FRIZZELL

AGRICULTURAL ELECTRONICS

Solar Water Systems

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AGRICULTURAL ELECTRONICS

Contents

What is A Solar Pump System?

Solar Water Systems:

Solar water pumping systems require a change of thinking compared to mains powered units.

Solar water pumps have significant advantage over other types of pumps, one of the main ones being they do not require the presence of an mains electricity to operate. This feature alone makes them extremely useful in rural locations such as farms or where mains electricity is not easily accessible.

Types of Pumps

Surface Pumps: These types of pumps are probably the most common pumps used in solar systems. Ideal with shallow wells, ponds, streams or storage tanks. They work best if the water supply is 4 meters or less from the surface. As with other solar pumps the solar panels for the pump can be remote from the pump itself which allows a great deal of flexibility in placement.

Circulating Pumps: These types of pumps are often used in low head stock water systems, solar water heating applications, pool heating systems and in landscaping applications for waterfalls or fountains. These pumps are normally centrifugal types shifting larger quantities at low pressure.

Submersible Pumps: Submersible solar pumps are generally used for pumping from wells, and are designed to fit inside the well casing but are efficient and versatile and can also be mounted in tanks, ponds and streams. Submersible pumps can lift water hundreds of meters and can move large quantities of water.

Solar Panels

Solar pumps get their power from solar panels. Solar panels come in many different sizes. Generally the larger they are the more watts of electricity or energy they can generate. When using solar pumps the number of panels you will need is a function of the volume of water you need to move (usually measured in litres per minute.) and the water pressure you must generate. Pressure (head or vertical “lift”) you require has the largest impact on the number of solar panels you need. A 30 litre a minute pump pumping up to a tank 10 meters above the pump will require less power than a 6 litre a minute pump lifting water 100 meters.

Using advanced software systems, Pumps are matched to solar panels. The amount of panels needed varies depending on the performance required, most panels are designed to be connected in strings or modules to increase the power output.

Performance:

One disadvantage of DC solar pumps is that the energy they generate varies throughout the day based upon the available sunshine to the solar panels. Because of local factors such as cloud and shading solar system performance is often difficult to accurately predict system performance. Every installation tends to be unique which also makes system performance difficult to accurately predict.

Due to this we have developed a range to tools to optimise the performance of our Solar Pump Systems.

Cost:

Cost for each system can vary depending on volume, vertical lift and Peak supply required and seasonal demand. Because the systems have a one off initial cost the rewards are far more beneficial than mains, petrol and diesel systems that have continuing costs such as line rentals and fuelling costs. Solar systems are low maintenance, cost effective and reliable.

Example: In a 10-hour sunny day a small solar pump can pump more than two thousand litres.. That's enough to supply several families, or 30 head of cattle, or 40 fruit trees! Slow solar pumping lets us utilize low-yield water sources. It also reduces the cost of long pipelines, since small-sized pipe may be used.

Determining the System you need.

The type, size and performance of the pump you need varies depending on use. The size of solar panels and configuration of you system depends on a number of factors. We have tools and experience to design systems to meet your needs.

Large Systems

There is technically no limit to the size of solar systems.

Large Frizzell Solar pumping and irrigation systems, main modules consist of a solar pumping inverter, pump and PV (Solar Panel) array. The system is normally designed to directly drive the pump without batteries, this configuration can reduce the construction, operating cost and long term maintenance cost of a Solar Irrigation System.

The PV array consists of multiple solar panels connected in series or parallel which can supply the whole system with power by converting absorbed solar radiation energy to electrical energy.

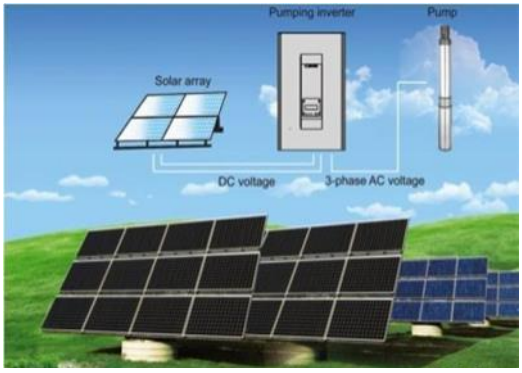
The Solar Pumping Inverter controls the whole system. The controller drives the pump by converting DC power (from the PV Panels) to AC power for the pump. This inverter can adjust the output energy and frequency according to the solar radiation intensity in real time to implement the MPPT (Maximum Power Point Tracking) technology.

The pump is typically driven by a 3 phase AC motor which then pumps water from a well, river or other source. Pumped water is fed into a reservoir, water tank or connected to an irrigation system or fountain system directly.

Solar Pump Optimisation

A solar pump system is different from a traditional mains powered pump system in that the power generated to run the pump is dependent on the Sun's radiation. This means that the pump needs to be accurately matched with the PV array and the electronics have to optimise the power generated to maximise the pumps output.

The goal of system optimisation is to reduce the number of PV modules required whilst still meeting the head and water output requirements. The pump rotational speed can be regulated according to the variation of solar irradiation (solar energy).

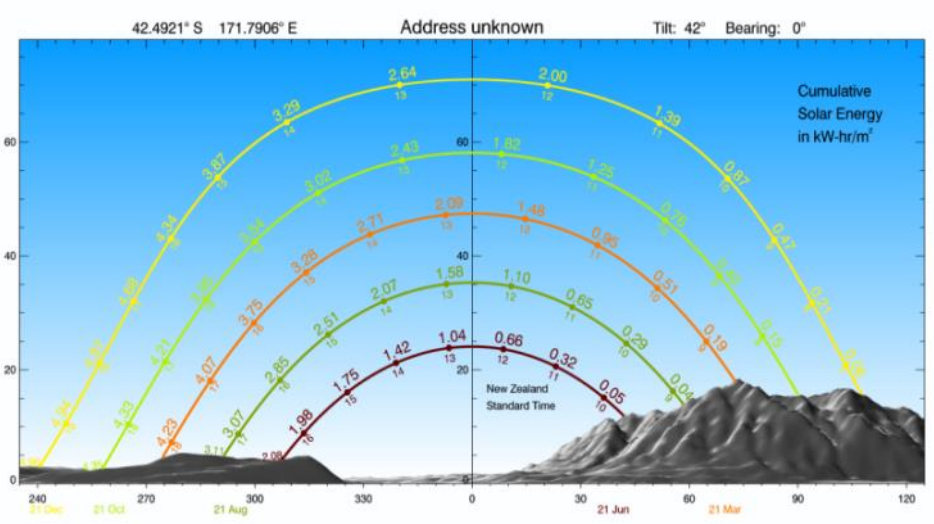


When the solar radiation intensity reaches the peak the pump runs at its rated speed and the output power is close to the maximum power of the PV array. When the solar radiation intensity is relatively weak, the pump runs with the low speed based on the MPPT algorithm. When the solar radiation is so weak that no water flow is available the system stops pumping until the solar radiation levels increase.

Smart Solar Water

Water is a necessity! Shortage, availability and management are all becoming important. Utilising water efficiently is the way of the future and is driving the need for better water systems.

Meeting the above comes with a number of challenges, among them is often the high cost of supplying mains power to a water system. Mains power can cost thousands to install, plus the additional lines charges can often exceed the unit power charges. Petrol and Diesel pumps have continuous high costs attached with fuel prices sky rocketing each year



Irradiance curves showing average monthly solar energy and topography

The Challenge. With a number of variables affecting the design of a solar water system it is important that all variables are quantified and integrated to the most cost effective system to deliver the amount of water needed. Site location including latitude, sunshine hours, cloudiness, precipitation and temperature all affect performance.

Local topography including hills, aspects and even trees need to be considered. The source of the water, whether well, stream or tank affect design even before the height that the water has to be pumped and the distance from both the source and delivery point need to be known.

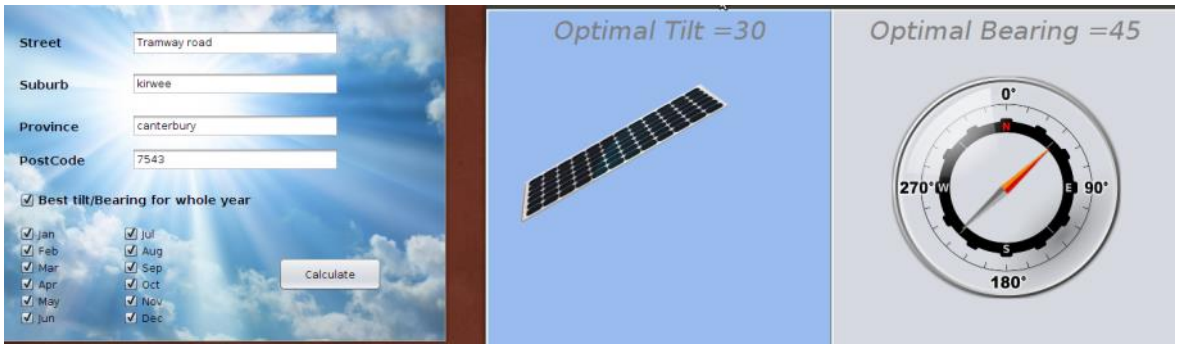
Every project or installation is unique. A schemes capacity varies depending on use of the supply. If for animals, the number of animals and class of stock and the season affect the amount and reliability of water that is required.

One of the biggest variables is the amount of energy that is produced from the solar panels. Location, season, weather, and the individual location of panels affect the energy produced. This determines the amount of water that can be delivered. The solar energy available can vary by a factor of ten, from a sunny summer day to a wet winters day. A system that delivers 1000 litres a day in midsummer may only deliver 100 litres a day in winter. The same system in Fiordland may have much lower performance in summer than one in Nelson.

Our solution – The Innovation

Over the last ten years we have developed software systems that allow us to use topological, metrological and geographic information to calculate the amount of solar radiation energy available for any location in New Zealand.

When the farmer calls, we collect the relevant information and compute the best combination of components for their individual needs and provide the best solution.



Graphics from the program showing optimal tilt and bearing for 111 Tramway Rd. Kirwee.

What's the difference.

In the past, the best information that has been available was based on the average solar energy for the latitude of the location. But to calculate solar energy, a site on the slopes of Mount Taranaki is likely to have a lot less solar radiation than a site in Hawkes Bay, even though both locations are on the same latitude. **How**

How We Do It.

The heart of our system is the software. We have developed the software to calculate the optimum configuration of solar panels, controller and pump for a specific location. The software calculates the specific irradiance curves for the specific location.

The use of the software gives us the ability to customise systems to each unique application and get the best performance from our systems.

Our system collates all the information about the site including specific radiance data. The software then calculates the optimum declination, orientation and capacity of the panels to maximise the solar energy relative to the system demand.

The software provides us with the information to select the correct control systems, solar panels and pump. With the wide range of panels we stock, the controllers we use and the pumps we stock and can access, we have an almost unlimited combination of systems to meet any farmers needs.

Systems are supplied complete. The farmer just needs to mount pump and panels, plug in the wires and add water.

Typical Pump Systems

Small Centrifugal Solar Pumps

This pump system is ideal for low head applications such as house water supplies, small stock water systems, pond circulation. Our range of small centrifugal pump systems are a cost efficient way to get water where you need it.

We carry four stock pump sizes up to 40 litres a minute flow to 28 meters head.

Prices for complete systems include solar panels, mounting (depending on situation), controller and pump prices range from $690.00 to $1,570.

We can supply these pump systems with a wide range of accessories such as Float switches, 2 stage switches and battery systems. Please enquire for details and pricing.

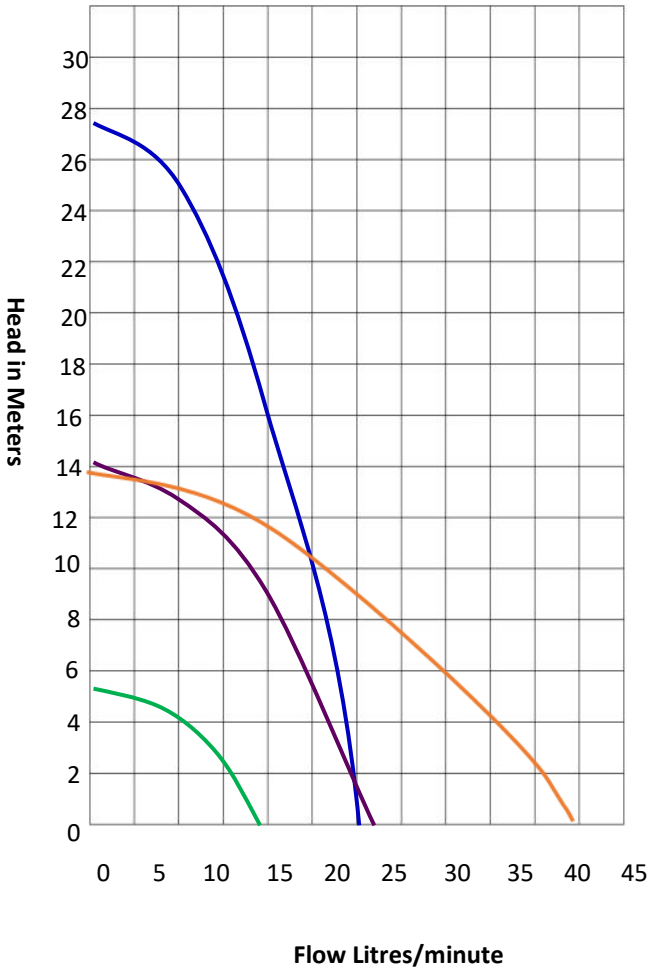
Pump Performance curves:

Pump model: 1250 (green)

24150 (Purple)

24300S (Blue)

24300P (Orange)



Typical Pump Systems

MPPT Diaphragm Solar Pumps

Ideal for medium flow, medium to high head applications such as house water supplies, stock water systems and small irrigation, our range of MPPT diaphragm pump systems are a cost efficient way to get supply water to higher heads than our small systems.

We carry three stock pump sizes ranging from 5 liters per minute up to 16 liters a minute and a maximum of 100 meters head.

Prices for complete systems including solar panels, mounting bracket, controller and pump range from $1321.00 to $2350.00 + gst.

(We have a large version of diaphragm pump available. The 252D has a typical summer day water delivery of 6000L @ 100m. With ability to pump to over 200m head. Prices range from $5500 to $12000 depending on requirements)

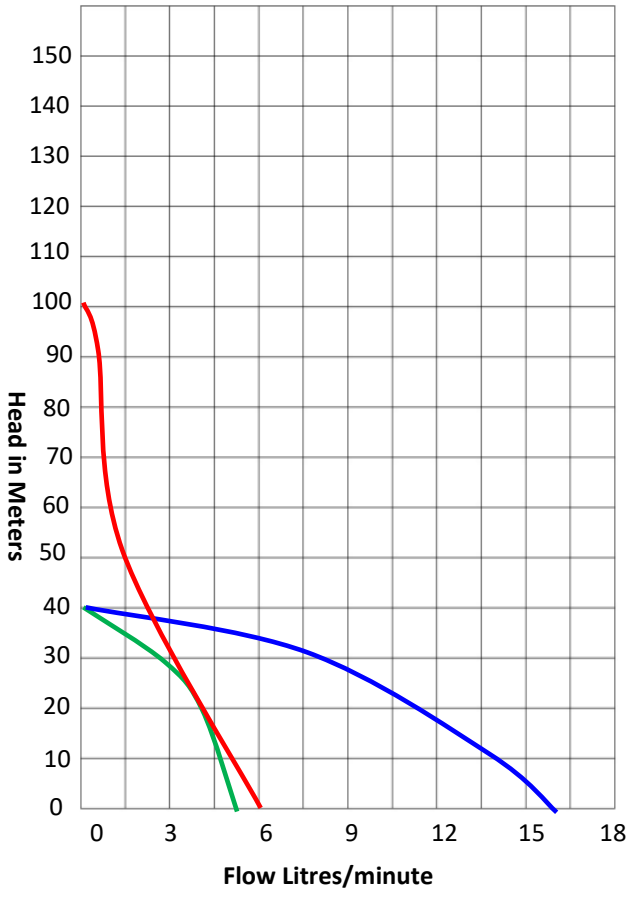
We can supply these pump systems with a wide range of accessories to complete any job!

Pump Performance curves:

Pump model: 5120 (Green)

6160 (Red)

17120 (Blue)

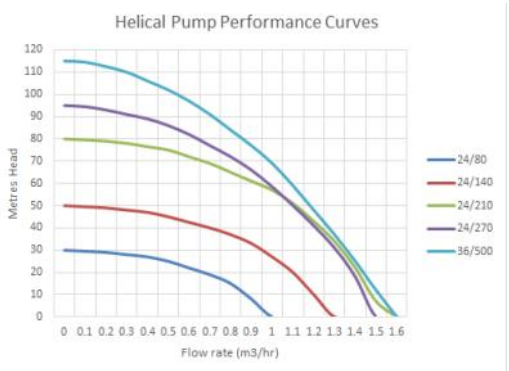


Large Solar Pump System

Ideal for high flow and/or high head applications. These systems can pump hundreds of cubic metres per day and can pump hundreds of metres of head (vertical lift).

We design these systems to your specific requirements, please contact us for more information.

Examples of systems (please enquire for your specific needs.)



PUMPS

(Pump capabilities are done to a conservative number so please contact the team to find that ideal pump for your needs)

1250C: Typical Summer Day Delivery: **1500l @ 3metres**
Flow Litres/Min: 6l/m in @ 4m

24150C: Typical Summer Day Delivery: **4000l @ 10 metres**
Flow Litres/Min: 12l/min @ 10m

24300C Typical Summer Day Delivery: **4000l @ 20 metres**
Flow Litres/Min: 12l/min @ 20m

D15 Typical Summer Day Delivery: **50000l @ 3 metres**
Flow Litres/Min:150 l/min @ 3m

MPPT Diaphragm Pumps

5120D: Typical Summer Day Delivery: **1000l @ 20metres**
Flow Litres/Min: 3l/m @ 20metres

6150D: Typical Summer Day Delivery: **500l @ 80 metres**
Flow Litres/Min: 2l/m @ 80 metres

17250D: Typical Summer Day Delivery: **3000l @ 20 metres**
Flow Litres/Min: 3l/m @ 20 metres

252D: Typical Summer Day Delivery: **6000l @ 100 metres**
Flow Litres/Min: 20l/m @ 100 metres

Large Solar Pumps

200W Helical Rotor: Typical Summer Day Delivery: **5000l @ 30 metres**
Flow Litres/Min: 14l/m @ 30 metres

400W Helical Rotor: Typical Summer Day Delivery: **6000l @ 50 metres**
Flow Litres/Min: 15l/m @ 50 metres

600W Helical Rotor: Typical Summer Day Delivery: **6000l @ 100 metres**
Flow Litres/Min: 15l/m @ 100 metres

370W Centrifugal: Typical Summer Day Delivery: **10,000l @ 40 metres**
Flow Litres/Min: 27l/m @ 40 metres

500W Centrifugal: Typical Summer Day Delivery: **12,000l @ 50 metres**
Flow Litres/Min: 30l/m @ 50 metres

750W Centrifugal: Typical Summer Day Delivery: **20,000l @ 45 metres**
Flow Litres/Min: 60l/m @ 45 metres

1.1kW Centrifugal: Typical Summer Day Delivery: **25,000l @ 45 metres**
Flow Litres/Min: 65l/m @ 45metres

1.5kW Centrifugal: Typical Summer Day Delivery: **30,000l @ 70 metres**
Flow Litres/Min: 80l/m @ 70 metres

2.2kW Centrifugal: Typical Summer Day Delivery: **48,000l @ 60 metres**
Flow Litres/Min: 130l/m @ 60 metres

3kW Centrifugal: Typical Summer Day Delivery: **48,000l @ 90 metres**
Flow litres/Min: 130l/m @ 90 metres

***Prices exclusive of GST and delivery For larger pump systems please enquire at: info@frizzell.co.nz**

Solar Pump Accessories

Switches and Controllers

Adjustable Electronic Pressure Switch

Float switch

2 stage, Adjustable Float Switch

Pwm Controller– small controller designed to regulate the input energy to run the pump efficiently whilst allowing batteries to be safely added to the system.

MPPT Controller– More efficient/ industrial than the PWM, better suited for the bigger systems than the PWM with a handy LCD display providing accurate system information at a touch of a button.

Stands/Mounts

Post Mount Bracket for 60W – 120W Solar Panels

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Pump System FAQ (Frequently Asked Questions) and information.

Where can solar pump systems be used?

For any application from stock water to irrigation, house supplies to swimming pool or pond circulation.

How much water can you pump with solar?

We Have a huge range of pumps and have designed systems from domestic systems pumping a few hundreds of litres per day and a few metres head up to systems that will lift hundred of metres ad pump hundreds of thousands or litres per day. Anything is possible with solar!

What is included in my system?

Normally we supply the pump, solar panels controllers and batteries (if required.) Solar Panel mounts can be supplied. Normally you need to supply pipe and fittings. Unless required, most systems are designed to be used without batteries. Please ask.

How long will it last?

The solar panels and controllers are rated at 20 years+ and the pump should last 10-15 years depending on the type of pump. Ask us for information.

Why should I buy from you?

We have the largest ranges of pump systems available. We don't just sell package deals, we create a solution for your particular need. We can offer better performance from a lower price.

Using our smart water system design means a system personalised for you so you can be confident you will have water where and when you need it.

Is it economical to replace a diesel or petrol pump with solar?

With a solar system, you are paying for all running costs up front. Although a petrol or mains system may have lower initial cost, when you factor in running costs and maintenance. Solar systems are typically half the cost of diesel or petrol systems. If you are close to the mains power solar systems can still be more economical to run. Solar systems will save you time and money long term.