

PV Based Solar Water Pumping System

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ABSTRACT

Due to the continuous decrease of the solar cells cost, photovoltaic energy is used in diverse applications. The most important one is the batteries-coupled water pumping system powered by photovoltaic generators. The use of batteries allows the system to deliver a constant water flow during the low light periods and night. With the increased use of this application, more attention has been paid to their optimum utilization. Microcontrollers provide attractive features such as fast response, accuracy and good performance compared to the classical controllers. The photovoltaic pumping system is composed of a PV generator, inverter, batteries, AC motor and centrifugal pump. The surplus energy produced by PV panels during light hours charges the batteries and the batteries in turn supply power to the pump during backup energy. A simulation study is presented under variable weather conditions and the results show the effectiveness of the studied method.

Keywords: Photovoltaic System, Controller, PV Pumping, Induction Motor, Battery.

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I. INTRODUCTION

The gap between demand and supply of electricity in India is not only huge, but widening by the day. Add to this, the grim facts that power and fuel prices are inexorably increasing and power supply, when available is also very erratic. Against this backdrop, renewable energy comes as the perfect answer. It is derived from natural processes that are recovered constantly and are sustainable in the sense that they can never run out and solar energy, the mother of all renewable energies is the ideal solution. It is a perfect combination of the 3 E's: Energy, Ecology, Economy.

The global energy crisis that is being experienced today has lead to the need for more energy efficient systems. Solar energy is an ideal form of energy with the features of being environment friendly and substitute of decreasing energy resources. It is clean, non-exhaustible and available all over the world with varying intensity. Silicon - the main material used in manufacturing of solar cells - is the second-most plentiful element available on the earth. Thus, there is no problem of resource availability.

A solar-powered pump is a pump running on electricity generated by photovoltaic panels or the radiated thermal energy available from collected sunlight as opposed to grid electricity or diesel run water pumps. The operation of solar powered pumps is more economical mainly due to the lower operation and maintenance costs and has less environmental impact than pumps powered by an internal combustion engine (ICE). Solar pumps are useful where grid electricity is unavailable and alternative sources (in particular wind) do not provide sufficient energy. Specially designed low-inertia motors fed by the MOSFET-based current-controlled voltage-source inverter (CC-VSI), provide desirable features such as high power-to weight ratio, high torque-to-current ratio, fast response and above all high operating efficiency. In this paper a system for solar energy operated water pump is designed and implemented. The solar pump system may designed on the basis of requirement of water. Parameter of system will be varied according to requirement.

II. PROPOSED WORK

A solar pump uses power derived from sunlight that is converted into electrical power by Solar Photo Voltaic (SPV) modules, which give higher power output in the afternoons and lower power output in the mornings and evenings. As per the power requirement by water pump, a set point is set into the microcontroller to extract maximum power from solar panel. The water pump is submerged or centrifugal type pump which is used to pump the water from lower level to upper level. Water level sensors are used to sense the water level in tank. E.g. a standard 5 HP pump working on grid power/ diesel engine for, say 2.5 hours a day, may give the same water output in a day as a solar pump of 3 HP working for 8 hours using sunlight.

This is an important fact for appropriate solar pump selection and application engineering. The most important parameters to select a solar pump are: how much daily water is needed, at what pump head, and at which location. The location is important because solar energy varies from region to region, and sizing of solar panels depends on the solar energy of a region.

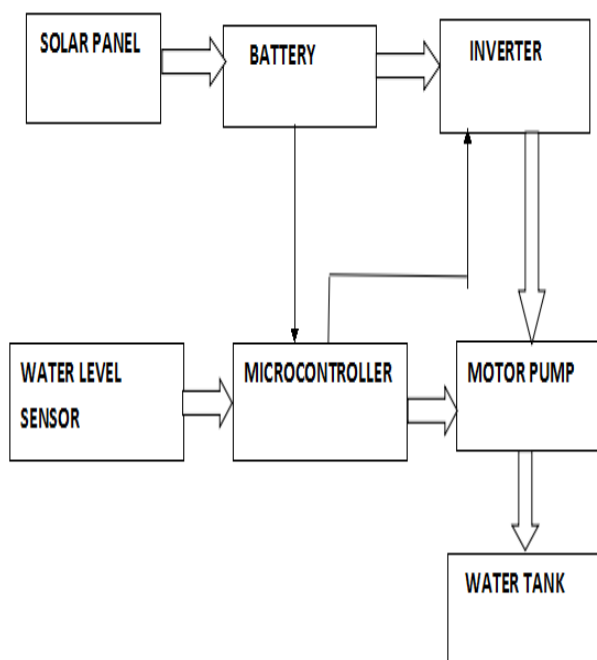


Fig.1 Block diagram of PV based water pumping system

III. ADVANTAGES AND APPLICATION

Advantages

- It is simple, durable, and reliable.
- Clean and efficient technology.
- Long operation life (20 to 40 years).
- Simple installation.
- No fuel cost.
- Electricity is not required.

- Low labour and maintenance cost.
- Ecofriendly.
- Non-polluting.

Disadvantages

- Variable yields.
- Water quality
- Possibility of theft.

Applications

1. Water supply

- Villages, schools, hospitals, homes etc.
- Adivasi settlement and other remote areas
- Rural schemes
- Resorts, hotels and farmhouse
- Tribal welfare departments
- Animal farms and poultries

2. Irrigation

- Farms, fields and greenhouses
- Government forest departments
- Corporate/industry parks and gardens
- Sprinklers and drip irrigation for agro-based industries

3. Decorative and leisure

- Fountains
- Water parks
- Swimming pool recirculation pumps, filter inlet pump

IV. CONCLUSION

In the Indian scenario standalone systems are gaining and increasing interest and they are becoming a very competitive solution, particularly because many sunny days are available throughout the year.

One of the most important applications of PV standalone system is for water pumping, in particular areas that have considerable amount of solar radiation and have no access to national grid.

Photovoltaic based water pumping system is studied and presented. By effective designing of charge controller, Inverter and selecting solar array desired results can be obtained.

REFERENCES

[1]Biji.G., Assistant Professor, Member Ieee, Department Of Electrical & Electronics, College Of Engineering,

Attingal,Thiruvananthapuram,“Modelling And Simulation Of Pv Based Pumping System For Maximum Efficiency”,978-1-4673-0449-8/12/\$31.00,2012 Ieee.

[2]Guilherme De Carvalho Farias, Student Member, Ieee,Luis Felipe Moreira Teixeira, Student Member, Ieee, And Luiz Antonio De Souza Ribeiro, Member, Ieee,“Implementation Of A High-Efficiency, High-Lifetime And Low-Cost Converter For An Autonomous Photovoltaic Water Pumping System”,Ieee Transactions On Industry Applications, Vol. 50, No. 1, January/February 2014.

[3]S.G.Malla,C.N.Bhende And S.Mishra,“Photovoltaic Based Water Pumping System”,978-1-4673-0136-7/11/\$26.00,2011 Ieee.

[4] P.Abarnaal, Mrs.S.P.G.Bhavani2,“A Solar Powered Pv Based Induction Motor Drive In Water Pumping System Using Flc”,International Journal Of Scientific & Engineering Research, Volume 5, Issue 4, April-2014 39 Issn 2229-5518.

[5]Teresa D. Morales, Oregon State Design Engineer, United States Department Of Agriculture (Usda),“Design Of Small Photovoltaic (Pv) Solar-Powered Water Pump Systems”,Natural Resources Conservation Service October 2010.

[6]Sofia Lalouni, Djamila Rekioua (Department Of Electrical Engineering, Laboratory Ltii, University Of Bejaia, Algeria),“Control Of Photovoltaic Water Pumping System With Battery Storage”.