A Hybrid Approach To Water Pumping System

Swaleh Ahmed[1], Azeem Ahmed[2], Mohammed Mansoor[3], Mohammed Thajuddin[4], Kiran Kumar G R[5]
Department of Electrical and Electronics Engineering, PES Institute of Technology & Management
Shivamogga, Karnataka
swalehahmed92@gmail.com kirankumargr@pestrust.edu.in

Abstract— **Electricity is one of the most important part of people's lives in today's world. The electricity is generated majorly by either hydro power plant, thermal power plant, or nuclear power plant etc. This generated power is distributed to the consumers by various companies and the consumers will have to pay to the power consumed according the pricing listed by the companies. Sometimes there will also be a problem of power cut which may affect the daily life of people. The backbone of India is agriculture and hence the farmers require quite large amount of power. But the farmers sometimes have to face issues of power cut or huge amount of electricity bills. In this paper we provide solution to these major problems faced by many farmers and also general public. In this paper we explain about how we can utilize natural sources i.e., solar and wind energy to solve these problems. In this paper we attempt to make a project which utilizes both solar and wind energy. The solar panel and the wind mill convert light and mechanical energy respectively to electrical energy. This obtained electrical power will be in dc and is converted to ac with the help of an inverter then stepped-up with a transformer and give to the ac load.**

Keywords—Solar Panel, Water Pump, Wind Turbine, Inverter, Step-up Transformer

I. INTRODUCTION

Why do we need a water pumping system? The answer to this question is simple its to save time and energy. With increasing population of our country, it is natural that there will also be increase in demand and in order to fulfill that demand there must be enough supply or the country will be in the state of chaos. In olden days farmers would have to walk miles to just to fetch the water and spend even more time to water the crops. With improved technology with time, agricultural field is not an exception. There many advancements in agricultural field too. One of that advancement is water pumping system. A pump is a device that moves the fluids or sometimes slurries, by mechanical action, typically converted from electrical energy to mechanical energy. The electrical that is required to operate the pump in supplied by the distribution companies to which the consumers will have to pay. Also sometimes there might be instances where the power supply might be cut off due to various reasons like if there is a fault or for maintenance. Hence, we've adapted a method independent of distribution companies and one which is more economical.

In this work we've used solar and wind energy to achieve our desired result. To utilize the solar energy, we've used a solar panel. Also known by other names, solar cell panel, solar electric panel, photo-voltaic (PV) module or solar panel is and assembly of photo-voltaic cells mounted in a framework for installation. Solar panels use sunlight (photons) as a source of energy to generate direct current electricity. Most modules use wafer-based crystalline silicon cells or thin-film cells. To extract the wind energy, we've used a dc motor to demonstrate the energy extraction.

II. PROBLEM FORMULATION

The modern world today, is completely dependent on electricity for day-to-day basic necessities. And water is the most basic necessities of all living beings and is a vital thing for the survival likewise crops also need water and it is very time consuming to fetch it from water bodies and water the crops. Hence, we need an alternative that is more efficient and economic.

The objectives of proposed work are as follows:

1. To build a hybrid model of water pumping system to reduce electricity bill.
2. To reduce environmental pollution caused due to usage of fossil fuel-based water pumping system.
3. To eradicate dependency on power distribution companies whenever there is power cut.

III. METHODOLOGY

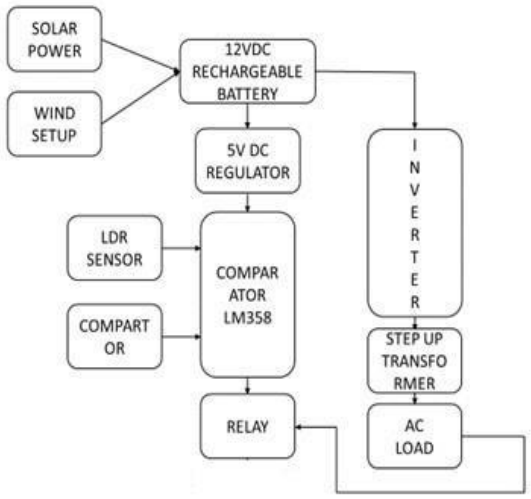

Fig 1. Proposed Block Diagram

The proposed methodology is, as shown in the form of block diagram in Fig.1, is described below

Working

The solar panel collects light incident on it from the sun and the wind turbine rotates and these two phenomena generate electricity. This generated electricity will be in the form of dc power and since it can't be used directly as the load, we've used is ac, the dc power stored in the battery is processed through inverter to convert direct current to alternating current. Now this converted power is fed to the step-up transformer since, the dc power voltage will be very small to run the load.

An LDR sensor is used in this project so that when the sunlight is available the power extracted from the solar panel and in absence of sunlight power will be extracted from wind turbine. A relay circuit is used mainly for the protection on the battery. When both solar and wind power is available the relay circuit disconnects one of the sources and extracts the power from only one source. This helps to extend the battery life by avoiding the storage of excess power from both sources.

Components Used

Components that are used to make this proposed work and their functions is as described below:

Solar Panel

Solar panel is a device that effectively converts the light incident on it to electrical energy and the current produced by it is dc.

Wind Turbine

Wind turbine is a device that effectively converts the wind energy to electrical energy. The wind turbine consists of wind blades that is mounted on the shaft which is in turn connected to the generator to produce electricity. This generated electricity is stored in a rechargeable battery.

Rechargeable Battery

Rechargeable battery or a storage battery is storage type of battery that can be charged and discharged as many times required. The most widely used rechargeable battery nowadays is li-ion battery. It is a dry battery and unlike lead acid battery it doesn't require much maintenance.

LDR Sensor

Light dependent resistor (LDR) is a semiconductor device that works depending on the intensity of light. When there is light the and it falls on the LDR it absorbs the photons from the light incident on it and this energy of photons gives enough energy for the electrons to break through the crystal lattice and conduct electricity.

Inverter

Inverter is a device that converts alternating current into direct current. Since the electrical energy obtained in this project is in dc, we need to convert it into ac since the load we're using is in ac.

Transformer

Transformer is a static device that transfers electrical voltage from one circuit to another circuit without changing that frequency by using the principle of electromagnetic induction. If the voltage increases from primary windings to secondary windings the transformer is said to be step-up transformer and the vice-versa function of transformer is called step-down transformer.

Relay

A relay is an electrical device which is generally operated as a switch. It opens upon detecting a fault and operates normally in absence of fault. In this project a relay is used so that when both solar and wind energy is available one of the sources is shut down and energy is drawn only from one of the sources. This is so as to protect the battery form overcharging.

IV. EXPERMENTAL SETUP

The battery is charged beforehand for experimental purpose. The battery is then connected to the circuit and then the DC motors will start. The red LED that glows indicated that the power is being received form the wind energy. Now, when the pump is kept inside the water the motor will start pumping. In case of solar panel, its activity is dependent on the LDR. An orange color LED is used to show that there is solar power but

it does not go to the circuit until and unless light intensity is strong enough for the LDR to become a conductor. When light intensity becomes strong enough the LDR sensor becomes active and solar power flows into the circuit and this is indicated by a blue LED light. A switch is connected to turn ON and turn OFF the motor and it runs only when the switch is in ON position. The output from the secondary is 200V which is the required voltage for the pump to run.

Fig 2. Experimental Setup

CONCLUSION

The proposed scheme is successfully developed as a model with the considered specifications, based on the results obtained, here are the few conclusions drawn;

The wind turbine generates variable output power and hence, it cannot be matched with the PV module in normal cases. But in this hybrid system this problem is overcome by connecting the solar module and the wint turbine to the utility pumping system. It only uses the renewable sources of energy thus forming a standalone hybrid system. The water pumping model we have developed helps the farmer to be independent of power distribution companies and it also enable them an extra source of income, if the electricity generated is more than required.

Furthermore, the methodology can be implemented with extended range of specifications for higher efficiency.

REFERENCES

[1] A Review on Solar Photovoltaic Powered Water Pumping System for off-Grid Rural Areas for Domestic use and Irrigation Purpose by Yigrem Solomon, P. N Rao, Tigist Tadesse.

[2] Design and Fabrication of Water Pumping Mechanism using Wind Energy S. Mathivanan, S. Amrith, A. Jemshid, N Anvar Sadik, Assistant Professor UG Scholar Department of Mechanical Engineering, Hindustan Institute of Technology, Coimbatore.

[3] Solar Water Pump using BLDC Motor Drive with High Gain DC-DC Converter by Kavya Pramod M, Elizabeth Cherian Department of Electrical and Electronics Engineering, Government Engineering College, Barton Hill, Thiruvananthapuram, India.

[4] BLDC Motor Driven Water Pump Fed by Solar Photovoltaic Array using Boost Converter by Kumar Harsh Alumni, Dept. of Electrical Engineering Vellore Institute of Technology, Chennai, Tamil-Nadu, India.

[5] Solar Tracking and Automated Water Pumping System by S Sushruthi Pai, Yashaswini Y Acharya, Vibha K P, Dept. of Electrical and electronic Engineering, NMAMIT Nitte, Karnataka – 57410.