Off-Grid Solar Array Sizing

Once you've determined your daily energy consumption in watt-hours, follow the advice offered below.

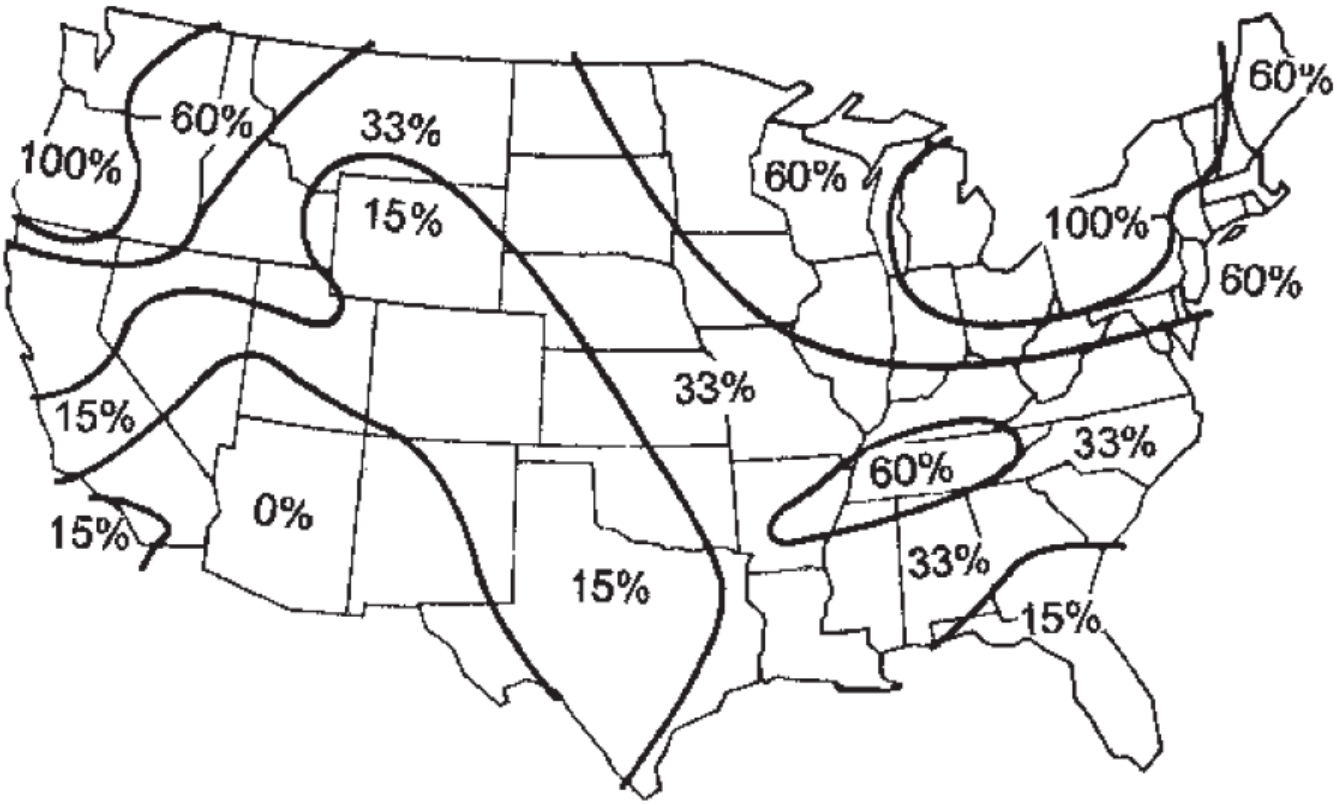
There are many methods used for calculating your system's solar array size. Traditionally off-grid systems are sized using a worst-case scenario of sun hours for December 21st, the shortest day of the year. This insures that the system will give the power needed on the lowest sun production day and any other day will exceed this output. We have found many instances with our customers where this doesn't always fit the need of the system's load usage or budgetary constraints that someone might have (i.e: winter homes, summer homes, acceptance of longer generator run time, etc).

What we have found is that we can get a good idea of a solar array's size by using the following thought process and calculations.

On any day that the sun shines brightly on your solar modules from morning until night, Backwoods Solar estimates the energy (watt-hours) that each solar module produces is 5 times its rated wattage. For example, a 300-watt solar module will produce 1500 watt-hours of energy on a sunny day. (300 watts x 5 = 1500). If you've determined your daily energy consumption in watt-hours, divide that number by 5 to get your initial solar array wattage. For example, if you will consume 10,000 watt-hours of energy, you will need 2000 watts of solar modules. (10,000 divided by 5 = 2000). But wait, you are not done yet.

Unfortunately, and inevitably, inefficiencies exist throughout the entire system. These inefficiencies apply to solar module ratings, losses due to temperature, practical wire sizing, phantom component loads, etc. To compensate for these inefficiencies, we recommend using a multiplier of 1.5. In the above example, we calculated we needed 2000 watts of solar modules to produce 10,000 watt-hours of energy on a sunny day. Now we multiply that 2000 by 1.5 to get the actual sunny day array size = 3000 watts. But wait, you are not done yet as the sun does not shine every day.

Throughout the country, different locations experience different numbers of sunny days per year. We must compensate for these differences by adding more modules. The percentage to add for areas in the 48 states is shown on the U.S. map below. For example, in north Idaho, the map tells us to add 60% to the calculated module wattage. So our 3000 watt array in the above example becomes a 4800 watt array (3000 x 1.6 = 4800).
This final number is the total rated solar watts needed to meet your level of energy consumption on average in your climate. Because weather changes year to year, and because seasons vary more in some areas than in others, this estimate is a rough figure, but close enough to work.


60%
100%
60%
33%
15%
60%
100%
60%
60%
33%
15%
33%
60%
15%
0%
33%
15%
15%