

## Solar Irrigation System: An Efficient Way of Water Management in Agriculture

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### Introduction

Irrigation is the controlled application of water to respond to crop needs. To grow the best 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. Farmers can produce energy from the wind, the sun or the biomass and they can use it for their own farm, or, if they have a surplus, resell it to companies.

Solar energy might be one of the easiest ways for farmers to produce energy. Farmers usually have several large buildings whose roofs are directly under the sun, without being hindered by the shadows of the trees, turning them into an ideal place to settle a photovoltaic system. Therefore, the use of solar energy in agriculture is becoming increasingly popular and the energy produced from this renewable source can be used either on the farm or in the local power grid, providing the farmer with an additional income. One of the areas in agriculture that benefits the most from solar energy is irrigation, especially in arid regions. The main reason is that using the sun for irrigation represents a virtuous circle: when the sun shines, it feeds the irrigation system. Therefore, a large quantity of energy is available when it is actually needed.

### How does a solar irrigation system work?

The pumps used for the transport of the water are equipped with solar cells. The solar energy absorbed by the cells is then converted into electrical energy via a generator which then feeds an electric motor driving the pump. Most of the traditional pump systems mainly

work with a diesel engine or with the local power grid. However, these two modes of operations present disadvantages compared to solar pumps.

In many rural areas, especially in developing and emerging countries, the access to the electricity grid is not always guaranteed. In this case, farmers cannot rely on the traditional irrigation system. Thus, using an independent and alternative energy system can be a solution for the farmer to secure a safe power source and for the public grid to avoid saturation.

Diesel pumps are slightly more efficient than AC powered pumps as they allow 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 and depend heavily on the diesel price. In solar-powered systems, it works the other way round, that is, although this system is relatively expensive, the source of energy is free, therefore, after the amortization period, there are no longer operating costs (only the maintenance costs must be considered). Therefore, solar pumps turn out to be a viable long term investment.

As several studies, such as Water for wealth and food security by AgWater Solutions Project, have shown, the access to water for agricultural purposes remains critical in some areas such as in arid regions of Africa and Southern Asia. Many Indian and African farmers fetch the water directly from the well or the rivers and irrigate their fields 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 tends to focus on creating solar pumps that are affordable in arid regions. 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”. The main advantage lies in the fact that there are low acquisition costs as the existing infrastructure is used.

### **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 farmers

productivity and as a consequence, improving their living conditions. There is also an increasing interest in solar irrigation systems in Europe.

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, contrary to a sprinkler system in which water evaporates into the air or seeps into soils where no plants grow. Therefore, drip irrigation method enables to grow more crops with less water, turning it into a highly efficient irrigation method.

### **Conclusion**

In countries which suffer from high temperatures and scarce water resources, the drip irrigation system could contribute to an efficient water management. This is all the more important as farmers have to face three challenges: save water, money and energy. Mobile solar drip irrigation systems shall turn out to be the perfect answer to face these challenges. 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.