

Solar Irrigation System- Improve Livelihood

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Introduction

The world's population is fed by farmers hence they play a very crucial role in today's world. However, on the other hand they provide renewable source of energies too such as energy from wind, biomass for their own fields or if it's in abundant quantity they resell it too. So one should not forget the importance of farmers.



Farmers usually have large houses with huge roof which are directly exposed to sun without being hindered by tree shadow thus turning them into an ideal place to settle a photovoltaic system. That is why solar energy in agriculture is becoming popular and the energy can be used on the farm or in the local power grid, providing the farmer with an additional income. The areas in agriculture that benefits the most from solar energy is arid regions. The main reason for using the sun for irrigation is described by a circle: when the sun shines, crops needs more water. Therefore, a large quantity of energy is available when it is actually needed.

Solar irrigation and its importance

Solar irrigation uses the sun's energy to power a pump water to crops for growth. To grow the highest quality crops in the most efficient way they must have the right amount of water at the right time. Too little or too much water will lead to crops wilting, soil erosion and poor nutrient uptake of the plants. Irrigation is the controlled application of water to respond to crop needs.

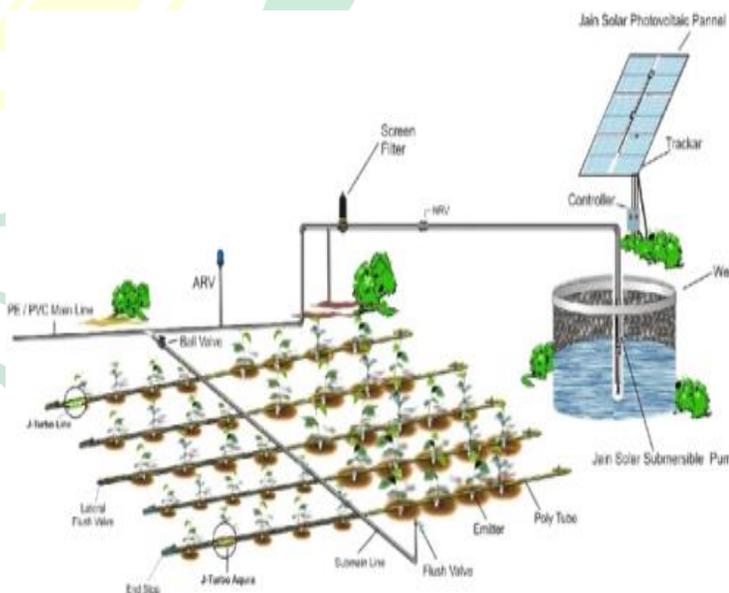
Some advantages of a typical solar irrigation system are

- It makes irrigation possible in remote areas
- Is environment friendly
- No grid connection required
- No electricity bills to be paid
- No fuel required
- Is durable, requiring minimal maintenance



How does a solar irrigation system work?

The pumps for water transport are connected with solar cells. The cells absorb solar energy which is further converted into electrical energy with the help of a generator, now this generator runs motor of the pumps. Most of the traditional pump work with a diesel engine or with the local power. These two modes of operations present disadvantages as compared to solar pumps. In rural areas, in developing countries, the access to the electricity grid is not always guaranteed. In this case, the traditional irrigation system fails. Thus, an independent and alternative energy system can be a solution for the farmer to secure a safe power source. Diesel pumps are slightly more efficient as compared to AC powered pumps due to greater flexibility. However, one of the main constraints is that this system relies on the fuel availability, added to a greater impact on the environment. Diesel-driven pumps are cheaper than solar-powered pumps but the operating costs are quite high. In solar-powered



systems, the system is relatively expensive but the source of energy is free (only the maintenance costs must be considered). Therefore, solar pumps long term investment.

Several studies, like Water for wealth and food security by AgWater Solutions Project, have shown, water access for agriculture use in arid regions like regions of Africa and Southern Asia. Many Indian and African farmers fetch the water from the well or the rivers using buckets. If farmers of those regions could have access to a motorized pump, they would increase their yield by 300%. Therefore, nowadays, R&D now focus on affordable solar pumps for such regions. The company IBC SOLAR along with Siemens, has developed a solution to replace diesel engine by solar-powered engine. In this case, the whole irrigation system including the pump can remain as it is; only the diesel engine is replaced by a photovoltaic system and the so-called “IBC pump drive controller”. A prototype of this system was tested in 2015 in a farm in Namibia and according to the manufacturer, turned out to be quite efficient.

Where is solar irrigation happening?

The installation of solar pumps in arid regions such as in Africa, India and South America is also part of many development projects, aiming at increasing local farmer’s productivity and improving their livelihood. One of the successful example of this is of a Physics teacher in a school in Blankenese (Germany) where students have developed two solar-powered pumping systems in cooperation with the company SET GmbH from Wedel. They installed these systems in two farms in Nicaragua to pump underground water. This project has been running for over 10 years and 30 pumps are in operation now in Nicaragua. It is supervised by the Nicaraguan company Enicalsa that helps farmers benefit from solar irrigation. The use of solar pumps allows to produce all year round, even in dry season thus increase their income. There is also an increasing interest in solar irrigation systems in Europe. A mobile solar drip irrigation system is made by an Austrian company. The Austrian company Wien Energie carried out a dual objective out of it: firstly reduction of CO₂ emissions owing to the use of solar energy, and secondly, achievement of 30% water savings.

The principle of the drip irrigation method is quite simple. With the use of various valves, hoses and pipes, water drips slowly and at regular intervals to the roots of the plants. Therefore, there is no water waste as water goes directly where it should go. Therefore, drip irrigation

method enables to grow more crops with less water, turning it into a highly efficient irrigation method.

In the Wien Energie solar irrigation system, a mobile solar energy system with photovoltaic modules (up to 3kW) is connected to a wheeled pump which can pump from wells or rivers. Thanks to an app on your smartphone, you can determine the amount of energy produced by the system. The solar-powered pump then distributes the water through the hoses, directly to the crops. And this system has been successfully tested.



Therefore, in countries which suffer from high temperatures and scarce water resources, the drip irrigation system or mobile drip irrigation contribute to an efficient water management. Although these systems are still quite expensive and complicated to settle, many R&D projects are working on the democratization of the use of solar power in agriculture, which, in the future (and even now), could play a vital part in the management of the food and energy crisis.

Solar power systems

There are two types of solar systems – one that converts solar energy to D.C. power and the other one convert's solar energy to heat. Both types are used for in agricultural settings.

Type one solar to D.C. power

- In this solar energy is converted to D.C. power, and it is called photovoltaic (or PV). Photovoltaic are solar cells, which convert the sunlight into D.C. electricity.

- The solar cells in a PV module are semiconductor materials. When light energy strikes the cell, electrons are released from the atoms.
- Electrical conductors are installed at the positive and negative sides of the material which allow the electrons to be captured in the form of a D.C. current.
- Then this electricity can then be used to power a load, such as a water pump, or it can be stored in a battery. It is a fact that PV modules produce electricity only under sunlight.
- The energy can be stored as water by pumping it into a tank while the sun is shining and distributing it by gravity when it's needed after dark.
- And these PV systems are the best systems, cost effective and very economical in providing electricity in remote locations on farms, ranches, orchards and other agricultural operations.

Different types of solar pumps for irrigation

- **Submersible pumps:** The submersible pumps are located deep below the ground level and are submerged under water. The intake head of the submersible pump is beyond a depth of 10 meters. These pumps are installed by digging a bore well, which leads to an increase in its installation and maintenance cost.
- **Surface pumps:** The surface pumps remain out of water and in the open. These pumps are installed in place where the water table is within a depth of 10 meters. As they need to be on the surface, these pumps have a very easy to install and easy maintenance. These pumps are not suitable for the deep water table.
- **DC pump:** These pumps run on a motor which operates on direct current, therefore no battery or inverter is needed in this type of pump.
- **AC pump:** The motor of this pump operates on alternating current that means the direct current produced by the solar panels are converted to AC using the inverter. The conversion from DC to AC can lead to loss of power from generation and consumption.

Comparing above types of solar pumps, it is best to choose in between, DC or AC pump. Even though DC pumps have an advantage over AC pumps in terms of higher efficiency and no requirement of an inverter for operation, the cost of DC pumps are very high. And the repair and

maintenance of DC pumps are difficult in rural and remote areas due to lack of service canters in these areas.

Best place to install solar pumps

- The area should be shade free and has no dust or dirt and have a low incidence of bird droppings and which can provide space for unrestricted tracking movement and the surface for mounting panels should be even. Panels should be easily accessible for cleaning and should be close to the pump and water source.
- The pumps should be installed near to the solar panels, but within the area to be irrigated. The intake lift for the pump should be low. In case of multiple water sources, the source with the highest water table should be chosen for installing the pump.

Companies offering solar pumps for irrigation

There has been many companies offering solar pumping systems, from giant companies such as Jain Irrigation, Tata Power Solar, Moserbaer, Shakti Pumps (India), Jain Irrigation Systems, Topsun Energy Ltd, Duke Plasto Technique Pvt. Ltd, Kirloskar Pvt, and SunEdison, to smaller companies such as Claro and Atom Solar. It doesn't mean that the solar pumps are cheap. A one horsepower solar pump can cost approximately 1Lakh Rupees— and the upfront cost typically unbearable for most small, marginal rural farmers with a couple hectares of land or less.

Scheme for solar water pumps in India

The Ministry of New and Renewable Energy (MNRE) has introduced a five-year program, Solar Pumping Program for Irrigation and Drinking Water, in 2014-15 which provides a financial support of Rs 400 crores for the installing 10 lakh solar water pumping systems around the country for irrigation and drinking water needs. This scheme is implemented through the state governments that can either carry out solar pumping projects or offer financing through NABARD, all the commercial banks and other financial agencies for the farmers to encourage solar water pumping. All the states are offering subsidies to promote usage of solar water pumps. In the budget 2017-18, the Andhra government has announced the distribution of solar pump sets to farmers at subsidized prices. And the Haryana government had offered a 90 percent subsidy to encourage solar water pumps among farmers.