Laboratory 1: Shading Experiment

Florida Solar Energy Center

Introduction and Background

Shading can provide a major obstacle to the performance of photovoltaic systems. Before spending time and money on a PV system that may not meet customer expectations, it is important to verify that there is adequate solar access. Many people attempt to 'eyeball' the site and guess as to whether the site will have shading or not. This can be incredibly inaccurate, and often leads to unexpected shading.

There are many relatively accurate methods for determining shading. The most common method is to use a piece of equipment called a Solar Pathfinder. Any device used for this purpose must take into account the sun's path throughout the year and the latitude range.

Objectives

- Recognize potential solar radiation obstructions
- Use the Solar Pathfinder properly to obtain shading information
- Interpret the results of the Solar Pathfinder
- Understand the implications of shading

Equipment

- Solar Pathfinder
- Wax marking pencil
- Compass (Note: Users need to know the difference between solar South and magnetic South.)

Procedure

The Solar Pathfinder can be used any time where reflections can be seen in the plastic dome. It is not necessary to have a clear day – in fact, it is actually beneficial to have a cloudy day since it reduces the glare when viewing he reflections.

1. Check the Solar Pathfinder data sheet (the black form with lines) to make sure it is for the correct latitude.

2. Place the Solar Pathfinder on a corner of the mock roof in the plane of the array.

3. Place the Solar Pathfinder facing solar South, with the December lines closest to the South. The Solar Pathfinder compass is relatively inaccurate, so having a second, more accurate one is helpful. In either case, you should also have a rough idea of the magnetic declination, or number of degrees difference between solar South and magnetic South. Adjust the direction to align it with solar South.

4. Level the Solar Pathfinder so the bubble is directly in the center of the black circle on the bubble leveler.

5. From directly overhead, look for reflections in the plastic dome. In particular, look for trees, buildings, telephone/power poles, and other stationary objects.

6. Using the wax pencil, draw a line that traces the outline of these potential obstructions.

7. Examine the resultant form. Determine if there will be any shading between 9am and 3pm any time during the year.

8. Mark the roof and/or a to-scale drawing to indicate whether that particular spot is acceptable for PV.

9. Repeat everywhere on the roof where the array may be placed – especially the corners, the center, and along the edges of the potential PV array footprint.

Results/ Review Questions

1. Where on the roof could you place the array?

2. What were the obstructions?

3. When would these limit your system output?

4. Approximately what percentage of power would your array lose as a result of shading?

5. What would cause this shading pattern to change over time? How realistic is it that this profile will change?

6. Given the same exact site at 45 ºN latitude, would the shading be greater or less?

Conclusions

- Shading can cause a substantial loss in PV output.
- There are quantitative ways of measuring this potential loss – 'eyeballing' is not acceptable.
- When using the Solar Pathfinder, make sure it is facing due solar South, is perfectly horizontal, and is in the plane of the array.
- Tools such as the Solar Pathfinder can assist you in making sure your PV system output will be optimized.
- Plan on trees growing, and other realistic potential site changes.