

Water Desalination System for Rural Areas using Solar Energy

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Abstract— Drinking Water is important need for daily life as there is scarcity of water in many region worldwide. But water quality should be such that it can be used by human being for drinking purpose There are already lot of filters present in the market that can do purifying process, as the available filters made water safe to drink, but they did nothing to decrease its saltiness, so the drinking water tasted salty and eroded pots and pans, that providing little awareness to use these filters. In desalination process the removal of salt and other minerals from the water is carried out to make it suitable for human consumption and industrial use. RO is the one and only one commonly used domestic filtration system that removes even all the impurities. RO is required if the Total Dissolved Solids (TDS) exceeds a certain value. The main Objectives of this project is to use the conventional source of energy, Make a device/equipment which provide water for drinking purpose and designed a village level desalination system that runs on solar power.

Key words: RO (Reverse Osmosis), TDS (Total Dissolved Solids)

I. INTRODUCTION

Water scarcities, inconsistency of water supply and demand have become large problems now a days global, and water scarcity have showed up in several countries and regions. So opening up new water source by desalination has become the development trend of the world. As we know earth's surface is covered with water more than two-thirds of the available water. Most of the present water is either present as seawater or icebergs in the Polar areas. As out of total present water More than 97% of the earth's water is salty; the remaining 2.6% is fresh water and 1% and less fresh water is in human range. This slight amount is very less to support life and vegetation on earth. So nature itself make available most of the essential fresh water, over the hydrological cycle. At present, the common desalination technologies available such as distillation, electrodialysis method and reverse osmosis.

The most common desalination methods used is reverse-osmosis in which salt is forced to pass through a membrane that allows only water molecules to pass but blocks all other molecules like the molecules of salt and other minerals. Reverse osmosis method have come to a certain level. However, traditional desalination technology always have problem of excessive energy consumption, the energy mainly come from fossil fuels such as coal and oil, which resulting in slower promotion of seawater desalination technology. These conventional energy is not only the non-renewable resources, but also react upon on the surrounding environment in the process of use. The deterioration of ecological environment and the influence of conventional energy shortage can make for advantages of solar energy. Solar desalination has many advantages, such as not consume energy, no pollution, and save the normal operating expenses.

II. LITERATURE REVIEW

There were many system has been designed for desalination of water for usual life style. There is some survey of existing system for desalination.

An energy management method is presented for the stand-alone Wind-Powered-Desalination Micro grid and sea water desalination system in [1]. In the stand-alone WPDM, here the ESS comprises total three lead carbon battery banks connected to the bus through each power control system (PCS). The WT generator used in the micro grid is a direct-drive permanent magnet WT generator, whose output power can be regulated made regular. This desalination system consists of total three desalination units and a common unit which must be started when any desalination unit is working. Then, different operation modes is presented based on the super short-term wind speed prediction, which is on account of the GA-BP prediction model for real-time rolling horizon energy management method in accordance with the final result of the super short-term wind speed prediction, the operation mode of the micro grid system can be determined, and the instructions of power control for the WT generator can be ensured.

Design And Simulation of Photovoltaic Energy System to Drive and perform Reverse osmosis is shown in [2]. If the huge energy requirement for desalination can be fulfilled by renewable energy resources like solar photovoltaic can reduce the problems due to the usage of fossil fuels. The usage of solar photovoltaic energy to run a desalination plant with reverse osmosis technology will be good solution for of fresh water crisis and also at the same time for energy crisis too. In this paper a microcontroller model is used. In the simulation of tracker system it is designed in such a way that the LDR block produce output voltage corresponding to the change in the irradiation. These two voltages and the current panel position has been given to the microcontroller model as inputs. It will in turn produce a PWM signal as a function these three inputs and this signal will be given as the input to the motor model.

By using Solar powered Reverse Osmosis the water and energy crisis can be solved in a sustainable way without harming the environment is shown in [3]. Solar Powered Reverse Osmosis System was designed and Hybrid optimization model for Electric Renewables (HOMER) was used for simulation and from the results obtained the design has been validated. HOMER software optimizes the combinations based on the Net Present Cost and Net Present Cost of the Solar PV system was found to be least among all the possible Energy combination. For modeling using HOMER software, the components which are required are added, there are varieties of components, according to the requirement it can be added. In the present case in order to find the most optimized solution from all the possible energy sources, various energy sources such Solar PV, Wind Turbine Generator, Converter and Battery Bank were chosen. The load of the system is the RO Pump that must be powered

using these energy sources. For all these components the inputs required are the initial cost of the component, the replacement cost, the operation price of the component according to for each year and also life time of the component.

Coupling sustainable energy with membrane distillation processes for desalination of seawater is presented in [4]. All desalination processes can be coupled to sustainable energy sources according to the type of energy adopted by the process. In which the separation of pure water is performed through the evaporation of seawater, can be easily coupled with thermal solar energy and geothermal energy. On the other side, desalination processes requiring only mechanical or electrical energy (i.e. Reverse Osmosis, Electrodialysis, Mechanical Vapour Compression), can be coupled with solar photovoltaic, wind and wave/tidal energy. A very important aspect is that in most cases the need for non-conventional water sources is coupled with the abundance of one of the for mentioned renewable energy sources. For example, this is the case of sunny countries, which often suffer of water scarcity problems, or windy coast where availability of seawater can be a source of fresh water through desalination.

Reverse Osmosis Desalination Plant using System Design and Load Profile Shaping which is powered by a Stand-Alone PV System is discussed in [5]. Brackish Water Reverse Osmosis (BWRO) [5] desalination is a technique that can be useful to produce drinkable water from brackish earth water by resources. This requires electricity to drive the high compression pumps that permit reverse osmosis. In this paper a preliminary BWRO plant design for a village is presented, supplied by a stand-alone PV system using loading of battery. The energy want for the desalination plant is predictable for sizing the power supply and loading systems. Brackish Water Reverse Osmosis (BWRO) [5] desalination is a method that can be functional to produce drinkable water from saline groundwater available resources. This requires electricity to work the high pressure pumps that enable reverse osmosis. In this paper, a preliminary BWRO [5] is presented to plant design for a village. Supplied by a stand-alone PV system with storage of battery. Here the energy requirement of the desalination plant is projected for sizing the power source and storage systems.

III. PROPOSED PLAN

The thermal purification plants burning fuels effect global warming. It harms sensitive marine living as algal, coral reefs, salt marsh, mangrove flats. The thermal energy may be obtained from different sources like fossil-fuel source, nuclear energy. MSF and MEB processes consist of different set of stages at consecutively decreasing temperature and Pressure. While so many companies are already installing their desalination systems across India, their designs are depend on grid-powered that is conventional. When operating off the grid, these systems are not useful and cost-effective, as essentially blocking disconnected, rural villages from using them. In many countries that suffer a shortage of water, over 80% of all fresh water consumed is used for agriculture purpose. As fresh water resources are limited, there is a pressure to reduce agricultural use of water to meet with growing demand for both domestic and industrial use. In this project, going to use pH sensor system that provides a direct

and convenient way to monitor water quality and impurities. Here the sensor is connected with microcontroller to operate. The wireless function of system is performed using zigbee. The status of water purification will be sent by zigbee transceiver to the PC which connected with the zigbee receiver. This status also been shown in LCD continuously. The existing method doesn't have the wireless communication to transfer the data. So here going to propose such featured system.

IV. WORKING METHODOLOGY

A. RO System

- In a reverse osmosis process the water that is to be treated has to be passed through a series of RO module which filters away the salt content or impurities.
- This feed water must be passed through the RO membranes at very high pressure.
- The high pressure will make the feed water to pass through the membranes at a very high pressure.
- Here the power for this HP pump will be provided by the solar modules.

B. pH Sensor

A pH electrode sensor consists of two primary parts:

- Measuring electrode: The measuring electrode is called the glass electrode, and is also referred to as a membrane or active electrode.
- Reference electrode: The reference electrode is also referred to as a standard electrode.

Here pH sensor is connected with pH kit for further processing. When pH sensor is dipped in a RO purified water then it takes continuous value of pH level of water and transmit to LCD display and zigbee transmitter, from transmitter values are transferred to zigbee receiver then values are shown on hyper terminal of computer.

C. Solar Panel

Here solar panel is connected with battery so that power will save in battery n provided to RO motor to drive filterization process. Also direct power is also provided there as an option. In this way solar energy is converted into electric energy n provided to motor of RO water purifier system . Then working of RO system started to purify water and remove salt from it.

D. ZIGBEE

It is wireless technology and it provides noise free for communication, low cost with low power consumption. Here it is used to transfer data values of water pH, temperature and humidity to hyper terminal of desktop. So that water quality can be continuously observed to maintain salt mineral level and taste.

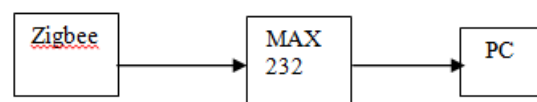


Fig 1:-Block diagram of Monitoring Section

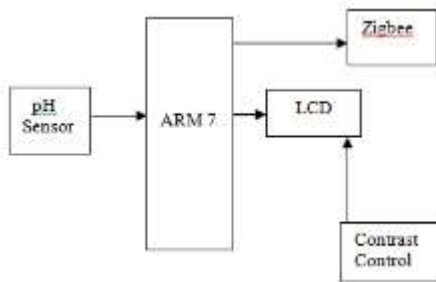


Fig. 2: Block Diagram of Transmit Section

V. RESULT

Working of the designed system consists of following two stages:

- Solar RO System: Water is purified by Reverse Osmosis process using energy as solar energy. In Ro Process water salt level is reduced and water is purified so that it becomes drinking water.
- Water Testing System: In this system ARM 7 is connected with pH sensor kit and it is connected with pH sensor to take pH value from water and then it is transmit to zigbee transmitter and from transmitter to zigbee receiver to display it on hyper terminal.



Fig. 3: System Hardware

VI. CONCLUSION

In this paper, Reverse osmosis, solar energy and wireless communication to transfer the data of water desalination is discussed. Thus system provides best water desalination procedure for purification and salt level minimization using non-conventional source of energy. System will detect automatically if any of the filter not working properly like cartridge filter before any hazardous condition. This project aims to build a system that's scaled for a village of 500 people and still cost-effective. The solution offers an alternative to grid power. Here designed a village level desalination system that runs on solar power. Since this system is powered by the sun due to which operative and conservation costs are impartially negligible. This system will provide better accurate result and early indication at low cost for the security of human health.

As world changes rapidly, technology also increases to acquire new terminology. In future GSM technology can be used to transfer data to long distance and android app can be developed to handle wirelessly.

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