Green Energy for your Home ~ A Series ~ Part 8 – Off Grid Water Pumping

I have read that more than two billion people worldwide rely on wells for their water and many devote countless hours to collecting the valuable commodity. As water tables recede available groundwater becomes less accessible. Water as a resource is becoming more precious, probably in direct proportion to population growth.

For those of us fortunate to be living in water abundant British Columbia we may pay little heed to water shortages; but if you are living off the grid you will need to develop a reliable and efficient way to supply water for your needs. There are some key decisions you will have to make in order to do this and the problem becomes compounded if you have livestock or need to irrigate a garden or crops.

The good news is that there are many innovative solutions available; you just have to understand the problem. It really comes down to a matter of answering questions in a decision tree and you will be led in the right direction. I'll provide a few of the clues in this article.

In this discussion I'm making the assumption that you are living off the grid or you have a requirement for a remote pumping application, for example watering cattle; but some of these applications can be useful for emergency water supply as well.

If you're off grid and just need water for your household then the first question is what is your resource; surface water, dug well, drilled well or spring? Second question is. what is the production capability of the resource? The average person uses around 466 liters or 100 imperial gallons of water per day and this doesn't include outdoor uses.

- What is your resource: surface water, dug well, deep well or spring?
- What is the production capability of the resource gallons per minute (gpm)?
- Do you use a dishwasher, a flush toilet, a washing machine?
- Do you have a garden, lawn or crops?
- Do you have livestock?

If you have a drilled well you will want a submersible pump. They come in a variety of models depending on the required gpm; the depth of the well; the distance from the well to the delivery point; and the elevation from the well to the delivery point (up or down). Submersibles are available in direct current (DC) models that connect directly to your battery bank and avoid the inefficiencies of converting to AC through an inverter. One company, Grundfos, makes a series of pumps that will operate either on DC or AC power which can be very useful if you want to operate your pump from your PV solar panels when the sun shines and from your inverter or generator when it doesn't.

If you have a shallow well or want to use surface water directly you can still use a

submersible pump or you can use an above ground pump. But bear in mind that water is much easier to push than it is to pull so a submersible will usually do a better job, read that as more efficient job, of delivering the water, especially if you require higher volumes from a deep well. More efficiency equals less power consumed and when you're off grid every watt of power counts.

While a submersible is often the best choice there are always exceptions to the rule. If your water needs are modest, for example around four gallons a minute then one of the most efficient pumps available is an above ground model called the solar slowpump made by Dankoff. This pump is ideal if you don't require a lot of water in a hurry. The slowpump operates at a slow rate that will typically provide about 3.5 to 5 gpm. A shower takes around 3 gpm so if you rely on a slowpump to provide household water you will also want a pressure tank in the system. A pressure tank stores water under pressure and the larger the tank the more reserve you have. This means that you can have several demands in your household at once without affecting the water flow until the reserve is depleted. Once the reserve is depleted the pump may run for 10 or 15 minutes to fill it up and while you will still have water during that time it will be at the rate of 3.5 – 5 gpm.

There are nearly as many solutions for water pumping as there are flavours of ice cream and each one is tailored to the application. Another example would be pumping water in a field for livestock watering where there is no power available. Lets say you want to bring the water from a nearby stream to a reservoir so the livestock won't pollute the water or riparian area of the resource. You can either use a PV-direct method or a battery powered method. The PV-direct method will use a solar panel to activate a pump whenever the sun shines. The water can be delivered to a water trough with a float switch that shuts the pump off when full or use an overflow pipe. The obvious problem is that if the sun doesn't shine you don't get any water. This may not be an issue if the pump can deliver more gallons per day (gpd) than your livestock requires and the excess is stored in a holding tank. The holding tank should allow for a capacity of several days in case of cloudy weather.

PV-direct pumping is very popular for some applications as it is simple and low cost compared to a battery-based system. However, you will need an extra device called a linear current booster, a small electronic device that boosts the output from the solar panel in low light such as early morning and late afternoon. This allows the pump to achieve the higher startup current required to get pumping.

A real world example of PV-direct pumping can be seen at Scout Island in Williams Lake where a solar slowpump is used to deliver irrigation water to their cultivated trees.

As opposed to PV-direct a battery-based system is able to operate the pump on demand because the energy from the sun is stored in the battery and available to the pump whenever a signal is sent. A floating switch can generate the signal. As the water level drops the contact inside the float opens and starts the pump. When the

water level rises the contact closes and the pump quits.

Battery-based pumps are desirable at remote locations, which have larger volume requirements as they are more easily scaled to meet requirements, i.e. more solar panels and batteries can be added as necessary. Of course if you already were powering your household with a renewable energy system the pump would be a battery-based configuration.

Remote pumping applications can also be made mobile by building a solar rack on a trailer with water storage. Just adjust the pipe length for the distance to the water resource and you can move your livestock around the property.

Other innovative water pumping methods include the ram pump and the high-lifter pump. Both of these use the hydraulic pressure of the water to power the pumping and do not require PV or batteries to operate. They have their limitations but are very useful in some applications.

Speaking of useful applications of solar pumping an emergency water supply can be provided in the event of an extended grid failure. A backup pump and solar panel can be kept on hand and setup quickly if needed.

By the way if you'd like to see us in action view the video I just completed of our innovative hybrid installations for the Xeni Gwet'in First Nations in the Nemiah Valley see the video on our web page: www.solareagle.com

Please feel free to email me with questions at: info@solareagle.com. The complete series of articles is available at our website: http://www.solareagle.com

Ron Young is a Renewable Energy professional operating the earthRight store in Williams Lake, BC selling and installing RE systems