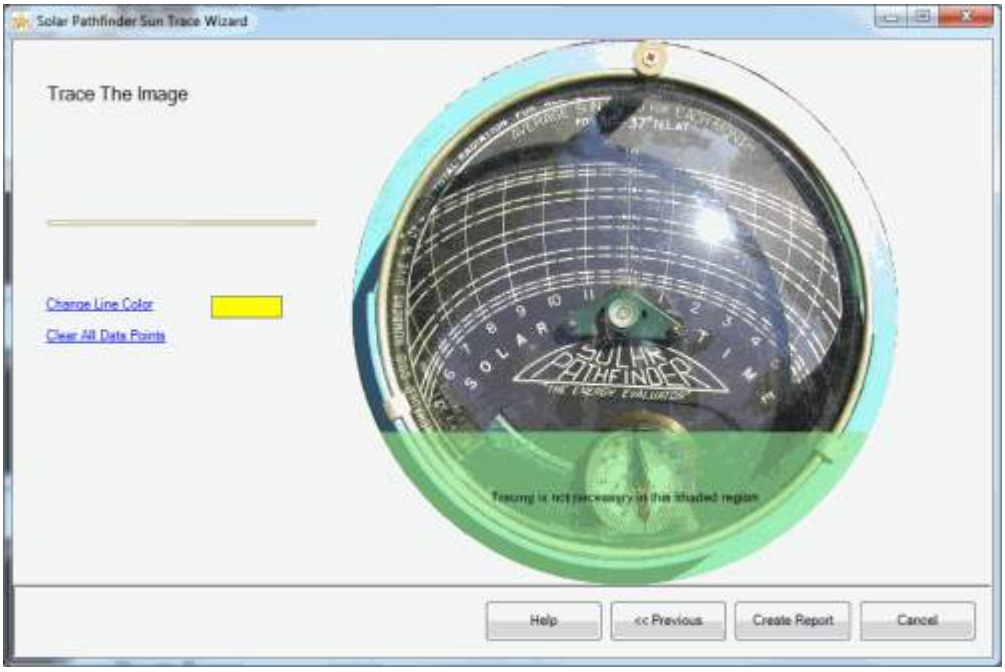
Once you have properly set the reference points, click the "Next" button to continue.

2.9.5 Fisheye Image Tracing

This page discusses tracing on the Fisheye Image. If you've unrolled the image into a landscape panorama then you'll want to read the Rectilinear Image Tracing 48 page.

After the image has been calibrated, the application can properly size and rotate the image as well as remove extraneous information from

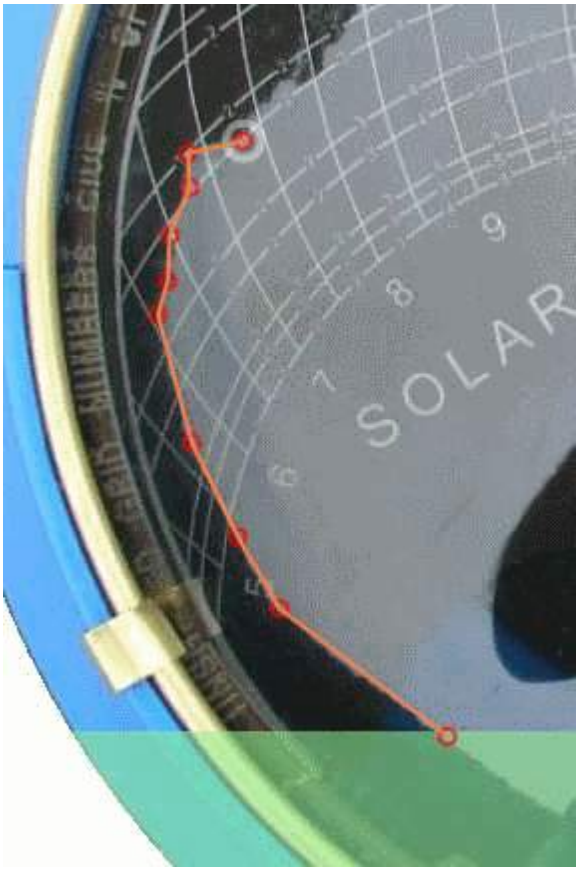
the picture. Note that in addition to rotating the image based on level and compass location, the application also applies rotation due to magnetic declination at this point. The next wizard page shows the modified picture and asks you to trace the reflection.



Fisheye Image Tracing Page

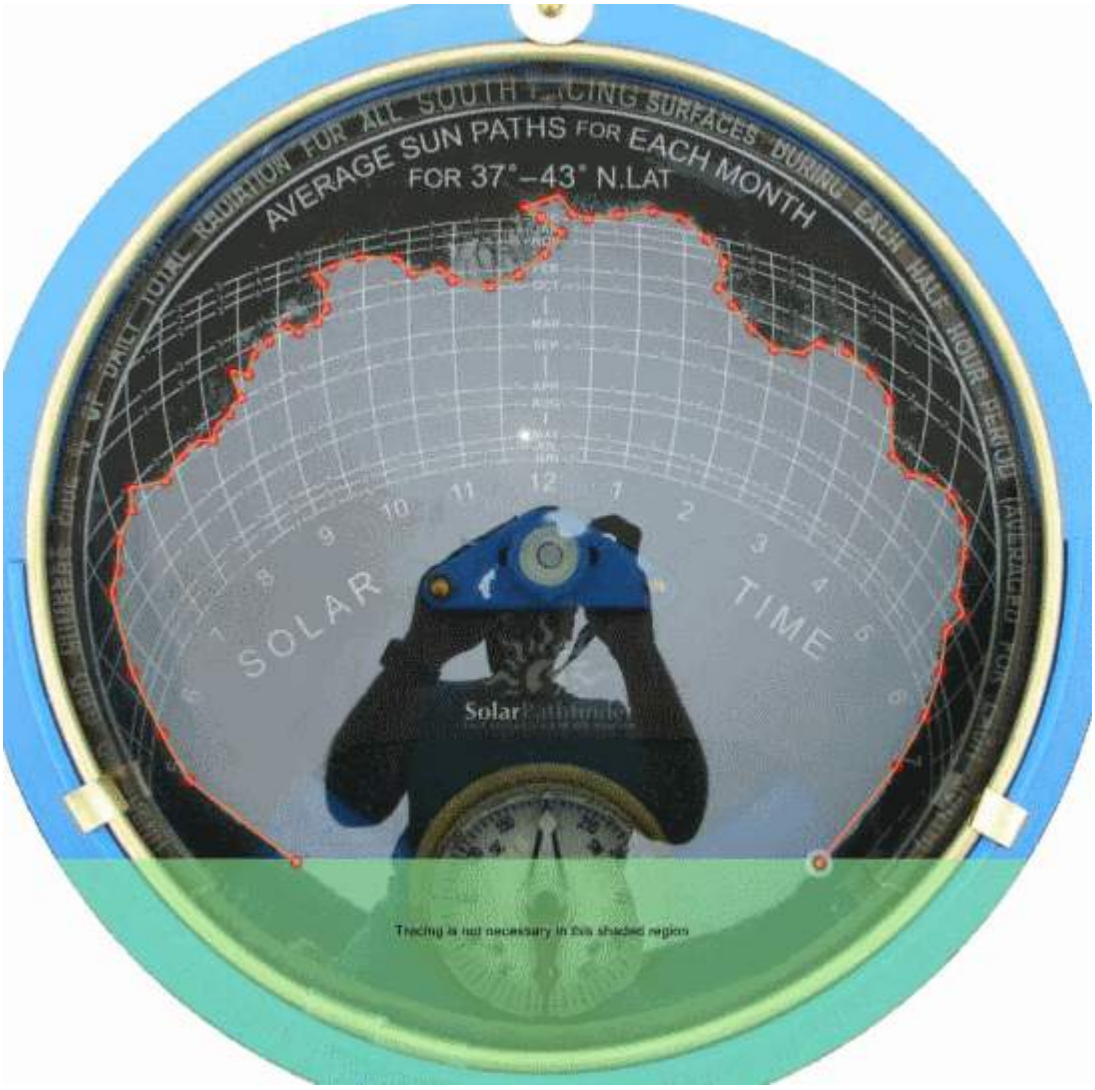
A section of the image will have a translucent overlay that indicates that tracing is not necessary in this region.

To trace the obstruction curve, use your mouse to click along the horizon points. You must start at the left and move to the right side. Starting in the middle or right will produce an unworkable trace. As you add data points, the application will automatically connect the points to define your obstruction curve.



Adding Trace Points

Continue adding data points until the obstruction has been fully traced.



Traced Image

If you need to move some of the data points, simply click and drag the offending data point and move it to the new location. To delete a data point, right click on the offending data point. To insert a data point between two existing points, hold down the Ctrl key on the keyboard and click the line between two data points. This will insert a new data point between them.

The control also responds to keyboard input. The "selected" data point will have a translucent circle around it. To change which data point is selected, press the tab key (or shift-tab to go backwards through the list). To move a data point, use the arrow keys on the keyboard. To move it more quickly, hold down the shift key while pressing the arrow key. To delete a data point, press the delete key.

Should it be necessary, you can click the "Clear All Data Points" link

on the bottom left of the form to clear all current data points.

Changing the Line Color

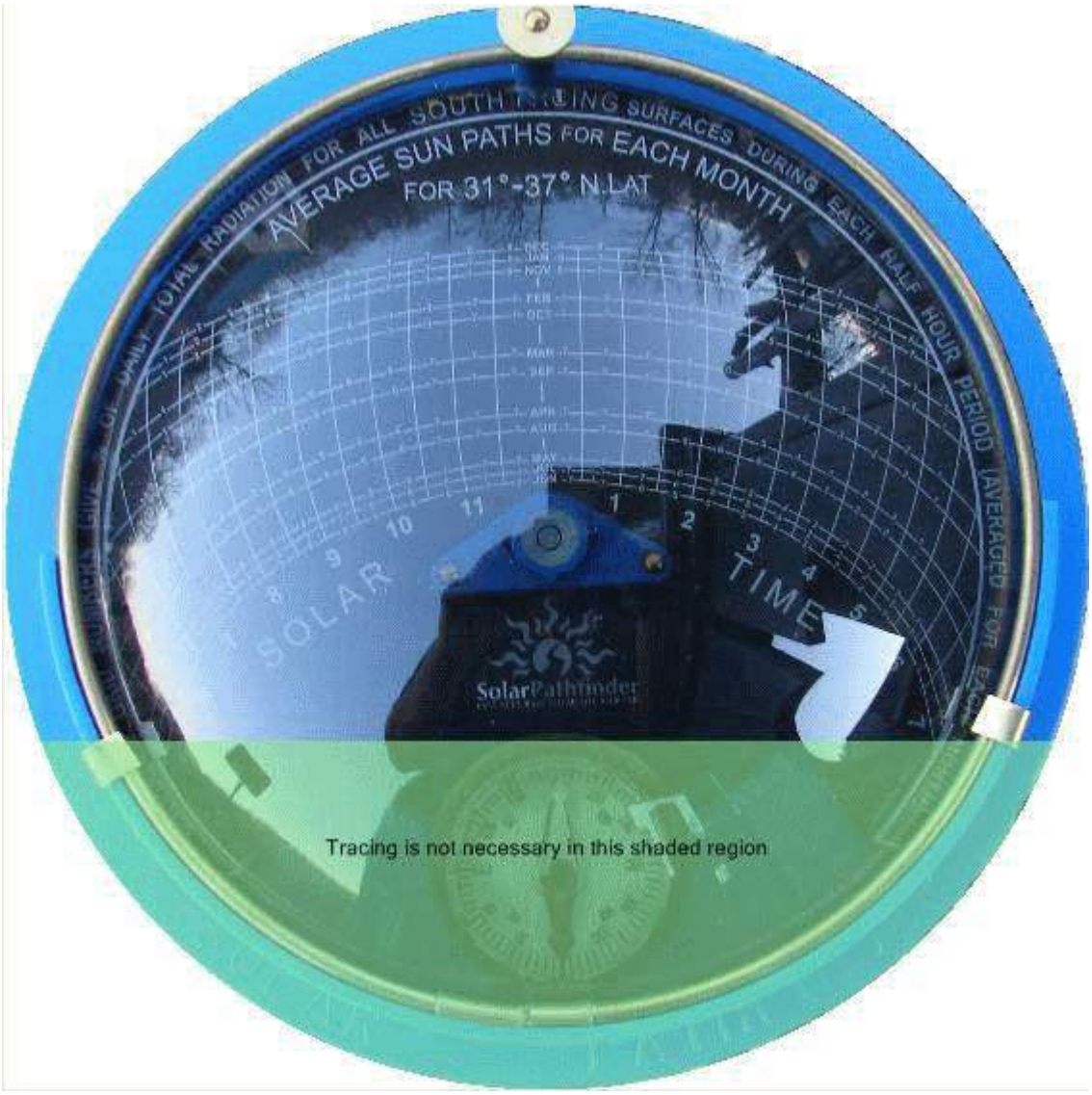
You also have the option of setting the color of the line that is used to connect trace data points.

Change Line Color

Simply click the Change Line Color link at the bottom left of the form and choose your desired color.

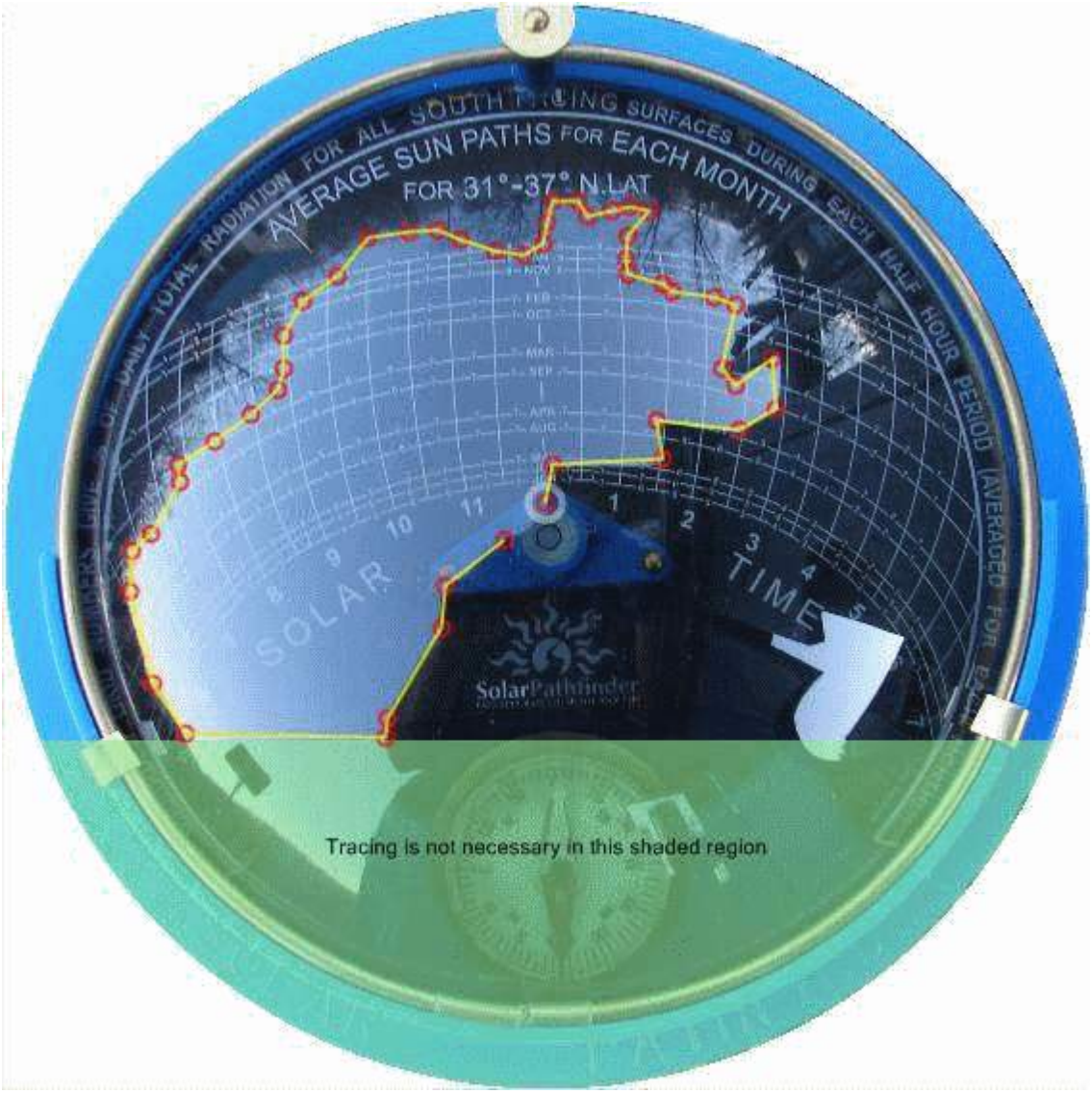
Some important tips regarding tracing

In order to get good and accurate traces, there are a couple of things that you need to keep in mind. Let's look at an example.



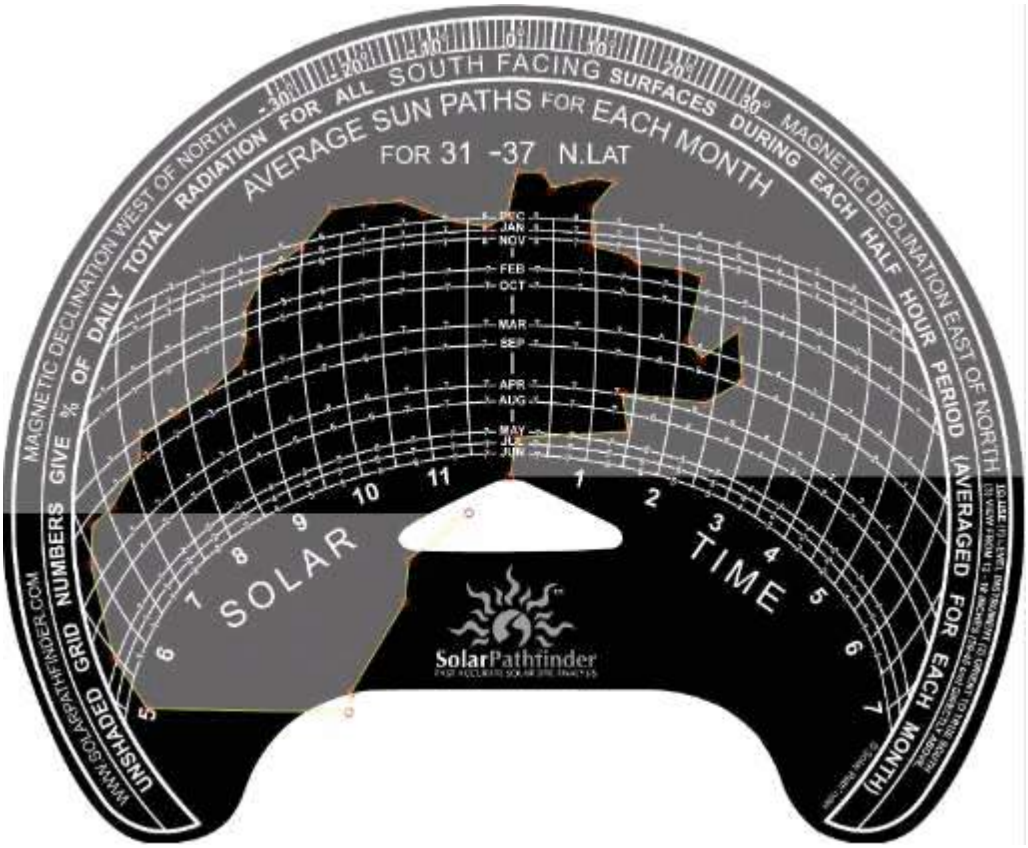
Obstructions

Say you have an obstruction in the middle of the image. You might be tempted to trace it like this:



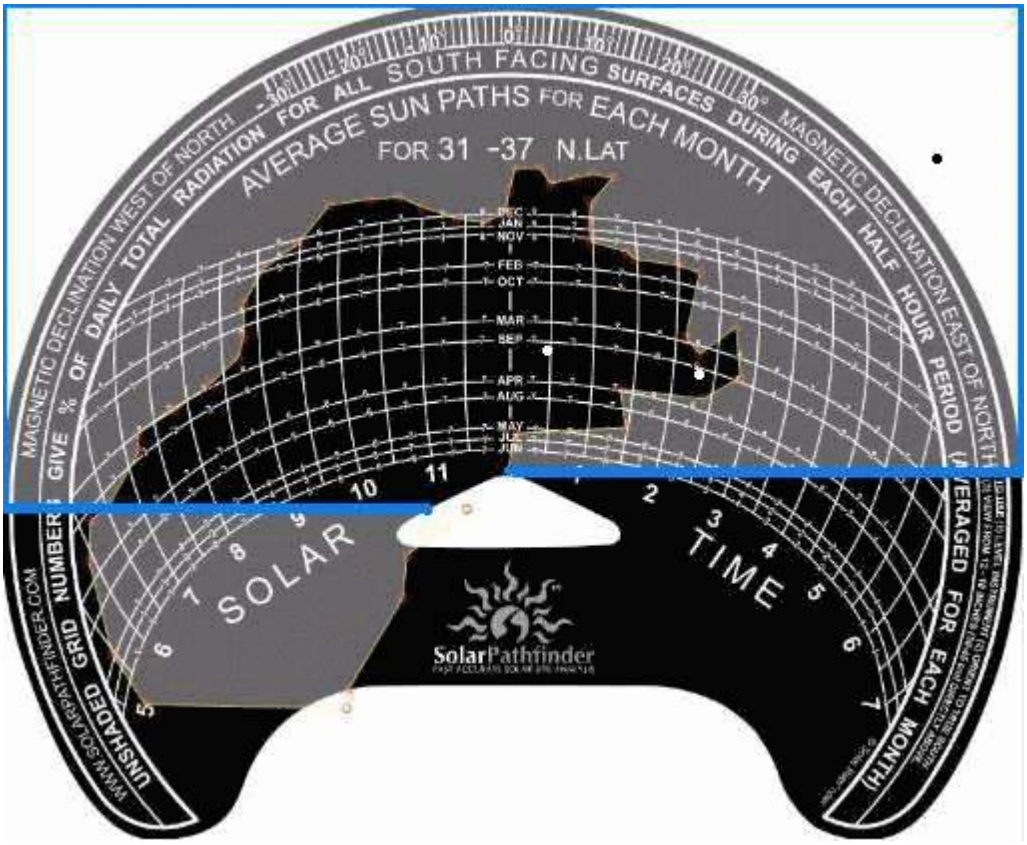
Incorrect Tracing

The problem is that this will give you inaccurate results. Why? Well the reason isn't obvious at first. Let's look at the resulting trace.



Resulting Templage Due to Incorrect Tracing

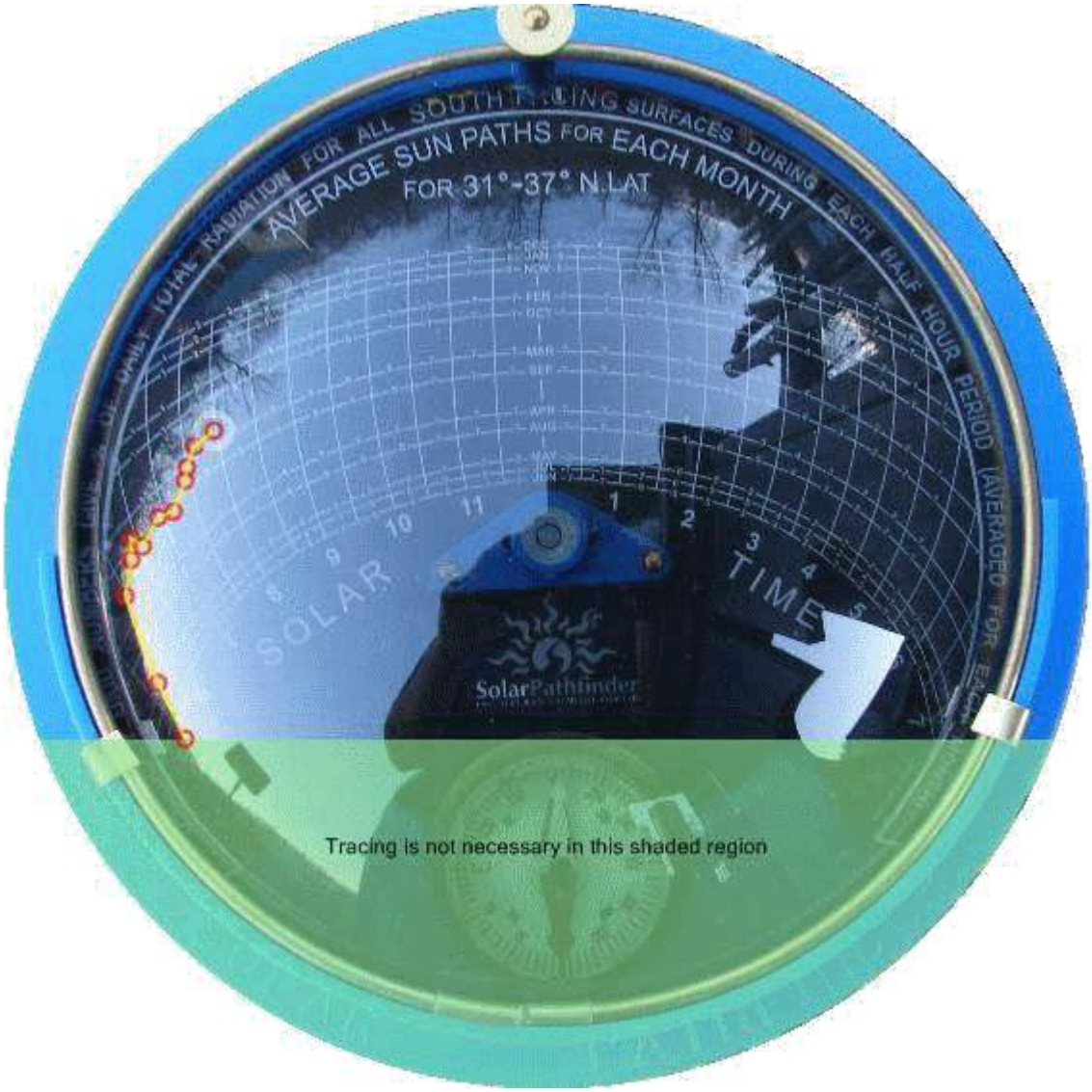
Remember how we stated that the areas that the software considers obstructed are filled with a semi-transparent white color? With that in mind we can see a problem: The morning hours (5-9) for Jun to Apr should NOT be obstructed, but they partially are. How did this happen? The software has to determine what the region is that you are trying to obstruct. In order to do this, the system takes the trace that you drew and adds a couple of points to define a closed region.



The Closed Region

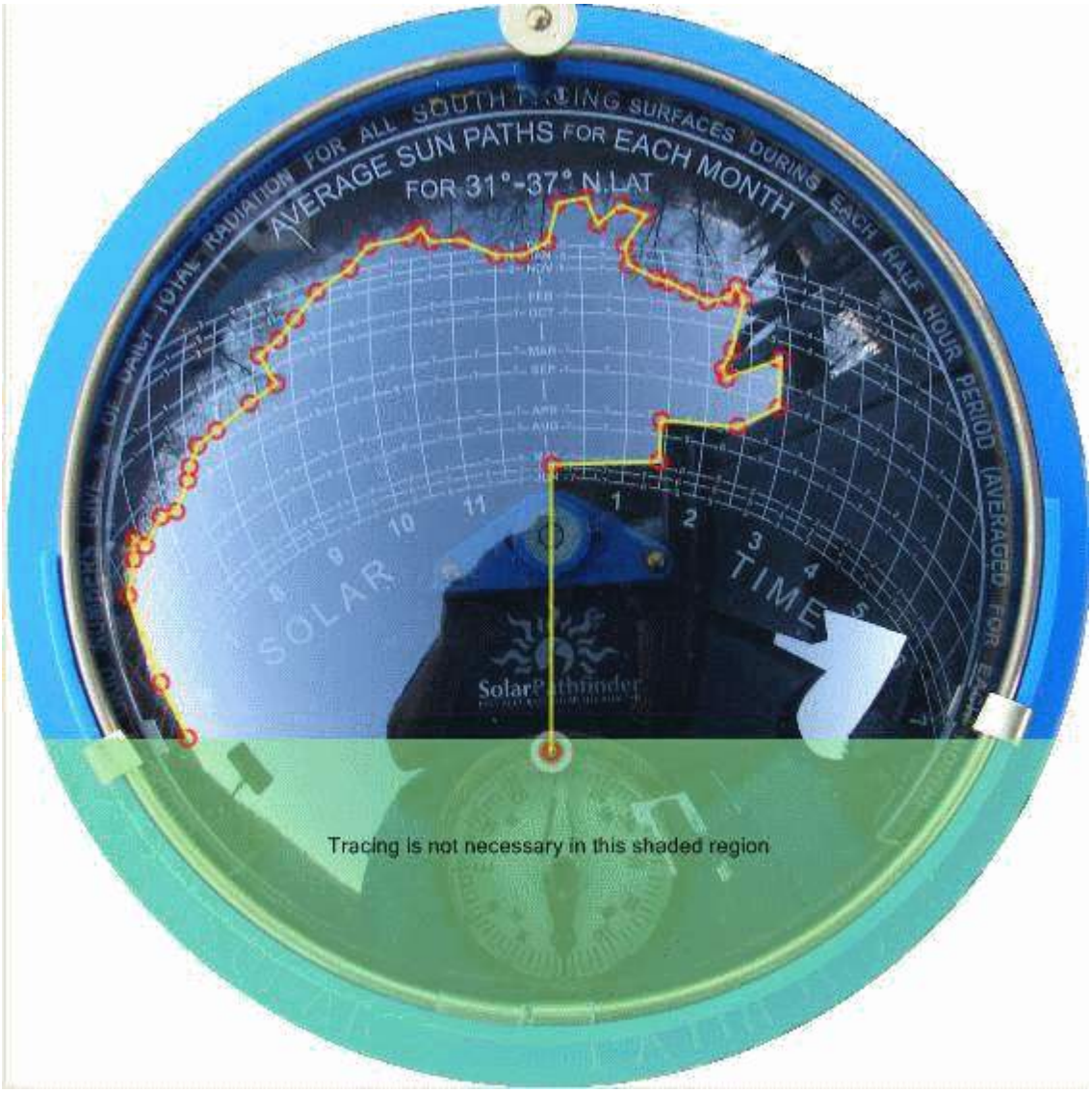
It takes the first data point and draws a straight line to the left. It takes the last data point and draws a straight line to the right.. The issue is that when your beginning point of the trace crosses over lower data points, the software has no idea whether the crossed region should be obstructed or not. The same is true if data points to the right of the endpoint are lower than the end point.

So how should we trace this image? First, we should always start on the left hand side. Realizing that the first and last data point help us define a box, it should stand to reason that the other data points can really go wherever they like within the box as long as they don't cross. Our first data point needs to be the lowest point on the left hand side of the image. Note that obstructions below the sun trace curves on the diagram have no bearing on the analysis results.



Tracing the Right Way

Notice that we started on the left hand side. This point must be lowest than any point that will appear to the left of it. After choosing this point, start tracing around.



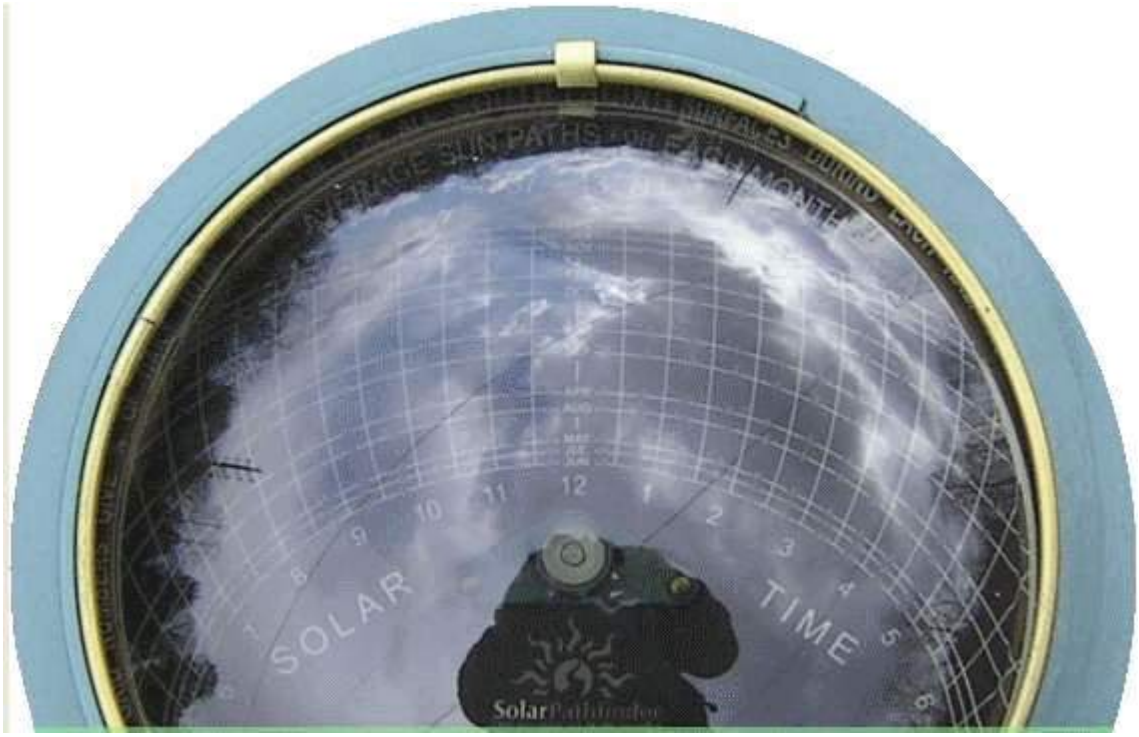
Completed Correct Tracing

Notice, that at the end, I added a final data point that is lower than any data point to its right. Oddly enough, I didn't follow the obstruction as I went down. The reason for this is that the obstruction is below the sun path curves and therefore has no bearing on the final report data.

Keep these points in mind as you trace:

1. The finish point must be to the right of the starting point.
2. Traces can never cross
3. The starting point must be lower than any other point to the left of it.
4. The ending point must be lower than any other point to the right of it.

Let's look at another example.



Another Tracing Example

In this example consider the case if the trees to the right were removed. Our first obstruction then is around 6 am in June. Based on rule#3, our first point must be lower than any other point that is to the left of it. But there are no points to the left of it, so we pass that rule. And our finish point is to the right of the first point as well as being lower than any point to the right of it. There are no further points to the right of it after 3 pm. Notice that the trace turned out fine.

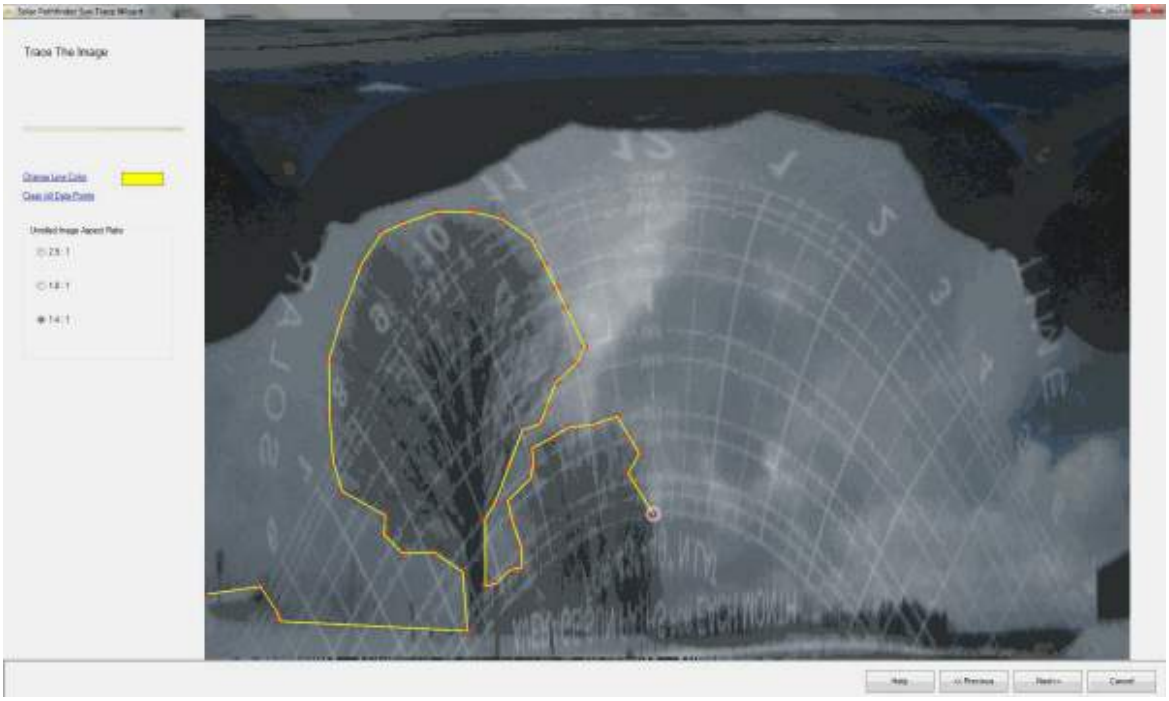
Correct Tracing

Now, suppose that the trees to the right were not removed. The thing of interest for us is that there is a "blank" after 3 pm until about 4:30 pm. In such a place, I can go along the outer rim until I get to the next obstruction.

"Dead" Space Between Obstructions

With these four rules you should be able to generate a good trace at all times. Once you are satisfied with the trace, click the "Create Report" button. You will be returned to the main form.

2.9.6 Rectilinear Image Tracing



Rectilinear Image Tracing Page

You have 3 options for the image aspect ratio, pick the one that maximizes your screen area. The 1.4 to 1 ratio should give you the best results.

The "Trace the Image" page shows the trace image in a "rolled-out" panoramic view as opposed to the traditionally round "fish-eye" panoramic view of previous versions of the SolarPathfinder Assistant software. Starting from left to right, trace (by "left-clicking") the outlines of shading with your mouse. Trace the horizon all the way to the right.

2.9.7 Deciduous Shade Tracing

This is an optional step to be used as you see fit:

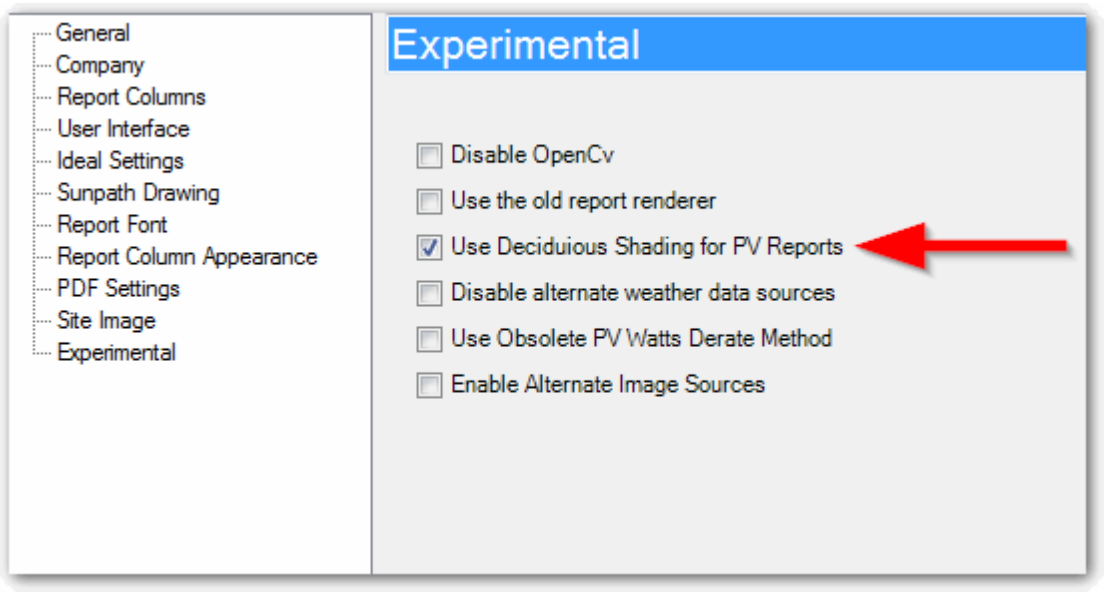
Introduction
All report types can take advantage of deciduous shade tracing.

Ecological reports benefit from calculating deciduous shade because many plants still grow well in the reduced sunlight filtering through bare branches.

Likewise, hot water collectors are able to generate a reasonable amount of solar heat during the winter months. Taking into account

deciduous trees that have dropped their leaves, will increase the estimate of the amount of solar radiation striking the collectors.

Calculating deciduous shading for Photovoltaic (PV) reports is questionable because of the nature of PV technology. PV cells do not generate power in a linear manner, and merely reducing the sunlight by 40% will cause a much greater decrease in power production. However, deciduous shade tracing is still available for PV to be used at your discretion. To enable this feature for PV reports, enable this feature in the experimental options[117]:



Creating a Deciduous Area

This screen enables you to outline the leafy areas of deciduous trees. You may create as many of these deciduous areas as you need. As a default, all deciduous areas will be calculated as receiving 50% of the available solar radiation from the months of October through March in the northern hemisphere, and during the months of April through September in the southern hemisphere. You can modify these calculation defaults as discussed below.

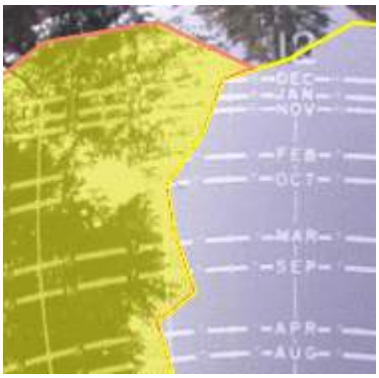
Create the deciduous area polygon by clicking the mouse down at selected points immediately outside of the deciduous tree. The tracing is much like what you did to outline the obstruction curve, except that the deciduous area must be a fully enclosed polygon. This means that the final point must be the same as the starting point. When you select the final point, the polygon will close and the tracer will allow you to start another polygon.

Only those parts of the deciduous polygon inside the obstruction region will count towards the deciduous area calculation. Those

portions of the deciduous polygon that overlap the obstruction curve will be clipped at the obstruction curve once you close the polygon.

When a deciduous polygon overlaps with one or more other deciduous polygons, the shade calculations for the overlapping areas is only performed once.

The currently selected area will have a border. The example image below shows a deciduous area surrounded by a red border. The red border signifies that an area is selected. The interior of the area is filled with a transparent yellow shade.

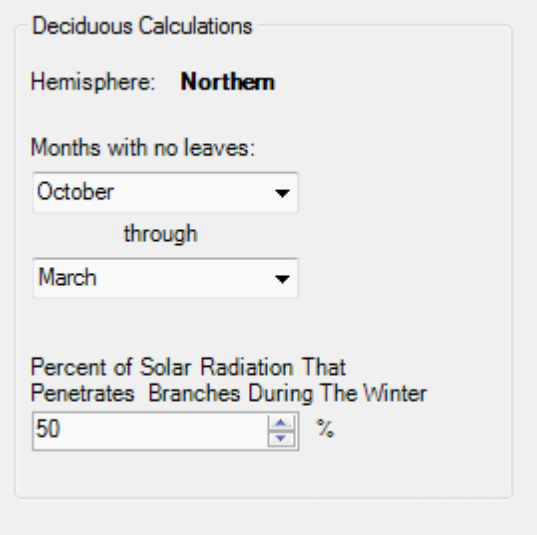


Deciduous Area as a Polygon

Keys Available for Use in Deciduous Mode

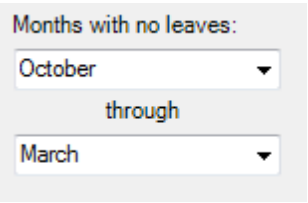
- Delete - if the deciduous area is selected (surrounded by a red border), hitting the delete key will erase this deciduous area.
- Left Mouse Button - (1) starts a new deciduous area, or (2) select another point of the area currently being outlined, or (3) select an existing deciduous area by clicking anywhere inside of it.
- Right Mouse Button - while creating a deciduous area, clicking the right mouse button will delete the last point created.
- Esc - deletes the area currently being drawn
- Tab - if there are multiple deciduous areas, this key will select the next area

Defaults for Deciduous Calculations



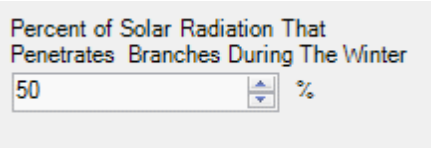
Default Deciduous Calculations

The defaults should work well in most cases. But, if you have a unique situation, you can change the length of time where there are no leaves in the deciduous area and the amount of sun that gets through the branches. The calculation applies to all deciduous areas so if you have trees that drop their leaves at different times, you'll need to pick a range that covers all trees.



Range of Months With No Leaves

The drop down boxes above enable you to select the range of months where there are no leaves at your survey site. You can only select whole months. This example shows the default of October through March for the Northern Hemisphere. In the Southern Hemisphere, the default would be April through September.



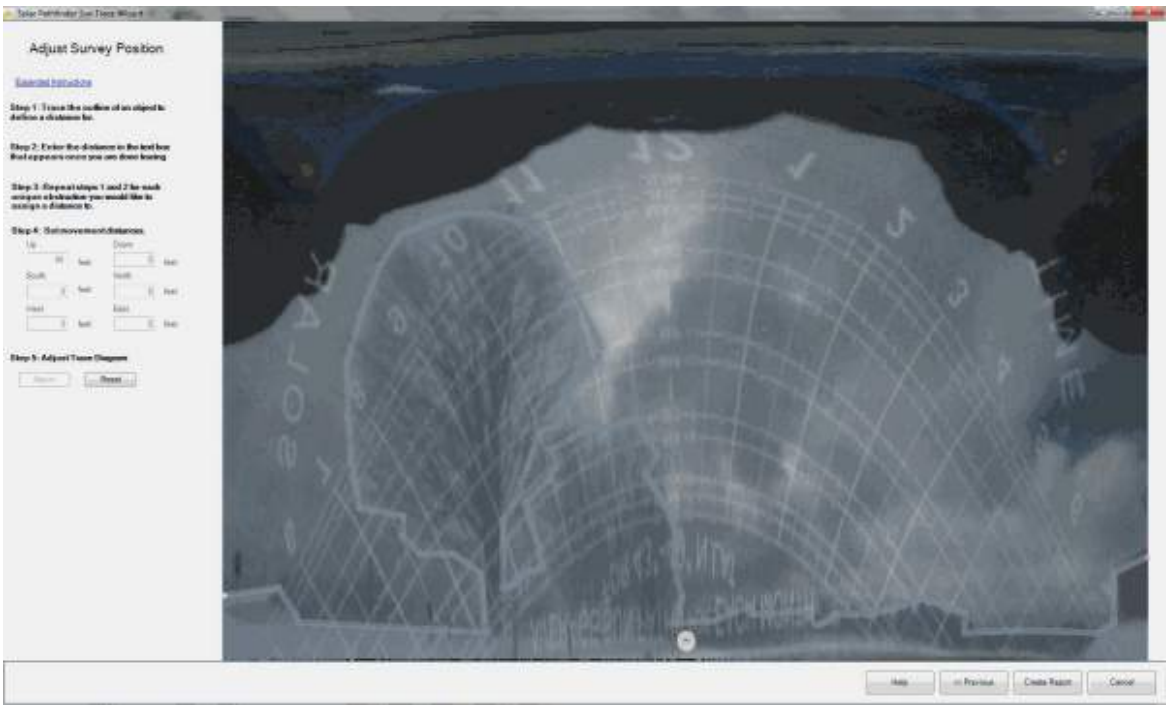
Transparency Through The Bare Branches

The transparency settings are whole integers, from 1 to 99, that represent the percent of available light through the bare branches. We don't support a fractional precision such as 55.5% because it

would only have a minuscule effect on the result. A setting of 0% means that no sun will get through at all, and a setting of 100% means that the tree never creates any shade. Since either of these settings imply that you don't need deciduous areas, allowable values are from 1 to 99.

2.9.8 Adjust Survey Position

This is an optional step to be used as you see fit:

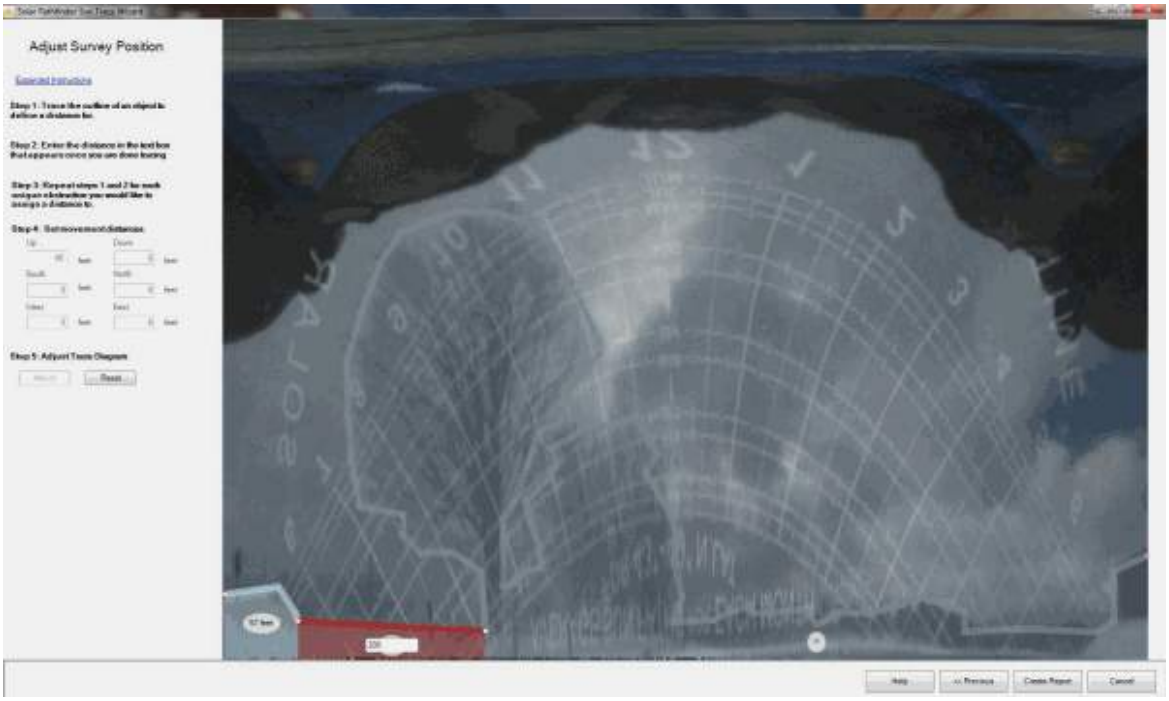


Adjust Survey Position Page

You will only see this page if the Unroll Site Image checkbox is selected in the Site Image Options 116 screen.

If you don't want to climb up on the roof, or even if you don't have a roof to climb up on yet, these adjustments enable you to mathematically model shade many feet removed from the survey location.

To skip this adjustment, merely click on the Create Report button at the bottom right of this form.



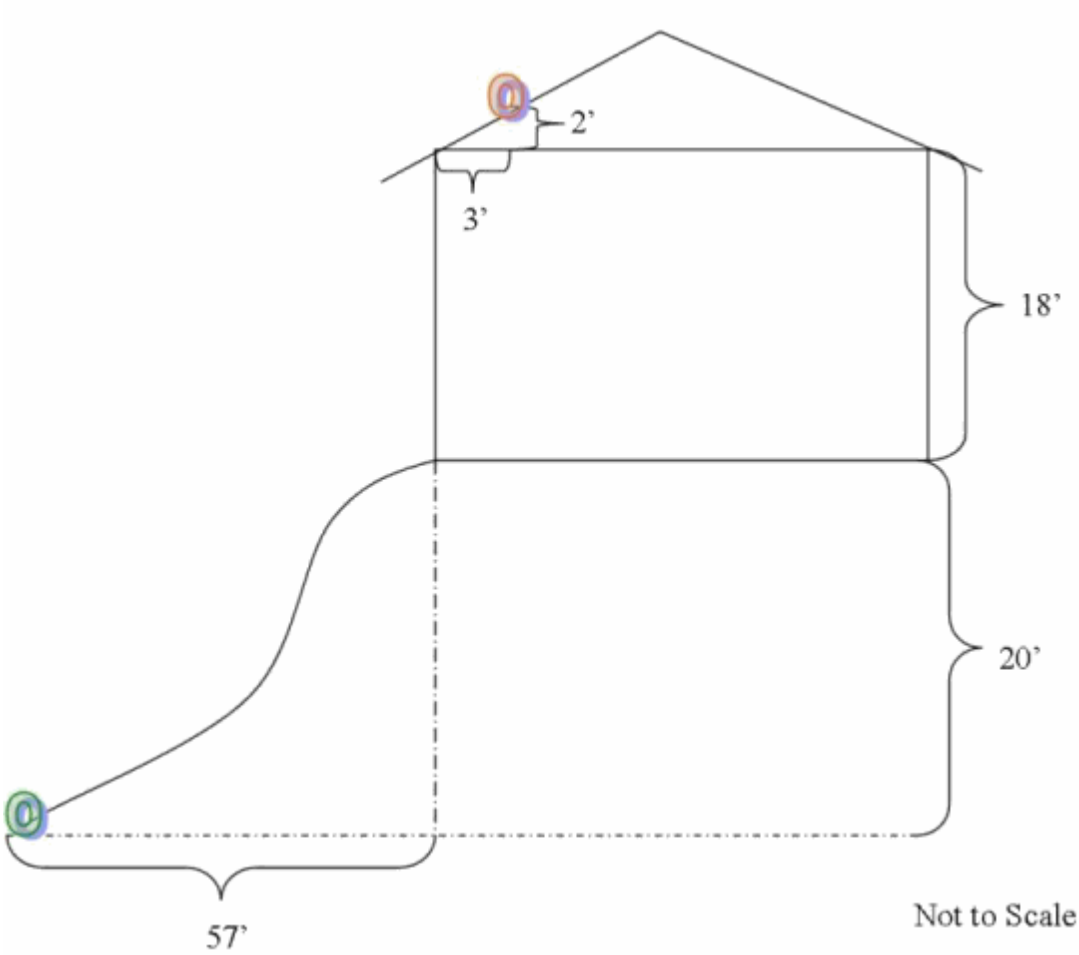
Outline the Individual Obstruction Objects

Enter Distance Regions (Steps 1 to 3)

Use the "pencil"/cursor to outline each object (individually) by holding down the left mouse button and "drawing" around each "pre-outlined" shaded object. Once you have delineated an object and released the left mouse button, the software will highlight that object and prompt you to input the distance that the object is from the SolarPathfinder unit. Each of the objects will be highlighted in a different color. Continue to mark and give the distance to each object.

Enter Movement Distances (Step 4)

Below is an example of how to calculate the movement distances.



Sketch of Movement Distances

The SolarPathfinder unit in the above sketch is located at the bottom of a hill that is 20' lower than the building upon which the array is to be placed. The building is 18' high. The point that the new trace is to be projected is up the roof 2 more feet above that. Therefore, the total height adjustment is 40 feet. That number is placed in the "Up" input box on the left side of this page (under "Step 4" above).

The horizontal distance that the "point of projection" for the new trace (on top of roof in example above) is from the Solar Pathfinder unit is input in the appropriate directional box [i.e. North, South, East, or West]. In the above sketch, this equals 57' from the unit to the building and 3' from the side of the building up the roof. In our example, the "point of projection" for the new trace is due North of the Solar Pathfinder unit. Therefore, the "60" should be put in the "North" box.

NOTE: *Your measurement work will be easier if you only move the unit along the East/West or North/South axis.*

Adjust Button (Step 5)

Clicking on the Adjust button will recalculate the shading diagram based on the adjustments you entered in Step 2. The Reset button will undo any position adjustments you have made.

When you are done, click the Create Report button.

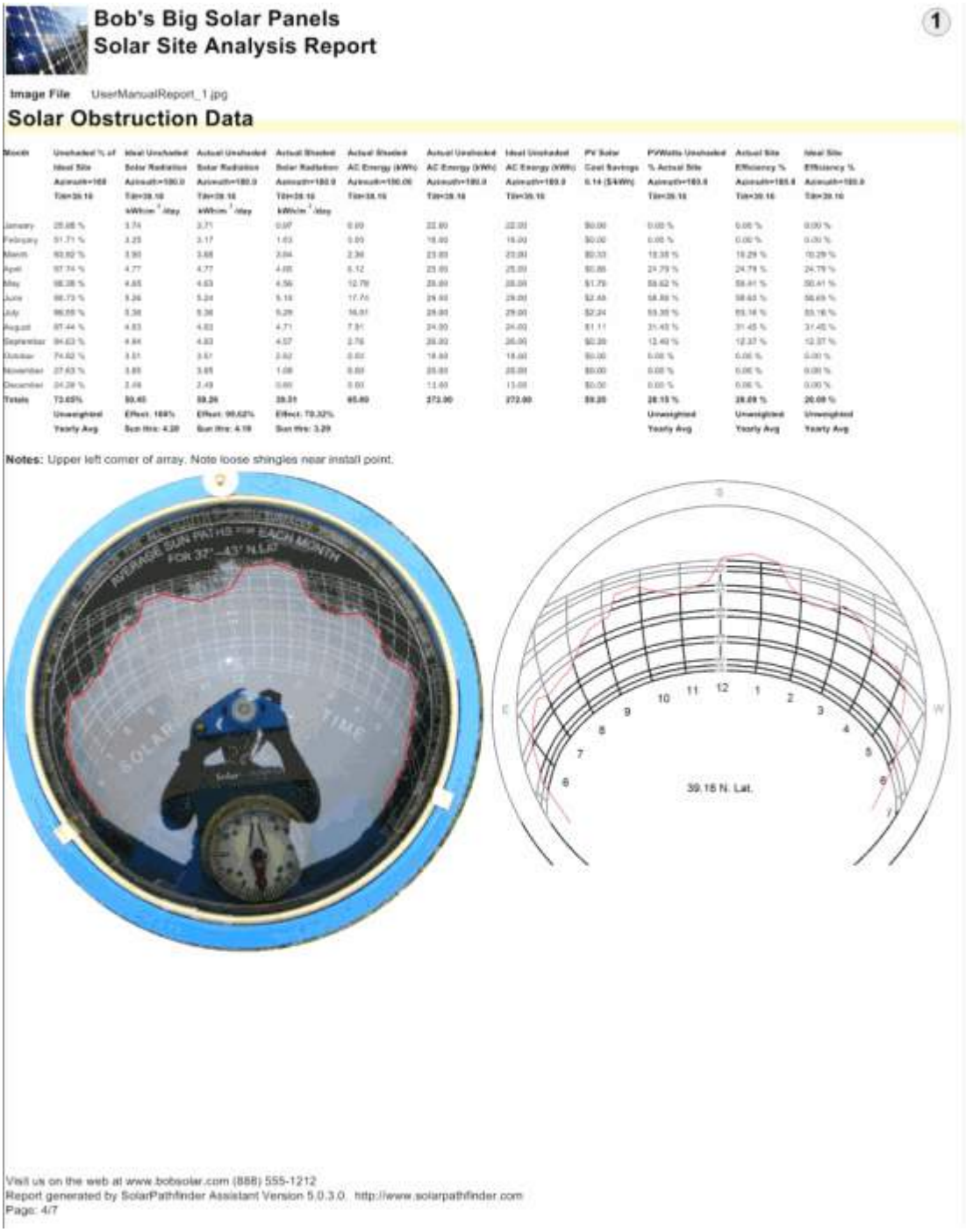
3 Manage A Report

There are various things you can do with an open report:

3.1 Manipulate Your Report

Report Display Size

If the report text size is too small, you can change the zoom factor in the view menu 91.



Bob's Big Solar Panels
Solar Site Analysis Report

1

Image File UserManualReport_1.jpg

Solar Obstruction Data

Month	Unshaded % of Ideal Site Azimuth=180 Tilt=39.15	Ideal Unshaded Solar Radiation Azimuth=180.0 Tilt=39.15 kWh/m²/day	Actual Unshaded Solar Radiation Azimuth=180.0 Tilt=39.15 kWh/m²/day	Actual Shaded Solar Radiation Azimuth=180.0 Tilt=39.15 kWh/m²/day	Actual Shaded AC Energy (kWh) Azimuth=180.00 Tilt=39.15	Actual Unshaded AC Energy (kWh) Azimuth=180.0 Tilt=39.15	Ideal Unshaded AC Energy (kWh) Azimuth=180.0 Tilt=39.15	PV Solar Cost Savings 0.14 ($/kWh)	PVWatts Unshaded % Actual Site Azimuth=180.0 Tilt=39.15	Actual Site Efficiency % Azimuth=180.0 Tilt=39.15	Ideal Site Efficiency % Azimuth=180.0 Tilt=39.15
January	25.68 %	3.74	3.71	0.97	0.00	22.00	22.00	$0.00	0.00 %	0.00 %	0.00 %
February	51.71 %	3.25	3.17	1.63	0.00	18.00	18.00	$0.00	0.00 %	0.00 %	0.00 %
March	93.82 %	3.90	3.68	3.04	2.36	23.00	23.00	$0.33	18.38 %	19.29 %	19.29 %
April	97.74 %	4.77	4.77	4.66	5.12	25.00	25.00	$0.86	24.79 %	24.79 %	24.79 %
May	98.38 %	4.65	4.63	4.56	12.78	28.00	28.00	$1.79	58.62 %	58.41 %	58.41 %
June	98.73 %	5.24	5.24	5.19	17.76	29.00	29.00	$2.48	58.89 %	58.63 %	58.63 %
July	98.55 %	5.38	5.38	5.29	16.91	29.00	29.00	$2.24	59.38 %	59.18 %	59.18 %
August	97.44 %	4.83	4.83	4.71	7.91	24.00	24.00	$1.11	31.45 %	31.45 %	31.45 %
September	94.63 %	4.64	4.63	4.57	2.76	26.00	26.00	$0.39	12.40 %	12.37 %	12.37 %
October	74.62 %	3.51	3.51	3.62	0.00	18.00	18.00	$0.00	0.00 %	0.00 %	0.00 %
November	37.63 %	3.85	3.85	1.08	0.00	20.00	20.00	$0.00	0.00 %	0.00 %	0.00 %
December	24.28 %	2.49	2.49	0.00	0.00	13.00	13.00	$0.00	0.00 %	0.00 %	0.00 %
Totals	72.65% Unweighted Yearly Avg	50.45 Effect: 100% Sun Hrs: 4.20	50.26 Effect: 99.62% Sun Hrs: 4.19	39.51 Effect: 78.32% Sun Hrs: 3.29	65.80	272.00	272.00	$9.20	28.15 % Unweighted Yearly Avg	28.09 % Unweighted Yearly Avg	28.09 % Unweighted Yearly Avg

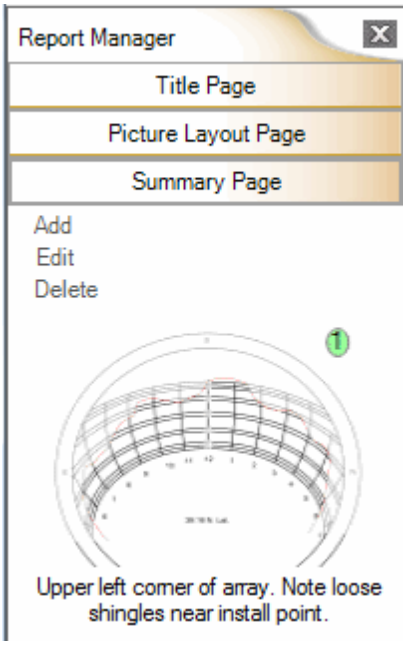
Notes: Upper left corner of array. Note loose shingles near install point.

Visit us on the web at www.bobsolar.com (888) 555-1212
Report generated by SolarPathfinder Assistant Version 5.0.3.0. http://www.solarpathfinder.com
Page: 4/7

Our Newly Created Trace

Report Manager Tips

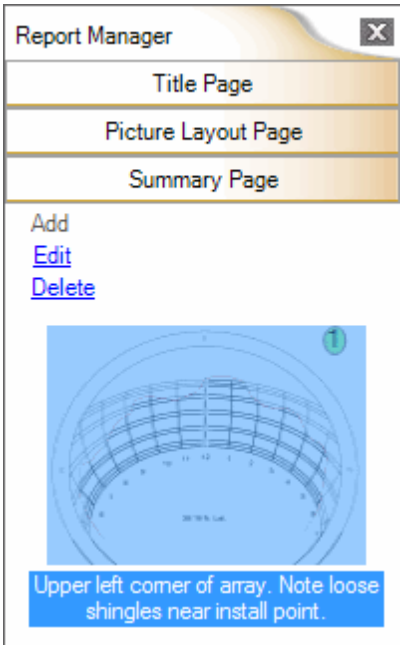
By adding a new trace, we have added a new page to our report. In fact, your report will contain one page per trace in addition to some other supporting pages. Let's look once again at our Report Manager.



Report Manager With One Trace

Underneath the "Report Manager" title, there are actually several buttons which correspond to pages on your report. You can click on those buttons to move around your report. In addition, your newly created trace shows up as a thumbnail of your trace image. By default, once you create a new trace, you will be taken to the page of the report corresponding to your new trace. If you are on another page (i.e. the Title Page), you can move to the trace page simply by clicking once on the trace thumbnail. Double-clicking the trace thumbnail will allow you to edit that trace.

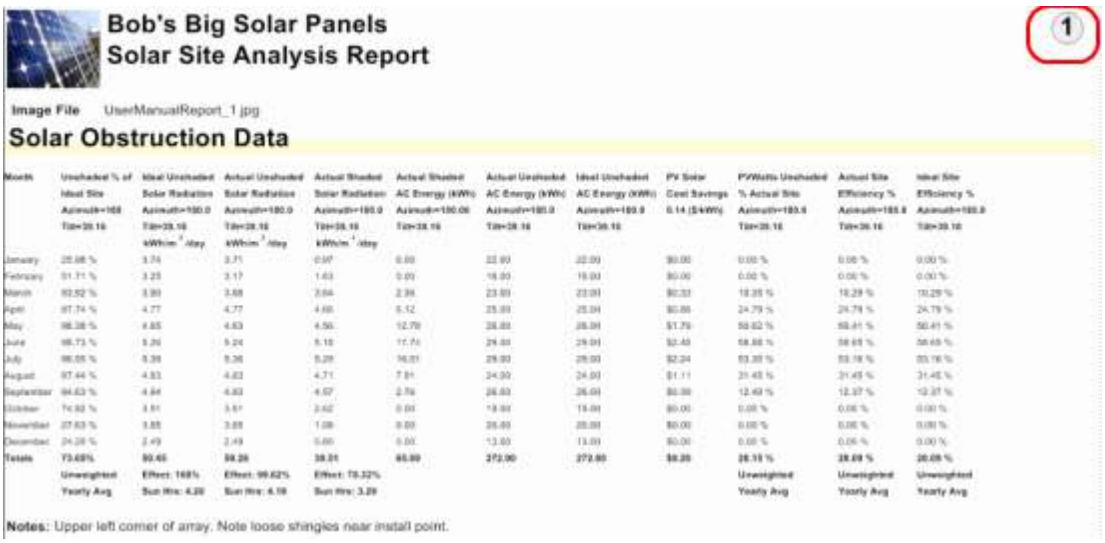
If you click on the trace thumbnail, you will notice that the Edit and Delete hyperlinks are now enabled.



Selected Trace Thumbnail

Clicking the Edit link will allow you to edit the associated trace while clicking the Delete link will allow you to delete the trace from your report.

If you examine the trace thumbnail closely, you will also notice a circled number in the upper right hand corner of the thumbnail. This number indicates which layout data point the trace is associated with. If you look at the report page for that trace, you will see the corresponding number in the upper right hand corner of the report page.

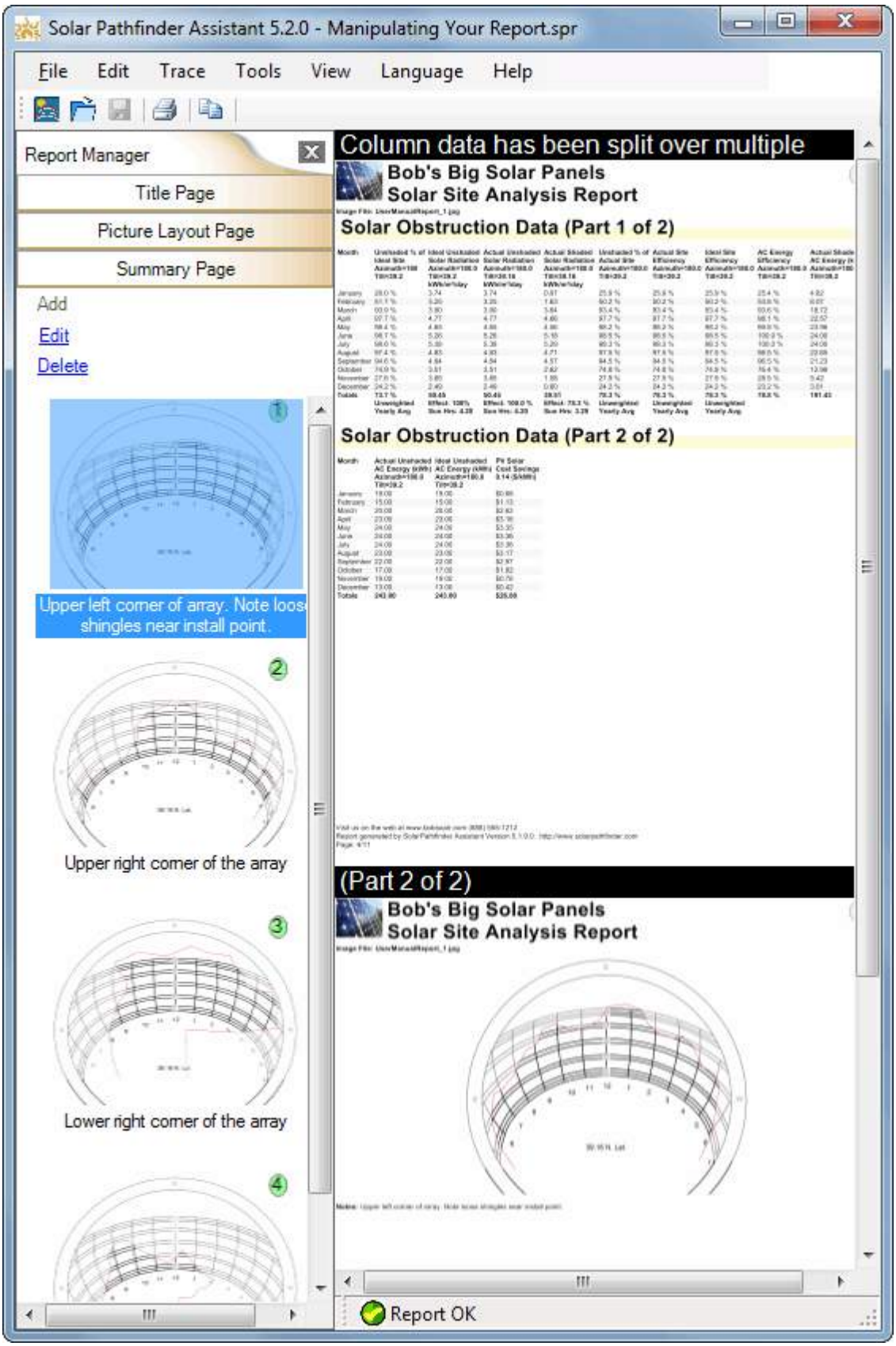


Associated Layout Data Point For Trace

3.2 Look At The Report Data

Trace Pages

The tracing data that you provided has been properly rotated for magnetic declination. It has also been drawn on top of a reference template so that you can clearly see where the obstructions are. In some of our screen shots, we see the side by side option which shows the original image beside the auto generated sunpath diagram. Should you desire to see the auto generated diagram only, you can choose Tools|Options|General 96 and uncheck the "Side by side report images" checkbox.



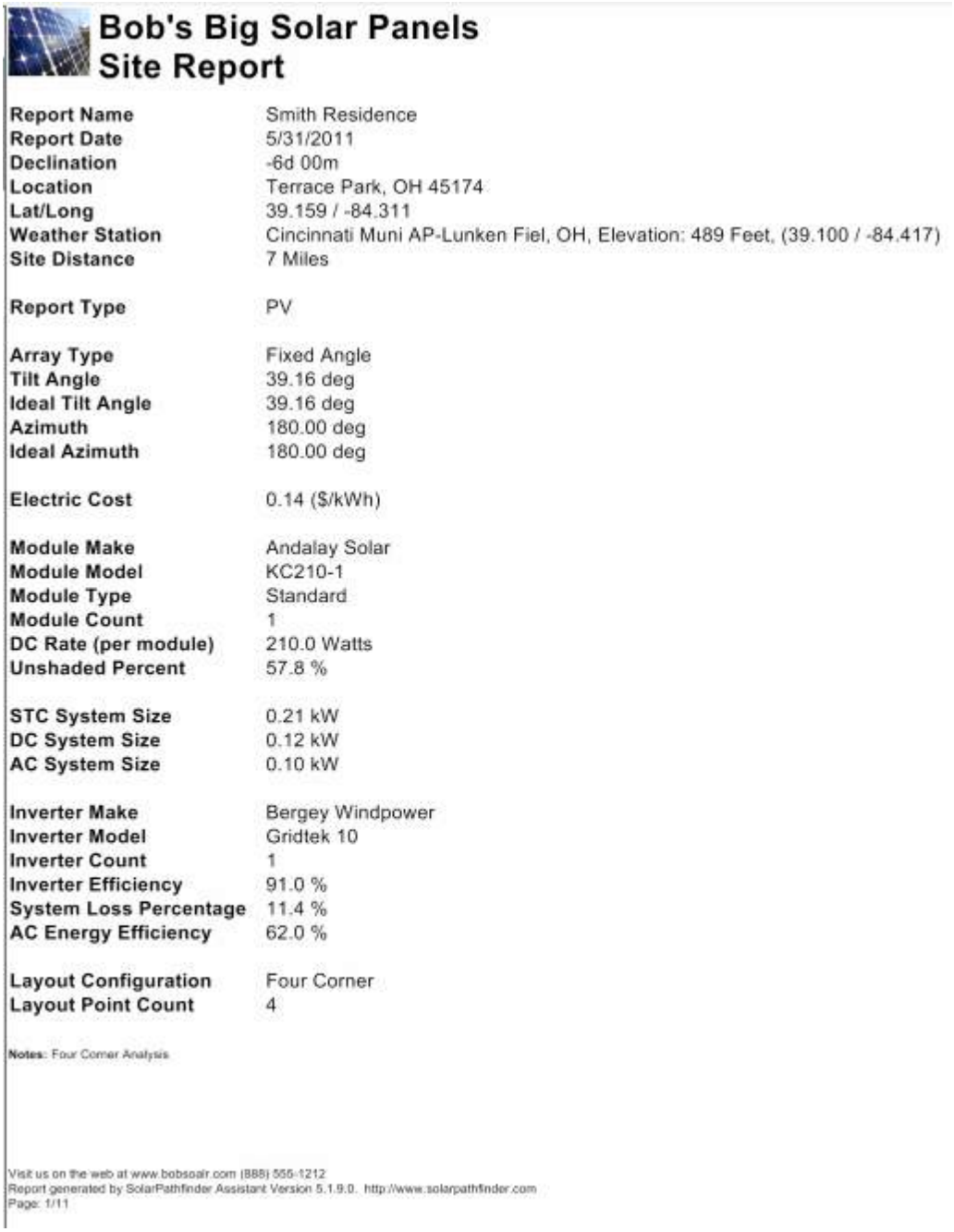
First Trace Image with no side by side view

Aside from the report title information, each trace report page contains column data and the site image template. If the Azimuth/ Altitude data has been selected, it will also be on this page. The kind of data presented here depends on the report type and on the enabled report columns 102.

NOTE: Many persons will likely keep a paper template within their solar Pathfinder unit for reference purposes. The application does not concern itself with this template, although you need to be careful when examining the final report in side-by-side mode. The application will always correctly rotate the image for magnetic declination based on the current date and your location. If your Pathfinder paper template is not correctly rotated, you will see a discrepancy between the paper template trace and the reference template trace. Be assured that the reference template trace is correct as it does not concern itself with the paper template orientation. If this concerns you, feel free to manually rotate your Pathfinder template for magnetic declination until you are satisfied that the application is calculating it correctly.

The Title Page

If we click on the "Title Page" button in the Report Manager, we will see the title page of our report.



Bob's Big Solar Panels
Site Report

Report Name	Smith Residence
Report Date	5/31/2011
Declination	-6d 00m
Location	Terrace Park, OH 45174
Lat/Long	39.159 / -84.311
Weather Station	Cincinnati Muni AP-Lunken Fiel, OH, Elevation: 489 Feet, (39.100 / -84.417)
Site Distance	7 Miles
Report Type	PV
Array Type	Fixed Angle
Tilt Angle	39.16 deg
Ideal Tilt Angle	39.16 deg
Azimuth	180.00 deg
Ideal Azimuth	180.00 deg
Electric Cost	0.14 ($/kWh)
Module Make	Andalay Solar
Module Model	KC210-1
Module Type	Standard
Module Count	1
DC Rate (per module)	210.0 Watts
Unshaded Percent	57.8 %
STC System Size	0.21 kW
DC System Size	0.12 kW
AC System Size	0.10 kW
Inverter Make	Bergey Windpower
Inverter Model	Gridtek 10
Inverter Count	1
Inverter Efficiency	91.0 %
System Loss Percentage	11.4 %
AC Energy Efficiency	62.0 %
Layout Configuration	Four Corner
Layout Point Count	4

Notes: Four Corner Analysis

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Report generated by SolarPathfinder Assistant Version 5.1.9.0. http://www.solarpathfinder.com
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Report Title Page

This gives us some basic information such as the site location and analysis settings, the panel and inverter configuration information and the report notes.

System Size Calculations:

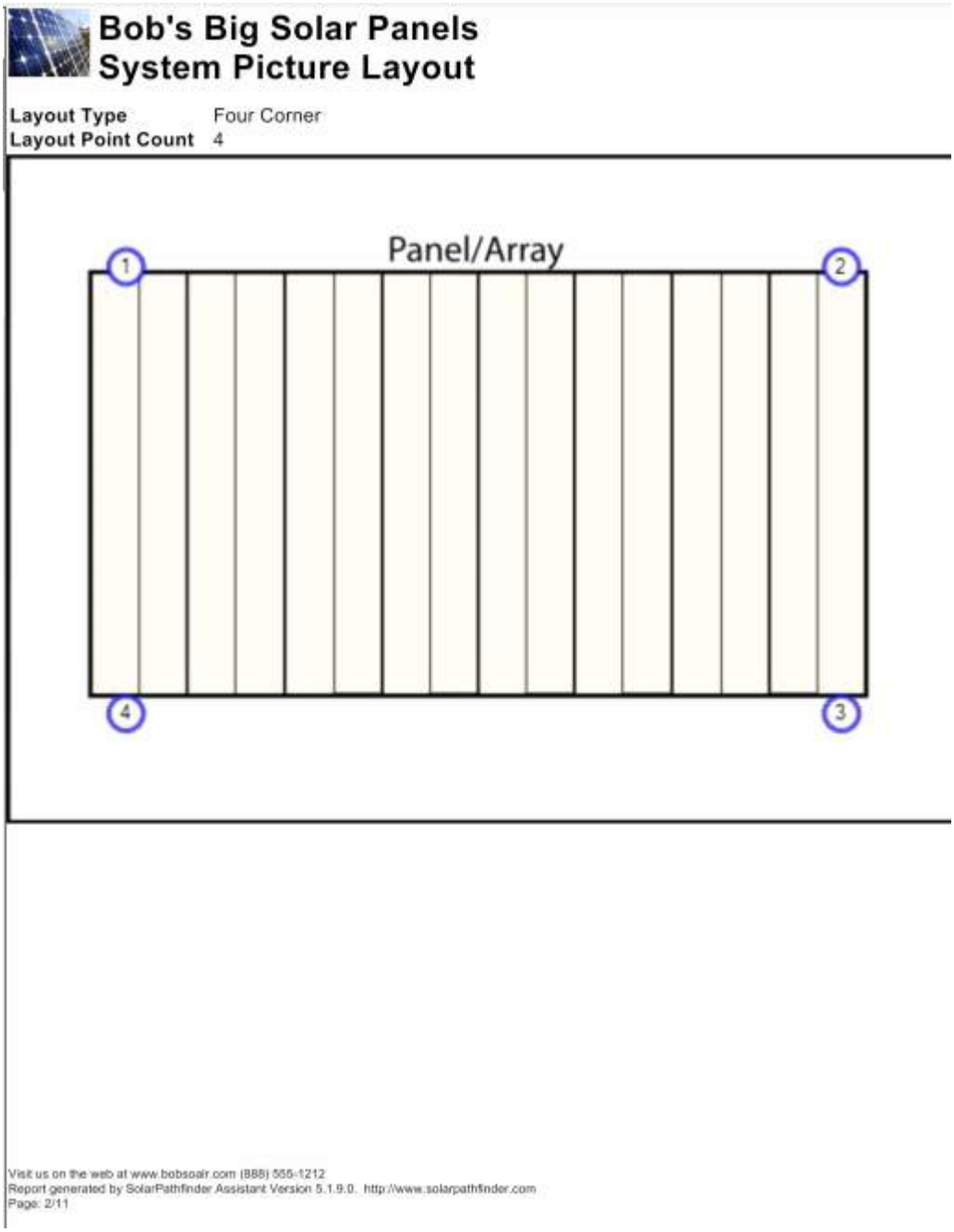
STC System System Size = Number of modules times the module STC size (rating)

DC System Size = STC System Size minus the shade losses

AC System Size = DC System Size minus the system losses

Picture Layout Page

Clicking on the "Picture Layout Page" button on the Report Manager shows us the layout page of the report.

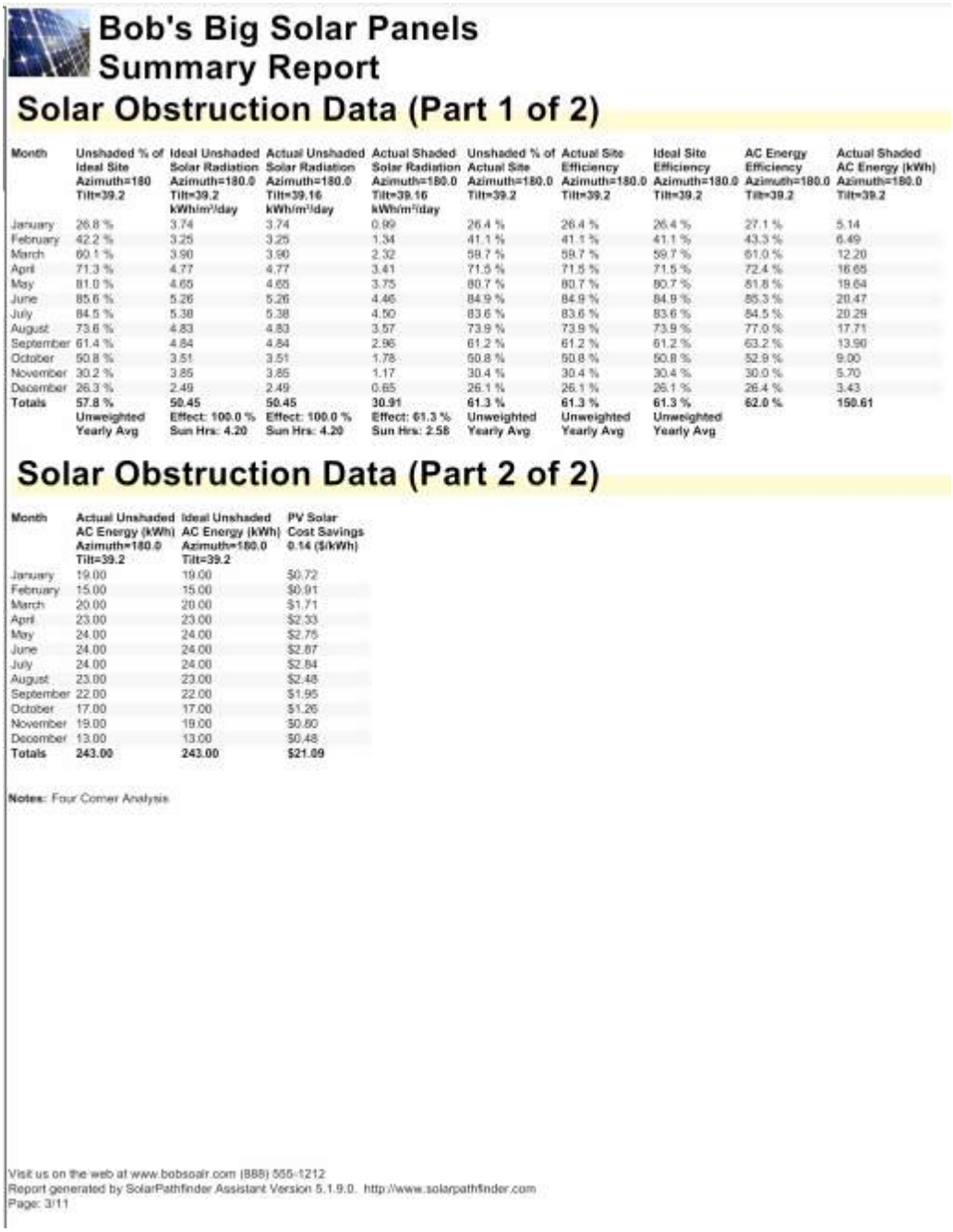


System Layout Page

Here we see the site picture that was provided as well as the layout data points that were defined.

Summary Page

The most interesting page of all is the Summary Page.



Bob's Big Solar Panels
Summary Report
Solar Obstruction Data (Part 1 of 2)

Month	Unshaded % of Ideal Site Azimuth=180 Tilt=39.2	Ideal Unshaded Solar Radiation Azimuth=180.0 Tilt=39.2 kWh/m²/day	Actual Unshaded Solar Radiation Azimuth=180.0 Tilt=39.16 kWh/m²/day	Actual Shaded Solar Radiation Azimuth=180.0 Tilt=39.16 kWh/m²/day	Unshaded % of Actual Site Azimuth=180.0 Tilt=39.2	Actual Site Efficiency Azimuth=180.0 Tilt=39.2	Ideal Site Efficiency Azimuth=180.0 Tilt=39.2	AC Energy Efficiency Azimuth=180.0 Tilt=39.2	Actual Shaded AC Energy (kWh) Azimuth=180.0 Tilt=39.2
January	26.8 %	3.74	3.74	0.99	26.4 %	26.4 %	26.4 %	27.1 %	5.14
February	42.2 %	3.25	3.25	1.34	41.1 %	41.1 %	41.1 %	43.3 %	6.49
March	60.1 %	3.90	3.90	2.32	59.7 %	59.7 %	59.7 %	61.0 %	12.20
April	71.3 %	4.77	4.77	3.41	71.5 %	71.5 %	71.5 %	72.4 %	16.65
May	81.0 %	4.65	4.65	3.75	80.7 %	80.7 %	80.7 %	81.8 %	19.64
June	85.6 %	5.26	5.26	4.46	84.9 %	84.9 %	84.9 %	85.3 %	20.47
July	84.5 %	5.38	5.38	4.50	83.6 %	83.6 %	83.6 %	84.5 %	20.29
August	73.6 %	4.83	4.83	3.57	73.9 %	73.9 %	73.9 %	77.0 %	17.71
September	61.4 %	4.84	4.84	2.96	61.2 %	61.2 %	61.2 %	63.2 %	13.90
October	50.8 %	3.51	3.51	1.78	50.8 %	50.8 %	50.8 %	52.9 %	9.00
November	30.2 %	3.85	3.85	1.17	30.4 %	30.4 %	30.4 %	30.0 %	5.70
December	26.3 %	2.49	2.49	0.65	26.1 %	26.1 %	26.1 %	26.4 %	3.43
Totals	**57.8 % Unweighted Yearly Avg**	**50.45 Effect: 100.0 % Sun Hrs: 4.20**	**50.45 Effect: 100.0 % Sun Hrs: 4.20**	**30.91 Effect: 61.3 % Sun Hrs: 2.58**	**61.3 % Unweighted Yearly Avg**	**61.3 % Unweighted Yearly Avg**	**61.3 % Unweighted Yearly Avg**	**62.0 %**	**150.61**

Solar Obstruction Data (Part 2 of 2)

Month	Actual Unshaded AC Energy (kWh) Azimuth=180.0 Tilt=39.2	Ideal Unshaded AC Energy (kWh) Azimuth=180.0 Tilt=39.2	PV Solar Cost Savings 0.14 ($/kWh)
January	19.00	19.00	$0.72
February	15.00	15.00	$0.91
March	20.00	20.00	$1.71
April	23.00	23.00	$2.33
May	24.00	24.00	$2.75
June	24.00	24.00	$2.87
July	24.00	24.00	$2.84
August	23.00	23.00	$2.48
September	22.00	22.00	$1.95
October	17.00	17.00	$1.26
November	19.00	19.00	$0.80
December	13.00	13.00	$0.48
Totals	**243.00**	**243.00**	**$21.09**

Notes: Four Corner Analysis

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Summary Page

The values shown on this page represent an aggregate of the data

values for all of the traces defined in the report. Note that currently this assumes that all of the traces play an equal part in determining the effectiveness of the system.

Assuming that you have the "Show Altitude/Azimuth data" option checked in Tools|Options|General 96, then below the Solar Obstruction Data grid, we will see the Azimuth/Altitude Data grid. Rather than being a simple average here, the altitude represented by the summary is the highest altitude for each azimuth angle when combining the report traces.

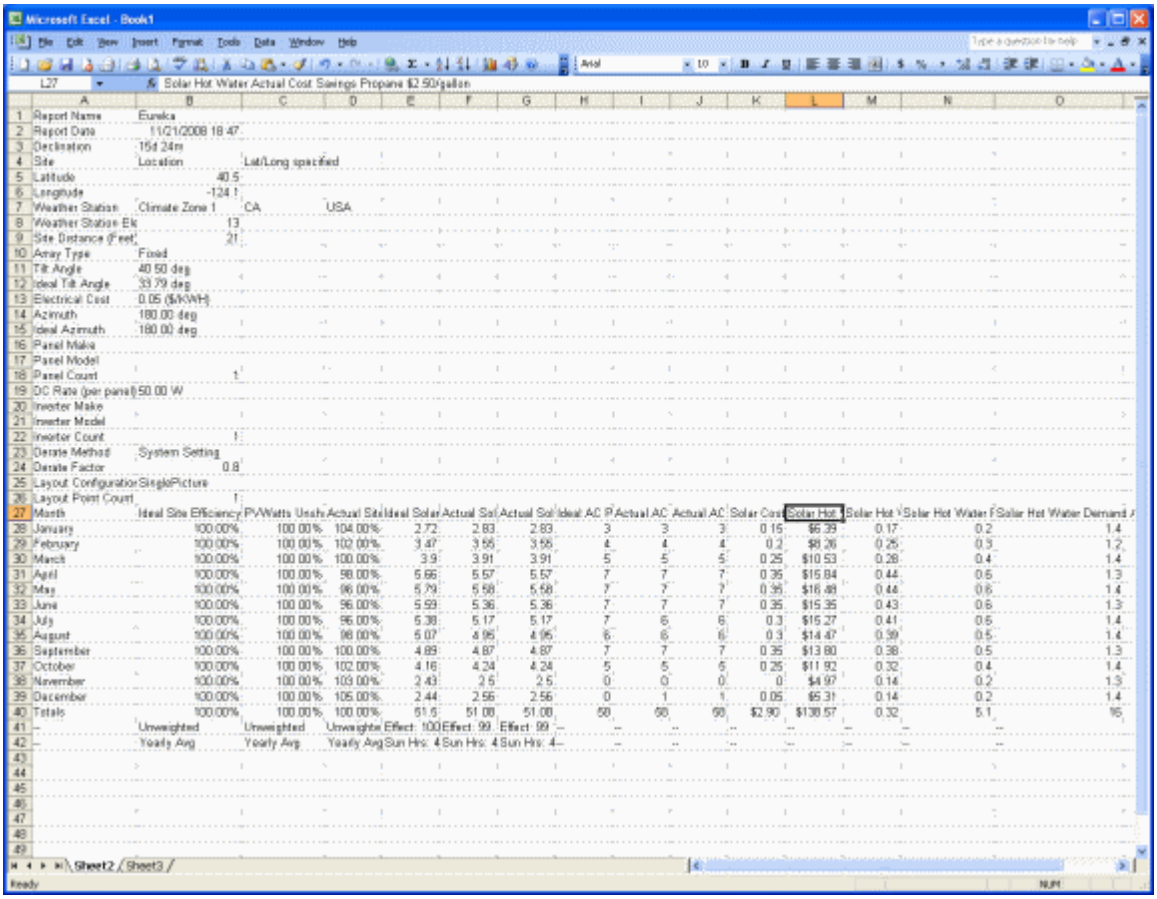
3.3 Copy Report to Clipboard

It is sometimes necessary to copy report data from the SolarPathfinder Assistant application so that it can be used with other applications. The "Copy Report Data" menu option copies the data from the report and puts it on the Windows Clipboard. The data can then be pasted into other applications such as Microsoft Excel ®. Note that the resulting data is tab delimited (there are tabs between each of the columns).

Once a report has been loaded or created, you can copy the data to the clipboard by choosing this command from the main menu or by pressing CTRL+C while the main form is selected. This will copy all of the data to the clipboard including column headers. You can then paste this data into another application by selecting the application and using CTRL+V.

Only columns selected in the Options|Report Columns 102 will be included in the copy.

Below is an example of a report copied and pasted into Excel.



Copy Report

3.4 Run What-If Scenarios

To perform "what-if" scenarios, you can edit any of your traces and change the analysis settings as well as the trace. For instance, we could see what would happen if we removed a couple of trees in our sample image.

Removing trees for "what if" scenario

Now, comparing the original report with the new report, we can easily see the effects.

Month	PVWatts Unshaded % Ideal Site Azimuth=180.0 Tilt=42.5	Actual Solar Rad w/ Shading Azimuth=180.0 Tilt=42.5 KWH/m /day
January	27.36%	0.89
February	53.35%	2.19
March	90.72%	4.31
April	99.51%	5.03
May	98.81%	5.45
June	98.20%	5.57
July	98.57%	5.66
August	99.20%	5.44
September	99.61%	5.24
October	80.50%	3.79
November	38.98%	1.19
December	27.33%	0.82
Totals	**76.01%**	**--**
	Unweighted	**Effect: 81.95%**
	Yearly Avg	**Sun Hrs: 3.80**

Original Report

Month	PVWatts Unshaded % Ideal Site Azimuth=180.0 Tilt=42.5	Actual Solar Rad w/ Shading Azimuth=180.0 Tilt=42.5 KWH/m /day
January	41.51%	1.36
February	63.80%	2.61
March	90.72%	4.31
April	99.51%	5.03
May	98.81%	5.45
June	98.20%	5.57
July	98.57%	5.66
August	99.20%	5.44
September	99.61%	5.24
October	80.50%	3.79
November	57.75%	1.77
December	35.69%	1.07
Totals	**80.32%**	**--**
	Unweighted	**Effect: 85.04%**
	Yearly Avg	**Sun Hrs: 3.94**

New Report

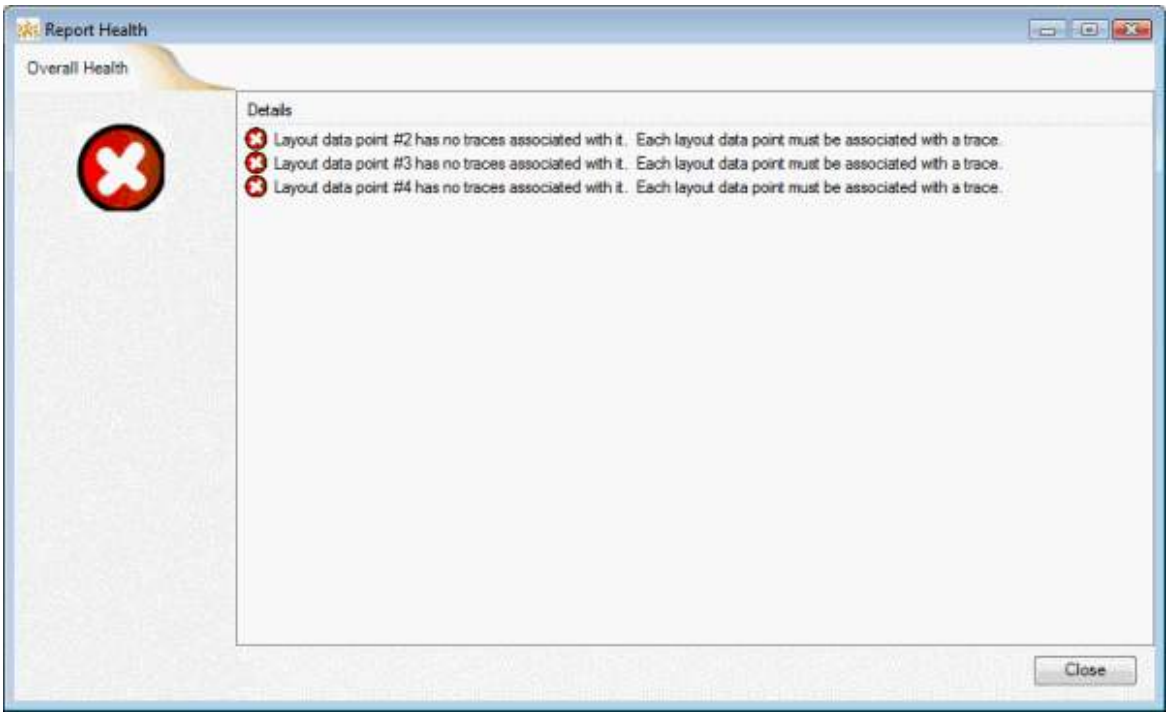
Examining the actual solar radiation with shading, you will see what

the "what if" scenario will increase our solar radiation exposure from 81.95% to 85.04%. Also, as a result of the change, the average sun hours for the year is 3.94, which is up from 3.80.

3.5 View Report Health

At the lower left part of the main form is what we call the "Report Health" indicator. It shows errors that can only be caught after the report has been completed. Most "error" conditions can be caught at the time that the end user enters the data. For instance, if you try to enter a 10 digit zip code, we can alert you to the fact that the format of the zip code is incorrect. However, there are some "error" conditions that are transient in nature and may go away with time.

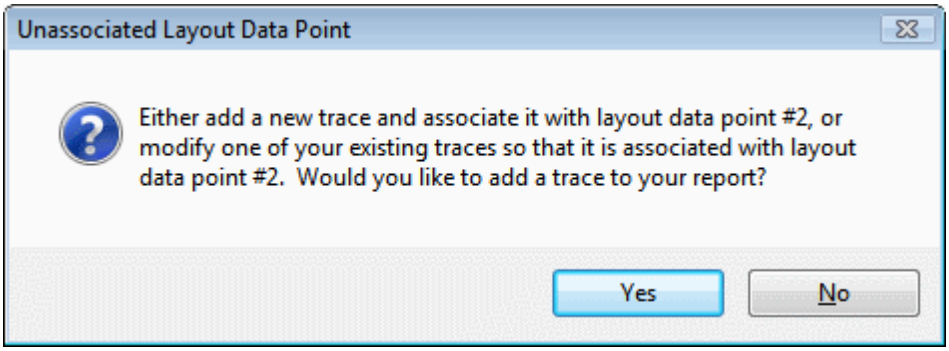
Let's look at this a bit closer. Simply click on the error icon in the status bar at the bottom of the form, or choose File|Report Health 84 from the main menu. This will bring up the Report Health form.



Report Health

Now we see what it was complaining about. When we set up our report, we defined four layout data points, but as of yet, we have only provided a single trace. This represents a "transient" error condition. Once we have loaded the other three trace images, this error condition will go away. To rectify the problem, simply double click on the offending line on the Report Health form, and it will either suggest a solution or take you to the place where you can correct the condition. For instance, in our case above, double clicking

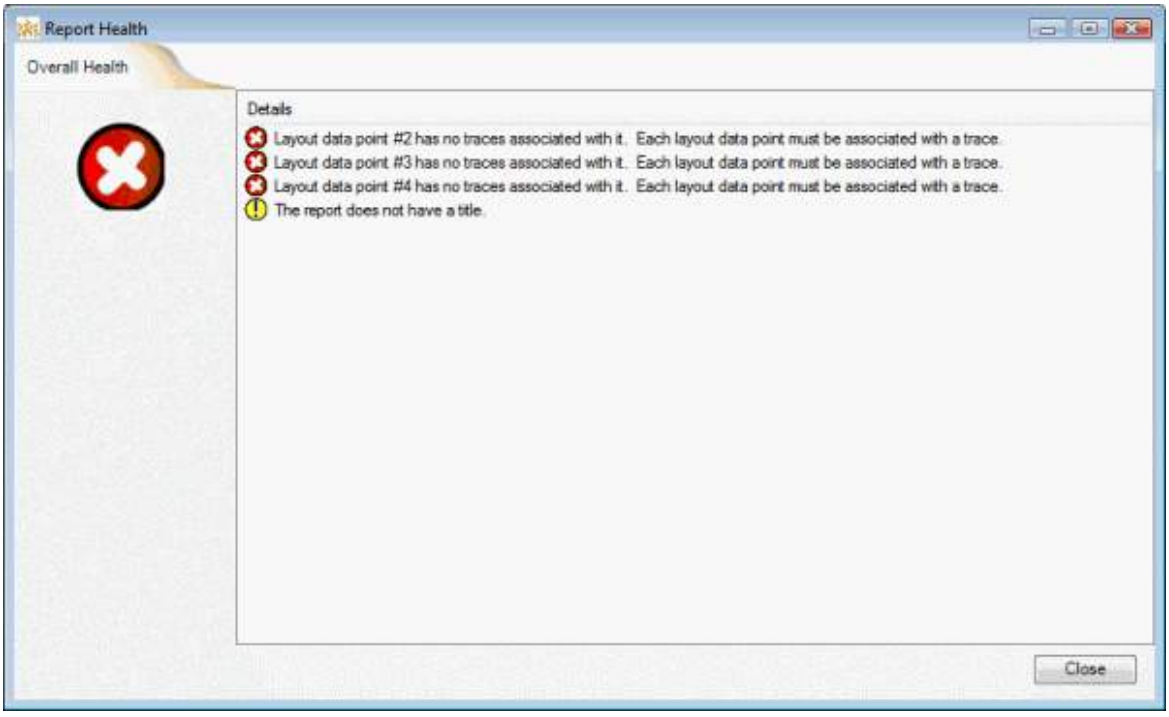
on the first error line brings up a dialog box.



Solution To Error condition

In our case, we want to add a new trace, so click the Yes button which will take you through the now familiar Sun Trace Wizard to load and associate a trace with layout data point #2.

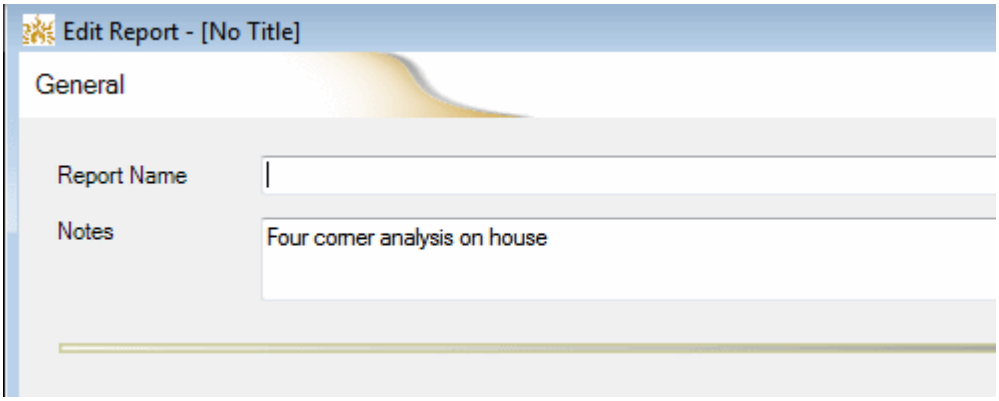
In addition to error conditions, you may also encounter warnings. Warnings are things that you might want to fix, but it does not necessarily indicate that your report is in error. For instance, if you forget to supply a report title, everything will still work, but it is likely an omission that you should take care of.



Report Health With Warning

Again, to correct the problem, double click on the offending item in the list. In this case, it will bring up the Report Editor form where I

can enter the missing title.



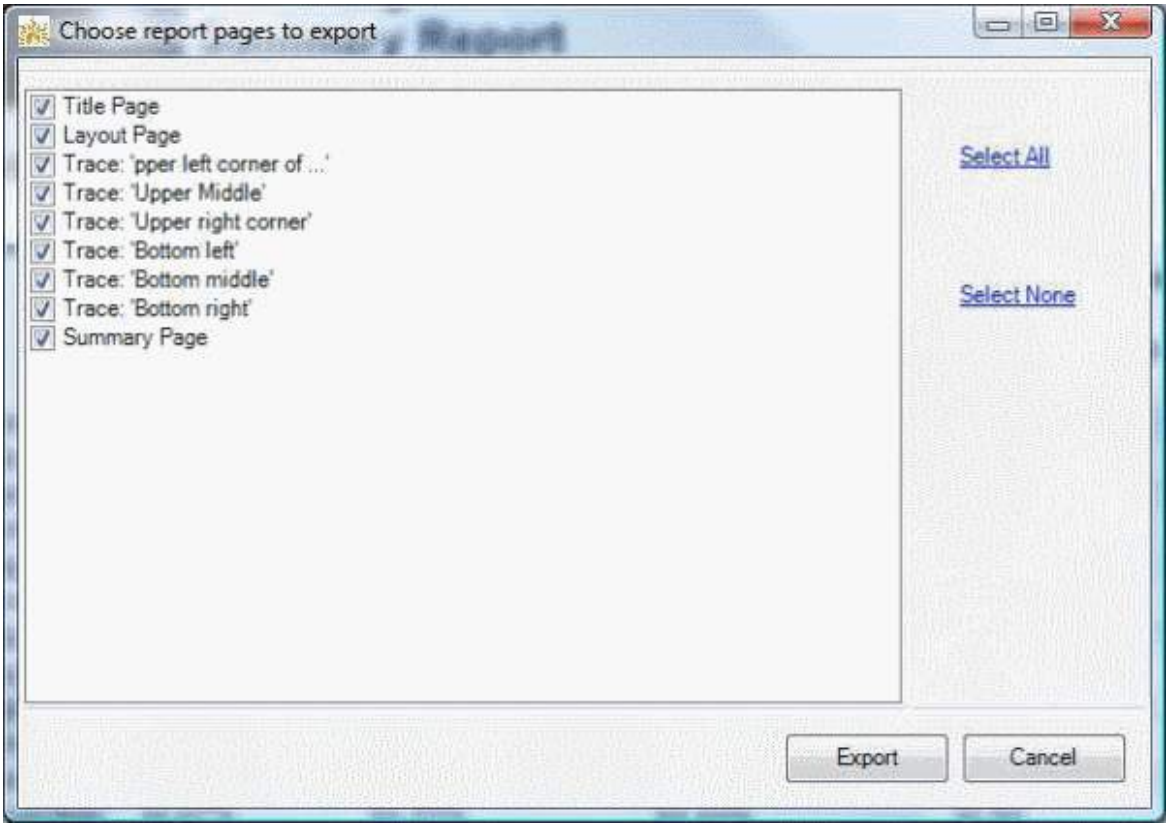
Missing Title On Report Editor Form

Once I fix all the errors in my report, the indicator at the bottom of the form will indicate that the report is "healthy".

Healthy Report

3.6 Send The Report To Others

In order to send the report to others, you will need to export the report as either a PDF file or as a set of jpeg images. To export a PDF file, choose File | Save as PDF 84. This will generate a multi-page PDF file containing all pages on the report. To export as a set of JPEG files, choose File | Save As Jpeg 85. You will be presented with a dialog box that allows you to indicate which report pages should be included in the JPEG generation. A single jpeg image will be created for each selected report page. These images can then be easily attached to an email.



Export Jpeg Images

As with printing, you are given the option of selecting which report pages you would like to export. Check the ones you would like to export and uncheck the ones you would not like exported. The file names of the exported jpeg files will be the file name you choose with a "_N" appended where N represents the page number. For example, the title page jpeg image will be "MyFileName_1.jpg" since it is the first page.

4 Types of Reports

4.1 Photovoltaic (PV) Report

Photovoltaic (PV) reports use inverters and panels (modules) to calculate the expected energy production of the array. These reports can also use PV Optimizers and microinverters.

4.2 CSI Report

4.2.1 California Solar Initiative (CSI)

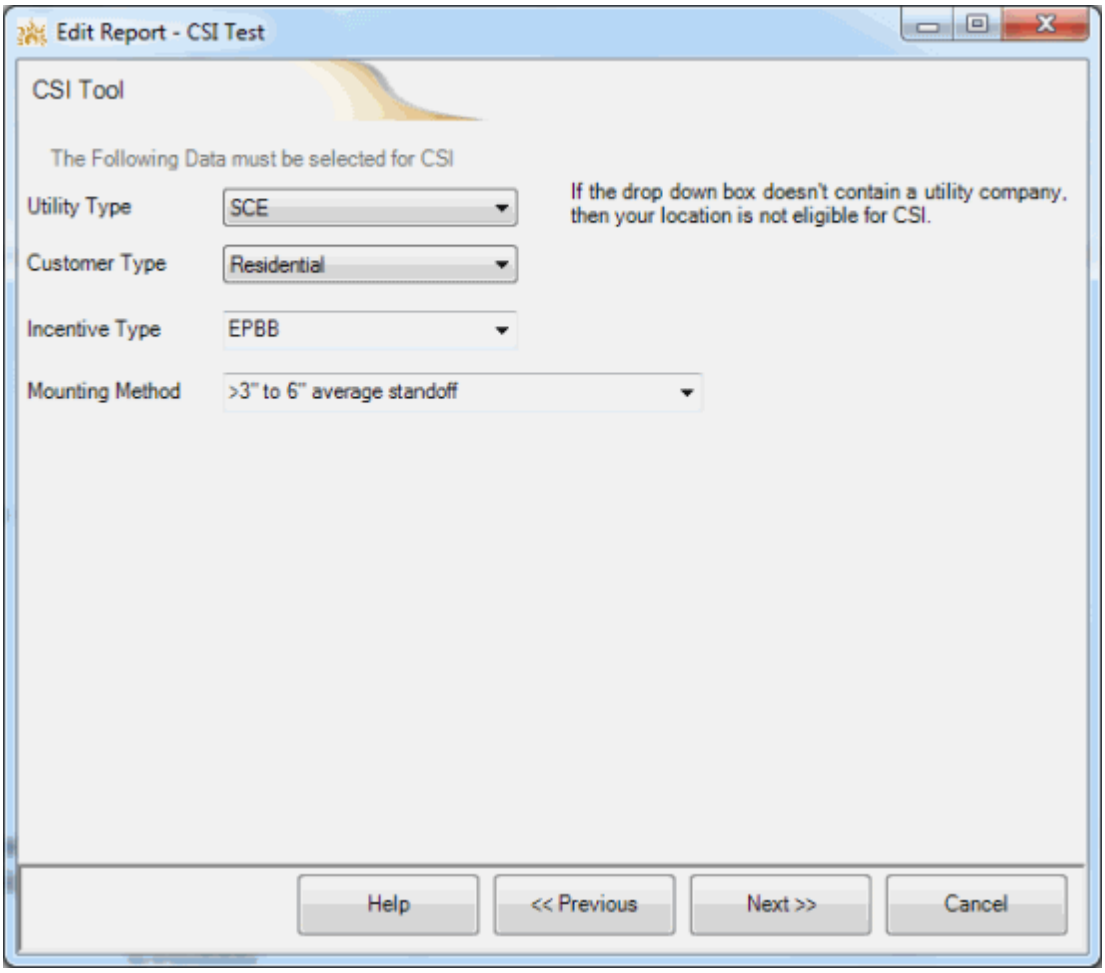
The SolarPathfinder Assistant has the ability to submit report data to the CSI web site. Such "buy-back" information will be included on your final report. In order for a report to be considered CSI compliant, you

must perform the following steps.

STEP 1: Choosing your location

When you first define your report, you must choose your location by zip code and your location must be within California. The CSI web site requires zip code entry in order to calculate you results.

STEP 2: Choose your utility and customer type



Choosing Your Utility And Customer Type

When defining your report, you must choose the utility type and customer type for your proposed site. Note that if your location is not a valid CSI location, these combo boxes will be disabled. The SolarPathfinder Assistant application filters the list of utilities based on your location.

STEP 3: Choose at least four layout data points

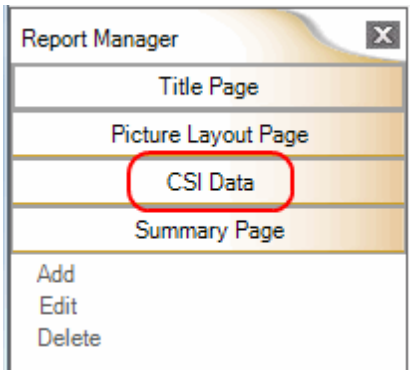
The California Solar Initiative requires a trace point to be defined at

each corner of the proposed array.

STEP 4: Supply and fill in traces for all layout data points

Once you have defined your report, you must add traces for each of the layout data points. Once you have done this, the system will automatically try to retrieve CSI information for your report. Note that an active internet connection is required in order for this retrieval to take place. If unsuccessful, you will be alerted of the failure.

Once the CSI data has been retrieved, you can view the data by selecting the CSI Data Page from the Report Manager.



CSI Data Button

Bob's Big Solar Panels
CSI Results

CSI Data

Utility	SCE
Customer Type	Residential
Incentive Type	EPBB
Mounting Method	>3" to 6" average standoff
CEC Rating	1.674 kW
Design Factor	76.654 %
CSI Rating	1.283 kW
Incentive Rate	$1.10/Watt
Incentive	$1,411
Optimal Tilt	17
Optimal Azimuth	180

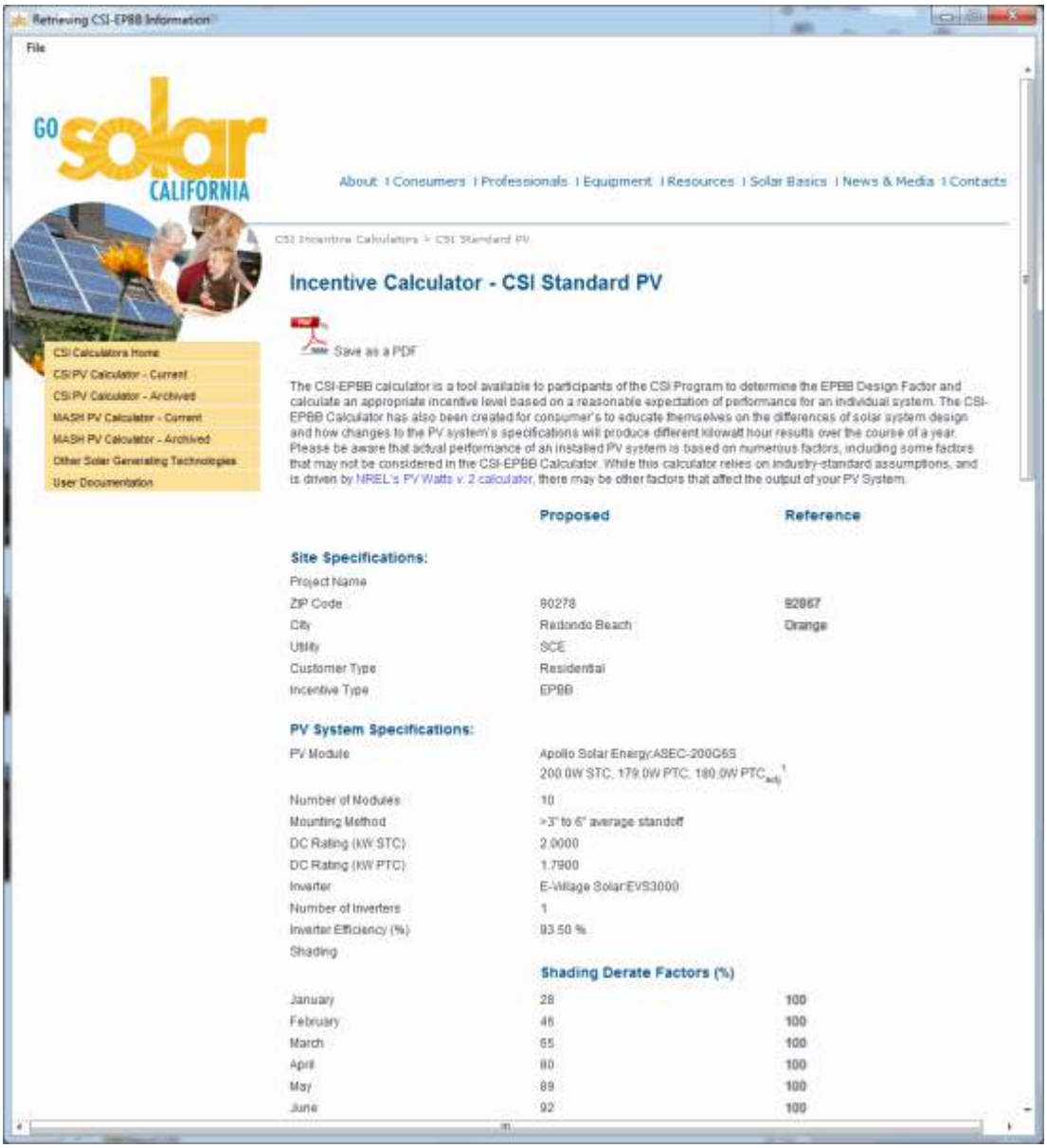
Notes: Redondo CSI Test

In the image above, we see that the report now contains the CSI buy back information for our proposed analysis site.

Note that any modifications that you do to the traces or to the report will cause the CSI data to be retrieved again to reflect any changes.

The CSI web site

If you would rather go directly to the CSI web site to view the data, you can choose the Tools|View CSI web page 90 menu option. This web page will contain the same data as is embedded within your report.



CSI Web Page Result

You can enter data on the CSI site directly by going to www.csi-epbb.com

4.2.2 CSI Errors

If your report has CSI errors, you will not be able to upload it to the CSI website. There are several reasons for CSI errors:

- The site analysis location might not be in California.
- The site analysis location was entered using latitude/longitude instead of zip code.
- The report has less than four layout data points defined.
- The report was not configured to use approved panels and inverters.
- The report does not have trace images for all defined layout data points.

Note that after each trace is added, the CSI feasibility of the report is reassessed. So, assuming that our report was in a valid California location, once we define our sixth trace, we will see this CSI status indicator change.

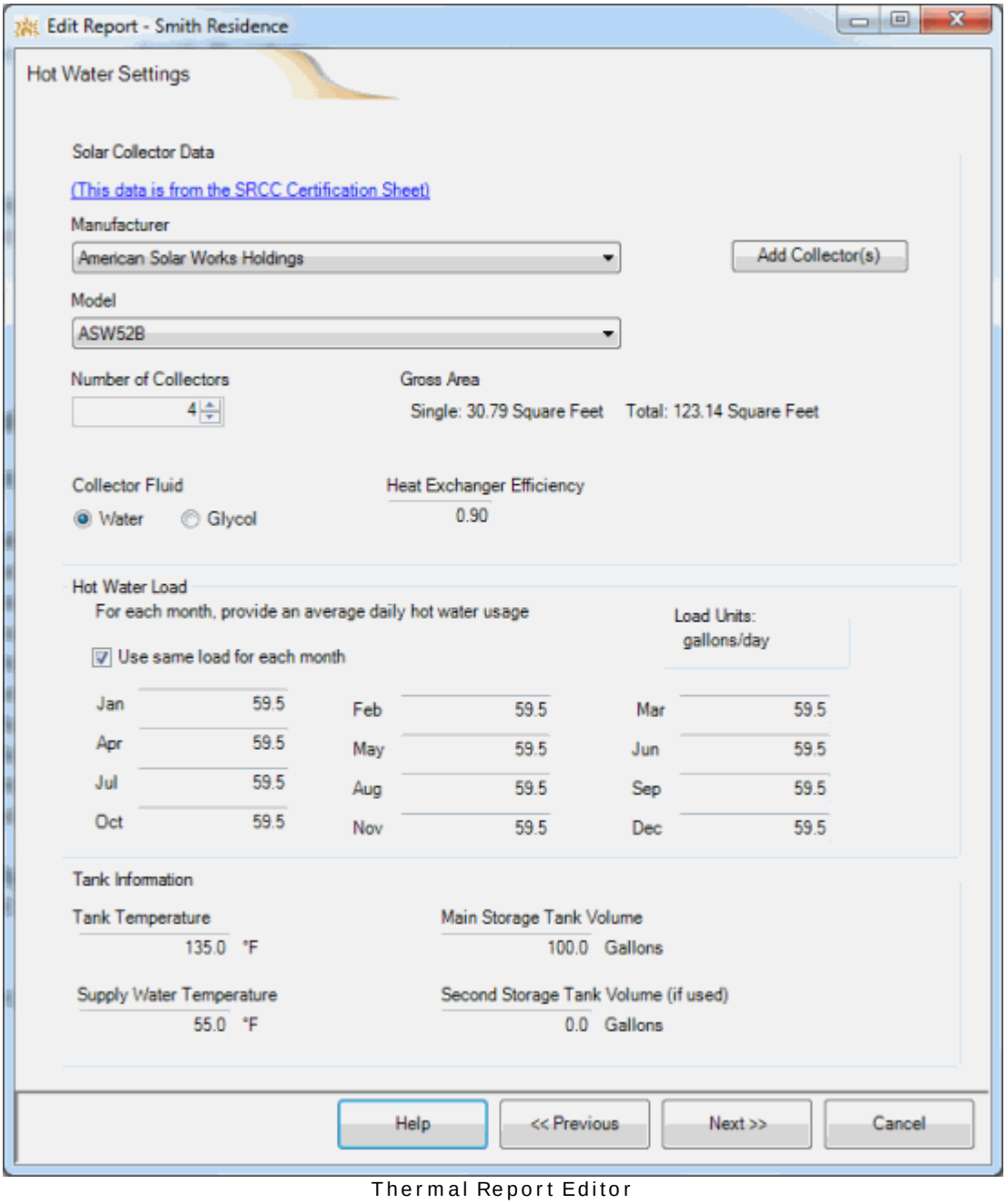
4.3 Ecological Report

Ecological reports are used to survey a site without taking into account any type of equipment such as solar panels or the orientation of those solar panels. Therefore, the tilt angle is automatically set to zero when this report type is selected.

4.4 Thermal Report

4.4.1 Thermal Settings

The Thermal input page is shown in the report editor when you select a Report Type of "Thermal" in the report editor general 11 tab. The page usually comes right after the general page, unless the slot has been taken by another plugin.



Thermal Report Editor

- Select Collector Model

The units in the Thermal editor are displayed in either English or Metric units. The setting for this is found in the general options 96 page.

The first step in the Thermal editor is to select the collector manufacturer and model from the pull-down lists.

If the pull-down lists do not contain your models, you can add your

own collectors by clicking on the "Add Collectors" button to bring you to the User Collector Editor 79.

- Specify the Collector Count

Use the numeric up/down box to specify the number of collectors in your system.

- Heat Exchanger Efficiency

Unless you have a good reason to change this, it's best to stay with the default of 70%.

- Specify the Fluid Type

You have two options -- you can choose between water and glycol by selecting the appropriate radio button. A location with freezing temperatures at any time during the year would require you to use glycol.

- Enter Hot Water Load

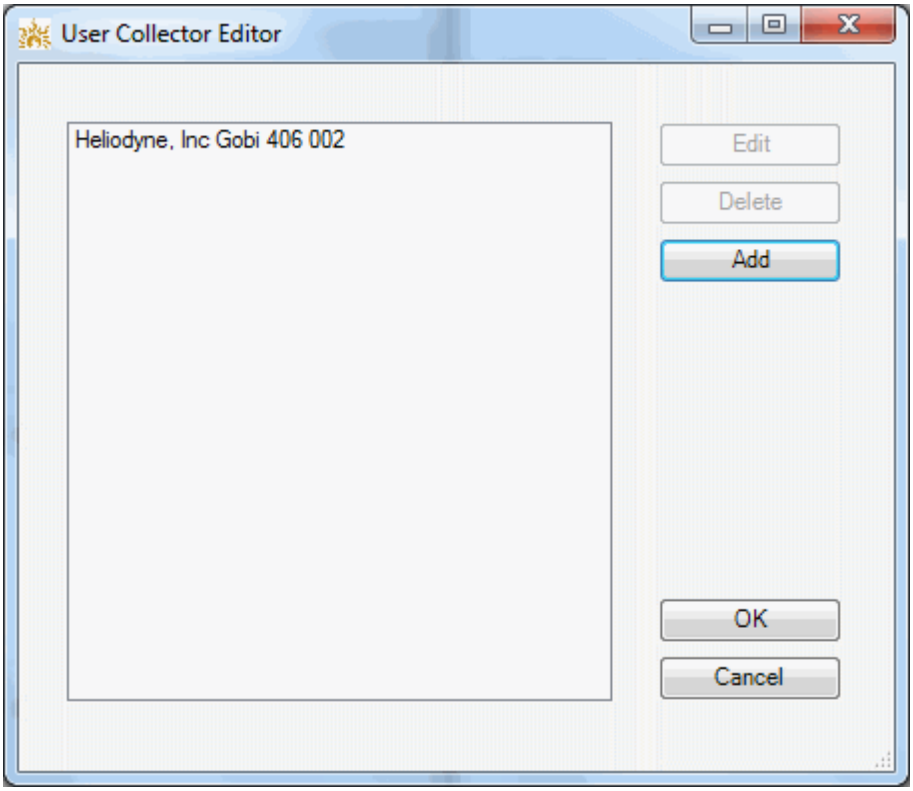
You'll probably need to estimate this value. The values for each month are the amount of hot water used by the customer, not the total water usage.

- Enter Tank Information

The tank temperature is the thermostat setting on your hot water tank.

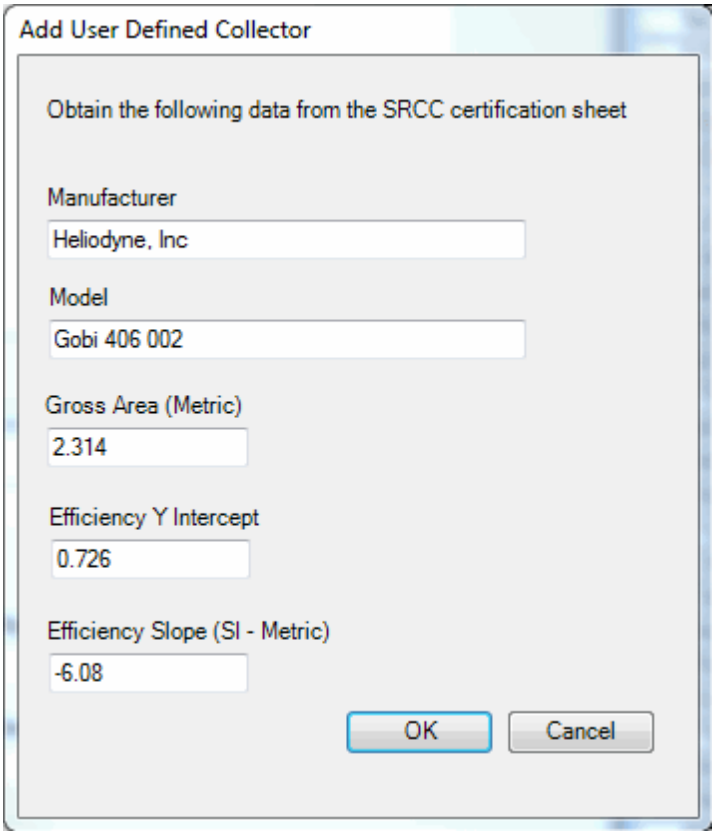
Both the primary and the second tank are storage tanks. The secondary tank is not backup heating and it does not contain an independent source of heating.

4.4.2 Thermal Collector Editor



Add Collectors

In this editor, you can modify existing collectors, delete existing collectors, or add new collectors. Click on the Add button brings up the Edit Collector form.



Edit Collector

In this form, enter your data and click on the Enter button to return back to the prior editor. Then to complete the process of adding a collector, click on the Update button.

To edit an existing collector, first highlight the collector in the left-side collector list and then click on the Edit button. This brings you to the Edit Collector form where you can modify the values by editing the text boxes.

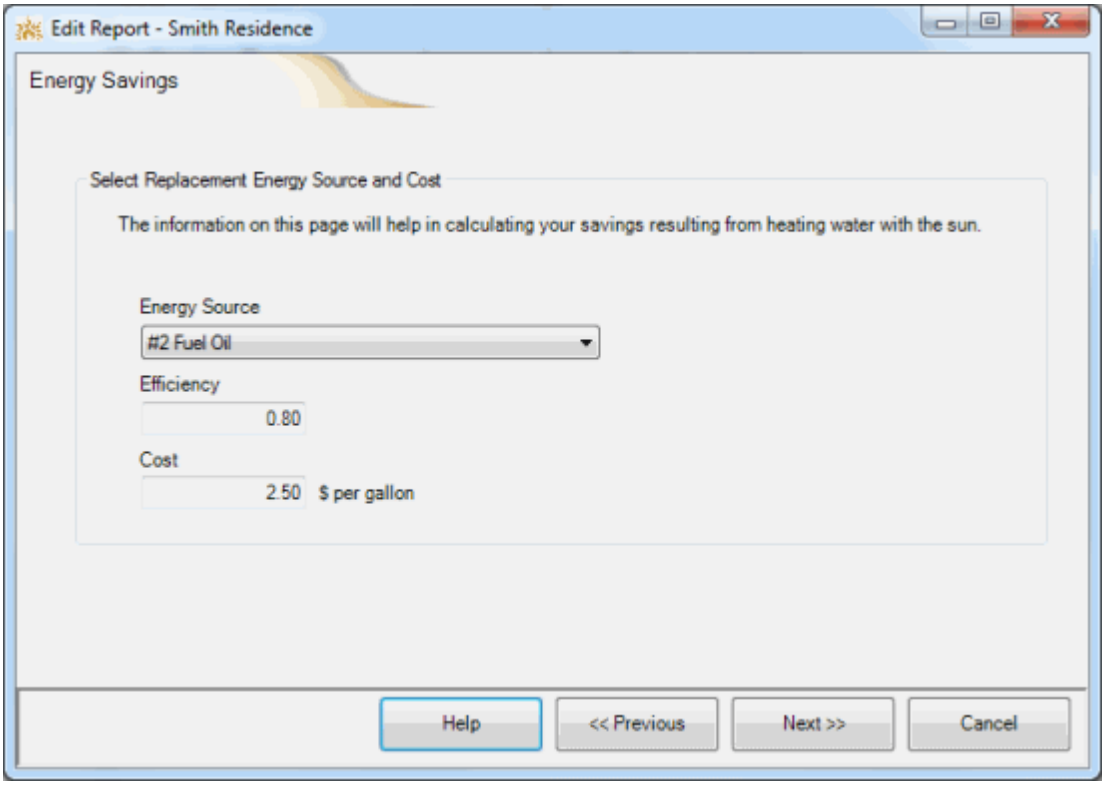
4.4.3 Thermal Savings

The fuel savings screen is part of the Thermal plugin. The data from this form is used to calculate your fuel and monetary savings from using Solar Energy to heat hot water.

1) Select the fuel you use to heat hot water,

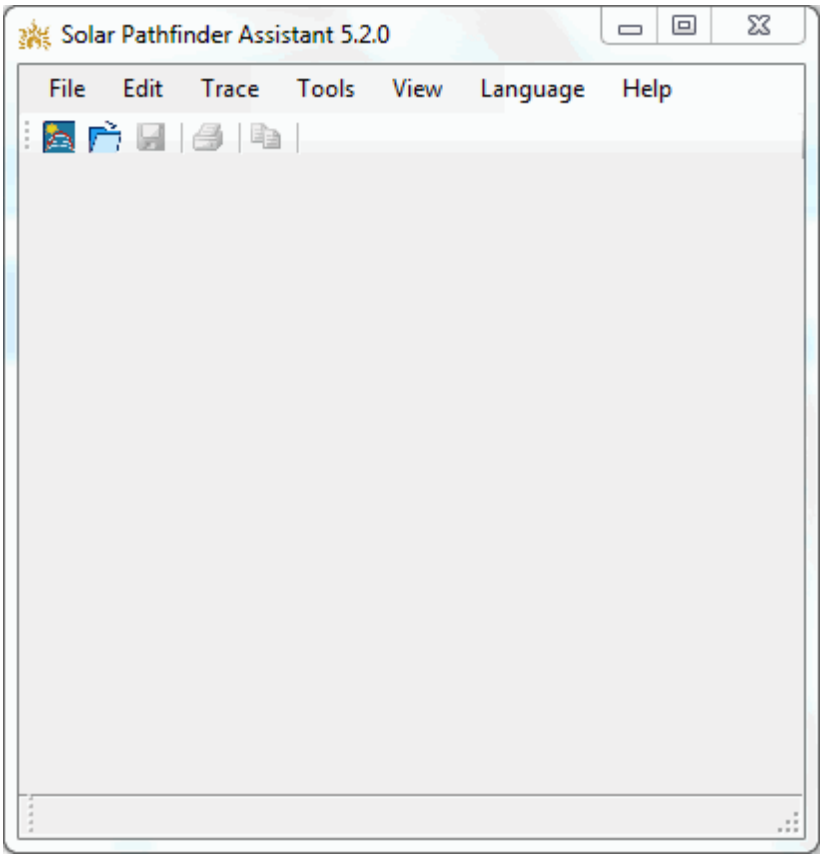
2) Enter the efficieny of your water heater (The program provides you with a default of 0.80 (80%) but older heaters might be closer to 65% and a high efficiency heater might be better than 90%. Electric water heaters have an efficiency of 100%),

3) and, enter your local fuel cost.



Fuel Saving Report Editor

5 The Main Form



Main Form

When there is no report currently loaded, there is not much to look at on the main form. You will notice the menu bar and the tool bar icons that. We will go over each of these.

5.1 Main Form Menus

5.1.1 File Menu

Export|Horizon Angles 85 (.hor file type)
Export Images 85
Print 86
Exit 86

5.1.1.1 File|Quick Start

The QuickStart form shows the most common operations that are performed when the application is started. It also contains links for getting various types of help: video help, search able help file, and PDF help file.

If you would rather be taken directly to the main form at startup, clear out the "Show this form at startup" checkbox. To close this form and go to the main application form, click the "Close" button.

If you want to re-enable the Quick Start form, you can do that in the general options 96 tab.

5.1.1.2 File|Open Report

The SolarPathfinder Assistant application allows you to open an existing report for viewing, editing and printing. This includes reports generated with previous versions of the software.

There are two ways to open an existing report. First, you can choose "Open Report" from the Quick Start form, or you can choose File | Open Report from the main menu. Upon doing this, you will be presented with the File Open dialog which allows you to navigate to your saved report (file extensions ".spr" and ".xml" are supported). Once you select and open your report, the main form will display your saved report.

If there is an unsaved report already in memory, you be prompted to either save the current report or discard it.

5.1.1.3 File|New Report

The New Report menu option allows you to create a new report. If an unsaved report is currently open, you will be asked to save the report before continuing. The SPFA only allows you to have a single report open at a given time.

5.1.1.4 File|Edit Current Report

The Edit Current Report menu option allows you to edit the report that is currently opened within the application. If there is no report currently opened, this option will be disabled.

One of the main reasons for editing a report is for "what if" scenarios 66. For instance, you may trace an obstruction and generate a report to get the "before" analysis numbers. Then you edit the current report, change the tracing to remove the obstruction and generate the "after" analysis numbers. Thus a customer can see what the effects of removing certain obstructions would be.

To edit traces within the report, simply double click on the trace thumbnail of interest in the Report Manager or select the trace thumbnail of interest and click on the Edit link in the Report Manager.

5.1.1.5 File|Close Current Report

The Close Current Report menu option allows you to close the current report. If the report has not been saved, you will be asked to save the report before continuing. If there is no report currently opened, this option will be disabled.

5.1.1.6 File|Report Health

The Report Health menu option presents the Report Health form 68 which shows informational, warning and error messages related to your report. We will discuss Report Health in detail shortly.

You can also open the Report Health form by single clicking on the report health icon at the lower left corner of the main form.

5.1.1.7 File|Save

The Save menu option allows you to save the current report if there are unsaved modifications. If the report has not been modified, or if there is no report loaded, this option will be disabled.

5.1.1.8 File|Save As

The Save As menu option allows you to save the current report using a different file name than the one currently associated with the report. This option will be enabled even if the current report is not "dirty". If no report is loaded, this option will be disabled.

5.1.1.9 File|Save As PDF

The Save As PDF menu option generates a multi-page PDF file containing all of the pages of the current report. If no report is loaded, this option will be disabled.

5.1.1.10 File|Save As Jpeg

A separate jpeg file will be created for each page of the report. The file name for each will be the file name chosen with the page number appended to it. For example, if I choose the file name "MyReport," then the first page will be "MyReport_1.jpg."

5.1.1.11 File|Export|Clean Power Report

Exports an industry standard XML file containing azimuth/elevation data for the aggregate (summary) values of your analysis site.

5.1.1.12 File|Export|Shading Data

Exports report data as comma separated values (CSV) which can then be loaded into programs such as Microsoft Excel or consumed by other applications. (Application developers desiring to use SPFA report data should consume SolarPathfinder report (spr) files instead as they are simply XML files that contain structured data about the analysis.)

5.1.1.13 File|Export|Horizon Angles

This exports the horizon angle data into the .hor file format. This format is a basic text format that can be opened with any text editor or word processor.

The data in this file is a pair of numbers for each degree of azimuth from -130 to 130. Each pair is on a separate line. The first number in the pair is the azimuth in degrees and the second this the elevation in degrees of the obstruction.

The the compass orientation of the azimuth value is depended on the Hemisphere. In the Northern Hemisphere, 0 is pointing South and therefore, -90 is East and 90 is West. In the Southern Hemisphere, azimuth 0 is pointing North and -90 is West and 90 is East.

5.1.1.14 File|Export Images

Use this command to extract any of the report images into a separate image file (jpg).

This command lets you select the image that you want to export. You can export a single image, or all the images in the report.

Original Image - This the picture that you import when creating the traces.

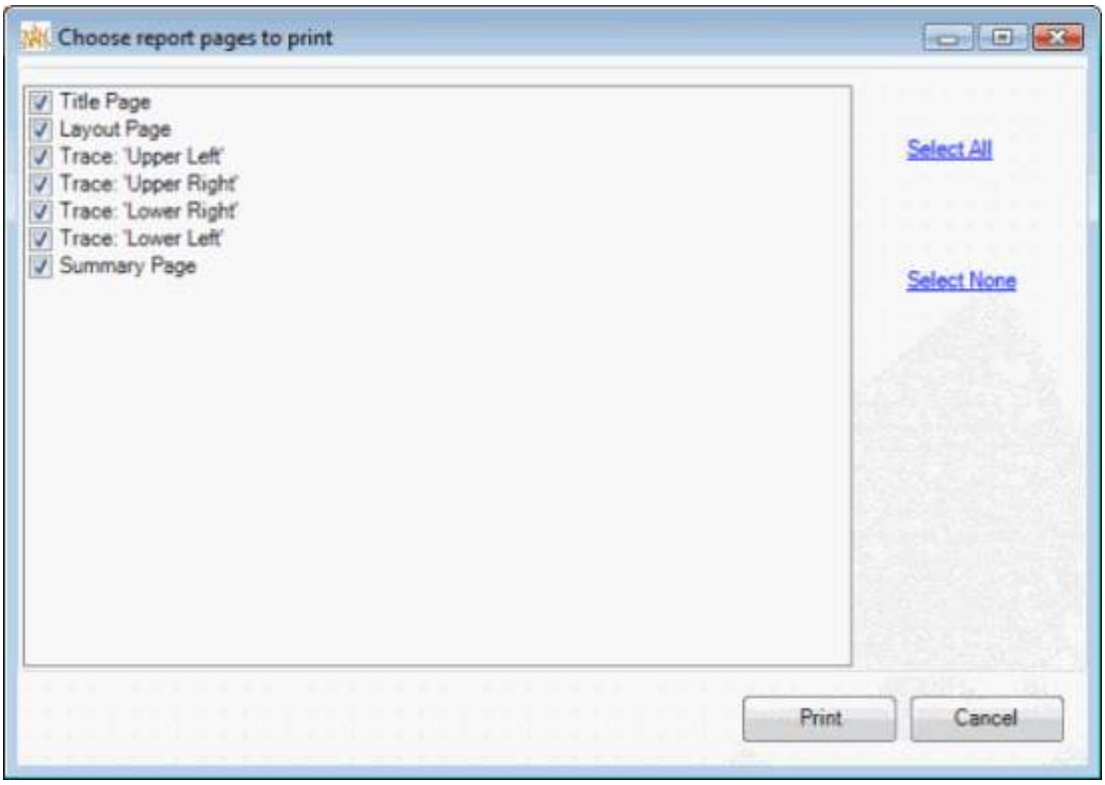
Composite Image - This is your original image with the shading trace superimposed on top of it.

Sunpath Image - This is the sunpath template generated for your location.

5.1.1.15 File|Print

The Print option allows you to print a copy of the current report. You will be able to choose which pages you would like to print. If there is no report currently opened, this option will be disabled.

The following image is a screen shot of the print selection page.



Choosing Pages To Print

Check the pages of interest and click the Print button to print those pages. The unchecked pages will not be printed.

5.1.1.16 File|Exit

The Exit menu option allows you to exit the application. This can also be accomplished by clicking the red "X" in the upper right corner of the main form. If there is an unsaved report opened in the application, you will be given the opportunity to save that data before exiting.

5.1.2 Edit Menu

Copy Report Data 87
Edit Current Report 87

5.1.2.1 Edit|Copy Report Data

SEE: Copy Report to Clipboard 65

5.1.2.2 Edit|Edit Current Report

Edit the current report in the report editor. This is the same command as that found under the File Menu: File | Edit Current Report 87

5.1.3 Trace Menu

Add Trace 87
(Hide or Show) Report Manager 87

5.1.3.1 Trace|Add Trace

The Add Trace menu item allows you to add a new trace to the current report. If there is no report open, this option will be disabled.

5.1.3.2 Trace|(Hide or Show) Report Manager

This menu item toggles the report manager display state; it either hides or shows the report manager. The text of this menu item changes depending on the display state of the Report Manager. If no report is currently open, then this menu item will be disabled.

5.1.4 Tools Menu

Options 87
Optimal Orientation Tool 87
Plugin Information 89
View CSI Web page 90
Upload CSI Data 91

5.1.4.1 Tools|Options

Opens the Options form 95.

5.1.4.2 Tools|Optimal Orientation Tool

If your survey location has a lot of shade, this tool will help you find the best array orientation that will provide the most KWH production over the entire year.

This tool will only become available after a report has been generated

because it needs the shading information in the report to calculate an optimal array orientation.

Because the tool needs to do a PVWatts calculation for each possible orientation, it can take a long time to run. To make this iteration faster, the tool requires you to give it direction as to what ranges of azimuth and tilt it should check.

The azimuth values are always absolute and are not affected by the hemisphere.

Azimuth Compass Values (both hemispheres):
0 = North
90 = East
180 = South
270 = West

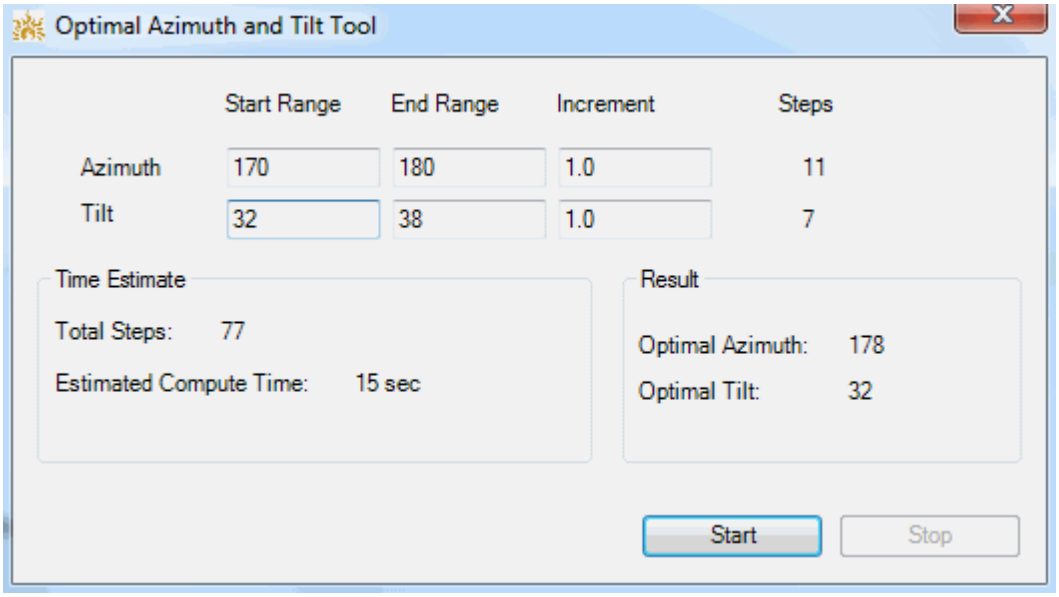
The tilt values are dependent on the hemisphere. In the north, use positive tilts from the horizontal to point south. In the southern hemisphere, use negative tilts to point north.

The image below has been filled in to tell the tool that the Azimuth range of 170 to 190 degrees should be checked. The step value tells it to increment the step by 1.0, so it would check 170, 171, 172, ..., 189, 190.

The step values work the same way for the tilts and the numerically lower value should be the start value.

The Total Steps value tells you how many unique orientations will be checked with PVWatts.

The Estimated Compute Time tells you approximately how long you will have to wait for an answer once you click on the Start button.

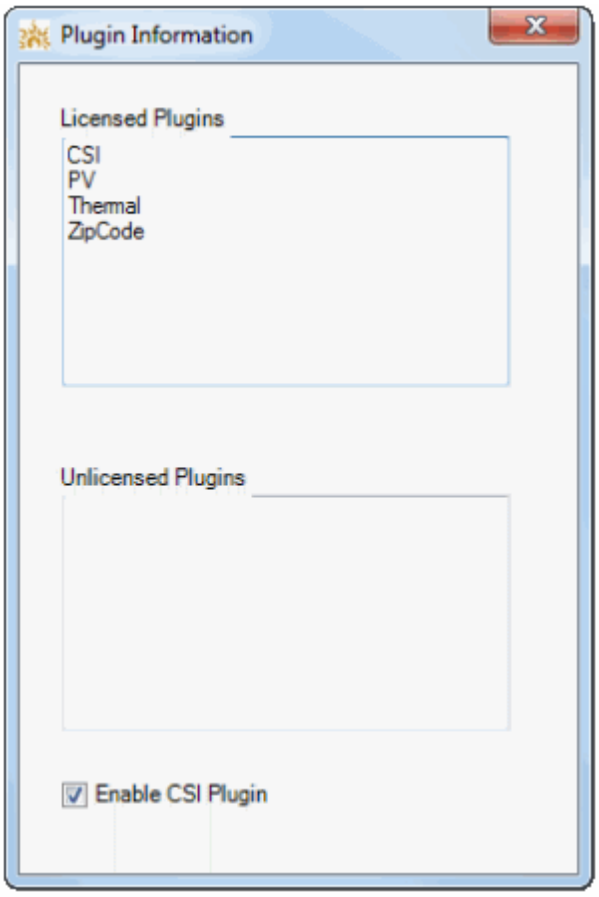


One point to look out for is when the result is on the azimuth or tilt boundary set by you. When this happens, readjust the boundaries and do another run.

The results produced by this tool do not alter the report. If you want to make changes to the report you will need to note these results and manually edit the report[11] with the new values for azimuth or tilt.

5.1.4.3 Tools|Plugin Information

This command provides you with information about enabled and disabled plugins. Some plugins can only be enabled by purchasing a license for that plugin.



The CSI Plugin is disabled by default. It requires the PV Plugin to work but it needs to be enabled by selecting the checkbox at the bottom of this window. Select this option if you live in California and need to submit a CSI report.

5.1.4.4 Tools|View CSI Web Page

The California Solar Initiative (CSI) offers solar information and analysis services for customers in applicable locations within California. Only acceptable reports can interact with CSI. If a given report is not CSI capable, the View CSI Web Page option will be disabled. There are several conditions that must be met in order for a report to be CSI capable:

- The site must be in California.
- The analysis site must be entered as a zip code, and must be a supported zip code for CSI analysis.
- When entering report information, you must choose from the known inverter/panel models.

5.1.4.5 Tools|Upload CSI Data

In 3.0 and earlier the CSI Plugin was an integral part of the SolarPathfinder Assistant. In 4.0 the CSI functionality was extracted from the Assistant and reimplemented as a separate Plugin. As a plugin, you will only see if this menu item if the plugin is present in the *Plugins* folder. This folder is located in the *Application* install folder.

The uploading of CSI data happens automatically for a valid CSI site. There may be times, however, where you might want to "refresh" your CSI data. Currently, the only time that would be necessary is if the CSI web site models were updated and you wanted to update your numbers.

5.1.5 View Menu

The view may be fit to the display or customized to a percentage of the page width. This can be used to see finer details of the report on screen. Note that this does not affect the size of a printed report. Two of the values need further explanation.

View Report On The Screen

Fit To Screen - The entire report will be sized so that it fits on the screen both vertically and horizontally. If you have a smaller monitor or a large resolution, you might not be able to read the text that is on the report. If this is the case, choose a higher view percentage.

Page Width - The report will fit width-wise on screen. Typically, the report will be longer than will fit vertically on screen. You must scroll down to see the entire report.

Screen Font Size

Adjust the screen font for high resolution monitors.

5.1.6 Help Menu

Contents 92
Printable Manual 92
SolarPathfinder Home 92
Online FAQ 92
Register 92
Check for Updates 92
Check for News 93

5.1.6.1 Help|Contents

Displays this help file.

5.1.6.2 Help|Printable Manual

This option opens the PDF version of the user's manual in Adobe Acrobat Reader. You must have Adobe Acrobat installed for this option to work.

5.1.6.3 Help|SolarPathfinder Home

The SolarPathfinder Home menu option takes you to the home page of SolarPathfinder (www.SolarPathfinder.com). Note that this action requires an active internet connection. On the web site, you can find product information, answers to frequently asked questions as well as software updates as they become available.

5.1.6.4 Help|Online FAQ

Opens a page in your web browser and displays the SolarPathfinder Online FAQ (www.solarpathfinder.com/faq).

5.1.6.5 Help|Register

If your program is not licensed, the registration screen will appear automatically every time you start the application. During registration, you have the option of validating your license or running the program in Evaluation mode. This mode will place a watermark on the report output but it otherwise enables you to use nearly all of the program features.

If your program is already registered, this command can be used to delete the current license file and re-register with the same or another license key.

See also: License Validation 8

5.1.6.6 Help|Check For Updates

You may download updates from the SolarPathfinder web site. This action requires an active internet connection. If updates are not available you will receive a message box with that message.

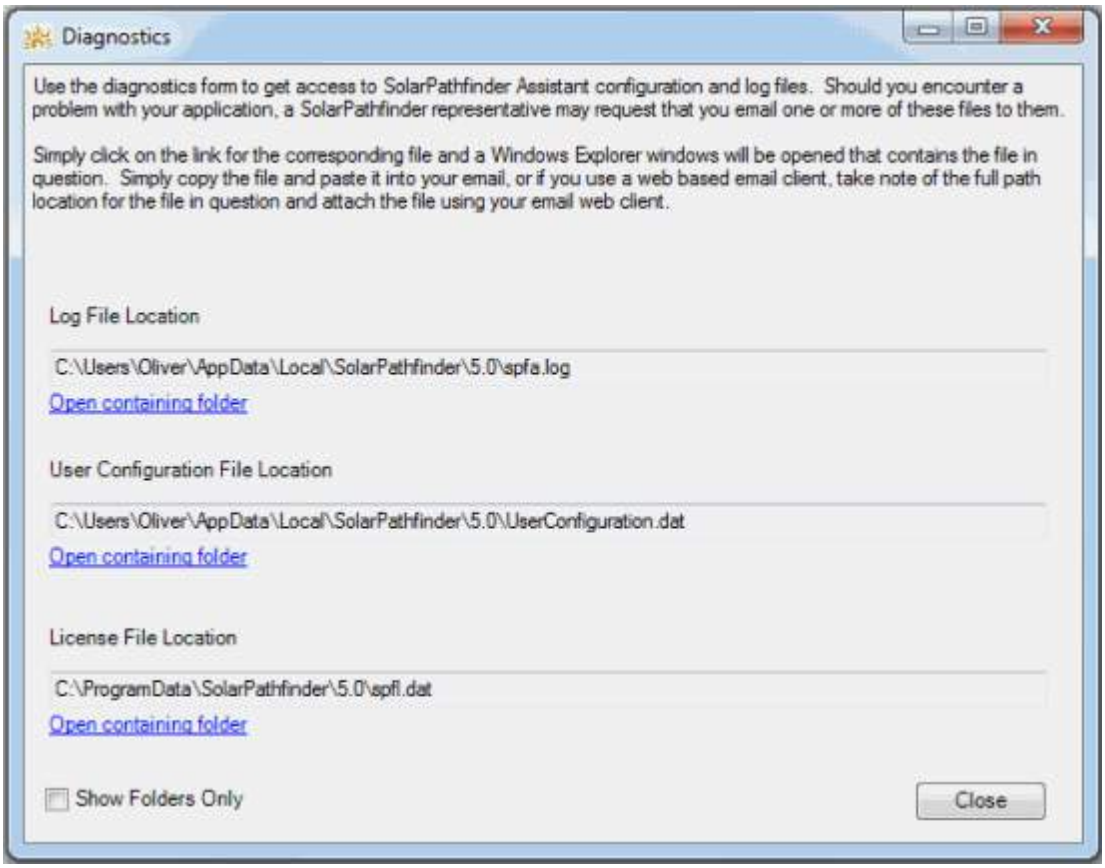
If there are updates available, the update (installer) program will be downloaded using HTTP and your default browser. The exact details

of the download depend upon your system and browser settings. In most cases, you will be given the option to Run or Save the installer file. Either option will work, although we recommend saving the installer to your to a known folder first and running it from there. When you run the installer, you will be prompted to close out any SolarPathfinder Assistant application instances that may be open.

5.1.6.7 Help|Check For News

This will bring up a new window that provides details of recent program updates.

5.1.6.8 Help|Diagnostics



The diagnostics menu brings up the diagnostics form which provides information about log file, license file and user configuration (userConfig) data locations. Should you have problems with the SolarPathfinder Assistant application, your technical support representative may need you to provide these files for troubleshooting purposes.

5.1.6.9 Help|Reset User Configuration

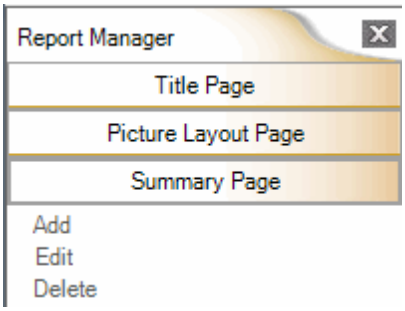
If you're experiencing unusual problems with this software, resetting the configuration will often solve the problem. One of the results of resetting the configuration is that any image loaded in the company options tab[100] will need to be set again.

5.1.6.10 Help|About

The About menu option displays the file version as well as the end user license agreement (EULA) that governs the use of this application.

5.2 The Report Manager

The Report Manager allows you to navigate between the pages in your report and add, edit or remove individual traces from within a given report. You can think of a report as being tied to a given geographic location and containing a set of traces for that location.



Report Manager

In the upper right corner of the Report Manager, there is an "X" button that can be used to close the Report Manager. To show the Report Manager if it is closed, choose Trace|Show Report Manager[87] from the main menu bar. As the Report Manager is the only way to navigate through your report, you will seldom find need to close it. Once we create our first report, we will return our attention to the Report Manager to show you the features it provides.

5.3 The Tool Bar

The Tool Bar sits right above the Report Manager and surfaces several common commands.

Tool Bar On Main Form

In order from left to right, these options are create report, open

report, save report, print report, copy report data to clipboard.

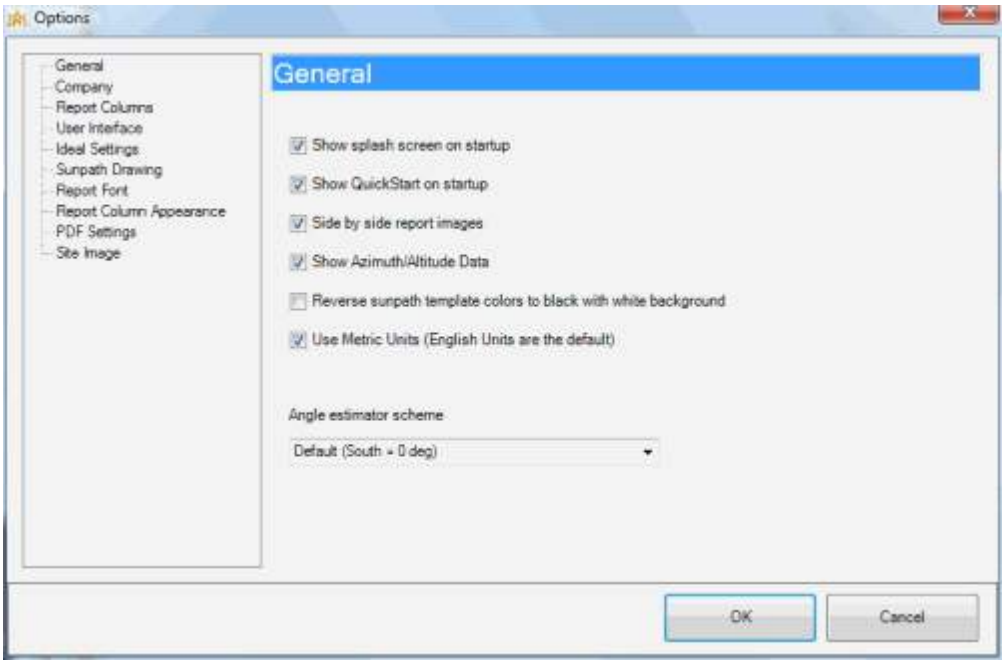
These options duplicate features found on the main menu and will be discussed in depth there.

If a given command is not currently applicable, it will be "grayed" out so that you cannot select it. For example, if there is no report currently loaded, it doesn't make sense to save or print it.

6 Options

The Tools|Options menu item will bring up the configuration options form. You can use these options to configure permanent settings or to change the behavior of certain parts of the program.

6.1 General Options



General Options

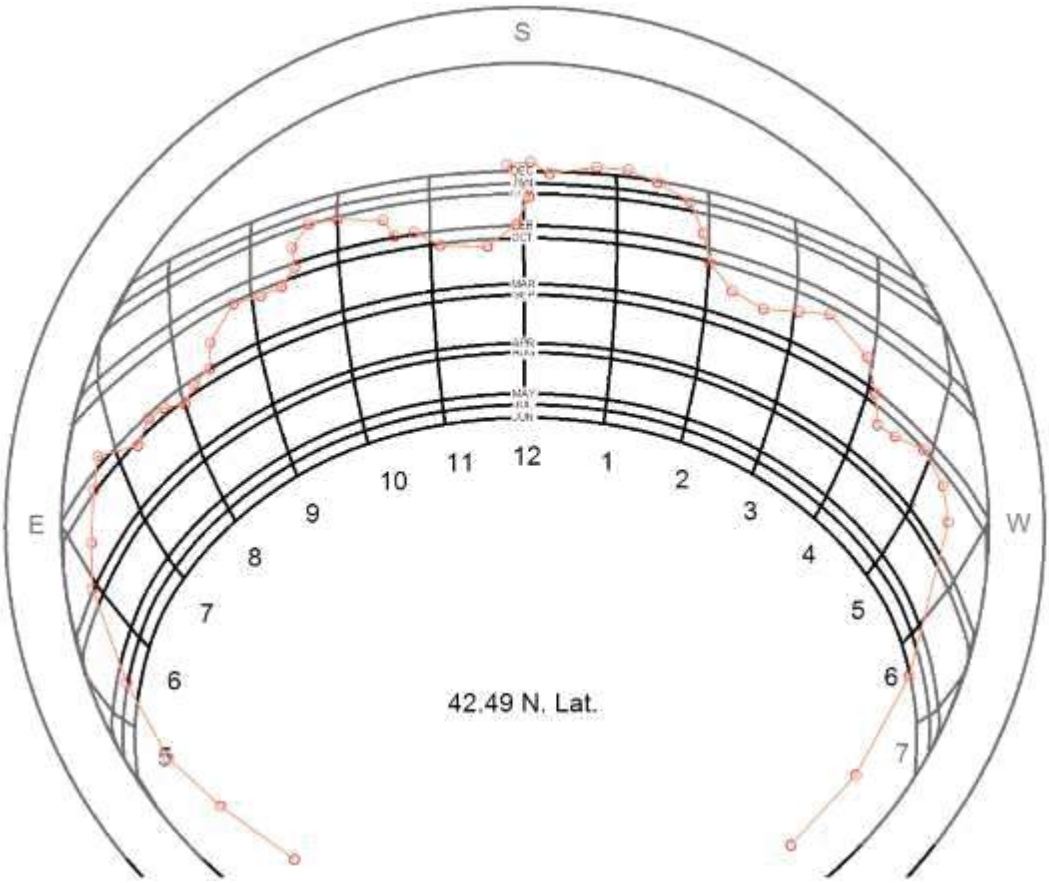
On the general tab, you have several settings to consider.

Show QuickStart on startup

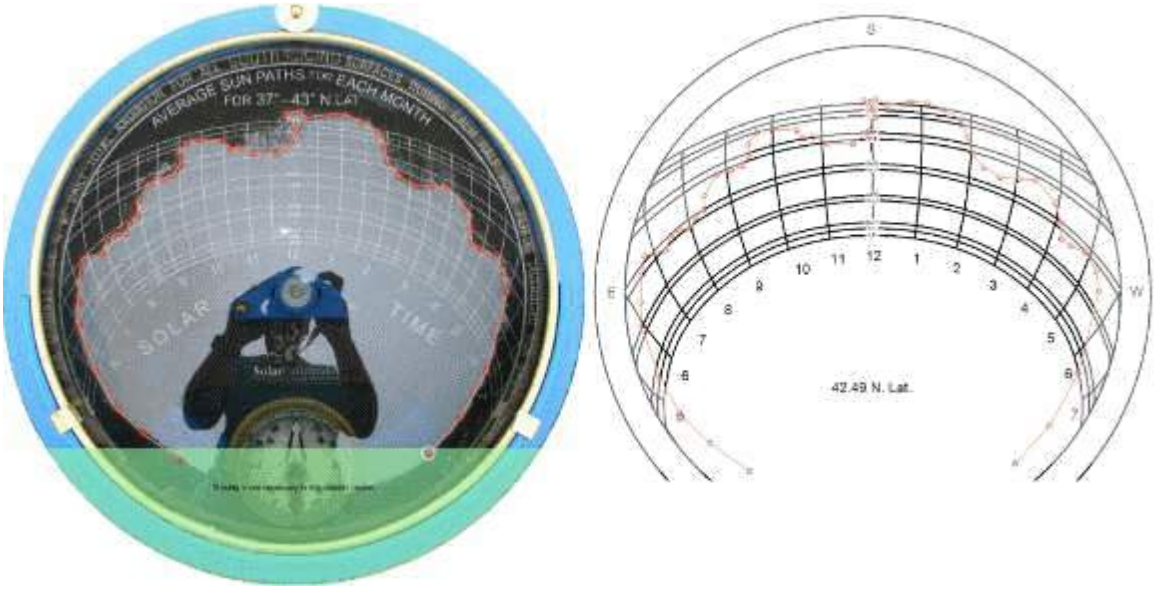
The Show QuickStart on startup menu option toggles whether or not the QuickStart form appears when you first open the application.

Side by Side Report Images

When a report is generated, you have the option of including just the composite image (trace on auto-generated template) or both the original traced image alongside the composite image. The composite image by itself will be more readable as it can be larger on the report. The side-by-side option allows you to see the original traced image and therefore the actual obstructions. Note that this will affect both the sunpath diagram as well as the angle estimator diagram.



Composite Image Option (no side-by-side)



Side By Side Option

Show Azimuth / Altitude Data in Report Summary
If this option is checked, each trace report page as well as the summary page will include the azimuth/altitude data for the

obstructions. This will be in addition to the standard month-based data columns. If unchecked, the azimuth/altitude data will be omitted.

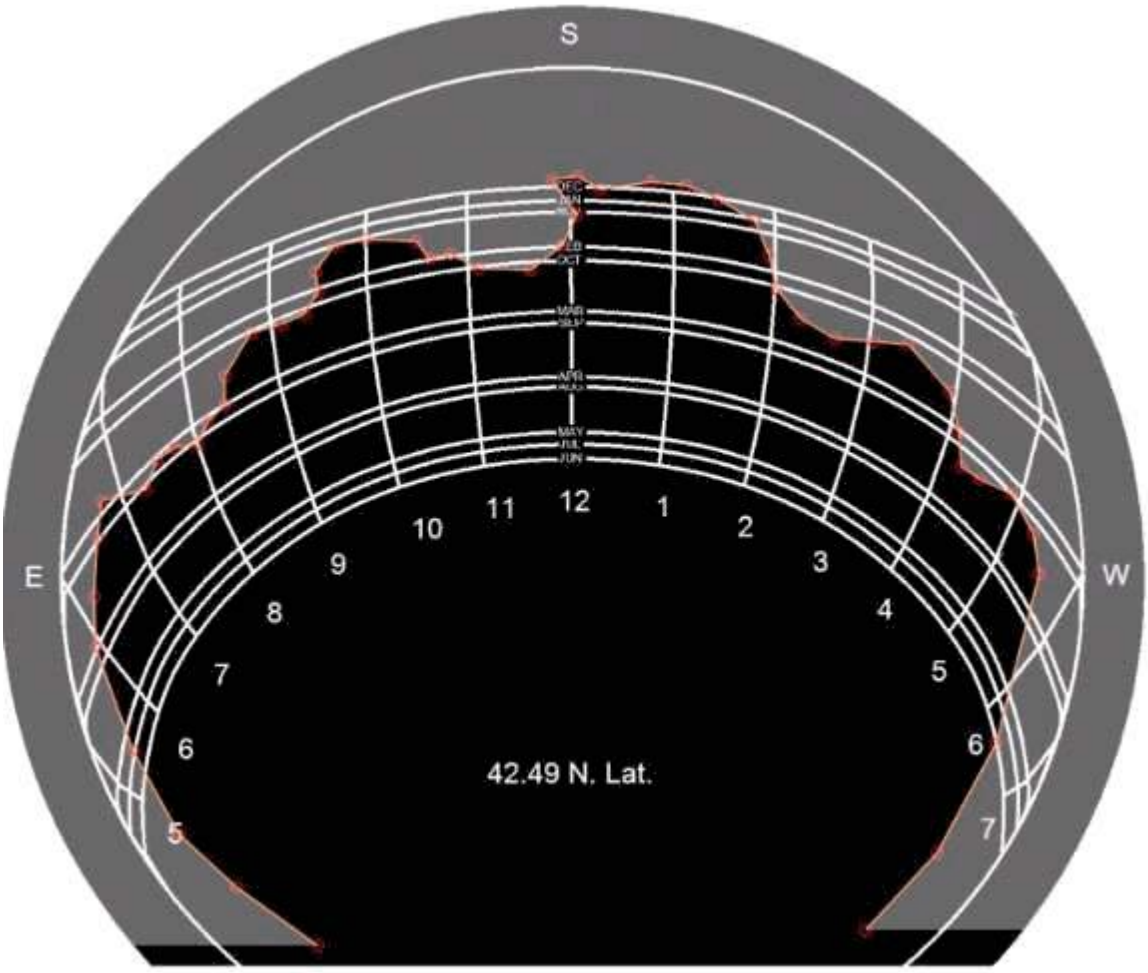
Azimuth/Altitude Data

Azimuth / Altitude (degrees) where North = 180 degrees

-125	9.0	-80	8.0	-35	21.0	10	22.5	55	21.0	100	11.5
-120 (ENE)	**8.5**	-75	16.0	**-30 (SSE)**	**24.0**	15	21.0	**60 (WSW)**	**19.5**	105	12.0
-115	8.0	-70	23.0	-25	27.5	20	21.0	65	19.0	110	11.5
-110	7.5	-65	24.0	-20	33.0	25	22.0	70	20.5	115	12.0
-105	7.5	**-60 (ESE)**	**22.0**	-15	36.5	**30 (SSW)**	**25.0**	75	20.5	**120 (WNW)**	**12.0**
-100	6.0	-55	22.0	-10	38.0	35	30.5	80	12.5	125	11.5
-95	6.0	-50	24.0	-5	37.0	40	32.0	85	9.5		
-90 (E)	**6.5**	**-45 (SE)**	**27.0**	**0 (S)**	**31.5**	**45 (SW)**	**31.5**	**90 (W)**	**9.0**		
-85	6.5	-40	23.0	5	24.0	50	28.0	95	10.5		

Azimuth Altitude Table

Reverse sunpath template colors to black with white background
While previous versions of the product always used a template with a black background, checking this option will generate templates with white backgrounds instead, saving on printer ink and making the trace easier to read for some users. The images above show a white background diagram. The following image shows a black background diagram of the same trace.



Trace With Black Background

Note that changing the value of this option will only affect new traces. If there are existing traces in the report that you would like to reflect this new change, you will need to re-edit the trace so that the diagram is regenerated.

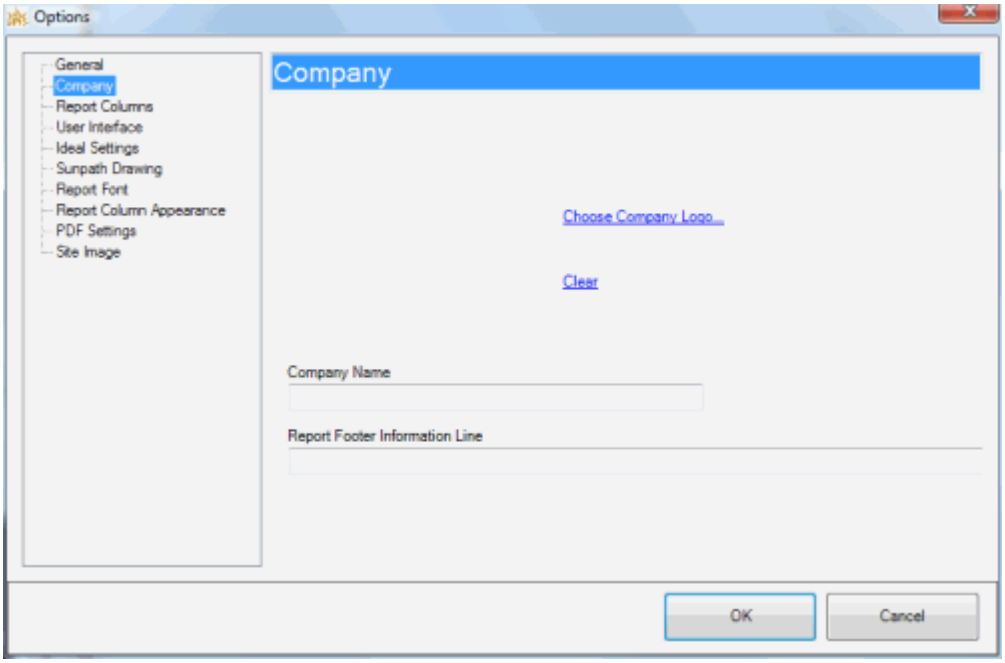
Use Metric Units
If checked, all distance measurements on the report will have units of kilometers instead of miles (the default). Also, if the plugins, such as Solar Hot Water (Thermal) will also be affected by this setting for its various units.

Angle Estimator Scheme
The angle estimator scheme determines that the angle value for South will be on the angle estimator report. For the default setting, south is 0 degrees. For the reverse setting, south is 180 degrees. Note that for each report, you can override this value. However, whatever is set within this options page will be the value that

initially comes up when creating a report.

6.2 Company Options

The company option screen contains settings that allow you to personalize your reports with your company name, logo and additional information.



Company Options

Company Logo

By default, each report that is generated will have the SolarPathfinder sun logo in the upper left of the report. Should you desire to override this, click on the "Choose Company Logo" link and select your company logo file. The application supports jpeg, gif, bmp and png files.

Company Logo Filled In

If you wish to clear you selection and return to the SolarPathfinder sun logo, click the Clear link.

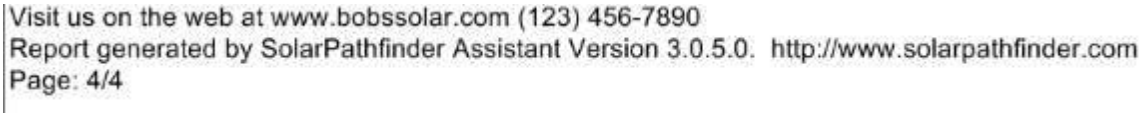
Company Name

The company name will appear at the top of the report if it is filled in. Note that the company name should be less than roughly 30 characters so that it does not run into the table to the right of the header.

Company Name On Report

Report Footer Information Line

The report footer contains additional contact information or tag lines that you would like to present to the consumer. This will appear at the bottom of each page of the report.



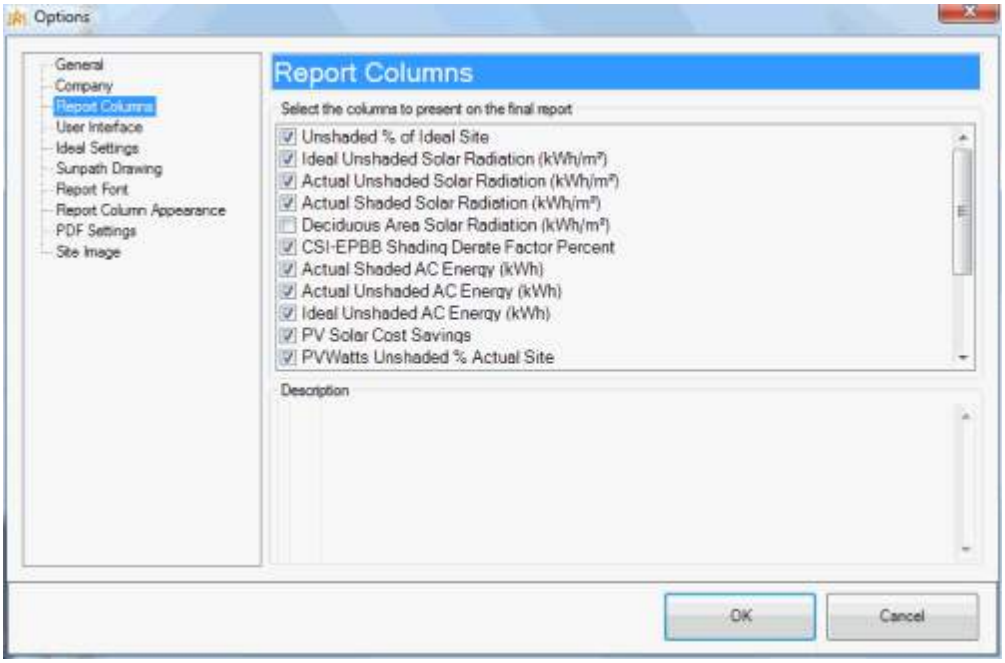
Report Footer

Apply Company Information to Current Report

Company information is saved with each report. Changing company information on the Options form will only affect new reports that are generated. However, if you would like to apply the new information to the currently opened report, click on the "Apply Company Information to Current Report" link at the bottom of the form. Once the Options form is closed, the report will be updated with the information.

6.3 Report Columns Options

This setting page enables you to select the columns you want to display on your report and it provides definitions for all of the report columns.



Report Columns Options

Terms Used On Column Data

Ideal - Refers to the best orientation your specific site. Because of various real world situations, it is often impossible to situate

the array in an ideal orientation. We use the ideal orientation as a standard to which we compare the actual orientation of the array. Orientation considers both Azimuth and Tilt. For the Northern Hemisphere, the ideal Azimuth is 180° or true South, and for the Southern Hemisphere is 0° or true North. The ideal tilt is a little more controversial. We consider the ideal tilt to be equal to latitude if the whole year is being considered. However, be aware that the ideal tilt could be very different if you are only considering a particular range of months or if your site has unique weather conditions.

Actual - The actual tilt and azimuth of the Array.

Unshaded (Unobstructed) - The absence of shade during a particular time period. We also refer to the shade producing object as an obstruction and use the terms Unshaded and Unobstructed interchangeably.

Shaded - The opposite of Unshaded.

(Ideal or Actual) Hourly Solar Radiation - The calculations use hourly historical weather data to obtain this value. This makes it impossible to use monthly average insolation data without significant change to this algorithm. The solar radiation (or insolation), is calculated for a tilted surface. Two calculations are done: the first using the actual tilt and azimuth settings, and a second time using the ideal tilt and azimuth settings. These calculations use the PVWatts V1 algorithm, which uses the Perez method, to calculate the solar radiation on a tilted surface. All significant sources of light are considered, direct solar radiation, diffuse solar radiation, including extra diffuse radiation from snow cover.

Deciduous Solar Radiation - This is solar radiation that gets through the branches of trees during the winter time after the leaves have fallen off the trees. The user enters this information in the form of a percentage that is then applied to the Hourly Solar Radiation.

Hourly Unobstructed Percent of Solar Radiation - Also sometimes called the shading data. The percent of an hour during which there is no shade on the site. This number can be calculated directly from a paper template where the outline of an obstruction curve has been drawn. The unobstructed percent is based on the amount of daily insolation received during the day and the time at which the insolation is received. An hour of unshaded sun during the middle of the day provides more

insolation than an hour of sun in the early morning, say from 8 to 9.

(Ideal or Actual) AC Energy - PVWatts is used to calculate the AC Energy produced by the specified array at the particular site. The "ideal" calculation uses the ideal orientation settings for azimuth and tilt and no shade. The "actual" calculation considers site shade and the actual array orientation.

Definitions of Solar Radiation Columns

Unshaded % of Ideal Site
Column Title: Unshaded % of Ideal Site Azimuth = [180 or 0] Tilt = [latitude]

Description: This value is the average percentage of the day during which there is no shade. The percentage represents ideal insolation for the site. The ideal value does not come from the ideal settings. For the northern hemisphere the ideal azimuth is true south (azimuth 180) and for the southern hemisphere the azimuth is true north (azimuth 0). The tilt is equal to latitude for PV or Thermal reports and a tilt of zero for Ecological reports.

Ideal Unshaded Solar Radiation (kWh/m²)
Column Title: Ideal Unshaded Solar Radiation Azimuth = [analysis settings] Tilt = [analysis settings] kWh/m²

Description: The total solar radiation that is realized at the current site on a tilted surface (given the ideal azimuth and tilt), but no obstructions. The total value includes the effective solar radiation percent that is realized at the current site for the entire year.

Actual Unshaded Solar Radiation (kWh/m²)
Column Title: Actual Unshaded Solar Radiation Azimuth= [analysis settings] Tilt= [analysis settings] kWh/m²

Description: The total solar radiation that is realized at the current site on a tilted surface (given the actual azimuth and tilt), but no obstructions. The total value includes the effective solar radiation percent that is realized at the current site for the entire year.

Actual Shaded Solar Radiation (kWh/m²)
Column Title: Actual Shaded Solar Radiation Azimuth= [analysis settings] Tilt= [analysis settings] kWh/m²

Description: The total solar radiation that is realized at the current site on a tilted surface (given the azimuth, tilt) and obstructions. The total value includes the effective solar radiation percent that is realized at the current site for the entire year.

Deciduous Area Solar Radiation (kWh/m²)
Column Title: Deciduous Areas Solar Radiation Transparency = [percent]

Description: The total solar radiation that is realized from the Deciduous Areas given the azimuth and tilt.

Unshaded % Actual Site
Column Title: Unshaded % Actual Site Azimuth= [setting] Tilt= [setting]

Description: This column compares Actual Shaded Solar Radiation with Actual Unshaded Solar Radiation.

Formula = (Actual site[azimuth & tilt] Shaded Solar Radiation) / (Actual site[azimuth & tilt] Unshaded Solar Radiation)

Total Solar Resource Fraction (TSRF)
Column Title: Total Solar Resource Fraction (TSRF) Azimuth= [actual setting] Tilt= [actual setting]

Description: Determines the actual site efficiency considering both orientation as well as shading. This column compares the actual solar radiation values against what could be realized with no obstructions and with ideal orientation.

Formula = (Actual site[azimuth & tilt] Shaded Solar Radiation) / (Ideal settings[azimuth & tilt] Unshaded Solar Radiation)

Ideal Site Efficiency
Column Title: Ideal Site Efficiency % Azimuth= [ideal setting] Tilt= [ideal setting]

Description: Determines the efficiency of a panel location considering only shading values. This column compares the ideal solar radiation values with shading against what could be realized without shading.

Formula = (Ideal settings[azimuth & tilt] Shaded Solar Radiation) / (Ideal settings[azimuth & tilt] Unshaded Solar Radiation)

Definitions of CSI Columns

CSI-EPBB Shading Derate Factor Percent
Column Title: CSI-EPBB Shading Derate Factor (%)

Description: This column is required by the state of California as part of the California Solar Initiative (CSI). Actual shaded solar radiation divided by actual unshaded solar radiation. Totals only consider May-Oct.

Definitions of PV Columns

Actual Shaded AC Energy (KWH)
Column Title: Actual Shaded AC Energy (KWH) Azimuth= [analysis settings] Tilt= [analysis settings]

Description: The actual amount of energy expected from the array.

Actual Unshaded AC Energy (KWH)
Column Title: Actual Unshaded AC Energy (KWH) Azimuth= [analysis settings] Tilt= [analysis settings]

Description: The unshaded (no obstructions) amount of energy expected from the array for the given azimuth and tilt.

Ideal Unshaded AC Energy (KWH)
Column Title: Ideal Unshaded AC Energy (KWH) Azimuth= [ideal settings] Tilt= [ideal settings]

Description: The unshaded amount of energy expected from the array taking the ideal orientation settings into account.

PV Solar Cost Savings
Column Title: PV Solar Cost Savings [actual cost (i.e. $0.11 / kWh)]

Description: The amount of actual savings that can be expected given the shading and analysis settings.

AC Energy Efficiency

Column Title: AC Energy Efficiency Azimuth = [actual setting] Tilt = [actual setting]

Description: The Actual AC Energy divided by the Ideal AC Energy, expressed as a percentage.

Definitions of Thermal Columns

Solar Hot Water Shaded Cost Savings
Column Title: Solar Hot Water Shaded Cost Savings

Description: The total solar hot water kWh equivalent savings that is realized at the current site given the azimuth and tilt and obstructions. The total value includes the effective solar hot water heating that is realized at the current site for the entire year.

Solar Hot Water Solar Fraction
Column Title: Solar Hot Water Solar Fraction Azimuth = [analysis setting] Tilt = [analysis setting]

Description: The percent of the monthly heating load generated at the current site given the azimuth and tilt and obstructions. The total value is the fraction of the annual heating load, which is supplied by solar energy.

Solar Hot Water Produced
Column Title: Solar Hot Water Produced Azimuth = [analysis setting] Tilt = [analysis setting]

Description: Amount of Giga Joules (or MMBTU) produced. The total value is the yearly Giga Joules (or MMBTU) which is supplied by solar energy. This is calculated using the F-Chart method.

Solar Hot Water Demand
Column Title: Solar Hot Water Demand Azimuth = [analysis setting] Tilt = [analysis setting]

Description: The hot water demand on this system.

Notes about the Solar Radiation columns

On the final report, each solar radiation column will include three totals rows.

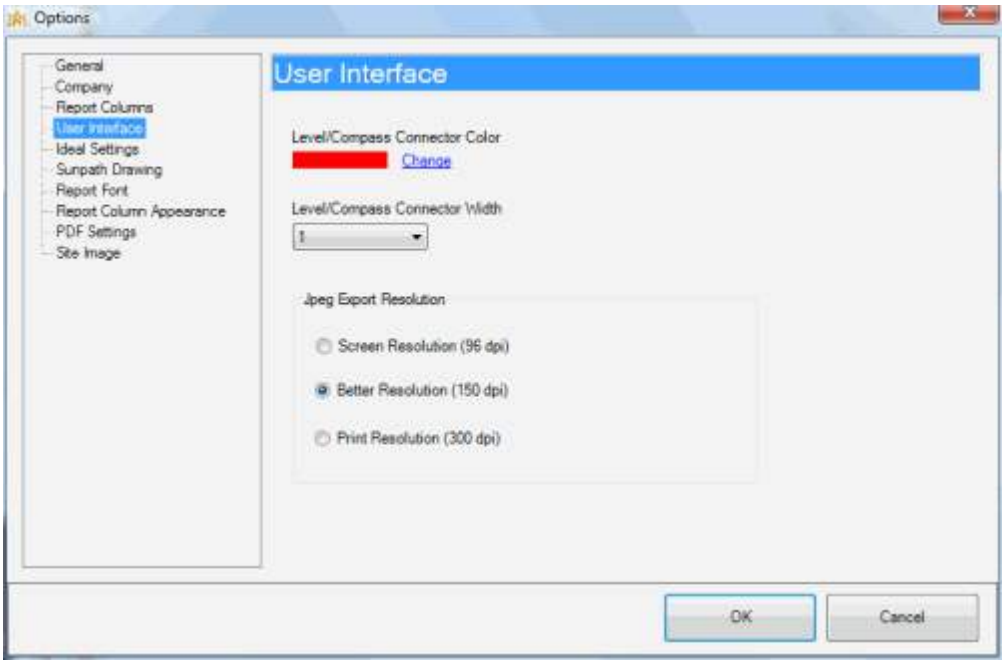
Actual Solar Rad w/ Shading Azimuth=165.0 Tilt=42.5 KWH/m^2 /day
1.68
2.94
4.18
5.10
5.53
5.65
5.75
5.44
5.18
3.87
1.99
1.14
48.45
Effect: 87.08%
Sun Hrs: 4.04

Solar Radiation Column

The first of the totals rows indicates the yearly total solar radiation at the site. This value is simply the sum of the solar radiation values for each month. The second row indicates the "effective" percentage for the site in question. This percentage indicates how the proposed panel with its tilt, azimuth and obstructions compares to the "ideal" configuration for that panel (azimuth = 180, tilt = latitude, no obstructions). The Ideal Solar Radiation column will always have an effective percent of 100 since we are dividing a number by itself in all cases. The third row indicates the average yearly sun hours per day. So in the above image, each day effectively has 4.04 sun hours exposure.

6.4 User Interface Options

The user interface tab gives you the option of setting the color of the line that connects the level and compass reference points when creating a trace. It also contains the setting for changing the Jpeg image export resolution.



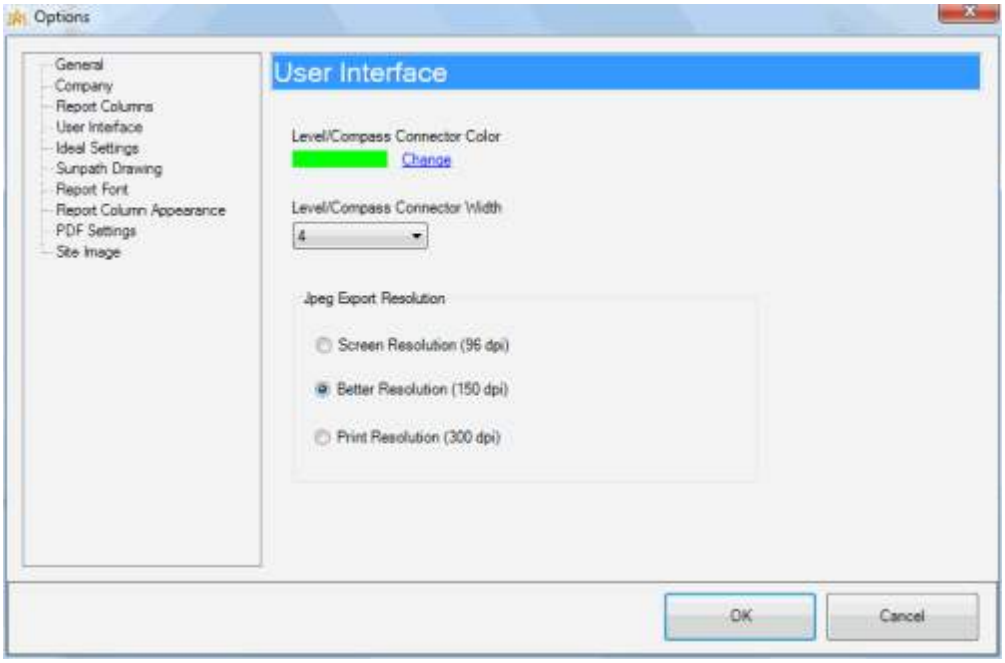
User Interface Options

To change the color, click on the Change link and choose the color of interest. Doing so will bring up the color picker form.

This can be helpful when using a laptop in the field, where you are often confronted by sunny conditions that make it difficult to see the graphics that are on the screen. A different color might make it easier to line up the reference points in such environments; it is often useful to choose a more contrasting color and increase the width of the reference line so that it is more visible.

If the basic colors are not acceptable, click on the "Default Custom Colors" button and choose your color from the extended area of the form.

It is advisable to choose a high contrast color so that the line will show up on the black background of the pathfinder. Once you have made your selection, click OK. You can also change the thickness of the line by setting the level/compass connector width drop down box to a larger value.



Custom Color And Width Selection

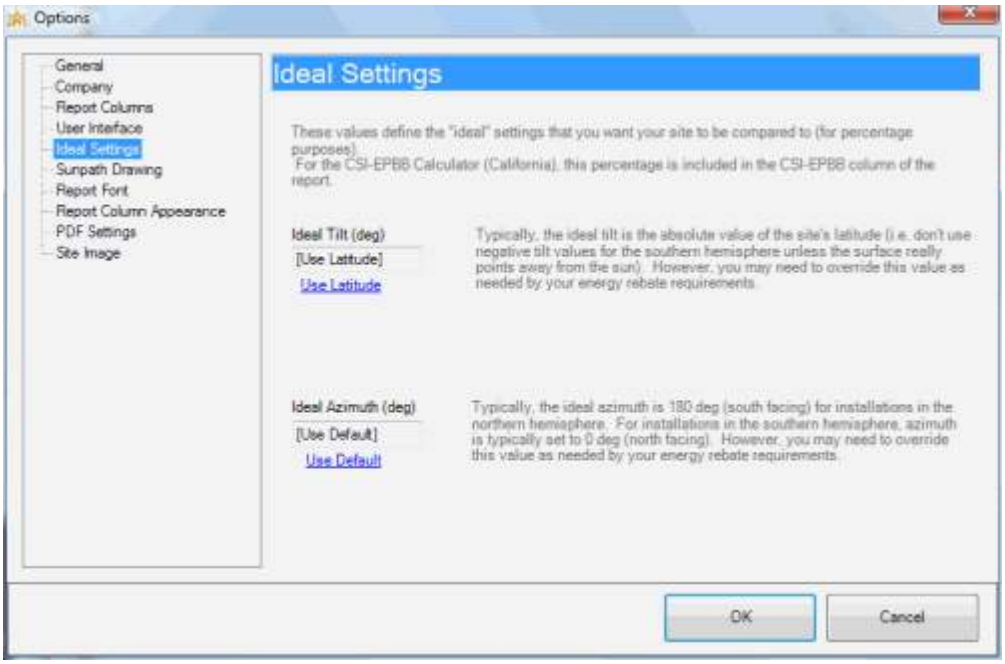
Notice the effect that it has on the image configuration tool.

Compass
Connector Used

Jpeg Export Resolution

You can select a resolution for jpeg images of report data to be exported in. You probably don't need to use any greater resolution than 300 dpi. The larger the resolution, the larger the resulting file will be.

6.5 Ideal Settings Options



Ideal Settings Options

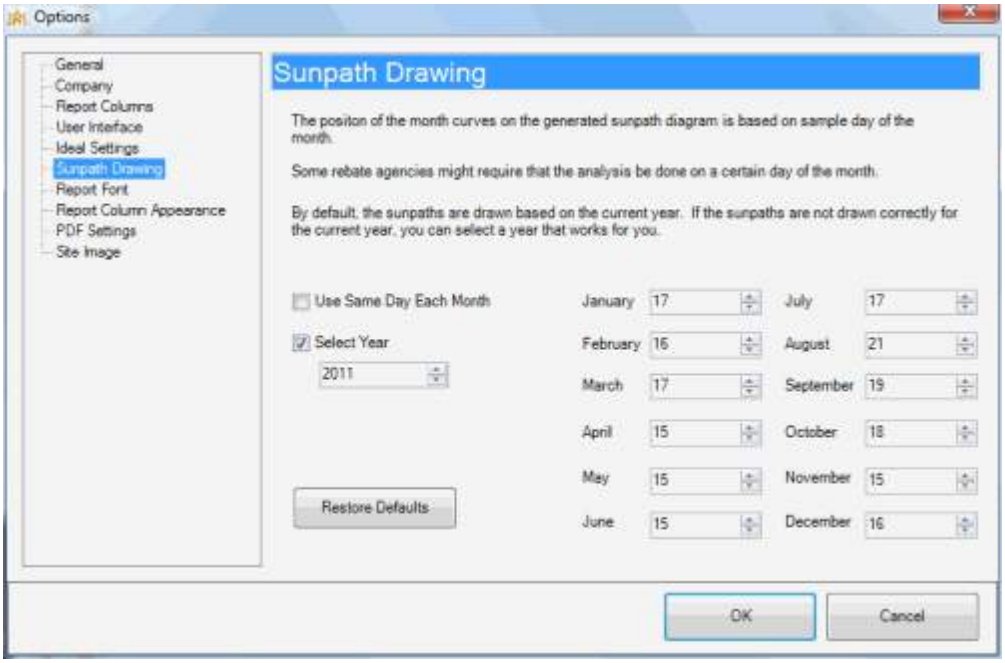
By default, "Ideal" means that the azimuth is 180 deg south and tilt is the same as the latitude value of the analysis site. However, you may want to change these values for one reason or another. To do so, enter the information here. This will be applied to all new reports. Note that reports that were saved before this information was entered will still use their old values for ideal tilt and azimuth.

If you have changed these values and would like to go back to the default "ideal" settings, simply click the "Use Default" link beside the appropriate text box.

When you create or edit a report, you can override these values. The above values are used to "pre-populate" the report when you first create a new report.

6.6 Sunpath Drawing Options

The Sunpath Drawing options page gives you some control over how the sunpath is generated. Each month curve on the generated diagram is based on a representative day of that given month. The mid-point day of the month is typically a good options, but certain jurisdictions might require you to use different values.



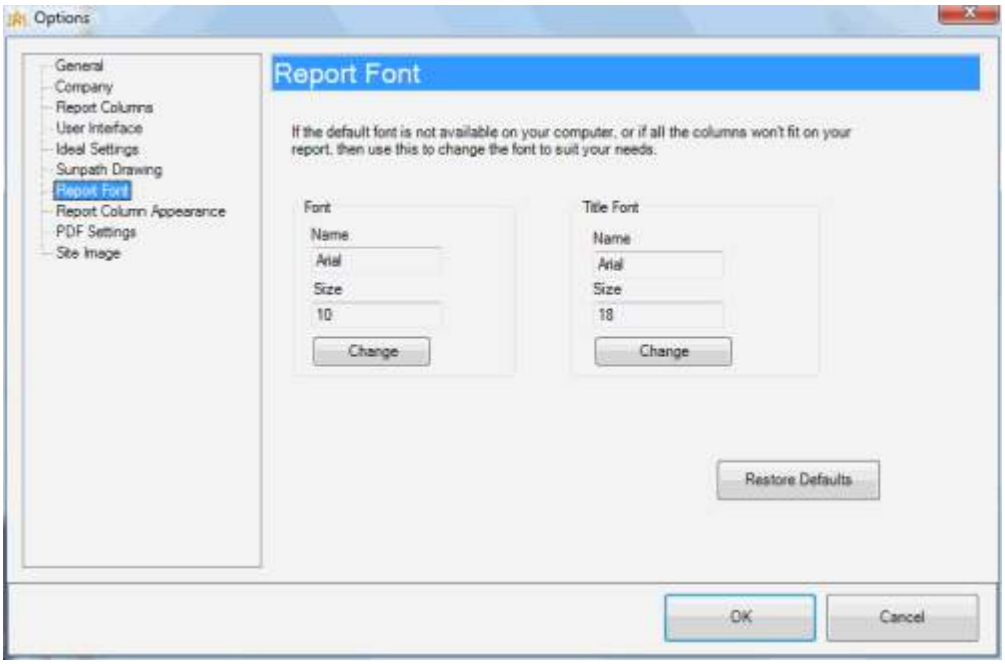
Sunpath Drawing Options

Use Same Day Each Month (January)
If this option is checked, all months will use the value entered in the January text box.

Select Year
By default the sun's position for the current year is used to generate the sun paths. If you would rather use another year as the basis for solar position, enter it here. Make sure to enter in the full four digit year value because a value of 08 would represent 8 A.D. rather than 2008.

Restore Defaults
Clicking this button restores the sunpath drawing options to their factory default values.

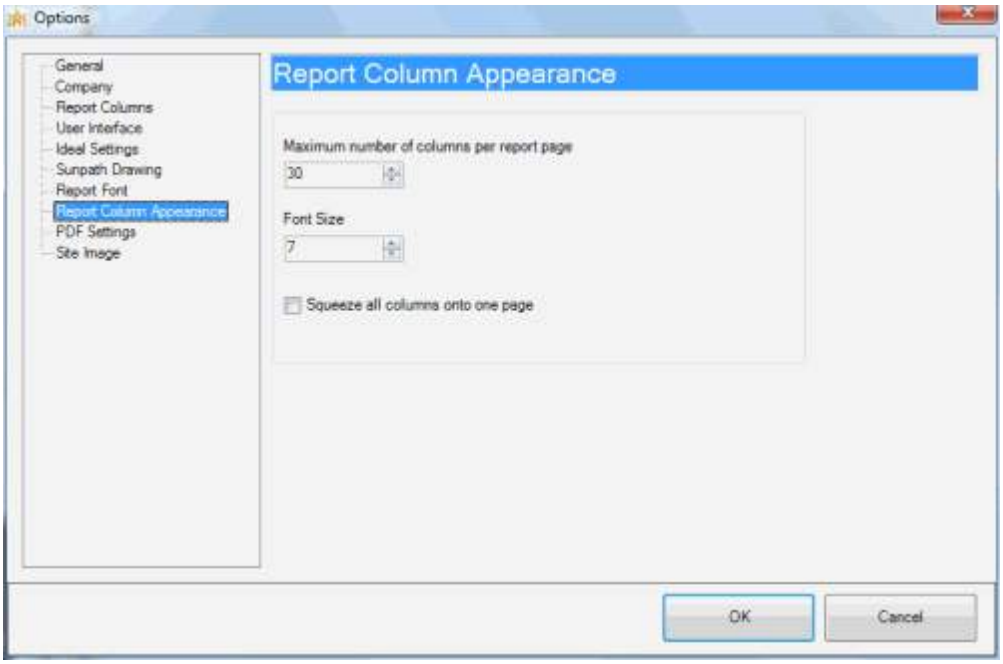
6.7 Report Font Options



Report Font Options

This option enables you to change the size and type of the font on the printed report. The font size for the column pages can be set separately in the Report Column Appeareance Options[115]. For PDF reports, use the PDF Settings Options[116].

6.8 Report Column Appearance Options



Report Column Appearance Options

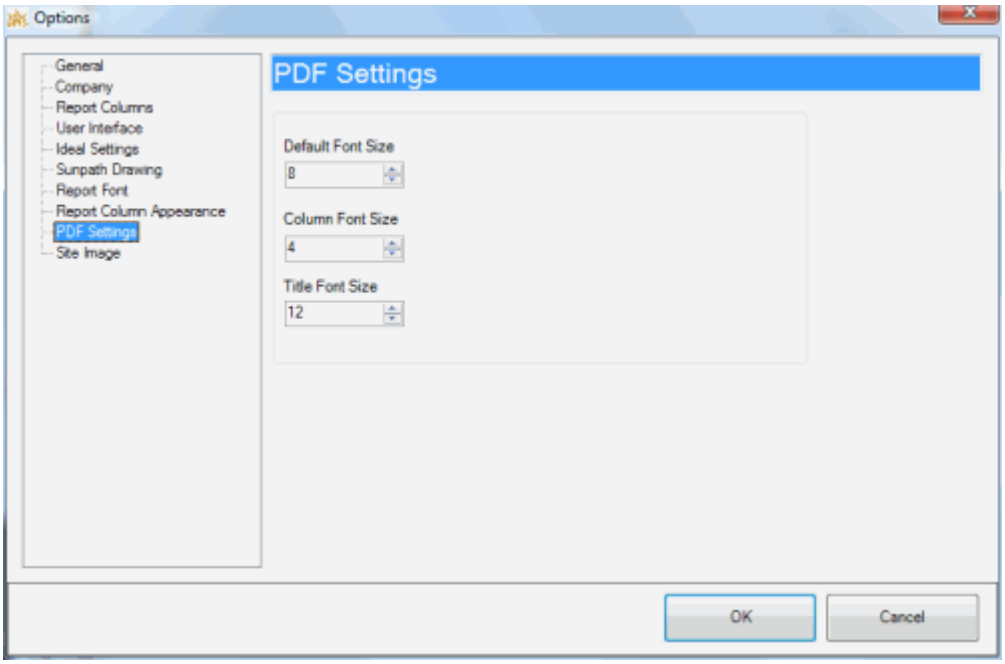
Maximum number of columns per report page - this is the upper limit of columns on a page, no matter how small the font is.

Font Size
These settings give you more control over how you want the columns to appear on the report page. In the default font, the display of the column pages must be done in two or more parts. Changing the size of the column font enables you to put all of the fonts on a single page. A smaller number in this input box produces a smaller font.

Squeeze all columns onto one page - setting this checkbox will override the column font size and automatically make the font small enough to fit all of the columns onto one page.

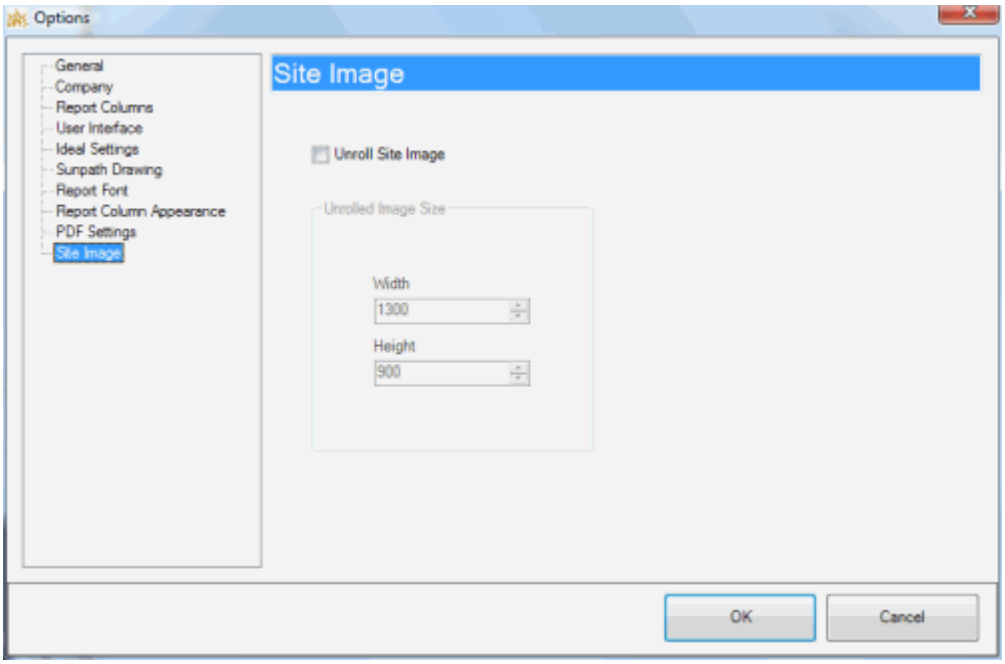
For PDF Reports, use the PDF Settings Options 116.

6.9 PDF Settings Options



Here you can change the font sizes for a PDF report. Unlike the printed report, you cannot change the font type on a PDF file. If you want to squeeze all of the columns onto one page, there is no automatic mode, instead you will need to try successively smaller column font sizes until all the selected columns fit onto one page.

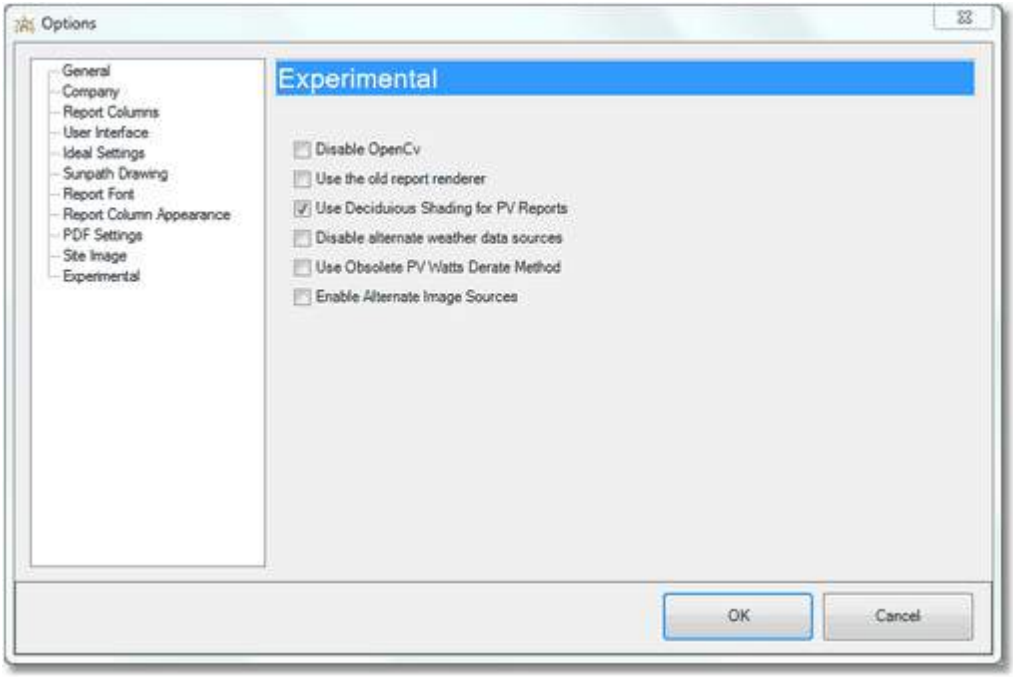
6.10 Site Image Options



Unroll Site Image

Selecting this checkbox will create a rectilinear image 48 of SolarPathfinder Unit image. The rectilinear image is similar to a panoramic or landscape image and it contains a 260° range of vision for most latitudes. You must select this setting if you want to adjust your survey position 52.

6.11 Experimental Options



Experimental options are used to disable/enable provisional features in the program. They are also used to work around bugs.

7 Weather Data

You have 3 options when selecting your weather data:

Weather Stations

The Unites States uses 30 Year TMY3 hourly weather data.

Information about TMY3 and other sources of weather data can be found at the Energy Plus Site (http://apps1.eere.energy.gov/buildings/energyplus/weatherdata_sources.cfm).

You can look that the data we use by finding your location starting at http://apps1.eere.energy.gov/buildings/energyplus/weatherdata_about.cfm

See Also: Weather Station Override Form 118

NASE SSE Weather Data

This is satellite weather data for each 1x1 degree grid on the planet. This is useful for when you don't have a weather station near by. This is average daily weather data 119.

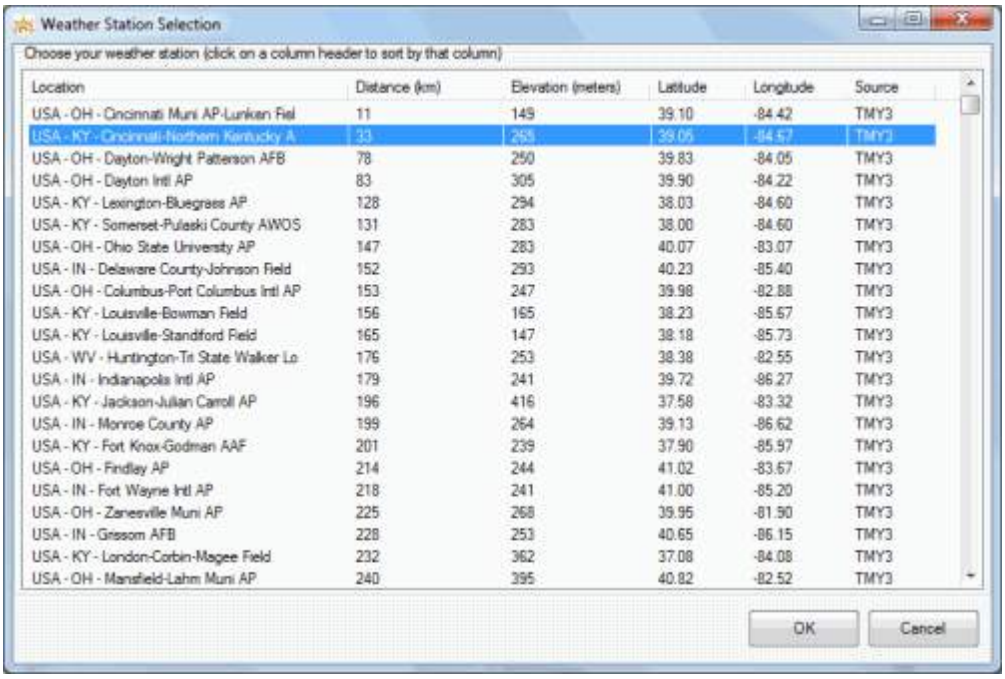
Custom Weather Data

You can use the NASA data as the starting point for adding your own custom data. See the Average Daily Weather Data Form 119 for more information.

7.1 Weather Station Override Form

Weather Station Override

You can override the automatic weather station selection by clicking in the "Override weather station selection" checkbox, and this is the window form you will see once the box is selected:



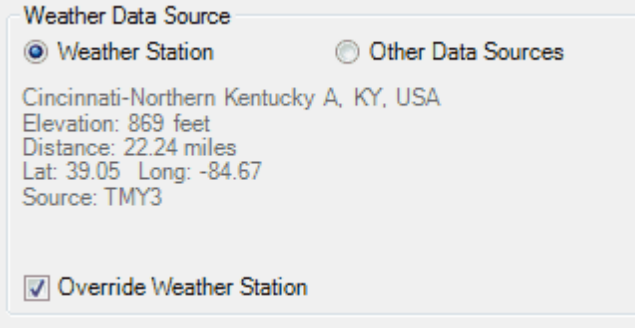
Weather Station Selection Form

Here, you can choose an alternate weather station. Each entry gives the distance from the analysis location as well as the elevation of the weather station. The weather station data can be ordered by any of the columns. For instance, to order the list by the distance from the

analysis site, simply click on the "Distance (miles)" column header.

Select an alternate station using the mouse and click "OK" to accept this new station or "Cancel" to exit without selecting a new station.

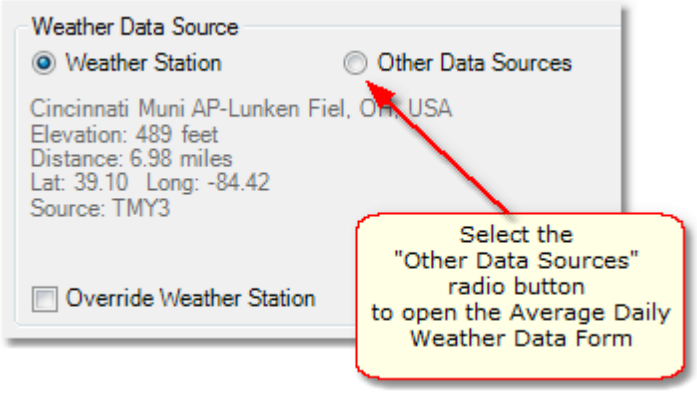
If you have selected a new station, the wizard will be updated to reflect your new selection.



Overridden Weather Station

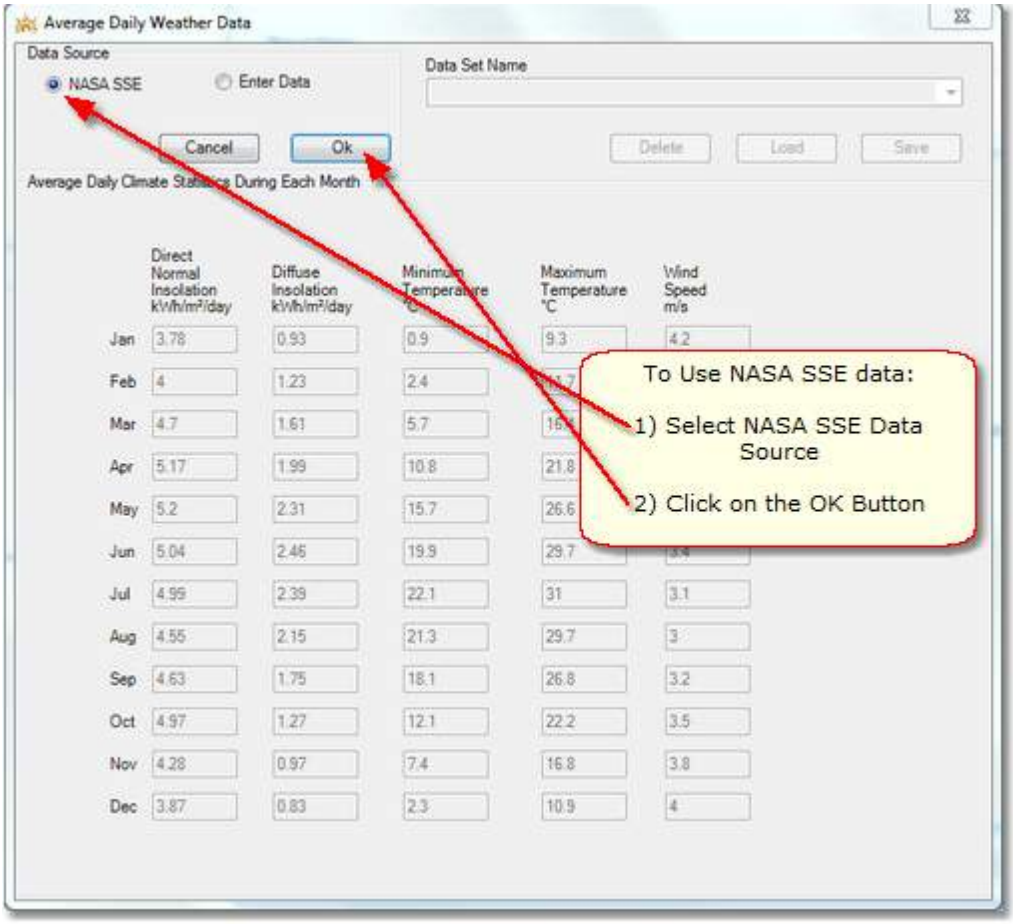
7.2 Average Daily Weather Data

How Open the Average Daily Weather Form



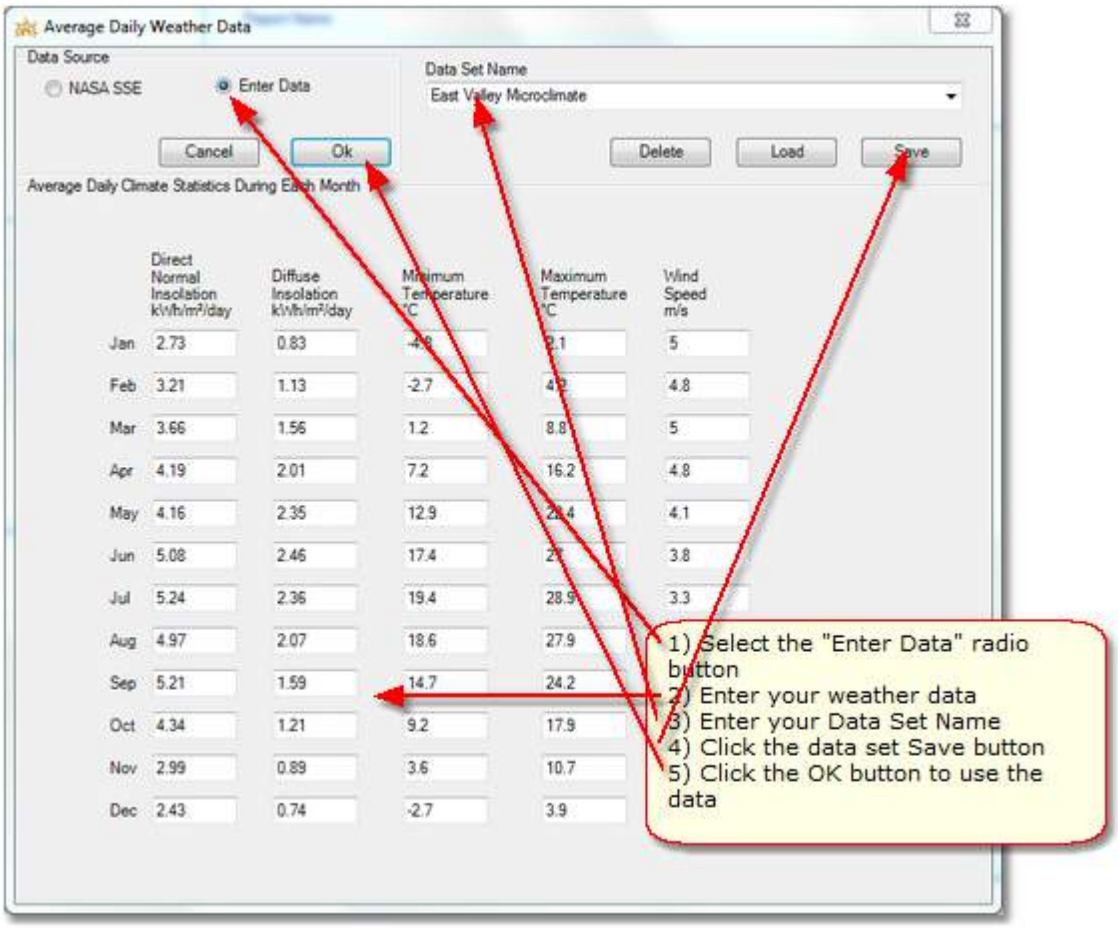
Open the Average Daily Weather Form

How to Use NASA SSE Data



Use NASA SSE weather data

How to Use Custom Weather Data



Enter Custom Weather Data

Once you save your custom data set, you can use it on another report by selecting the saved name from the drop-down list and clicking on the load button.

8 Paper Template Descrepancies

The application uses digital versions of the template for report generation. If you do use a paper template on the Pathfinder unit, you may notice some slight discrepancies between where you traced the reflection on the Pathfinder image and where the report says that the trace actually is. There are several possible reasons for this:

1. The magnetic declination that is used for rotation is exact. When you manually rotate your Pathfinder for magnetic declination, it is possible that the manual rotation amount differs from the calculated rotation amount. As such, the paper template will be over or under rotated when performing tracing. Note that this will not affect the calculations as you will be tracing the reflection on the dome. The

paper template location does not come into play when analyzing an image.

2. Paper templates can shift. Although the paper templates fit onto the level triangle relatively well, these templates can shift slightly from handling. As such, the resulting trace may not agree with what you can see by inspection. These errors will not be great. Note that the error is in the location of the paper template and not in the application. The application does not concern itself with the location or orientation of the paper template.

3. Camera parallax issues. When you take a picture of the Pathfinder unit, your camera should be facing directly down at the Pathfinder. If you are taking the picture from an angle, you will introduce parallax and the level will appear to be in a slightly different location. This can easily be seen during the calibration step as the gray lines will indicate where the level should be in an ideal picture.

9 Technical Support

Should you require technical support, you can contact SolarPathfinder via email at assistant@solarpathfinder.com

You can also check out the web site (www.solarpathfinder.com) for frequently asked questions, tips, as well as program updates.

Index

Note: The page numbers in this index point to the start of the numbered section that contains the keyword or concept. Because of this, the keyword might possibly be found several pages after page listed in this index.

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