



Solar Powered Water Pumping

Presented By:

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Introduction to Solar Water Pumping

- Applications:
 - Agricultural livestock watering/crop irrigation, home gardens and drip irrigation systems
 - Domestic potable water for remote homes, cabins or campgrounds
 - Pond water management and water transfer
 - Water supply for villages in developing world



Solar Basics

A solar-powered water pumping system is made up of **two** basic components:

1. the solar panels – aka. Photovoltaic Module, PV module
 - Mono crystalline, Poly crystalline, amorphous
 - 12, 24, 48 volt DC nominal

2. the pump -
 - PV direct or battery-based
 - centrifugal or helical rotor
 - surface or submersible

Solar Modules

- The power supply consists of *PV panels*.

- PV panels produce direct current (DC) and are made up of many cells wired in series.



- The smallest element of a PV panel is the *solar cell*.

- Each solar cell has two or more specially prepared layers of semiconductor material that produce direct current (DC) electricity when exposed to light.

Research "P-N Junction"



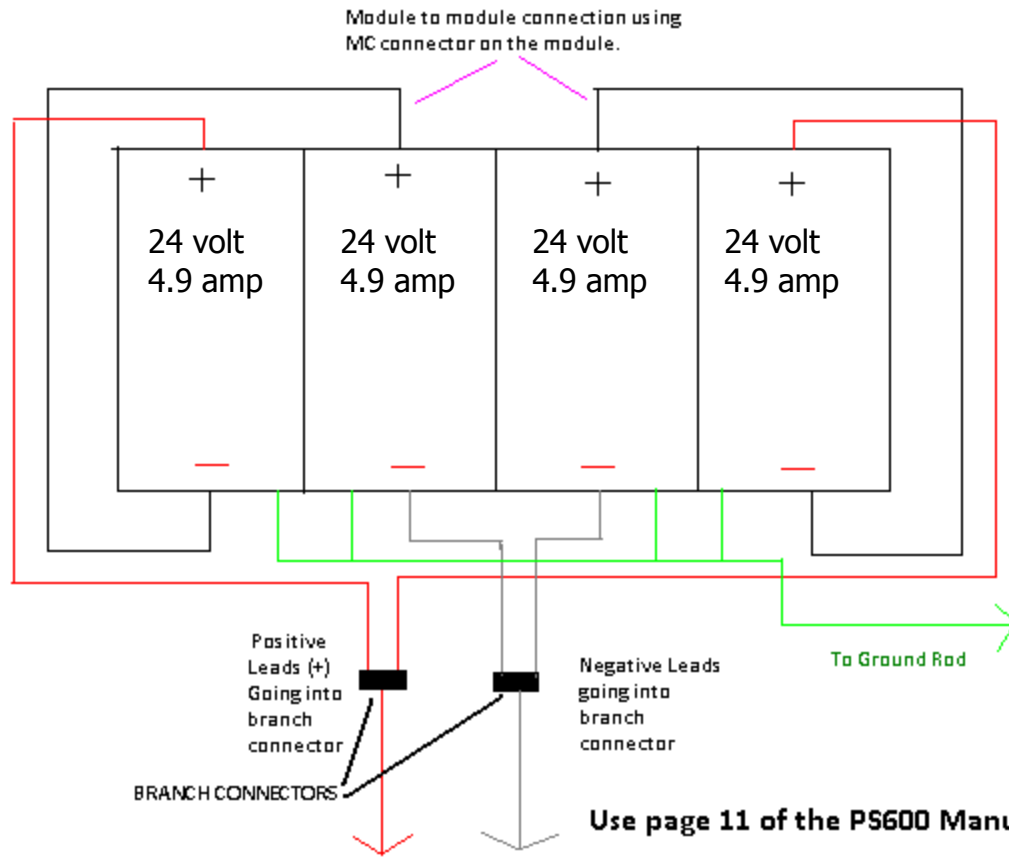
- 1 or more solar panels installed together is called a *solar array*.



Series and Parallel Configuration



- Individual PV panels can be wired in series or parallel to obtain the required voltage or current needed to run the pump.
- For example, a 24-volt DC pump requires a minimum of two, 12-volt panels wired in series.
- The voltage and current output from panels wired in parallel is the exact opposite of series-wired panels.



**48 volt
9.8 amps**

Power Law

- Manufacturers normally rate voltage (volts) and current (amps) output from PV panels. Peak power (watts=volts x amps) is the maximum power available from the PV panel .

Sharp 170:

$$34.8(V_{pm}) \times 4.9(I_{pm}) = 170.52(P_{max})$$

- The amount of DC current produced by a PV panel is much more sensitive to light intensity striking the panel than voltage. Roughly speaking, if you halve the light intensity, you halve the DC current output needed to run a pump.



Solar (DC) Water Pumps

- Surface Pump



Slowpump



Suncentric



Solar Force



Solar Ram

- Submersible Pump



Grundfos SQ Flex



Lorentz PS

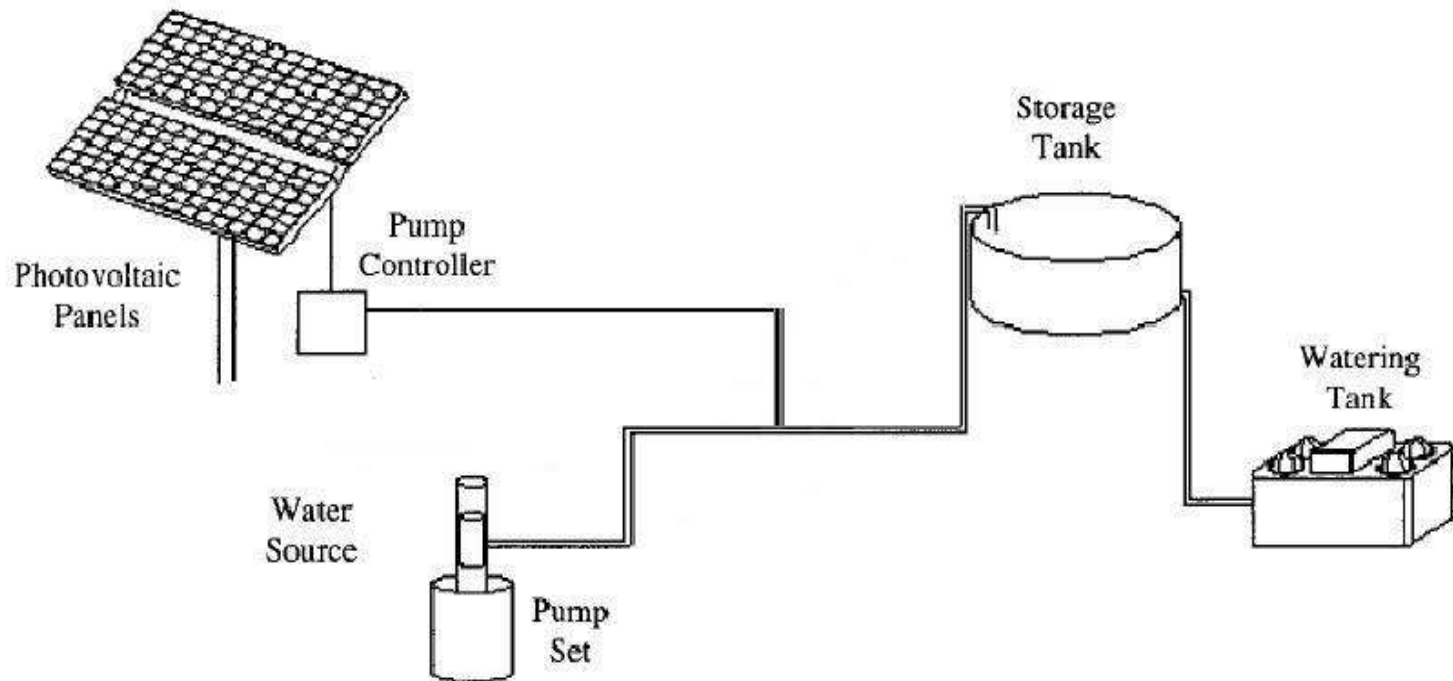


Shurflo 9300 Series

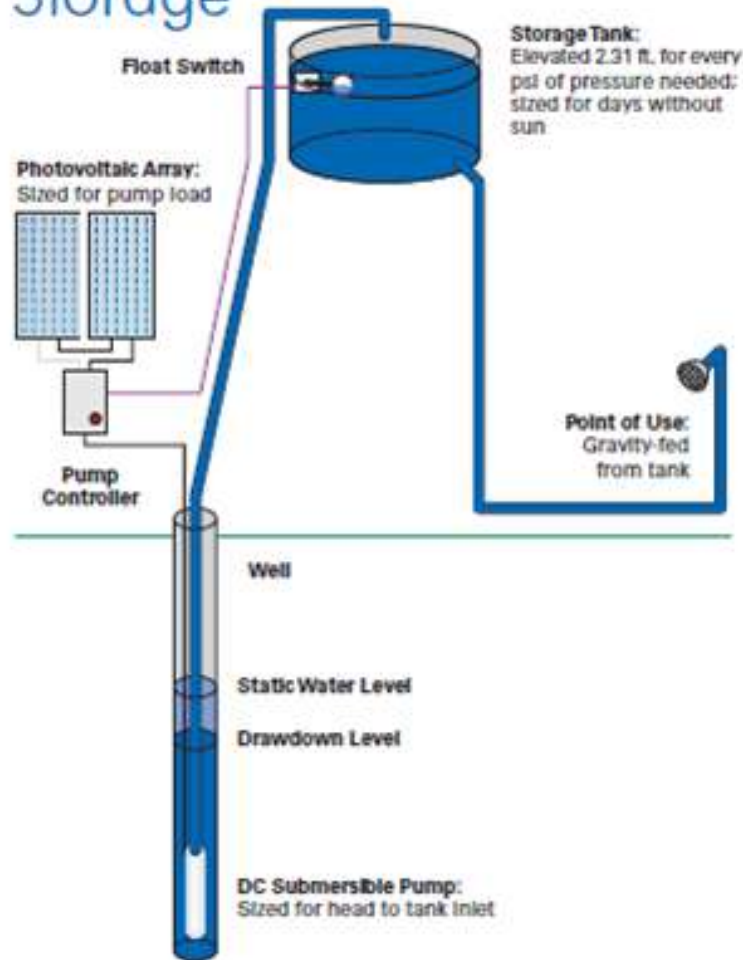
- There are two basic types of solar-powered water pumping systems: *battery-based* and *solar-direct*.
- A variety of factors must be considered in determining the optimum system for a particular application.

Solar-Direct Pumping System

- In solar direct pumping systems, electricity from the PV modules is sent directly to the pump, which in turn pumps water through a pipe to where it is needed.
- Solar-Direct pumping systems are sized to store extra water on sunny days so it is available on cloudy days and at night. Water can be stored in a larger-than-needed watering tank or in a separate storage tank and then gravity-fed to smaller watering tanks

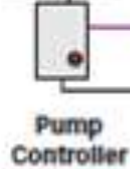
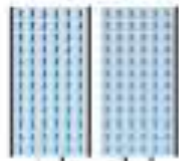


Array-Direct to Elevated Storage



Array-Direct to Storage Tank with Pressure Pump

Photovoltaic Array:
Sized for pump load



Float Switch



Storage Tank:
At grade; sized for days
without sun

Static Water Level

Drawdown Level

DC Submersible Pump:
Sized for head to top of tank

Point of Use

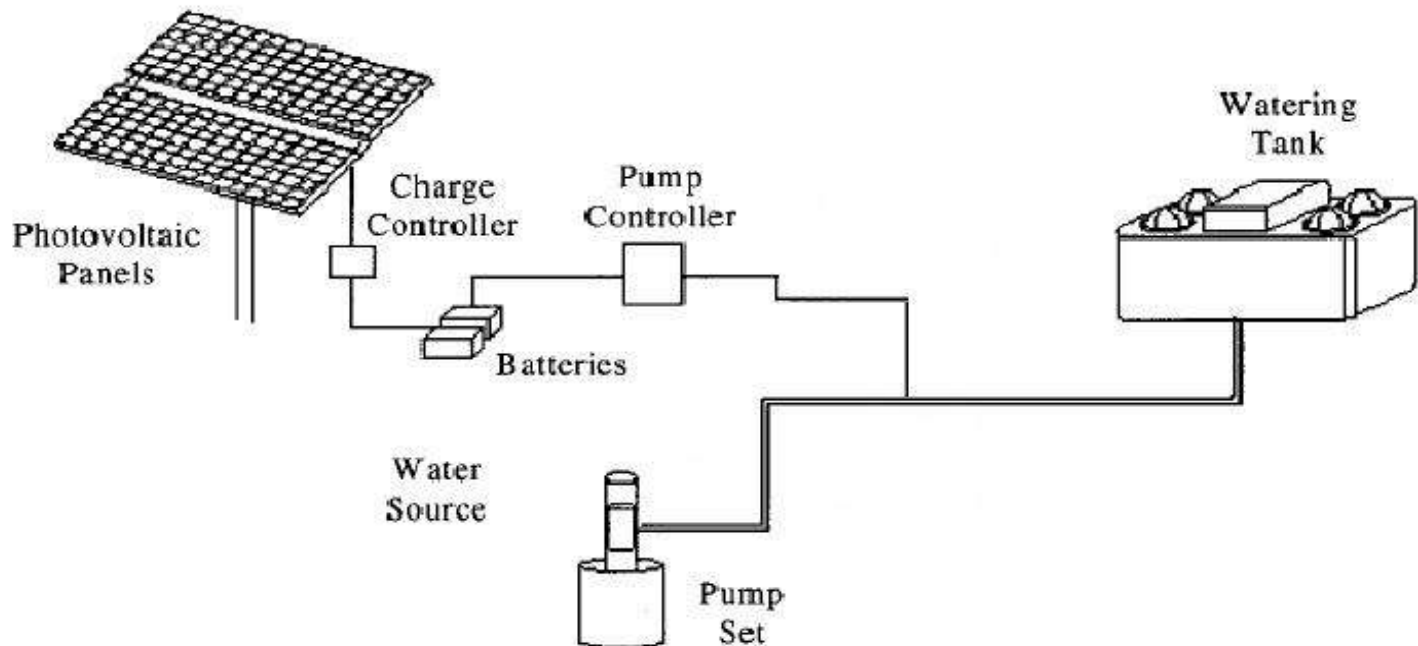


Booster Pump:
AC or DC powered;
pressurizes system

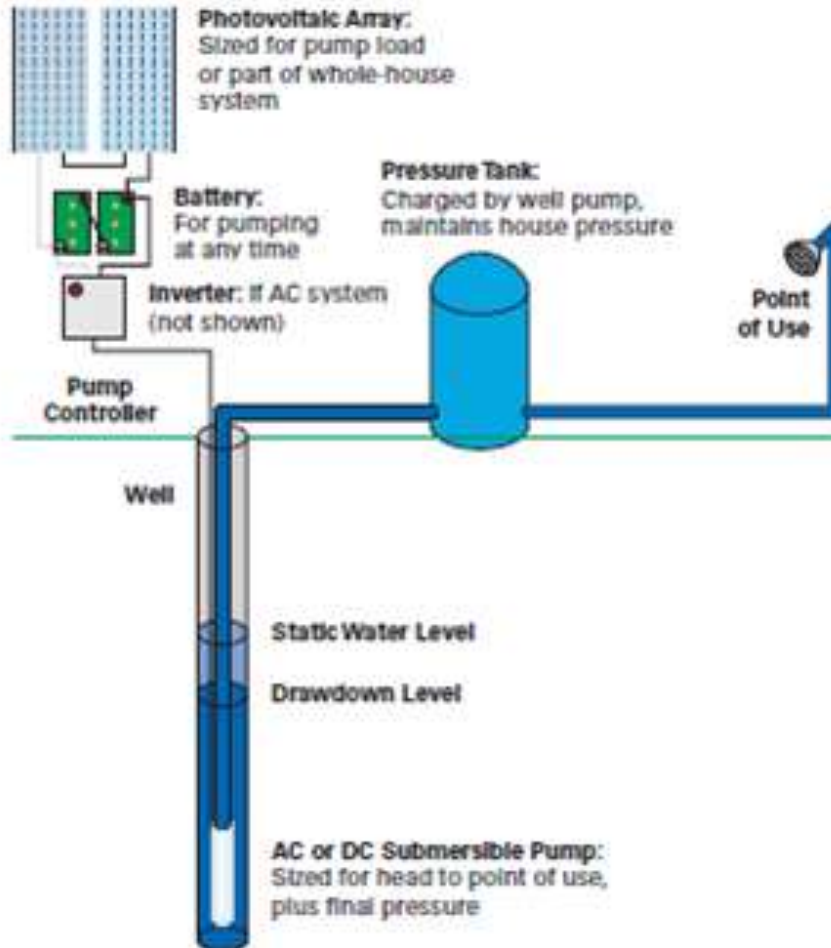


Battery-Based Solar Pumping Systems

- Battery-based water pumping systems consist of photovoltaic (PV) panels, charge controller, batteries, pump controller, and DC water pump.
- Water supply for home or cabin
-Pumping water at night
-Fragile water table/geological conditions.



Pump to Pressure Tank



Selecting a Solar-Powered Water Pumping System

- Cost is a factor that must be considered when selecting a solar pumping system. Total cost depends on many factors, such as the type of system (solar-direct or battery-based), daily water requirements, pressure to supply the required water flow, complexity of the water delivery system, etc.
- For example, low-volume solar pumping systems keep costs down, when compared to higher-output solar pumping systems, by using a minimum number of solar panels and by using the entire daylight period to charge batteries or pump water.

Livestock Water Requirements

- The daily livestock water requirement is one of the key factors in the design of the solar water pumping system.
- Size of the herd, pregnancy, lactation, animal weight, type of feed, physical activity and time of year all have to be considered when determining the minimum volume of water the solar pumping system must supply each day.

Table 3. Estimated daily water intake of cattle

Month	Cows		Bulls	Growing Cattle			Finishing Cattle			
	Nursing Cows	Bred Dry Cows & Heifers		400 lbs.	600 lbs.	800 lbs.	400 lbs.	600 lbs.	800 lbs.	1200 lbs
	gal./day	gal./day	gal./day	gal./day	gal./day	gal./day	gal./day	gal./day	gal./day	gal./day
Jan.	11	6	7	3.5	5	6	5.5	7	8.5	9.5
Feb.	11.5	6	8	4	5.5	6.5	6	7.5	9	10
Mar.	12.5	6.5	8.6	4.5	6	7	6.5	8	9.5	10.5
April	15.5	8	10.5	5.5	7	8.5	8	9.5	11	12.5
May	16.5	9	12	6	8	9.5	9	11	13	14.5
June	17	10	13	6.5	8.5	10	9.5	12	14	16
July	17.5	14.5	19	9.5	13	15	14.5	17.5	20.5	23
Aug.	17.5	14	18	9	12	14	14	17	20	22.5
Sept.	16.5	10	13	6.5	8.5	10	9.5	12	14	16
Oct.	16.5	8.5	11.5	5.5	7.5	9	8.5	10	12	14
Nov.	13	6.5	9	4.5	6	7	6.5	8	10	10.5
Dec.	11	6	7.5	4	5	6	6	7	8.5	9.5

Table prepared by Paul Q. Guyer, University of Nebraska, G77-372-A

Sizing the System

Many reputable solar equipment dealers will combine the information you provide about your water requirements and livestock operation with the information on solar energy available in your area, and help you select the solar pumping system that best fits your livestock watering needs and budget.

Common Information required to size a water pumping system includes:

1. The maximum number of gallons of water needed daily for each month of the year.
2. Total vertical distance that water is to be pumped, as measured from the lowest level from the water source to the highest level of the storage tank.
3. Description of water source.
4. Solar access: Is unobstructed sunlight available near the water source? If not, how far away?
5. Information on any water-pumping equipment, distribution system and storage capacity presently being used.

Installing the System

- When choosing a site, it is essential to avoid trees or other obstructions that could cast shadows on the solar panels and reduce their output. This is especially true during the winter when the arc of the sun is lowest over the horizon.
- The solar array should be mounted facing due south (True South) in a location where they receive maximum sunlight throughout the year. Panels facing 30 degrees away from south will lose approximately 10 to 15 percent of their power output.
- Solar panels produce the most power when they are pointed directly at the sun. The tilt angle is the angle between the plane of the solar panel surface and the ground. For maximum energy collection, the panel surface should be perpendicular to the sun. The desired tilt angle can be selected using the following general rules for optimum summer
- or winter use:
- Summer Use: tilt angle = 25 degrees Winter Use: tilt angle = 45 degrees
- For installations where the solar panels are permanently mounted, they should be tilted for maximum winter output. As a rule, if the power output is sufficient in the winter, it will be totally satisfactory during the rest of the year.

SC Solar, Inc.
 145 Rental Ct.
 Rock Hill, SC 29732

QUOTATION


Quote Number: SAMPLE
 Quote Date: Mar 12, 2007
 Page: 1

Voice: 866-856-9819
 Fax:

Quoted To:
QUOTE YOUR COMPANY

Customer ID	Good Thru	Payment Terms	Sales Rep
QUOTE	4/11/07	Prepaid	

Quantity	Item	Description	Unit Price	Amount
1.00	95078028	5 SQF-2 SQFlex Solar Pump 51x4x3 1 NPT MSF 3 MOTOR™	1,475.00	1,475.00
2.00	NE-170U1	170 WATT SHARP W/MC CONNECT CARTON SIZE IS 67 X 39 X 6 CARTON CONTAINS 2 PANELS	790.00	1,580.00
1.00	500106	TOP OF POLE RACK FOR 2- SHARP 175 USES 3 INCH SCHEDULE 40 POLE	199.00	199.00
1.00	cgyl-10101	MC Connector 2.5 Meter	25.00	25.00
1.00	96467801	CU200 SQFlex Control Box Solar/Wind Monitor with Float Switch Terminals DIMENSIONS 13 X 7 X 5	260.00	260.00
1.00	96481502	IO 101-115 SQFlex Generator Interface Box DIMENSIONS 11 X 8 X 9	285.00	285.00
1.00	DSP-02502	Submersible Splice Kit	10.00	10.00
			Subtotal	3,834.00
			Sales Tax	
			TOTAL	3,834.00



Thank You for attending.....

Now we will answer any questions that you may have.....