



Solar based Water-Pumping System

Bhagyashri Charjan

M.Tech in Integrated Powered System
Ankush Shikshan Sanstha

G.H. Raison Institute of Engineering and Technology
Nagpur, Maharashtra, India
bhagyashricharjan24@gmail.com

Prof. Sachin Wadhankar

Assistant Professor Department of Electrical Engineering
Ankush Shikshan Sanstha

G.H. Raison Institute of Engineering and Technology
Nagpur, Maharashtra, India
sachin.wadhankar@raisoni.net

Abstract—This paper presents the standalone solar-based water pumping system. One of the most important application of the solar pumping system is for the supply of water in the rural areas and has no access to national grid. However, the cost of solar energy system is high compare to other energy system. Hence the improvement of the efficiency is one of the solar system can be seen as one of the way to reduce the cost. Therefore, the use of the maximum power point tracking (MPPT) will allow generation of more energy with same amount of panel. In solar fed water pumping system, the DC-DC conversion stage is usually required. but due to this, the cost and complexity will increase and reduce the efficiency. Hence this work shows the single stage conversion, which consists of PV panel, inverter, induction motor based water pump. the simulation will perform using MATLAB SIMULINK Software

Keywords—PV panel, Single phase inverter, SPWM technique, MPPT technique.

I. INTRODUCTION

There are two huge problems for which the use of solar energy is the best option. First, the non-renewable energy resources like coal are mostly used for the generation and supply of electrical energy which demand in the world [1]. This generation of electricity will increase carbon

content in the climate, which lead to increase the pollution environment and global warming. Hence the use of renewable energy source are increased like wind energy, geothermal energy and solar energy etc.

Second, the lack of electrical energy is the main problem in the development of rural India. India's grid system is considerably under development, hence the most of the areas are not connected to the grid system. The solution for this problem is to use of standalone photovoltaic system [2]. Because many sunny days are accessible throughout the India.

There are mainly two types of photovoltaic system first, grid connected photovoltaic system and second, standalone photovoltaic system

One of the most important application of standalone photovoltaic system is for the water pumping, especially in the rural areas that have lot of amount of solar radiation and very far from the nation grid. So in that areas solar photovoltaic water pumping system can be used for the supply of water. Particularly an effective solution must ensure that the PV generator run at the maximum power point (MPP) and that the pump which is driven by the single phase induction motor run at the high efficiency and give the maximum output [3-4].

MPPT is very important in the solar power system because it will force the panel to work at

the maximum point and extract the maximum power from the photovoltaic module under certain condition. MPPT will force the PV module voltage and current closed at maximum power point to draw maximum available power. Hence it will help to reduce the cost of solar array by decreasing the number PV panels needed to obtain the desired output power.

In the PV pumping system there are usually utilize low power pumps and they are widely use in small scale irrigation as well as for domestic purpose. Because the main input to this type of system is the solar radiations. The PV connected system. In the grid connected system PV system will supply the power to

II. PROPOSED PLAN OF WORK

The solar photovoltaic water pumping system mainly consist the component such as solar panel, single phase inverter, pump. The block diagram of solar power based water pumping system is shown in figure 1. Where inverter will convert the DC input quantities obtained from inverter into AC quantities and the pump will drive on that output.

The system parameters like dc voltage and current or inverter output voltage and current will change as the input parameters like temperature and the radiation from the sun as well as load connected to the inverter. The pump output will higher at afternoon because solar radiation will be high. The pump output will low at the morning and at evening, because the solar radiation will low. At the night time battery will use to drive the pump and this battery will charge at the day time.

pumps have recently achieves everyone attention due to large development in the field of solar cell material and technology. Here, the PV pumping system based on induction motor is more reliable and maintains free as compare to the DC motor drive. There are large number of DC motor driven PV pumping system are use indifferent countries but they are suffer from the maintenances problem due to commutator and brushes [5].

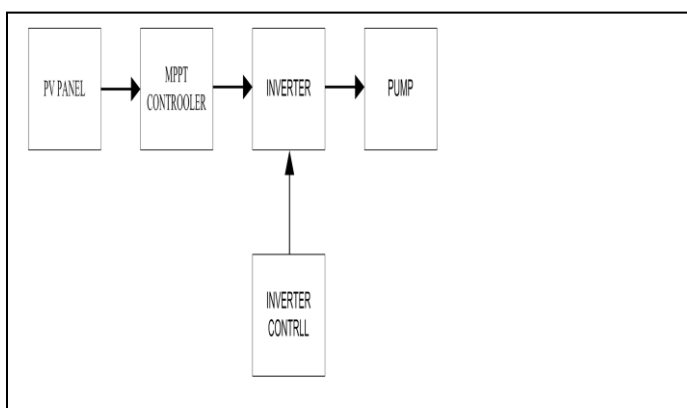
The output voltage and current from the panel are DC quantities, which are converted into AC quantities by using the inverter which are connected to the load or grid connected grid along with the load connected to it [6].

Figure1: Block diagram of Solar Power Water Pumping System

- *Solar Panel*

The most important factor of the solar system is the solar panel, solar panel are made from solar cell connected in series and parallel. Solar cell are manufacture in in different types like crystalline, polycrystalline, monocrystalline, thin film solar cell, amorphous silicon solar cell, bio-hybrid solar cell, cadmium telluride solar cell, concentrated PV cell. The thin film solar cell are portable and light weighted but it has several disadvantages. The polycrystalline cell are less efficient than monocrystalline cell, but it has significant cost advantage over the monocrystalline cell.

When the solar radiation will increase voltage and current from panel will also increase, when cell temperature increases, voltage decrease but current increases slightly. At the maximum power point cell will produce the maximum power. Solar cell can produce power from the combination of voltage and current and this power can limited by maximum voltage and maximum current a cell can produce.





- *Mppt Technique*

The MPPT algorithm are used in the MPPT controller. The MPPT controller insure that the solar cell or panel will operate at its maximum power point. There are different types of MPPT technique like Perturb and Observe, incremental conductance, Fuzzy logic method, Constant voltage methods etc. The Perturb and Observe technique is simple and easier than other technique but the incremental conductance is the more accurate technique than perturb and observe.

The MPPT extract the maximum power from the solar panel, but it will varies at different operating point. It will force the solar panel to operate at maximum point. The MPPT use between the solar panel and load.

- *Inverter*

The inverter will used into the PV system when the connected load is AC, because inverter will convert the DC input from the solar panel into AC which will used to drive the pump. The type of the inverter will depend on the load connect to it i.e. When the load is three phase the inverter will be three phase or for single phase load the single phase inverter will use. DC/AC inverter are of different types like half bride inverter, full bridge inverter, frequency commutated current source inverter etc.

Here, the single phase inverter will used for the conversion purpose. The inverter consist of the fore IGBT switch, because it is available in the wide range and more efficient than other in less size as well as cost, also it has lower switching losses and small snubber circuit than other power electronics switches.

For controlling the operation of the inverter input pulses to the gate terminal of the IGBT switch are required. The pulses are generated by using the different pulse width modulation

technique such as single pulse modulation, multiple pulse width modulation and sinusoidal pulse modulation. The use of sinusoidal pulse width modulation will reduced the harmonics

- *Pump Load*

The pump motor size depend on the required amount of water. Higher amount of power is required for the high rated motor. Here, the single phase induction motor are used as load for experimental purposes because the cost is less and mostly used load.

III. APPLICATIONS

- For water supply
 - a) Villages, rural area, remote areas.
 - b) Homes, hospitals, schools
 - c) Animal farms and poultries
 - d) Farmhouses, resorts, and hotels etc.
- For Decoration
 - a) Water parks
 - b) Fountains
 - c) Filter inlet pump

IV. CONCLUSION

In India, standalone photovoltaic system is gaining interested and they are become popular and become a competitive solution for other system, because many sunny days are available in India. One of the important application of the photovoltaic standalone system is for water pumping where the large amount of solar radiation are available and no access to nation grid. So, solar based water pumping system are studied and presented



V. REFERENCES

- [1] Rajan Kumar and Bhim Singh, fellow IEEE, "Single Stage Solar PV Fed Brushless DC Motor Driven Water Pump", *IEEE Journal of Emerging and Selected Topics in Power Electronics*, volume 5, pp. 1377-185, 3 September 2017.
- [2] S. G. Malla, C. N. Bhende and S. Mishra, "Photovoltaic based Water Pumping System", International Conference on Energy, Automation and Signal (ICEAS), Bhubaneswar, 28 December 2018.
- [3] Trishan Efram, Patrick L. Chapman, "Comparison of Photovoltaic Array Maximum Power Point Tracking Techniques", *IEEE Transaction on Energy Conversion*, Vo. 22, No. 2, pp. 439-449, June 2007.
- [4] Dezso Sera, Remus Teodorescu, Jochen Hantschel, and Michael Knoll, "Optimized Maximum Power Point Tracker For Fast-Changing Environment Conditions", *IEEE Transaction on Industrial Electronics*, Vol. 55, No. 7, pp.2629-2631, July 2008.
- [5] S. R. Bhat, Andre Pittet and B S. Sonde, "Performance Optimization of Induction Motor-Pump System Using Photovoltaic Energy Source", *IEEE Transaction on Industry Applications*, Vol. IA-23, No. 6, November /December 1987.
- [6] Kartika Dubey and M. T. Shaha, "Design and Simulation of Solar PV System", *International Conference on Automatic Control and Dynamic Optimization Techniques (ICACDOT) International Institute of Information Technology, Pune*. pp. 568-573, 16 March 2017.
- [7] Deshmukh Priyanka, Hothar Pradnya, Shelke Dnyaneshwari, Prof. Anupma Kamboj, "PV Based Solar Water Pumping System", *International Engineering Research Journal (IERJ)*, Volume 2, pp. 744-746, 26 April 2016,
- [8] Utkarsh Sharma, Shailendra Kumar and Bhim Singh, "solar array fed water pumping system using induction motor drive", IEEE international conference on power electronics, intelligent control and energy system (ICPEICES), 16 February 2017
- [9] S. R. Shaikh and Prof. A. M. Jain, "A Literature Survey Of Photovoltaic Water Pumping System", *International Conference On Control, Instrumentation, Communication and Computational Technologies (ICCICCT)*, pp. 511-516, 23 May 2016.
- [10] M. Bala Raghav, K. Naga Bhavya, Y Suchitra, G. Srinivasa Rao, "design of solar power based water pumping system", international journal of engineering research and technology (IJERT), Vol. 2, pp.333-339, October 2013.
- [11] Montie A. Vitorino, Mauricio Beltrao R. Correa, "High-Performance Photovoltaic Pumping System Using Induction Motor", *Power Electronics Conference, Brazil*, pp.797-804, 27 September 2009.
- [12] T. Lukhwari, O. Dobzhanskyi, R. Gouws, "Solar Power Pumping System for Domestic Appliances", *IEEE Conferences of Domestic Use of Energy (DUE)*, South Africa, 9 June 2014



International Journal of Research
eISSN: 2348-6848 & pISSN: 2348-795X Vol-5 Special Issue-13
**International Conference on Innovation and Research in
Engineering, Science & Technology**
Held on 23rd & 24th February 2018, Organized by Tulsiramji Gaikwad
Patil College of Engineering & Technology, Nagpur,
441108, Maharashtra, India.

