Guide to Solar Water Pump Sizing

Sizing a Solar Pump System

Step 1: Determine whether a submersible pump or surface pump is best. This is based on the nature of the water source. Submersible pumps are sometimes suitable for either deep or surface water sources. Surface pumps can draw water from 20-25 ft (7-8 m) below ground level, but they can push it far uphill.

Step 2: Determine your daily water requirements for your application using the table below:

Consumer	Daily Requirements	
Each person, for all purposes	75 gallons	285 liters
Each milking cow	30-35 gallons	113-133 liters
Each cow/calf pair	20 gallons	76 liters
Each horse, dry cow, or beef animal	15-20 gallons	57-76 liters
Each sheep	2 gallons	7.6 liters
Each hog	4 gallons	15.2 liters
Each 100 chickens	4 gallons	15.2 liters

Gallons per hour = Gallons per day divided by "peak sun hours per day"
Gallons per minute (GPM) = Gallons per hour divided by 60

Peak sun hours (also known as solar insolation) refers to the average equivalent hours of full sun energy received per day, and varies depending on the geographic location and season. For example, the arid central-west of the U.S. averages 5-6 peak hours in the summer, and dips to as low as 3-4 peak hours in mid-winter. Five hours is a good average figure for summertime pumping applications. For your convenience, we have provided a U.S. and global solar insolation map at the end of this document.

You can also visit www.nrel.gov/gis/solar.html for complete solar insolation information.

Calculation example:

- Let's say you need to design a solar water pumping system to water 50 cow/calf pairs. By looking at our table, we can see that each pair requires 20 gallons per day.
- Multiply your daily requirements by the number of pairs to get a total daily of 1,000 gallons.
- Now divide the 1,000 gallons by the number of peak sun hours, which in this example we'll say is 5 peak hours, to get 200 gallons per hours required daily.
- Lastly, divide that number by 60 (minutes) to arrive at 3.33 gallons per minute (GPM).
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This means you will need a pumping system that is capable of pumping at least 3.33 GPM to sustain the daily watering requirements. Due to variations in peak sun hours from summer to winter months, it is best to use this amount as your absolute minimum.
From this example, a 4 GPM system would yield extra water in the summer months, and still meet the requirements in the winter months.

Step 3: The most important question you need to answer is whether or not your water source will produce enough water to supply the application and pump system. You may determine you need 8 GPM, but if your water source only recovers at 3 GPM, you will be unable to sustain your daily water requirements. If the water source is a well or a stream and the flow rate or recovery rate is unknown, a pump test can be performed to calculate this rate.

We would recommend visiting the Water Systems Council Water Well Resources for links to numerous sources of information regarding groundwater and water wells.

Step 4: Determine other key measures crucial in accurately designing a solar water pumping system:

A. If the application is a well, measure the well depth. Total Depth (TD) = _____ ft
B. Water Levels:
   - Distance from the casing top to the dynamic water level during pump testing = _____ ft
   - Dynamic Water Level = _____ft
   - Static Water Level = _____ft
   - Water Source Recovery Rate = _____ GPM
   - Surface Pump Applications:
   - Suction Lift = _____ft
   - Pressure Lift = _____ft

   * For surface pump systems, the suction lift is the distance from the water surface to the pump inlet port. The pressure lift requirement from the pump outlet to the delivery point is required.

C. If the water delivery points is far from the water source, refer to the pipe sizing charts to determine which pipe size is required for the application flow rate. Also, determine the elevation difference to the total lift requirement.

D. What is the inside diameter of the well casing pipe? _____ inches
   *Small well casing sizes may prevent the use of some submersible solar pumps

Step 5: Access the Dankoff Solar data sheets for our pump/controller combinations at www.dankoffsolarpumps.com to locate which configuration will work best for your application. The vertical columns represent the various depths in feet, and the horizontal rows reflect the various solar panel configurations available for that pump. The resulting data provides the GPM that each configuration will produce at the listed depths (or lift).

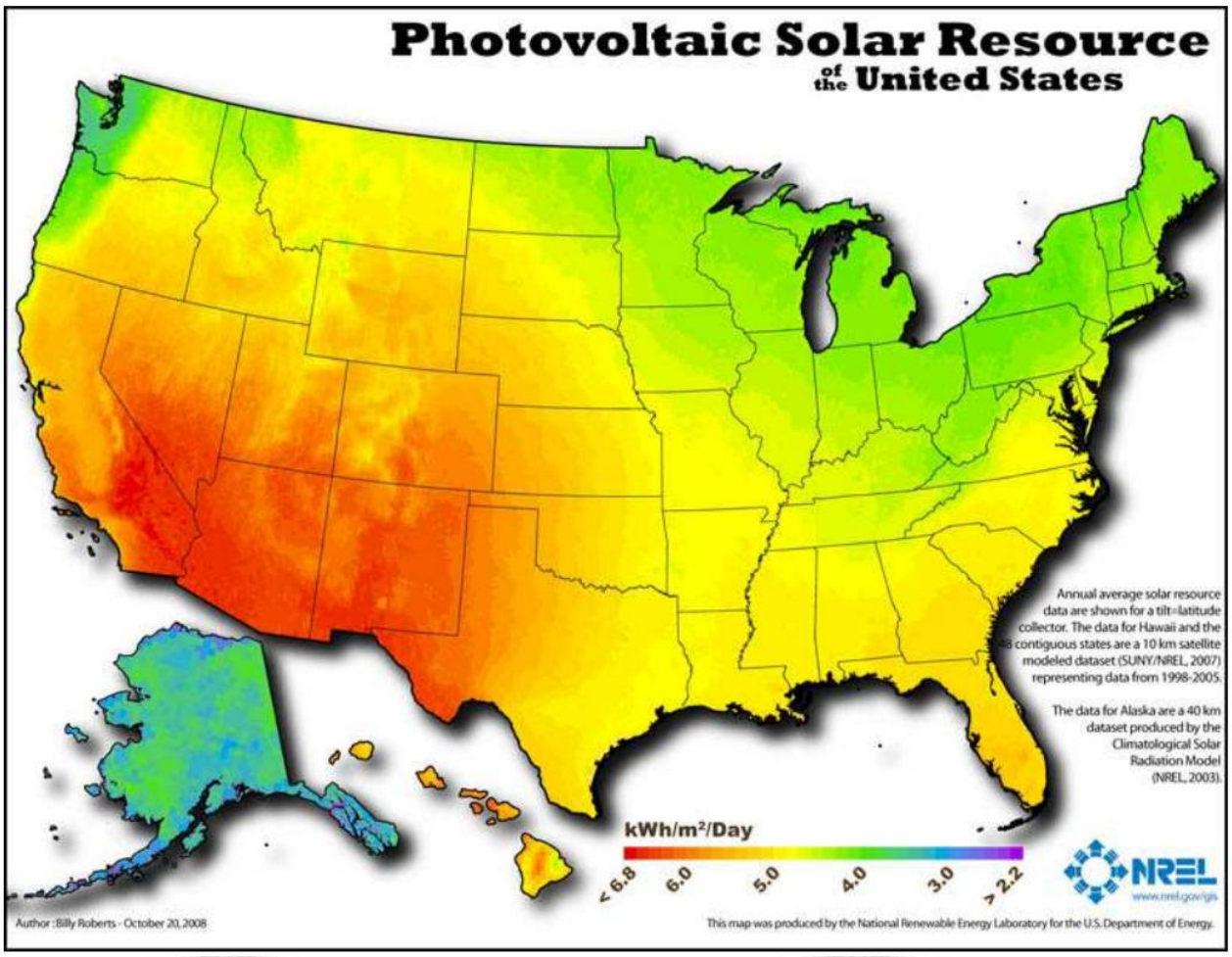
Please note that the listed depths are the depth limits for each configuration, and if the pumping results are at the low end of your requirements, look to increase your solar panel configuration or visit the next rated pump for better performance.

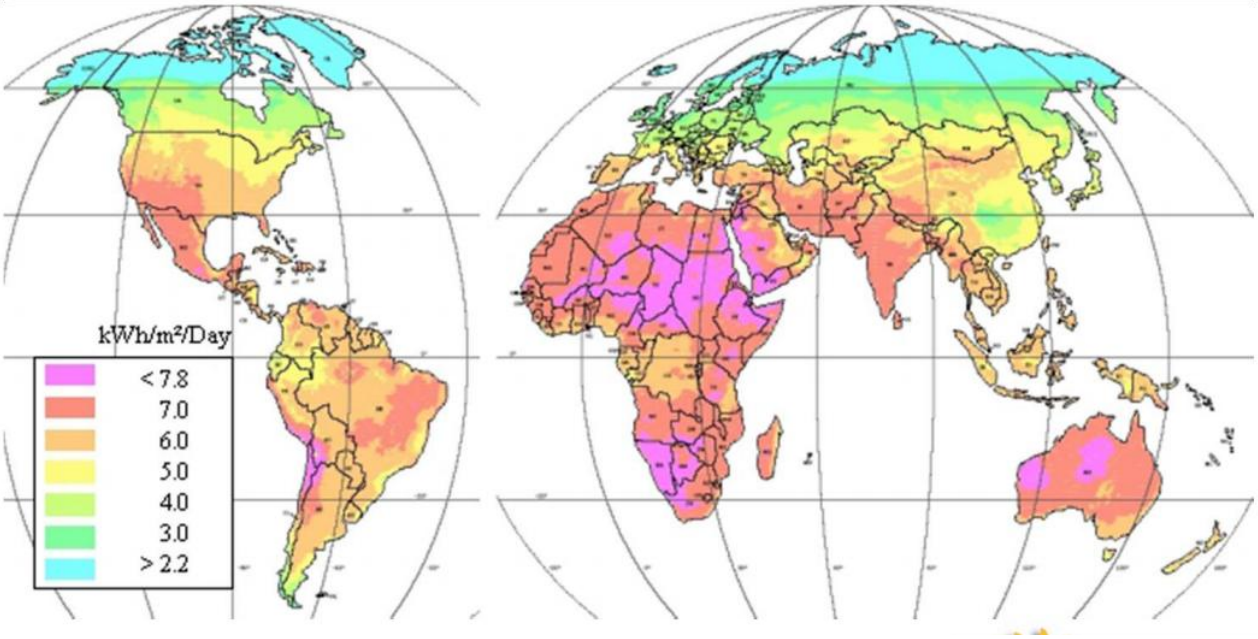
Dankoff Solar will happily assist you in designing a pumping system customized for your specification. Just call us at 1-505-471-3469 or visit www.dankoffsolarpumps.com and fill out the contact form to receive a custom quote from the Sales Team. We can get you a free quote by e-mail or phone within minutes.

No job is too big or too small for Dankoff Solar; we can design systems as simple as basic water well pumping systems to a complex solar powered irrigation pumping systems.

For more information on your drinking water, the following sites provide up-to-date information with their efforts to protect public water supplies as well as steps you can take as a private owner.

The Groundwater Foundation	www.groundwater.org
American Water Works Association	www.awwa.org


Photovoltaic Solar Resource
of the United States
Annual average solar resource data are shown for a tilt=latitude collector. The data for Hawaii and the 48 contiguous states are a 10 km satellite modeled dataset (SUNY/NREL, 2007) representing data from 1998-2005.
The data for Alaska are a 40 km dataset produced by the Climatological Solar Radiation Model (NREL, 2003).
kWh/m²/Day
< 6.8
6.0
5.0
4.0
3.0
> 2.2
NREL
www.nrel.gov/gis
Author : Billy Roberts - October 20, 2008
This map was produced by the National Renewable Energy Laboratory for the U.S. Department of Energy.


kWh/m²/Day
< 7.8
7.0
6.0
5.0
4.0
3.0
> 2.2