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Parabolic Solar Plate Water Pumping System

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ABSTRACT
Agricultural technology is changing rapidly. Farm machinery, farm building and production facilities are constantly being improved. Agricultural applications suitable for photovoltaic (PV) solutions are numerous. These applications are a mix of individual installations and systems installed by utility companies when they have found that a PV solution is the best solution for remote agricultural need such as water pumping for crops or livestock. A solar powered water pumping system is made up of two basic components. These are PV panels and pumps. The smallest element of a PV panel is the solar cell. Each solar cell has two or more specially prepared layers of semiconductor material that produce direct current (DC) electricity when exposed to light. This DC current is collected by the wiring in the panel. It is then supplied either to a DC pump, which in turn pumps water whenever the sun shines, or stored in batteries for later use by the pump. The aim of this article is to explain how solar powered water pumping system works and what the differences with the other energy sources

Keywords: parabolic solar plate, ECU, Diode, battery, Invertor, DC motor, Sensor and Centrifugal pump

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I. INTRODUCTION

Solar technology isn't new. Its history spans from the 7th Century B.C. to today. We started out concentrating the sun's heat with glass and mirrors to light fires. Today, we have everything from solar-powered buildings to solar-powered vehicles.

In 7th Century B.C. Magnifying glass used to concentrate sun's rays to make fire and to burn ants.

In 3rd century B.C Greeks and Romans use burning mirrors to light torches for religious purposes.

In 20 AD Chinese document use of burning mirrors to light torches for religious purposes.

From 1st to 4th century AD the famous Roman bathhouses in the first to fourth centuries A.D. had large south facing windows to let in the sun's warmth.

In 1200s AD Ancestors of Pueblo people called Anasazi in North America live in south-facing cliff dwellings that capture the winter sun.

In 1767 Swiss scientist Horace de Saussure was credited with building the world's first solar collector, later used by Sir John Herschel to cook food during his South Africa expedition in the 1830s.

In 1839 French scientist Edmond Becquerel discovers the photovoltaic effect while experimenting with an electrolytic cell made up of two metal electrodes placed in an electricity-conducting solution—electricity-generation increased when exposed to light

In 1883 Charles Fritts, an American inventor described the first solar cells made from selenium wafers.

In 1905 Albert Einstein published his paper on the photoelectric effect (along with a paper on his theory of relativity).

In 1908 William J. Bailley of the Carnegie Steel Company invents a solar collector with copper coils and an insulated box—roughly, it's present design.

In 1960 Hoffman Electronics achieves 14% efficient photovoltaic cells.

In 1964 NASA launches the first Nimbus spacecraft—a satellite powered by a 470-watt photovoltaic array.

In 1977 The U.S. Department of Energy launches the Solar Energy Research Institute. Total photovoltaic manufacturing production exceeds 500 kilowatts.

In 1980 ARCO Solar becomes the first company to produce more than 1 megawatt of photovoltaic modules in one year.

In 1983 Solar Design Associates completes a stand-alone, 4-kilowatt powered home in the Hudson River Valley. Worldwide photovoltaic production exceeds 21.3 megawatts, with sales of more than $250 million

In 1991 President George Bush designates the U.S. Department of Energy's Solar Energy Research

Institute as the National Renewable Energy Laboratory.

In 1998 The remote-controlled, solar-powered aircraft, "Pathfinder" sets an altitude In record, 80,000 feet, on its 39th consecutive flight on August 6, in Monrovia, California. This altitude is higher than any prop-driven aircraft thus far.

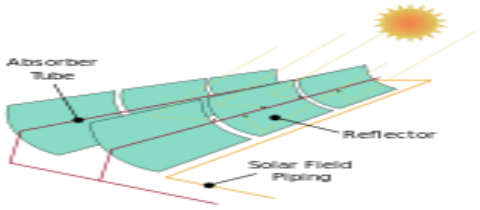
In 1999 Cumulative worldwide installed photovoltaic capacity reaches 1000 megawatts.

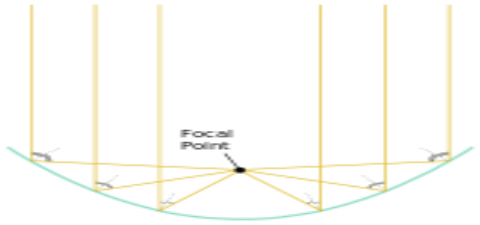
In 2001 NASA's solar-powered aircraft—Helios sets a new world record for non-rocket-powered aircraft: 96,863 feet, more than 18 miles high.

In 2012 Solar panels installed by Solar City cost the company $2.84 per watt (including sales and marketing plus overhead, in addition to the cost of the hardware), down from $4.73 in 2012

II. CONCEPT

In Parabolic solar cell concentration of solar radiation increased because reflection of solar radiation can be reabsorbed .Due to which more power output can be obtained, hence efficiency of solar power system increases. In parabolic solar plate, the reflected part of solar radiation concentrated on the focal line, due to which required temperature for semiconductor plate is maintained. Thus in parabolic plate the solar cell is charged for a long time as compared to flat plate. A parabolic trough is a type of solar thermal collector that is straight in one dimension and curved as a parabola in the other two, lined with a polished metal mirror. The energy of sunlight which enters the mirror parallel to its plane of symmetry is focused along the focal line, where objects are positioned that is intended to be heated.



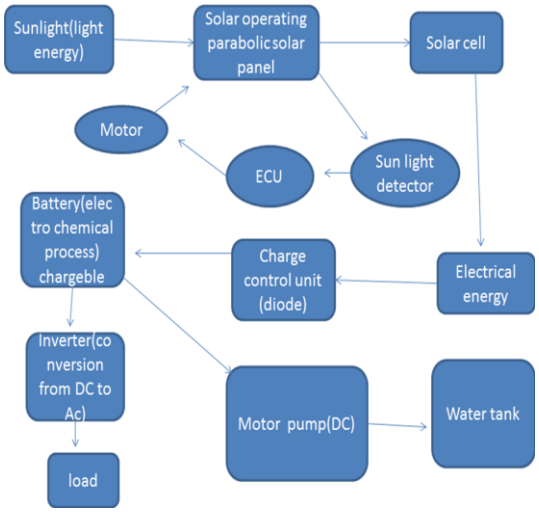


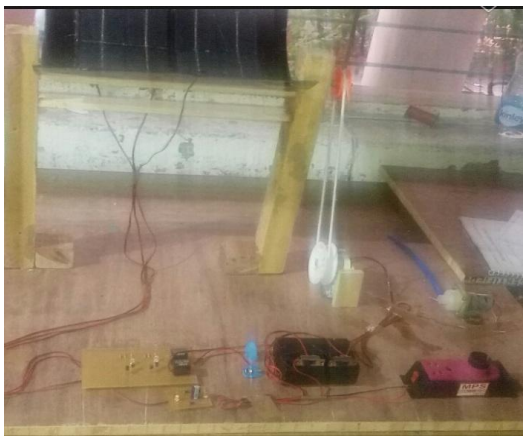
A parabolic trough is made of a number of solar collector modules (SCM) fixed together to move as one solar collector assembly (SCA). A SCM could have a length up to 15 meters (49 ft) or more. About a dozen or more of SCM make each SCA up to 200 meters (660 ft) length. Each SCA is an independently tracking parabolic trough

III. ASSEMBLY AND WORKING

3.1. Working

3.1.1. Working flow chart





When sunlight (light energy) falls on a solar operating parabolic solar panel. Light containing photons activate electrons attached on the semiconducting plate. Electrons bounded are now free electrons. Due to flow of free electrons electrical energy flows inside the solar panel. Electrical energy passes through the charge control unit (diode), which supports the flow of electric current in one direction and blocks opposite direction. Now electrochemical process takes place inside the battery due to which it gets charged. DC motor pump is operated by battery and water tank gets filled. On the other it there can be the conversion of DC current to AC currents and can be used in household applications. Sun light detector is also mounted on the solar panel which gives response to ECU(electric control unit) according to which signal is given to motor ,it starts rotating according to which parabolic solar plate rotates on its axis

IV. OUTPUT CALCULATIONS

4.1 Battery capacity is measured in Amp Hours (e.g. 1AH). We need to convert this to Watt Hours by multiplying the AH figure by the battery voltage (e.g. 12V). This is just the simple calculation below-
X (Battery size in AH) x Y (Battery Voltage) = Z (Power available in watt hours)
For a 3AH, 12V battery the Watt Hours figure is 3(X) x 12(Y) = 36 WH (Z)
Means this battery provides rated power of 36 watt - hour.
Lead acid batteries will give around 50% of their rated power
Means,
Pu =Usable power= 50% of 36WH =18 WH
To calculate the energy it can supply to the battery, multiply Watts (of the solar panel) by the hours exposed to sunshine.
3watt*6plates=18watt
18watt*2hours=36watt.hour
Means,
Energy provided by solar panel in 2hrs is 36WH
Hence ,
Battery will be charged in 2 hrs of sunshine.
Specification of DC pump-
Input voltage = 12v
Power =4.8w
Flow rate = 1.8lit/min
Hence,
According to our output we can run three pumps of this type.

V. CONCLUSION

Solar power generation in India currently is only 3.8 % .due to lack of power generation in India only 18% is supplied to agricultural flied. So this project parabolic solar plate water pumping system is very helpful. In this project power generation through can be used in domestic as well as agricultural use for water pumping. Some areas of north –east states, valley region where day time is less, parabolic solar system is useful for more power generation as compared to flat plate

As per the geographical location of the country, India stands to its benefit and has tremendous scope of generating solar energy. Solar Power Generation alone can cater more than 60-65% of our entire need of power. Thus, we have to focus on following future plans of installing large projects in Rajasthan and Jammu & Kashmir whereas in Uttar-Pradesh, Banda district - is most suitable location to cater our need of Uttar-Pradesh. Apart from above, we also have to focus on Roof Top Solar Energy Generation that may cut down our need to more than 50% need of every house hold.

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