

THE ULTIMATE GUIDE TO SOLAR WATER PUMPS



Using solar to pump water is still a relatively new concept on small farms, but they have huge potential to transform your farm yields, save you money and they're good for the planet too.

So, we're here to help you out...

This guide aims to help you decide if a solar water pump is for you and show you things to think about when going solar.

...everything you need, is all in the guide below



1 WHAT ARE SOLAR WATER PUMPS?



Solar water pumps work in the same way as other water pumps but they use the sun's energy as their power source.

A solar pump consists of:

- One or more solar panels (the size of a PV system is dependent on the size of the pump, the amount of water required, the vertical lift and solar irradiance available)
- Pump unit
- Some have a controller or inverter depending on whether the pump unit needs to use AC or DC power
- Occasionally a battery is also included which can be used as a backup power source to

regulate water flow if clouds come over or when the sun is low in the sky

The history of solar water pumps

The idea of using the sun's power as a resource has been around since records began. The first recorded solar powered pumping systems were developed in the 19th century. This was as a result of technology evolving to directly convert solar energy into other energy forms. In these first pumps, solar was harnessed in steam engines where the sun heated water to create steam.

These steam engines powered printing presses, stills, ovens, and water pumps and began to revolutionise the mechanisation of many labour intensive tasks.

While these steam pumps gained some traction through the 19th and 20th centuries, a parallel line of invention was occurring – that of solar photovoltaics (PV), using solar to directly generate electricity.

Initially, solar photovoltaics were very inefficient and contained rare materials which made costs very high. In the 1960s, it could cost around \$1000 per Watt!

A significant breakthrough in the semiconductor industry in the 1970s kick-started an exciting trend which has continued into today: an increase in panel efficiency (more power per square metre) and a rapid decrease in cost.

Modern solar water pumps

Nowadays most solar pumps are powered by solar PV panels and the technology continues

to improve, so that more powerful pumps can be powered by smaller, cheaper solar panels. No longer are solar panels only for the rich.

As panels become cheaper and increasingly portable, solar water pumps are just as versatile as water pumps powered by fossil fuels and in some cases more so.

They are ideal for delivering water to remote locations where power lines cannot reach, do not require expensive and polluting fuel, and are not labour intensive.

Did you know?

Solar water pumps are already used in:

Farming
Rural domestic situations
Construction and plumbing in rural areas



② ARE SOLAR WATER PUMPS ANY GOOD?

Now is a really good time for solar water pumps as technologies have been rapidly improving, becoming more efficient and cheaper. It is now easier than ever to find a solar water pump solution for your needs.

If you are not familiar with using solar to power a water pump for irrigation, it is likely that you will need to make some changes to your daily farming activities. Once you get into a routine with solar power, these changes can be used to your advantage.

From rain-fed agriculture to solar

Moving from rain-fed agriculture to a solar powered water pump will increase your farm's resilience to changing weather patterns, droughts, and seasons. Irrigating through drier periods of the year means that you will have longer growing seasons, and sometimes even grow an extra harvest, depending on the climate where you are.



Rainfed vs irrigated maize

From manual irrigation to solar

Manual irrigation is labour intensive and, as a result, the size of land you can cultivate is limited. Switching to solar can give you hours back in your day as the pump will move water for you –

either directly to the crops or to a tank for gravity irrigation later.

From electric pumps to solar pumps

If you have a reliable electric connection in your field, then the benefits of solar over electric are not so clear. However most farms do not have this luxury. Installing a grid connection can be expensive and also limits where you can place your pump. Solar pumps, especially with portable panels, give more flexibility to irrigation and will have zero fuel costs.

From fuel pumps to solar

Fuel pumps are often praised for their high flow rates which is something which must be considered when switching to solar. A solar pump will require a large PV array to pump equal amounts of water. However, water conservation and efficiency techniques such as using low-pressure sprinklers or drip irrigation can reduce the amount of water you need to deliver to your plants. You do not need to swap like for like.

One of the largest benefits of moving away from a dependence on fossil fuels is that your farm profits are less reliant on the often unpredictable price of fuel because solar energy is free. You also do not need to travel to fill a petrol can anymore.

The amount of solar energy that hits the Earth in a single hour is more than our energy requirement for the whole year. It does make a lot of sense to use this resource, especially for irrigation, as it is in abundance when your crops need irrigation the most – during hot, dry, and sunny weather.

③ TYPES OF SOLAR WATER PUMP

There are two main categories of solar water pumps, surface and submersible. Within these categories you will find several different pumping technologies each with different qualities.

Surface water pumps

A surface water pump is placed on the ground surface near the water source. It sucks water up into the pump (suction lift) and then pushes

it up or along to where the water is needed (discharge lift). The suction lift, plus discharge lift equates to the total lift – this is the 'lift' amount that is commonly referred to on datasheets and websites.

Due to physics, the maximum suction lift of a surface pump cannot exceed approx. 8 metres. They are ideal for accessible water sources as they are optimised for higher flow rate.



Submersible water pump

A submersible pump must be fully submerged to pump water. These pumps are often found in deep wells and boreholes (below the suction depth limit of a surface pump), pushing water up to where it is needed. As they are only pushing water they do not have a suction lift.

Choosing between a surface solar pump and a submersible should be quite an easy task.

If your water source is suitable for a surface pump (up to 7m suction depth), then this is the

option for you as they are optimised for surface pumping and you will likely benefit from higher flow rates than using a submersible. If your water is lower than 7m below the surface, look at submersibles.

Choosing between the different types of surface or submersible is more difficult, so it is best to discuss your requirements with your pump supplier.

We have written a list of the questions you should ask your supplier below.

④ HOW MUCH DOES A SOLAR WATER PUMP COST?



As with all technology for the farm, the cost of a solar water pump can vary widely depending on the type of pump, and the technical capabilities of the system. In general, the larger the system and especially the larger the solar PV panel, the larger the price tag. However, it is possible to purchase a solar pump on a budget, and over time, most solar systems will make and save you money too. Prices for solar water pumps can start as low as \$150 for small systems with short warranties, as you increase the capacity and the product warranties upfront costs will rise.

When considering the true cost of a solar water pump, it can be helpful to compare to other water pumps, as solar water pumps can be the cheapest option. It is also important to consider

your land's needs, how long you expect your pump to last, and how you plan to use it to get the most appropriate solar water pump for you.





Comparison to non-solar water pumps

It can be surprising how much a petrol, electric, or manual pump can cost you, once you add everything up. For example, the true cost of a petrol pump can be much greater when you consider:

- Transport costs of travelling to collect fuel
- Servicing and maintenance
- How often your pump needs replacing

The benefits of solar powered pumps include...

1. Eliminated fuel spend – solar energy is free
2. Reduced transport costs – a solar pump works by placing the solar panel in the sun – there is no need to travel to collect fuel which will save you both time and money
3. Savings on maintenance costs – take a look at the warranty offered with your pump, this could save you money on replacement pumps and parts over the years

Many Futurepump customers are reporting savings of US\$100 – \$200 a year, from reduced fuel, transport and maintenance costs.

This means that the price of the pump can be recouped in around 3 years from savings only – over our 10-year warranty period you should come out better off.

How much do you spend on fuel per month?

How much do you spend on travelling to get fuel per month?

How often do you have to maintain your pump? How much does this cost each time?

How often have you needed to replace your pump?

Total _____

⑤ WHICH FARMS ARE SUITABLE FOR SOLAR WATER PUMPS?



Solar water pumps are suitable for many different types and sizes of farms. From small garden plots and allotments to larger, industrial farms, you should be able to find a solar water pump that can match your needs.

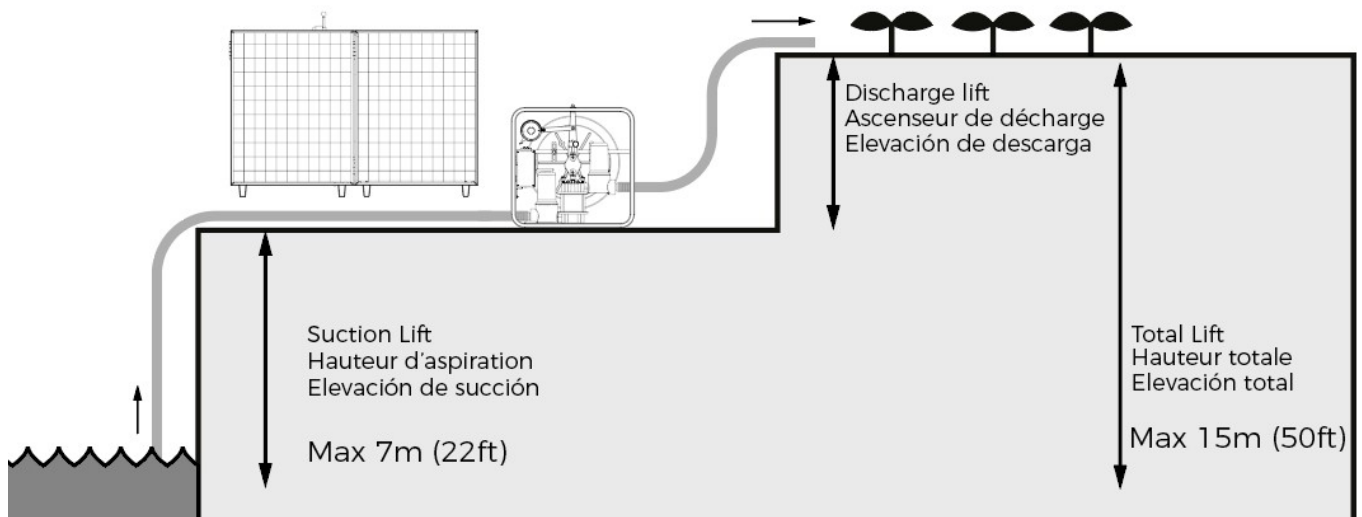
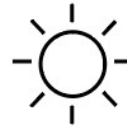
For large farms (over 2 hectares), you will likely need a fixed solar array to provide enough power to pump the volume of irrigation water needed. On smaller farms, you can use portable solar panels that can be lifted and placed where needed or adjusted to face the sunlight.

It is not only the size of land that needs to be considered but also its topography. You should consider how much your land varies in height,

and what this means for the total distance and vertical height you need to pump water.

Example:

You have a shallow well with water five meters below the surface and your crops are on land ten metres above your water source. This means that you require a pump with a total lift of 15m.



The flow rate and distance you can pump water will decrease with greater lift as more energy is required to move the water vertically. You can approximate your water needs and required flow rate using the equation below:

Area of land needing irrigating x by crop water requirement = volume of water required

Solar powered irrigation is now an option no matter where you are located. It is already commonly used to power everything from street lights to household appliances. Thanks to dramatic falls in the costs and increases in efficiency it is now possible to use large panels to

collect enough solar energy to power appliances even in cloudy regions.

If you are looking for an off-grid, sustainable, and/or efficient option to pump water – solar water pumps will be a great option to consider wherever you are.

Calculate your water requirement:

Area of land

Crop water requirement

_____ X _____ = _____



⑥ HOW TO CHOOSE THE BEST SOLAR PUMP

There are many things to consider when choosing a new machine for your farm, we've broken all this down into a few questions to help you gather the information you need.

What is your water source?

If your water source is at or near the ground surface (with the water level within 7m/22ft) you can look at surface water pumps. However, if it is deeper you will need to look at submersible/floating water pumps.

How clean is your water source?

Is it likely your water sources will have sand, dirt, or grit that will pass through the pump? If so, you'll need to make sure your chosen water pump can handle this to save on costly maintenance.

Will your water source run dry whilst pumping?

Some pumps will overheat or be damaged if water stops flowing through them. Think about your water levels and if needed, choose a pump that can handle this.

How much water do you need?

This can be difficult to work out as it can change season to season, so it is best to work to the peak water demand in the growing season.

When considering crop irrigation, here is a quick calculation to help figure out your water needs:

Area of land needing irrigating x by crop water requirement = volume of water required

Compare your answer to the manufacturer's reported flow rate (be mindful that the manufacturer will report the optimal output, usually at 1m head).

How high do you need to lift the water?

Do you have a sloping farm, or a steep river bank to get over? Is the farm uphill, or maybe you want to use your solar water pump to store water in multiple overhead tanks?

The key here is to think about the vertical height you need to lift water, this includes the distance from the water level below the ground and above the ground. Remember, surface water pumps can only lift water up from 7m down, but are optimised for high-flow.

The higher you need to lift water the more energy this will take and this will mean that you get a lower flow rate.

How can you maintain your water pump?

Water pumps need to be able to handle a lot of hard, repetitive work, as well as being moved around your land. To keep any water pump working at it's best some maintenance will be needed, but what this means and how much you can do yourself varies greatly between different water pumps.

Some water pumps are as easy as maintaining a bicycle, while others may need support from professional technicians, and others can't be fixed at all.

For example, with a simple set of tools Futurepump solar pumps can be taken apart and maintained. Whereas petrol pumps may need taking to a technician regularly and pumps that rely on a watertight seal may not be fixable if something goes wrong inside the pump.

Here's a guide to some common solar pump outputs:

1 litre/sec	0.5 litres/sec	0.1 litres/sec
3,600 litres hour	1,800 litres hour	360 litres hour
3.6 cubic metres of water per hour	1.8 cubic metres of water per hour	0.3 cubic metres of water per hour
20 seconds to fill a 20 litre jerry can	40 seconds to fill a 20 litre jerry can	3 minutes to fill a 20 litre jerry can
83 minutes to fill a 5,000 litre tank	3 hours to fill a 5,000 litre tank	14 hours* to fill a 5,000 litre tank

Land you can irrigate with that flow (Rule of thumb assuming 5mm water evenly applied)		
720m ² per hour	360m ² per hour	60m ² per hour
5,040m ² = 0.5ha = 1.25 acres per 7hr day	2,520m ² = 0.25ha = 0.62 acres per 7hr day	420m ² = 0.04ha = 0.10 acres per 7hr day

*14 hours would realistically be at least two 7-hour solar pumping days, probably more

So before you buy a water pump, make sure you know:

- How it works
- How it can be maintained
- Where you can get spare parts and support if needed
- What level of after-sales support is offered
- Whether there is a warranty promise – asking your supplier about what level of support they offer

One way to get a good idea of how long the pump is expected to last is by looking at their warranty and what this offers. To get familiar with what a warranty covers, you can have a look at what is included in Futurepump's 10-year warranty promise on our website.

CHOOSING THE BEST SOLAR PUMP FOR YOU - WORK SHEET

What is your water source?

How can you maintain your water pump?

How clean is your water source?

Is it often cloudy/do you want to use the pump in the mornings and evenings?

Will your water source run dry whilst pumping?

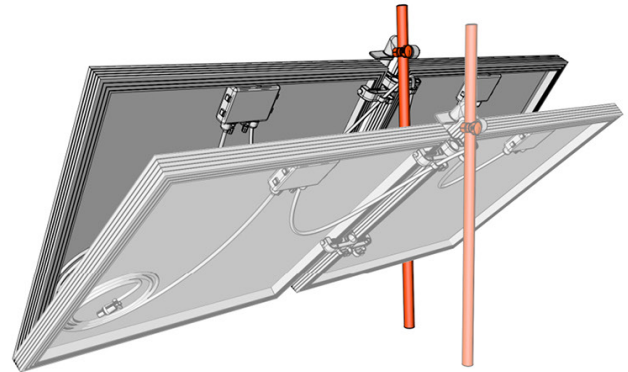
How much water do you need?

Area of land needing irrigating x by crop water requirement = volume of water required

How high do you need to lift the water?

Remember to measure depth to water from the surface and add it to lift required above the surface i.e. to a tank

7 SOLAR WATER PUMPS - TIPS & TRICKS



Once you know how to use the benefits of solar to your advantage, it is possible to have a thriving farm with the help of a solar water pump. We've put together a quick checklist of things you can do to get the most out of your solar water pump.

- Surface or submersible – make sure that you choose the right pump for your farm
- Solar panel size – speak to your distributor about which solar panel would be right for where your farm is located and how much water you need
- Pay attention to the technical requirements of the pump you choose – have you got the right hose pipe size, water source, or irrigation distribution method for the pump?
- Be prepared to service your pump system regularly to keep it working efficiently, check for air leaks in hose pipes and make

sure your solar panels remain clean – these will make a big difference

- Don't want to irrigate in the midday heat? Make the best use of your free solar energy to pump water to a tank during the day, you can then use gravity to irrigate whenever you choose.

If you have any questions or solar pump tips to share, please get in touch at hello@futurepump.com

Don't Forget:

Thanks to the rapid development in solar technology - solar powered irrigation is now a great option no matter where you are located!



A NOTE FROM FUTUREPUMP...

We hope that this guide will be useful to you going forward. Remember, you can print this guide and use the notes sections to help you find the right pump for your farm.

Our company mission is to help farmers earn more money through using our robust solar irrigation pumps.

Visit www.futurepump.com now to find out how a Futurepump Solar Pump can help grow your farming profits.



www.futurepump.com



With thank you to our distributors and for helping with content. Photo references:

Steve, Kenya

Daniel Odero, Kenya

Kijani Testing, Kenya

Pteah Baitong, Cambodia

Futurepump UK

SolarNow, Uganda

NOTES:

This image shows a full page of blank handwriting practice paper. It features approximately 30 evenly spaced, light gray horizontal lines extending across the entire width of the page. The lines are uniform in thickness and spacing, providing a guide for letter height and placement. There are no margins, text, or other markings on the page.