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DESIGN AND FABRICATION OF SOLAR POWERED CENTRIFUGAL PUMP TO EXCRETION OF SEWERAGE

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Abstract: In this paper, the proposed concept is to replace diesel based pumping system to solar-based system for sewerage cleaning. This solar pump is based on photovoltaic technology which converts solar energy into electrical energy to run a DC motor .This system consists of solar panel, battery motor, centrifugal pump solar sewerage pumping system has been found to economically viable in comparison to electrical or diesel based system for sewerage cleaning purpose .The project particularly aimed to address its use as the solar power supply for sewerage cleaning trucks with economical condition. The major difference in this system is relies on solar energy as a power source for pumps instead of diesel.

Keyword :Centrifugal Pump , Solar Panel ,Photovoltaic Cell, Battery

I. INTRODUCTION

Most of the increase in the area of irrigated land in the world has been through the increasing use of engine-driven pumps. However, the increasing price of oil-based fuel has reduced the margin to be gained by farmers from irrigation. Despite present short-term fluctuations in oil prices, conventional oil-based engine-driven power sources and mains electricity are expected to continue to increase in the longer term. If we are to decrease our dependence on imported oil, we have to find methods for energizing irrigation pumps that are independent of imported oil or centralized electricity.

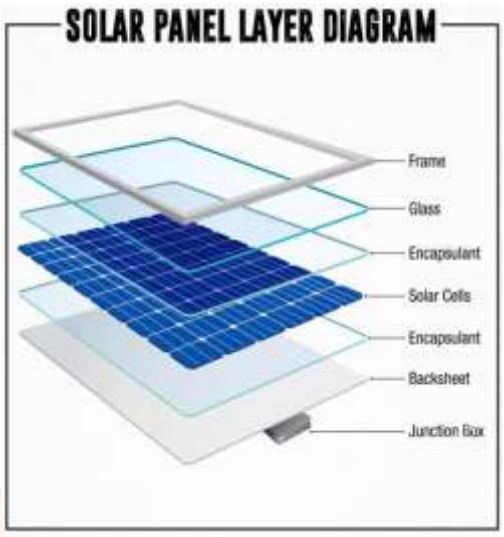
The sun is a clean and renewable energy source, which produces neither greenhouse effect gases nor hazardous wastes through its utilization. Renewable energy sources are being increasingly implemented in many applications due to the growing concern of environmental pollution. Photovoltaic (PV) is a technology in which the radiant energy from the sun is converted to direct current. The photovoltaic process produces power silently and is completely self-contained, as there are no moving parts the use of photovoltaics as the power source for pumping sewerage is considered as one of the most promising areas of PV application. Photovoltaic powered sewerage pumping systems require only that there be adequate sunshine. The use of photovoltaic power for sewerage pumping is appropriate, as there is often a natural relationship between the availability of solar power and the sewerage requirement. The sewerage requirement increases during hot weather periods when the solar radiation intensity is high and the output of the solar array is at its maximum. On the other hand, the sewerage requirement decreases when the weather is cool and the sunlight is less intense. The advantages of using sewerage pumps powered by photovoltaic systems include low maintenance, ease of installation, reliability and the matching between the powers generated and the sewerage usage needs.

It is common to use diesel to power generators in this operations. While these systems can provide power where needed. There are some significant drawbacks, including:

- Fuel has to be transported to the generator's location.
- Their noise and fumes can disturb livestock.
- Fuel costs add up, and spills can contaminate the land.

• Generators require a significant amount of maintenance and, like all mechanical systems, they break down and need replacement parts that are not always available.

For many agricultural needs, the alternative is solar energy. Modern, well designed, simpleto-maintain solar systems can provide the energy that is needed where it is needed, and when it is needed. These are systems that have been tested and proven around the world to be cost-effective and reliable, and they are already raising levels of agricultural productivity worldwide.



Solar panel

What is solar panel?

Solar panels are devices that allow for the input of sunlight, and convert this sunlight into electricity. The shape of solar panels can vary in different rectangular and a combination of these rectangular shaped panels are installed and used to produce the electricity. The solar panel consists of solar cells, which are semiconductor devices that change the sunlight into electricity or direct current. The cells make up a module.

The PV photovoltaic modules comprise of photovoltaic cell circuits that are enclosed and "sealed in an environmentally protective laminate". The solar panel includes from one or more "PV modules assembled as a pre-wired, field-installable unit". The PV Array is the full unit that generates the power and includes all the elements just discussed.

OVERVIEW OF TECHNOLOGY

The most common technologies of solar pump and diesel pumps are described in this section in terms of technical and performance aspects.

OBJECTIVE

- To develop continuous pumping system without use of fuels.
- To analyze the system techno economically with solar PV pumping system.
- To achieve the least cost
- To develop mechanism with least wastage of energy.

The major objectives of the proposed work are, Design of centrifugal pump taking into account the various factors that might should not affect the functionality of the equipment. Fabrication of the model and Assembling of the model carried out, and then process are studied and optimized for effective sewage water treatment for floating materials. During fabrication of the model are going to use the simple method by trapping the solar energy. The trapped solar energy is used to charge the battery for pumping sewage water

SCOPE

The objective of this study is to analyze the recent trends in the use and costs of PVPs and to conduct a comparative cost benefit analysis between diesel and PVP. With recent technical developments in the PVP sector and with anticipated increase in diesel fuel prices as well as possible shortages, breakeven between the two technologies may be shorter than expected.

In summary, the scope of work includes:

1. Installation quantities of solar PV centrifugal pumps in commercial, communal and public facilities

2. Conduct a comparative cost benefit analysis between diesel and solar PV centrifugal pumps taking into account the current diesel price (including variations of price within the country) as well as anticipated fuel price escalation.

3. Identify the operating and performance conditions under which it is viable to replace diesel pumps with solar PV pumps.

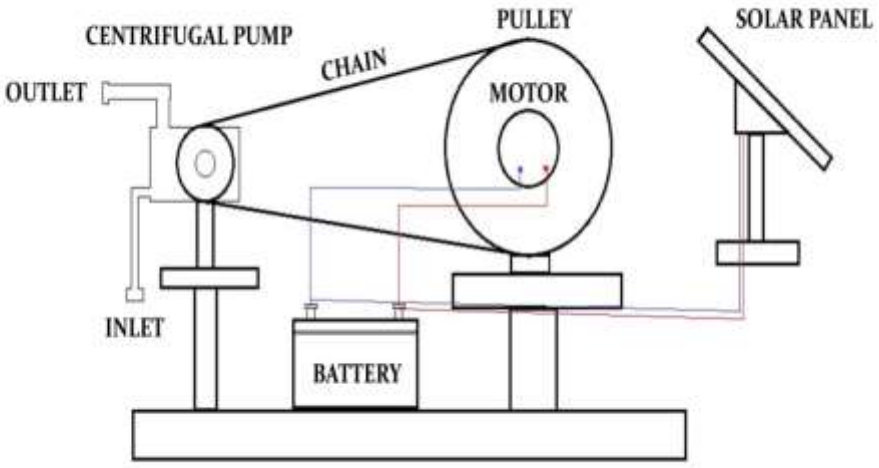
4. Identify the social factors, preferences and satisfaction levels that determine the criteria for selecting a PV pumping or a diesel pump.

5. Identify the barriers to PVP adoption in the commercial, communal and public sector and make recommendations on how to address these barriers

PUMP COMPARISON CHART

parameter	Centrifugal pump	Positive displacement pump
mechanics	The pump imparts a velocity to the liquid resulting in a pressure at the outlet pressure is created and flow result	The pump captures confined amount at liquid and transfers them from the suction to discharge port flow is created and pressure result
Performance	Flow varies with charging pressure	Flow is constant with charging pressure
Velocity	Efficiency decreases with increasing viscosity	Efficiency decreases with increasing viscosity
efficiency	Efficiency peaks at the beast –of-efficiency point at higher or lower pressure efficiency decreases	Efficiency increases with increase pressure
Internal conditions	Liquid must be in the pump to create a pressure sure differential .A dry pump will not prime on its own	Negative pressure is created at the inlet port .A dry pump will prime on its own

WORKING PRINCIPLE



WORKING DIAGRAM

These are by far the most widely used in the country in the past in sewage pumping and are generally classified as radial flow, mixed flow and axial flow pumps based on the specific speed .The specific speed of the pump is akin to a shape number and forms the basis for the design of the impeller of a centrifugal pump. The shape of the impeller is identifiable by the relative proportions of the inlet size, outlet width and the outside diameter. Broader inlet size and outlet width are logical for larger flows. For higher head-to-speed ratio, the impeller would be logically narrower than broader. Therefore, the specific speed is larger and the shape is broader. This is proportional to the flow-rate and inversely proportional to the head-to-speed ratio. In a narrow and tall impeller, the flow through the impeller will be radial, i.e., across a plane perpendicular to the axis of rotation. Hence, these are called as radial flow pumps and are pumps of low specific speed, generally between 40 and 150.In a broad and short impeller, the flow through the impeller will be radial and partly axial. Hence, these are called as mixed flow pumps and are pumps of specific speeds in the range from 150 to 350. If the impellers in the pumps has specific speeds higher than 350, the flow is more or less parallel to the axis of rotation and hence these pumps are called as the axial flow pumps. In a double-suction pump, the impeller is actually a composite impeller, with two identical flow-passages combined back to back. Each side is practically an independent impeller and each such impeller handles only half the flow. So, the specific speed for such pumps is calculated by taking only half the flow. By this, the specific speed of a double-suction pump is only 70% of what the specific speed would have been with a single-suction design.

Generally, pumps of low specific speed can work with more suction-lift than the pumps of higher specific speed. With the pumps of very high specific speed as that of the axial flow pumps, not only that they would not work with any suction-lift, instead they would need positive suction head or minimum delivery valve.

COMPONENT

There are several components in a solar centrifugal pump. Each components are crucial for the machine. Centrifugal pump is a positive displacement pump where certain volume of liquid is collected in enclosed volume and is discharged using pressure to the required application. Centrifugal pumps are more suitable for high volumes of flow at high pressures. The main components of the solar centrifugal pump is given below.

- 10W ,12V SOLAR PANEL
- 12V BATTERY
- 12V DC MOTOR
- SUCTION PIPE
- DELIVERY PIPE
- CONTROL SWITCH
- WIRE
- BELT DRIVE
- CENTRIFUGAL PUMP
- STORAGE CONTAINE

ADVANTAGES

- Solar-powered Systems are practical in flat terrain where the sun shines.
- Solar electric pumping cuts down on waste because it is based on natural cycles. Your panels give the most pumping power on the sunniest days.
- Solar-powered systems take very little maintenance because they only have a few moving parts.
- They have long life---usually 20 to 40 years. And solar systems never run out of fuel as long as the sun is shining
- Power required for driving the motor is small. Therefore, it is energy efficient.
- It is cost efficient.
- It does not require any electricity because the battery is charge by solar panel.
- It is ecofriendly: - It uses solar energy for charging the battery. Therefore, it does not create any pollution. Hence, it is ecofriendly.
- Mechanism is simple & easy to understand.
- No fatigue to the operator.

DISADVANTAGE

- Relatively high initial cost.
- Lower output in cloudy weather.
- Power loss is more comparison to electrical pumps.
- Instant current cannot be produced by solar panel.

CONCLUSION

The method used here to build solar powered sewerage 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 centrifugal pump built by us is built with the help of simple and easily available materials still we have successful to demonstrate the worth of a centrifugal pump. This device serves its purpose to some extent, but with proper course of actions, it can perform still better.

Under these circumstances of inadequate supply of electrical energy, the solar sewerage pump can play a significant role. Though the upfront cost of the solar pumping systems potentially hinder to popularize the systems in rural areas but private companies, bank, development organizations and government can provide loan, subsidy or other suitable options so that it can be widely used in rural areas. The proposed solar sewerage pumping system has long lifetime and it is maintenance free. Together with decreasing PV module costs and increasing efficiency, PV is getting more pervasive than ever.

Drainage from industries is treated through this project to meet the national emission standards, with stable operation, low cost and good effect. Drainage wastewater control is treated by this method to irrigate plants, clean toilets, etc. This project may be developed with the full utilization of men, machines, and materials and money. Also, we have followed thoroughly the study of time motion and made our project economical and efficient with the available resources. This system was Designed, Fabricated successfully and tested. It works satisfactorily. We hope that this will be done among the most versatile and interchangeable one even in future.

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