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Solar Water Pump

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ABSTRACT

Solar powered water pumping systems have become the interest of many people in the recent years. Acknowl-edging that nature has provided a bounty of energy which can be converted into electrical energy has createdinnovative ways of discovering materials that can be used to make a system that supports turning heat into elec-tricity. In this regard, the paper presented different concepts that relate to how the whole energy creation pro-cess is done and discusses useful ways of turning heat into useful energy. Furthermore, the recommendationsdictate that while advancements in the technology are given attention, the issue of the investment cost and how itwill thrive in the market is still a question. Nevertheless, many developing and developed countries continue to express interest in this area, and most are actively using and exploring how solar power can be used in otherways. Photovoltaic systems which are used to pump water for people, livestock and plants are an importantmove for technology and use of solar energy. Pumping water system using this PV technology has shown that issimple and that it does not require a lot of maintenance. In this regard, the idea gained the interest of farmerswhose main concern is providing sufficient water not only for themselves but also for their plants and crops andlivestock. The only major difference to this is that the system relies on solar energy as a power source for thepumps.

Keywords : Displaced or Volumetric Pump, Electric Power Plant, Energy, Photovoltaic Energy, Photovoltaic (PV) System

I. INTRODUCTION

The most practical and best source of lightand energy comes from the sun. It is the onesource that doesn't run out and is made available toeveryone without cost. So, it logically makes sensethat people find a way to make the best out of whatnature provides us so generously. One of the waysthat this can be done is by converting the sun'slight into useful electricity. Normally, when lighttouches an object, the energy is converted into

heat.This is the same feeling when you go out and baskin the heat of the sun. For some materials, however, the energy is converted into an electrical currentwhich can be used to generate power.In the old days, solar technology wouldinvolve using silicon crystals to produce the elec-tric current when heat is received. When siliconreceives heat from the sun, the electrons causes thecrystals to move, transforming the light energy intoelectricity. The only problem is that big crystalsare difficult to produce. Hence, the evolution ofnew materials meant smaller, cheaper materials andcrystals like copper-indium-gallium-selenide whichare shaped into usable, flexible films. The draw-back to using this material, however, is that it doesnot compare to silicon's performance when itcomes to converting energy into electricity. In the recent years, increasing awarenessof possible alternatives has been given attention,especially that solar energy is a great solution toacquiring electricity. However, while solar energycomes from a free source, the materials needed toproduce a decent solar energy panel is expensive,that scientists and researchers need to develop ma-terials that are cheap and can effectively convertsunlight into electricity.

Solar power can be especially useful inremote places where a general supply of electricitywould be developed. Such is the case of farmerswho need efficient ways of watering systems tohelp with the business of growing crops or manag-ing livestock. Solar-powered water pumping solu-tion and system is one of the answers to this. Itwould enable access to multiple distribution points,providing precious water to irrigations where need-ed and accessibility to clean animal pens and pro-vide them with needed water.

What the image above shows is an exam-ple of a solar panel system used in water pumps. Essentially, a solar powered pumping system would consist of a solar panel array which is used to power and the electric motor that causes a bore or surface pump to supply water is strategic farm-ing and livestock areas. The interest hence of this paper is placed on a thorough discussion of how solar energy can be used to extract water from well pump.

Figure 1: Solar Panels used in irrigation and live-stock areas (Butler)

Goals of the Research:

The study is interested in emphasizing the usefulness, potentials, and benefits. More particu-larly the study aimed at identifying how solar ener-gy is used in well pumps so that it provides the needed water to strategic locations. One of the benefits of a solar pump is especially highlighted in farming and livestock use. But then, more im-portantly, solar pump systems provide a cost-effective and more efficient means of providing priceless water to people.

DISCUSSION

The sun is like a natural nuclear reactor which releases tiny elements of energy called pho-tons, "that travel the 93 million miles from the Sun to Earth in about eight-and-a-half minutes. Every hour, enough photons impact our planet to theoreti- cally satisfy global energy needs for an entire year"(Butler). Needless to say, solar energy has been available since the solar system was formed billions of years ago. It was not observed until the 19th century that Alexandre Edmond Becquerelbdiscovered a breakthrough in solar energy's poten-tial. Considered as the father of solar panels, he was able to prove that electric current could flow through an electrode exposed to sunlight. Interest-ingly, his discovery "showed that shining light on an electrode within a conductive solution generates

an electrical current. This is known and now called as the photovoltaic effect, the same principle used in modern solar panels."("Who Invented Solar Pan-els?"). However, it took another century since the discovery, when Russel Ohl studied the infor-mation on photovoltaic effect and the invention of the transistor, to invent the solar cell. The solar cell becomes an efficient device to harness electric-ity from solar energy, particularly when integrated into a solar panel. Appropriately called photovolta-ic (PV) solar panels, solar cells captures sunlight and converts it to direct current (DC) electricity.

Solar Cells:

Silicon, a very good semiconductor, is the main component in a solar cell. Just like a battery, the solar cell is constructed with a positive and negative layer to form an electric field. The photons from the sun will hit the solar cell and excite the electrons from their atoms. The conditions aredictated by conductors which are attached to the positive and negative sides of a cell which forms an electrical circuit. "When electrons flow through such a circuit, they generate electricity" ("How Does Solar Energy Work?"). The more energy is required, the more solar cells are needed. If multiple solar cell panels are wired, it forms a solar array to generate more electricity.

Four types of solar panels are commonly available: single silicon, multi-silicon, BIPV (building integrated photovoltaics) and solar thermal panels. The most efficient type is the single silicon panel while the less efficient but less expensive to produce is the multi-silicon panel. The BPIV is designed to blend with the edifice of the structure or building, which make it very expensive. Solar thermal panels are not actual solar cell panels. They do not conduct electricity but absorbs the heat of the sun to warm the water. Larger solar thermal systems could heat up an entire building.("How Many Types Of Solar Panels Exist?"). As mentioned, solar cells produce direct current (DC)electric output.

What this means is that PV systems could directly supply electricity to DC-specified items like bulbs and batteries. If the so-lar cells are to be used to power alternating current(AC) devices like a generator or a motor or simply an AC lighting system, an inverter is needed to convert DC to AC. One of the first basic applications of the solar cells is to store power on batteries and supply household lights. The below image shows a fundamental PV system.

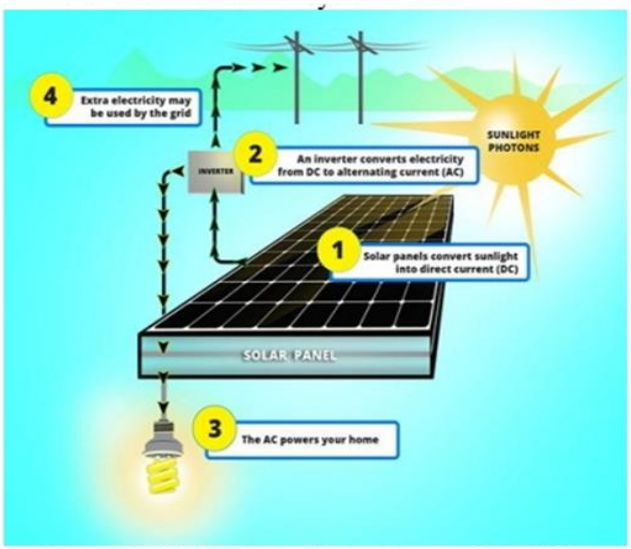

Figure 2: ("How Does Solar Energy Work?").

Solar Powered Water Pumps:

This article is focused on one of the major application of solar power – operating or powering pumps or motors to extract water from the ground. Feasibility for any PV system should include a study of the Global Horizontal Irradiance (GHI). "GHI is the total amount of shortwave radiation received from above by a surface horizontal to the ground and is the most important parameter forbevaluation of solar energy potential of a particular region..." ("The Future Of Solar Water Pumping"). From the map below, the efficiency and effectiveness of a PV system particularly depend on the amount of solar radiation being received on a site. Practically it will not be feasible to put a PV water pump system in cold places or where there are plenty of volcanic activities or cloud cover.

Solar Water Pump:

A solar water pump uses a mini power house which is found at its center. This consists of important elements such as a calibrated and matching a solar array of modules, specially designed to match and withstand the equivalent power of pump for that particular

application and use. Once this is established and is in place, the solar water pumping system would be able to process different types of electrical water pumps, as well as providing the needed water demand in various areas, from irrigation to household uses. Other systems such as irrigation pumps may be submersible, surface or deep well and can also be modified so that it caters to drip irrigation systems.

Furthermore, typical solar water pumping system is known by the "total of solar array size that is required to run the attached pump" ("Solar Water Pumps"). What can be seen is that typically, a 1000 Wp solar water pump can gather an amount of about 40,000 liters of water every day taken from a source that is up to 10 meters deep. This would be enough to supply and irrigate about 2acres of land with regular crops. Meanwhile, a 1000 Wp solar water pump helps save up to Rs 45,000 when compared to an equivalent use of a diesel-operated pump over a year ("Solar Water Pumps").

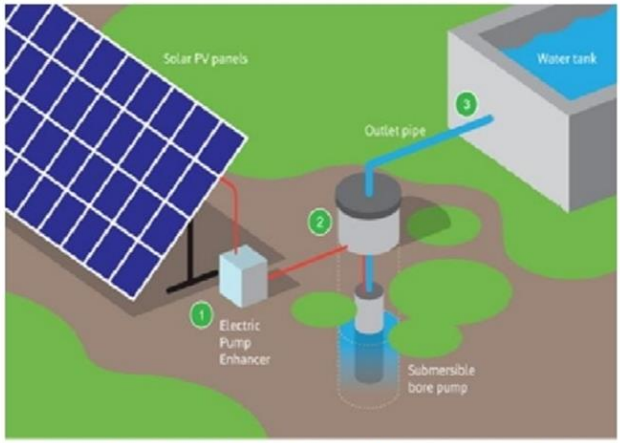

Figure 4: Solar Water Pump Mechanism ("Solar Water Pumps")

The process of how the solar panel works involve some steps. As each solar array has some solar modules that are connected in series or parallel connection. Each solar PV panel creates the electric current by changing the solar radiation it receives into electrical energy. This electrical energy is enhanced, manipulated and goes through an inbuilt controller in DC pumps and allows a connected pump to work so that it draws water taken from different sources such as ponds, rivers, wells and other sources. The water then that goes through a feed of pipelines and supplies irrigation systems and livestock areas with the needed water.

II. RECOMMENDATIONS

The study showed how solar energy can be converted and turned into useful energy to power water systems. However, there are considerations to the use of well pumps to extracting water.While there is an increasing awareness of its usefulness and that alternatives to materials used in creating solar panels that would provide the energy to pump water systems, the materials used are still expensive materials and would need a considerable amount of investment and that there would be implications to doing so as well. However, this is outweighed by more important effects. For instance, a swimming pool requires massive amounts of energy to keep it clean. A solar pump would save on energy bill and would also ensure that the pool is environmentally clean. It is worth noting, however, that while a proposal to extracting water through solar energy is environment-friendly and would lead to many benefits, it is important that more studies be taken to further develop more economical ways of extracting water by solar energy.

III. CONCLUSION

Solar pumps are evidently seen as efficient, environmentally friendly way to produce and supply water demands of many domestic and commercial purposes. Nowadays, the use of the solar system is highlighted in many agricultural and residential irrigation and cattle or livestock watering solutions. One clear advantage of solar pumps is that they can be easily installed and do not require heavy maintenance. Additionally, these pumps can survive up to 20 years, so that the benefit made on it outweighs the initial set up costs. However, aside from the economic and environmental benefits of solar powered water pumps, there are many other advantages that make them more

appealing than battery or any other conventionally powered pumps. For instance, as solar pumps do not rely on electricity or produce dangerous toxins. Thus, they are safe. Secondly, solar power pumps can be used to supply heat to homes and public buildings. Another benefit is that they operate quietly. Finally, they are self-priming and are easy to install.

Today, the viability and practicality solar energy as a future energy source is quickly becoming known all over the world. Installations of small and Solar PV Power Systems are increasing significantly. Solar PV systems show that people are becoming more aware of the potentials and possibilities of solar power energy. It goes on to say that the idea of solar power has become an interest for many including businesses that many investments are made in different types of energy conversion systems to suit the people's needs. Such is seen in Solar PV & Solar Thermal Power Plants, Solar Powered Electronic items, Solar Water Heater systems. Even satellites are now powered by solar panels. The discussion on how solar energy systems can be utilized to pump water and serve people effectively without depending on the grid power supply leads to clean energy that a continuous development of the idea of solar energy is being raised and is observed in many parts of the world.

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