

## Solar Radiation and Solar Power System Design

### What information do photovoltaic (PV) engineers use to size a system?

Solar radiation is the energy the earth receives every day as photons of light travel through space from the sun to the earth. For a standard unit of measure, the PV industry calculates the radiation on a 1 square meter piece of earth, at noon on a clear day with the sun directly overhead, as 1000 watts or 1 kilowatt (1kW). The PV industry refers to this calculation as one "peak sun". That same radiation, over the course of one hour, is called one peak sunhour.

This definition comes in handy when you consider the total energy received on a 1 square meter area for the duration of one day. If you measure the energy, you can equate that to some number of kilowatt-hours per day of energy received, also called "peak sunhours per day". For example, Houston, Texas receives 2.3 peak sunhours per day in December and 5.9 peak sunhours per day in June.

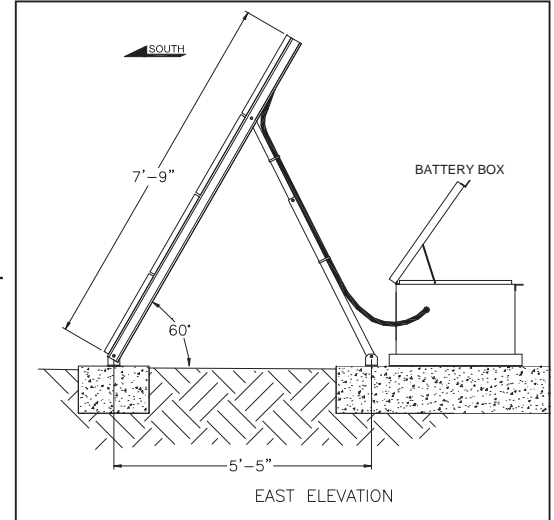
SunWize solar radiation databases tell us how many peak hours of sun a specific site is expected to receive

each day. From that information, we can determine how much energy a solar array will produce at that site.

Other information to be considered involves the adjustment of the solar radiation received on a flat (horizontal) surface versus a tilted surface. Solar arrays are almost always installed at a tilt angle to maximize the energy received during the "worst-case" month of the year (December for our Houston example). Maximizing the worst-case radiation minimizes the solar array size and the system cost.

The adjustment from horizontal energy captured to tilted energy captured comes from a geometric analysis using direct, diffused and reflected components of radiation. For example, the 2.3 sunhours per day received in Houston on a horizontal surface in December becomes 3.7 sunhours per day when the array is tilted at 50 degrees.

Our analysis of solar radiation is now complete. To summarize, PV industry

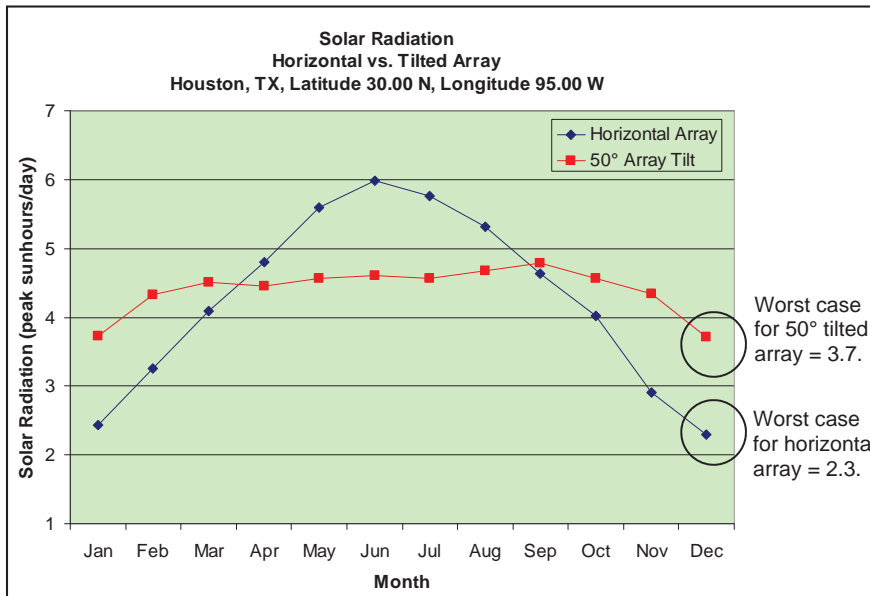


SunWize PR68024 Power Ready System (680 watts array rated output, 24 volt system) drawing showing 60° array tilt angle.

engineers consider the following information in order to size a solar power system:

- Peak sunhours/day for a particular location.
- What power a particular manufacturer's modules are capable of producing when exposed to one peak sun.
- The PV array tilt angle adjustment to maximize energy received on the array surface.
- How much energy a customer's load equipment requires during one day of operation.

By combining the above factors, we are able to accurately size a PV array to ensure it will produce a sufficient amount of energy to keep the load operational year round.



#### Corporate Headquarters

1337 Main Street, P.O. Box 895, Philomath, OR 97370

1.800.827.6527 | power@sunwize.com | www.sunwizepower.com