

# Using Solar Energy in Water Purifying System in Myanmar

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**Abstract**— People living in rural area of Myanmar do not get safe drinking water for everyday life. Therefore clear water is needed and simple water purification system play a vital role for most rural area in Myanmar. Water purification process consists of eliminating detrimental chemicals, biological poisons, suspended solids and gases from polluted water. In this paper, water purification with reverse osmosis (RO) and Ultra Violet (UV) system is proposed and implement with solar hybrid energy for water purification. This proposed system is very efficient for sustainable development in Myanmar. The main objective of this paper is breaking up the bacteria containing in water and to support the required clean water for household in rural area. 1m × 2m solar panel is required for this system and this solar panel collect energy from sunlight and then charges 12 V batteries to support energy. This system design has low cost, simple installation and portable use in all location. Moreover, the system must support enough clean water every household.

**Key words:** Solar energy, Water purification, Rural area, PV panel, Electricity in Myanmar.

## I. INTRODUCTION

Water and sunlight are most important natural resources in the world. However, getting clean water is the major problem for living human. The lack of electricity in most rural area of Myanmar faces the problem of using contaminated water in daily life. The geographical location of Myanmar is between latitude 9° 58' N and 28° 29' N and longitude 92° 10' E and 101° 10' E. Myanmar has a tropical monsoon climate. Myanmar has three seasons in the whole year [5]. The winter season start from October and end to February with average temperature of between 20°C to 24°C. The summer season generally start from March to May with the average temperature of between 30°C to 35°C. The rainy season generally start from June to September with the average temperature of between 25°C to 30°C. The period between March and May is hottest and get the highest temperature in Myanmar. Although the temperatures are cool in the mountains, the places under 4000ft (1200m) is hot. Due to the condition of high humidity, the weather is uncomfortable in coastal region. Sunshine is plentiful during the dry season, averaging 7 to 10 hours a day. During the rainy season the weather is cloudier and daily sunshine amounts average only 3 to 4 hours a day. Total area or total square miles of Myanmar is 261228. The radiated heat energy from the sun on to the earth converted to horse power is 469×1011. Therefore, total approximate horse power on total area of Myanmar is calculated to be 123×1010, that is the sun's radiated heat power.

## II. SOLAR ENERGY

Solar energy is very important for many agricultural works because electricity is not get everywhere in rural area of Myanmar. Solar based water purification systems design is efficient and simple structure. There are two types of natural resources in order to survival of people for all life is sunlight and water. Water is more valuable than other things in human life. However, not enough of water supply cause drought in many places due to the topography and weather of world's environmental condition. Therefore, the scarcity of both underground and surface water supplies require to develop new systems for providing fresh and clean water [2].

Solar energy is renewable, clean, and secure and does not require electricity. By combining solar energy and technology, such as solar photovoltaic (PV), solar heating, solar thermal electricity, and solar architecture, which can provide global energy demand significantly. To develop solar based system solar radiation data is the main factor that can be used to design solar PV system. These data can be applied to estimate solar energy for various application systems without installing solar energy measuring tool [1]. The amount of power generated by a PV generator is based on its operating voltage. A characteristic of a PV's Maximum Power Point (MPP) is measured on the nonlinear volt-ampere curve. It depends on solar irradiation and temperature. At the MPP, the PV generator operates at its highest efficiency. Therefore, many methods have been developed to determine the MPPT (Maximum Power Point Tracking) operating conditions. Alghuwainem [4] employed a step up converter with current-locked loop to match DC motor to PV generator. Enslin [3] employed an integrated PV maximum-power point tracker with soft switching to obtain the optimum efficiency. Hiyama [6] used a neural network to estimate maximum-power-point operating conditions. The perturbation and the observation method is also often used to track the MPP [Joeair Jiang] [1].

## III. SOLAR WATER PURIFICATION SYSTEM

In this paper, water purification process is done mainly based on the solar energy. The main concept is based on the reverse osmosis. Firstly, solar radiations are gathered by solar panels. After getting the solar energy, which is stored in a battery. Charge controller is used to control the energy. The battery is joined with the inverter to convert the DC power to AC power. Water tank is used to stored the purify

drinking water. The process of solar based water purification system is shown in figure 1.

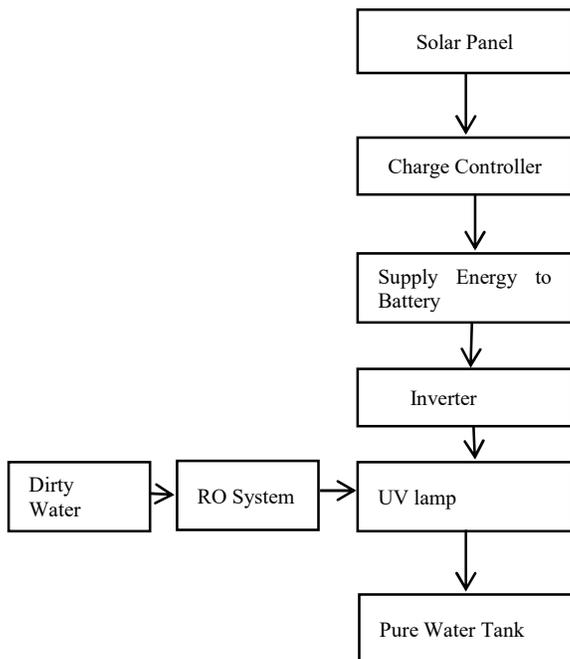


Fig 1. Process of the water purification system

#### A. Solar Panel

Solar panels also known as photovoltaic (PV) consists of “photons” energy particles. Solar panels convert the light from the sun into electricity that can be applied as electrical power. In the solar panel, some modules are connected by series or parallel in order to raise voltage or current based on electricity requirement. This panel works on photoluminescence principle.

Two solar panels with 250 watts is used in this system and it shown in figure 2.

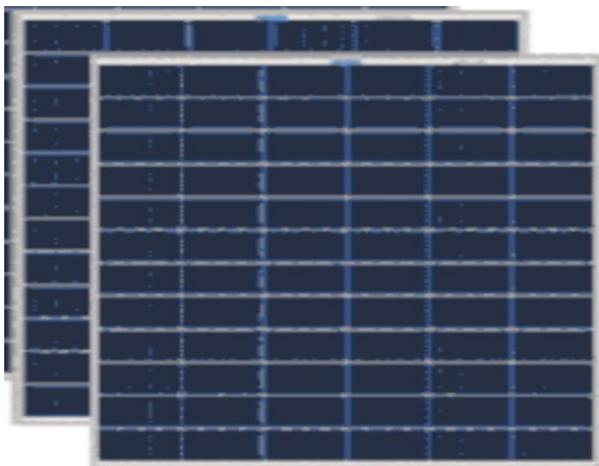


Fig 2. Solar panels

Number of module can be chosen by following steps:

Step 1 : Calculate the average electricity usage per month.

Step 2 : After getting the average usage monthly then divided by 30 days.

Step 3 : Find the place that can get highest sunlight hours per day.

Step 4 : To provide require kilowatt, compute the AC watts.

Step 5 : System AC watts is divided by the clean energy council (CEC) and then divide by efficiency of the inverter. After that the require amount of total module is get.

#### B. Solar Panel Processing

Energy from sunlight is collected in solar panel and converts into electricity to use as electrical power for many loads. Solar cell consists of silicon layers which contain phosphorous that give negative charge and boron that can give the positive charge. Energy generated from photons by hitting the surface of solar panel permit electron and then released atomic orbits into the directional current.

Solar modules can be set up by two methods: one is fixed structure and the other is tracking structure. The fixed mount structure is low cost and can stand higher wind loading but need to install carefully. In tracking structure, solar array allow the sunlight as it move across the sky. However, this method has more efficient than the fixed mount due to produce more electricity.

#### C. Charge Controller

In this paper, solar water purification system solar panel is connected with charge controller. Charge controller is used in solar based water purification system because when the sunlight is higher, the solar cells generate more voltage. In this condition, the over voltage will damage the batteries. Charge controller is the charge regulator or battery regulator that can limits the rate of electricity at which the electric current is added to batteries or reduced from the batteries. Pulse width modulation (PWM) and Maximum power point tracking (MPPT) is used to control the charge controller.

#### D. Battery

Batteries are widely used to install with solar panel systems. Grid-tied system batteries are mostly used for supporting backup power or for mitigating time-of-use (TOU) charges. A battery is used to change chemical energy to electricity by putting certain chemical in a specific way. In this system, 100 watt battery is used to store energy from solar panel. This battery is joined with the inverter in order to supply the require charge. 3K model battery is used in this system and it shown in figure 3.



Fig 3. Battery

#### E. Inverter

An inverter is the converting device than can convert the DC power in a battery to 240V AC electricity. There are three main types of inverters is used in solar system such as :

- (1) Square wave inverters
- (2) Modified square wave inverters
- (3) Pure sine wave inverters

In this water purification system, modified square wave inverter is used to give require output electricity. 315KVA is used for this system and it shown in Figure 4.



Fig4. Inverter

#### F. Ultra Violet (UV) Lamp

Electromagnetic radiation with shorter distance that light cannot see humans is called ultraviolet. This light carries more energy than other visible light. The efficiency of UV light is that can decompose bonds between atoms and molecules. Moreover UV light can support some things to emit visible light, this characteristic is called fluorescence.

#### G. Reverse Osmosis (RO) System

In this paper, reverse osmosis (RO) system is applied to avoid ions, unwanted molecules and large particles from drinking by using permeable membrane. Various types of specific chemicals as well as bacteria from drinking water is removed by using RO system method. In this system the solute is kept at the pressurized size of the membrane and the clean solvent is obtained at the other side of the membrane.

Generally, RO system can remove more than 99% of dissolved salt in water and ions. Dust particles, colloids, organics, bacteria, pyrogens and other many things can also be removed by applying this RO system in water purification system in Myanmar.

### IV. ADVANTAGES OF THE PROPOSED SYSTEM

Solar energy is renewable natural source that can fill the requirement of increase fuel rate. Solar power water purification system is very efficient for rural area in Myanmar which technology can replace the device that needs electricity for working properly. In this system, by giving minimum input, that system can offer drinking water with healthy and safe. By using portable water purification system, many households in rural areas of Myanmar can purify water anywhere. Moreover, this system can be used both for residential purposes and for large industries.

Solar panels is collected sunlight directly from the sun and it convert into serviceable energy for water purification system. By placing the solar panels in direct sunlight, the energy is obtained in optimal efficiency. Another advantages of this system are very simple to maintenance and do not require external electronics. Filters in RO system only need sunlight for processing and do not require much cleaning. Large water purifiers can be used to clean up to hundred gallons of water every day. The major benefits for this system are that system can reduce environmental pollution, easy to carry, easy to installation and reduce the use of fossil fuel.

### V. RESULTS AND DISCUSSION

The output of water purification system depends on the amount of solar panel using for this system. The solar panels can be set up to three panels based on the location of the area. The average sunlight per day is varies depend on the seasons of Myanmar is the main point on overall production time of this system. During the summer season, the radiation intensity is approximately more than 5kW/m<sup>2</sup> per day obtained in Myanmar. The least radiation data over the year should be applied to get the reliability of the system than average radiation data per day. Because, although the sunshine is get average of 7 to 10 hours per day in summer season, in the raining season sun light reduce to average 3 to 4 hours per day due to the weather.

## VI. CONCLUSIONS

The proposed system met the parameter required by the households of rural area in Myanmar to drink water safely and cleaning. Water produced by the proposed system consumes by humans and the water purifying process work well efficiently. Water purification system give save energy to have uncontaminated water.

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## REFERENCES

- [1] Joe-Air Jiang, Tsong-Liang Huang, YingTung Hsiao, Chia-Hong Chen, Tamkang Journal of Science and Engineering, Vol 8, No2, pp.147-153 (2005).
- [2] M. R. AlRashidi, K. M. El-Naggar, and M. F. AlHajri, "Parameters Estimation of Double Diode Solar Cell Model", International Journal of Electrical, Computer, Energetic, Electronic and Communication Engineering Vol:7, No:2, 2013.
- [3] S. Jebaraj, and S. Iniyar, 2006. "A review of energy models", Renewable and Sustainable Energy Review, Vol. 10.
- [4] S.M. Alghuwainem, "Matching of a dc motor to a photovoltaic generator using a step-up converter with a current-locked loop", IEEE Transaction on Energy Conversion Vol 9, No 1 March 1994, pp 192-198.
- [5] T. T.H. Yee, S.S.Win, and N. N. Soe, "Solar Energy Potential and Applications in Myanmar", International Journal of Humanities and Social Science, 2008.
- [6] T. Hiyama, K.Kitabayashi, "Neural netwrk based estimation of maximum power generation from PV module using environmental information " IEEE Transaction on Energy conversion. Vol 12, December.