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Original Research Paper

ENGINEERING

SOLAR THERMAL PUMP WITH NO MOVING PARTS FOR HIGHER IRRIGATION AND MULTI –STOREY BUILDING

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ABSTRACT Providing clean, environmentally safe water for livestock in sufficient quantities continues to be a major concern for farmers and ranchers. Abundant water in remote locations in needed to insure that grasslands are grazed evenly. A solar powered water pumping system designed for remote locations was operated to determine the performance and reliability of the system and components. The system began pumping water when the solar radiation intensity exceeded. Flow increased linearly with radiation intensity and reached a maximum flow of intensity. Maximum flow was dependent on using the correct controller adjustment as well as the radiation intensity. Solar water pumping system operates on direct current. The output of solar power system varies throughout the day and with changes in weather conditions. Photovoltaic module, the power source for solar pumping, have no moving parts, requires no maintenance and last for decades. A properly designed solar pumping system will be efficient, simple and reliable. Solar powered pumping systems are used principally for three applications town and city water supply, livestock watering and irrigation.

KEYWORDS : Solar Energy, Reciprocating Water Pump, Direct Current, DC Motor with Gear Box.

I. INTRODUCTION

A. Introduction to Non-Conventional Energy Sources:

While fossil fuels will be the main fuels for thermal power, there is a fear that they will get exhausted eventually in the next century. Therefore other system based on non-conventional and renewable sources are being tried by many countries. These are solar, wind, geo-thermal, sea and bio-mass.

1).Solar Energy:

Solar energy can be major source of power. Its potential is 178 billion MW which is about 20000 times the world's demand but so far it could not developed on large scale. Sun's energy can be utilized as thermal and photovoltaic. The former is currently being used for steam and hot water production.

2) Wind energy:

Wind energy which is indirect source of solar energy conversion can be utilized to run wind mill which in turn drives a generator to produce electricity. Wind can also be used to provide mechanical power such as for water pumping. The energy available in winds over the earth's surface is estimated to be 1.6X107 which is of same order of magnitude as present energy consumption on the earth.

3) Geothermal energy

Geothermal energy drives the heat in the Centre of the earth. According to various theories the earth has a molten core. The facts that volcanic action takes place in many places on the surface of the earth, supports these theories. The steam and hot water comes naturally to the surface of the earth in some location of the earth. India does not appear to have any major exploitable sources.

4). Ocean Energy:

Energy from seas can be utilized as wave tidal or ocean thermal energy. About 13 kW per meter height of wave can be generated. A plant to make 445000 kWh/yr of energy is being set up in Kerala State. Ocean thermal energy conversion utilizes the temperature difference between warm surface water at about 28°C and the cold deep sea water at 5-7°C at depth of 800-1000 meter in tropical areas. In India the Gulf of Kutch, Gulf of Cambay and Sunder bans are potential sites.

5). Biomass Energy:

Biomass is another renewable source of energy in the form of wood, agriculture residues, etc. The potential for application of biomass as an alternate source of energy in India is very great. We have plenty of agriculture and forest for production of biomass. Biomass is produced in nature through photosynthesis achieved by solar energy conversion. Biomass can be burnt directly to generate steam for use in steam turbine for power generation or they can be gasified and the gas used in an IC Engine.

B).*Introduction to Solar Energy:*

Sun is primary source of energy, and all form of energy on the earth is derived from it. Solar energy has the greatest potential of all the sources of renewable energy and if only a small amount of this form of energy could be use, it will be one of the most important supplies of energy especially when other source in country have depleted. Energy comes to the earth from the sun. This energy keeps the temperature of the earth above that in colder spaces, causes current in the atmosphere and in ocean, causes the water cycle and generates photosynthesis in plants. The solar power where sun hits atmosphere is 1017 watts, whereas the solar power on earth's surface is 1016. The total worldwide power demand of all needs of civilization is 1013 watts. Therefore, the sun gives us 1000 times more power than we need. If we can use 5% of this energy, it will be 50 times what the world requires. The energy radiated by the sun in bright sunny day is approximately I kW/m2. Utilization of solar

energy is of great importance to India since it lies in a temperature climate of the region of the world's where sun light is abundant for major parts of the year. India has the total land area of 3.28x1011 m2. On an average 5 kW/m2 per day solar energy is falling on this land over 300 days per annum.

C). *The Application of Solar Energy:*

- Heating and cooling of residential building.
- Solar water heating.
- Solar drying of agricultural and animal products.
- Solar distillation on a small community scale.
- Salt production by evaporation of sea water or inland brines.
- Solar cookers.
- Solar engines for water pumping.
- Food refrigeration.
- Bio conversion and wind energy, which are indirect source of solar energy.
- Solar furnaces.
- Solar electric power generation by solar ponds, steam generator.
- solar photovoltaic cells.

II. LITERATURE REVIEW

A).Malawi Solar Powered Water Pump System BY:- Hunter King1 and Dr. Andre Butler2:

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This project will consist of a water pumping system to supply potable water to an orphanage located in the Chuluchosema community of Malawi, Africa. The water will be pumped from a nearby well up to a water tower located in the orphanage center. The pump will be powered by a solar panel that will capture the solar energy from the sun. This project is in association with Mercer's University's Master's Program for Environmental Engineering and Mercer on a Mission. The water pump system will be built on Mercer's campus and will then be orphanage in Malawi to be assembled permanently. The water pumping system will be built by materials that are sustainable enough to allow the system to function properly long after the student has installed the system and has left. The intent of this project is to provide a hands-on experience for the graduate student by working with various professors and manufacturers as well as different contacts from the developing country. The goal of this project is to supply potable water to an orphanage without the residents retrieving it from a well.

B). Keywords: Solar water pumping; Pump; Photovoltaics; Efficiency; Diaphragm pump; Helical pump BY:- Brian D Vick , B. R.Nolan Clarck:

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For several years, many types of solar powered water pumping systems were evaluated, and in this paper, diaphragm and helical solar photovoltaic (PV) powered water pumping systems are discussed. Data were collected on diaphragm and helical pump which were powered by different solar PV arrays at multiple pumping depths to determine the pumping performance, efficiency, and reliability of the different systems. The highest diaphragm pump hydraulic efficiency measured was 48%, and the highest helical pump hydraulic efficiency measured was 60%. The peak total system efficiency (e.g. solar radiation to pumped water) measured for the diaphragm and helical pumps were5% and7%, respectively (based on PV modules with 12% efficiency). The daily water volume of the three-chamber high head diaphragm pump performed better than the dual-chamber high head diaphragm pump (5 to 100% depend-ing on PV array input power and pumping depth). Use of a controller was shown to improve the quad diaphragm pump performance below a solar irradiance of 600 W/m2(20 m head) to 800 W/m2(30 m head). While diaphragm pumps made mostly of plastic demonstrated similar to much etter pumping performance than diaphragm pumps made with a high proportion of metal, the metal pumps demonstrated a longer service life (>2 years) than the plastic pumps service life (<2 years). Helical pumps analyzed in this paper were capable of deeper pumping depths and usually demonstrated a longer service life than the diaphragm pumps that were analyzed.

C). Experimental Study Of Solar Water Pump BY:- Master of Science Erin Williamson:

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Bio resource Engineering Solar water pump studies for small-scale rigation Irrigation is a well established procedure on many farms in western Canada and is practiced on various levels around the world. It allows diversification of crops, while increasing crop yields. However, typical irrigation systems consume a great amount of conventional energy through the use of electric motors and generators powered by fuel. The overall objective of this research was to determine the feasibility of using photovoltaic (PV) modules to power a water pump for a small-scale drip irrigation system in Montréal (Québec, Canada). The study involved field observations, as well as computer simulations of global solar radiation and PV electrical output. Field observations involved a summer and winter installation of two amorphous silicon 42 W PV modules, directly connected to a 12 V surface water pump. The parameters monitored were voltage, current, back-of-panel temperature, pressure, and flow. These observed parameters were used to determine PV electrical output and volume of water pumped. Site latitude, elevation, and panel tilt were applied to the solar radiation and PV electrical output models, along with the following meteorological data: daily average, maximum, and minimum temperatures, and global solar radiation. Daily solar radiation prediction showed a linear correlation of 0.69 with the observed daily values, over the years 2000 to 2005. The correlation coefficient was improved to 0.91, when 7 day moving averages of both the observed and predicted solar radiation data were used. PV electrical output and volume of water pumped were monitored between August 2005 and May 2006. Both the power and water output observations were less than expected. However, the predicted daily PV electrical output ranged from 1.0 MJ d-1 in the summer to approximately 0.6 MJ d-1 in the winter .As expected, an increase in power caused an increase in the volume of water pumped.

III. CONCLUSION

The invention is the development of solar energy based pump for irrigating agriculture fields by lifting ground water. The method used here to build solar powered water pumping system is cost effective comparatively to an electrically operated hydraulic pump. Since here non-conventional energy is used to achieve the required head.

The most attractive part of pump , we are doing is that the solar energy based pump with absence of any moving component , which make its almost maintenance-free. solar thermal energy is used to create a pressure higher than the atmospheric pressure over the water table of the ground water. This pressure(higher than that of atmosphere) lifts underground water through a tube dipped in ground water and delivers at a head H =(Pc-Pa)/pg, where Pc is the pressure created by solar energy, Pa is the atmospheric pressure ,p is mass density of liquid and g is the acceleration due to gravity.

REFERENCES

[1] Wikipedia
[2] www.google.com