Desalination of Sea Water using Solar Energy

Gayathri. A[1], Vishnupriya. G[2], Mrs. Jaanaa Rupavathy[3]

[1,2]Student, Dept. of EEE, Jeppiaar SRR Engineering College, Chennai
[3]Professor, Dept. of EEE, Jeppiaar SRR Engineering College, Chennai

---***---

Abstract – *Extracting fresh water from seawater requires a great deal of energy, both thermal and mechanical. Renewable energy driven desalination is becoming more viable despite its expensive infrastructure because it employs free natural energy sources and releases no harmful effluents to the environment. Solar radiation is usually chosen over other renewable energy sources because its thermal energy can be directly applied to drive desalination systems without the inevitable energy loss associated with energy conversion according to the second law of thermodynamics. Solar desalination systems are classified into direct and indirect processes depending on the energy path to fresh water. Direct solar desalination systems combine solar energy collection and desalination in one process producing fresh water distillate by directly applying collected solar energy to seawater. Solar distillation using a solar still is an example of direct solar desalination. Indirect solar desalination systems comprise two subsystems: a solar collection system and a desalination system. The solar collection sub-system is used either to collect heat using solar collectors and supply it via a heat exchanger to a thermal desalination process or to convert electromagnetic solar radiation to electricity using photovoltaic cells to power a physical desalination process. The desalination sub-system can be any conventional desalination system.*

Key Words: **Renewable energy, distillate, heat exchanger, electromagnetic waves, photovoltaic cells.**

1. INTRODUCTION

In our country, sea water is considered to be one of the plentiest water source. Once ground water is felt insufficient for people to consume, sea water is the only alternate source. Hence, desalination of sea water is the much needed. We believe in the process of reverse osmosis which is being carried out till date for the desalination.

But such desalinated water is free from all essential minerals. Also, if desalination process is to be carried out, it requires much power by any means of energy. In today's world energy is the most important especially electricity is important. Renewable energy sources are expected to be the apt solution to solve the energy crisis problem. As natural resources and fossils fuels are on its verge of extinction, the researchers are striving hard to find an alternative energy sources from nature. Due to the depletion of fossil fuels and drastic changes in climatic conditions, the use of natural renewable energy for production of power has become essential. Fossils fuels are depleted for generation of electric power and scientist predicts that fossils fuels will be exhausted in near future. The alternatives should not be harmful to the environment.

1.1 Solar collection system

In the first unit, the solar energy is collected through the solar panel and is given to the Buck Boost converter. By using this converter the obtained energy is stabilised and given to the battery.

1.2 Desalination- Conventional System

The second circuit is the Arduino interfacing unit. Here, three types of sensors are used

1. Temperature sensor

2. PH sensor

3. Water level sensor

These three sensors are interfaced with the Arduino in order to control the temperature, check the water level and to maintain the PH of the water. This PH sensor is used to determine the salinity content of the water which is to be desalinated
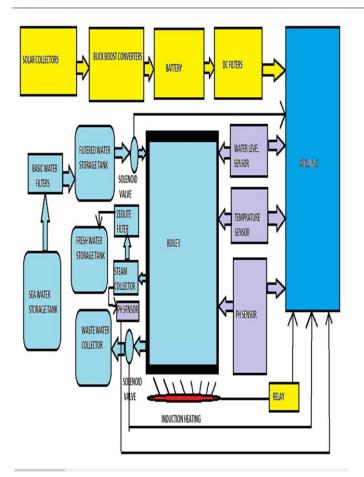
2. WORKING

Let us see about the block diagram and its explanation here. The block diagram of our project is shown in fig. In the main block diagram, the power supply is given to the Arduino UNO. The temperature sensor, PH sensor and the water level sensor are connected with the Arduino. Two solenoid valves, one from water inlet block and another from water outlet block are connected and interfaced with the Arduino.

Now the work flow diagram is completely divided into two major sections, first section is solar collecting section. Here, the solar energy is first collected by solar panels and given to the filter circuit. Then, by means of inverter circuit, solar power is obtained and provide as the input to the condensation unit. In the condensation unit, the sea water is first filled into the boiler and the power obtained from solar energy is given to the boiler through induction heating.
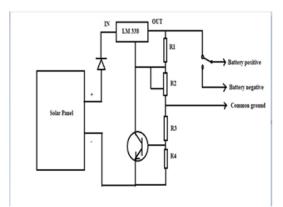
BLOCK DIAGRAM
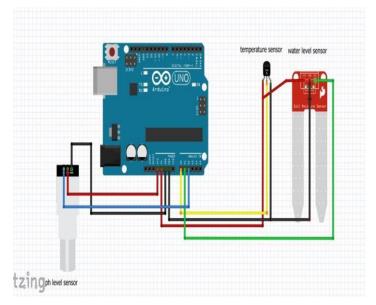

At the moment of giving supply, there is a slight increase in the water temperature. This makes the water to evaporate and the sensors acts upon the boiler which is connected to Arduino.

The fixed parameters programmed by the Arduino are once reached. Then the heating is stopped for certain time. The process is repeated again and again. The steam is collected and water is once again purified for further consumption.

3. SIMULATION

The Arduino microcontroller is an easy to use yet powerful single board computer that has gained considerable traction in the hobby and professional market. The Arduino is opensource, which means hardware is reasonably priced and development software is free. The Arduino Uno board (Spark fun DEV-09950, $29.95), a good choice for projects. With the Arduino board, we can write programs and create interface circuits to read switches and other sensors, and to control motors and lights with very little effort.
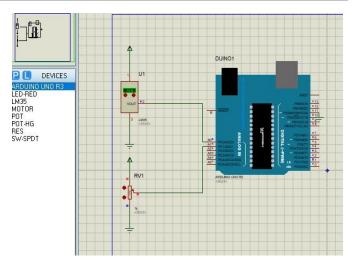
The Duemilanove board features an Atmel ATmega328 microcontroller operating at 5 V with 2 Kb of RAM, 32 Kb of flash memory for storing programs and 1 Kb of EEPROM for storing parameters. The clock speed is 16 MHz, which translates to about executing about 300,000 lines of C source code per second. The board has 14 digital I/O pins and 6 analog input pins. There is a USB connector for talking to the host computer and a DC power jack for connecting an external 6-20 V power source, when running a program while not connected to the host computer. Headers are provided for interfacing to the I/O pins using 22 g solid wire or header connectors.

The Arduino programming language is a simplified version of C/C++. If we know C, programming the Arduino will be familiar

An important feature of the Arduino is that we can create a control program on the host PC, download it to the Arduino and it will run automatically. Remove the USB cable connection to the PC, and the program will still run from the top each time you push the reset button. Remove the battery and put the Arduino board in a closet for six months. When we reconnect the battery, the last program we stored will run. This means that we connect the board to the host PC to develop and debug our program, but once that is done, no longer need the PC to run the program.

The Arduino Uno is a microcontroller board based on the ATmega328.It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz ceramic resonator, a USB connection, a power jack, an ICSP header, and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started.

The Uno differs from all preceding boards in that it does not use the FTDI USB-to-serial driver chip. Instead, it features the Atmega16U2 (Atmega8U2 up to version R2) programmed as a USB-to-serial converter.

4. CONCLUSION

In this project, a review of the renewable energy desalination system is presented together by comparing the existing desalination system. The selection of the appropriate desalination technology depends on a number of factors. These include, plant size, feed water salinity, remoteness, availability of grid electricity, technical infrastructure and the type and potential of the local renewable energy resource. Among the several possible combinations of desalination and renewable energy technologies, some seem to be more promising in terms of economic and technological feasibility than others. However, their applicability strongly depends on the local availability of renewable energy resources and the quality of water to be desalinated. In addition to that, some combinations are better suited for large size plants, whereas some others are better suited for small scale applications. Thus we conclude that the most popular combination of technologies are usage of thermal collectors along with evaporation and condensation processes.

REFERENCES

[1] Hongfei, Z., Xinshi, G., 2002, Steady-state experimental study of a closed recycle solar still with enhanced falling film evaporation and regeneration, Renewable Energy, 26:295308

[2] Janarthanan, B., Chandrasekaran, J., Kumar,S., 2005, Evaporative heat loss and heat transfer for open- and closed-cycle systems of a floating tilted wick solar still, Desalination, 180:291-305.

[3] Tripathi, R., Tiwari, G.N., 2004, Performance evaluation of a solar still by using the concept of solar fraction, Desalination. 169:69-80

[4] Singh, A. K., Tiwari, G. N., Sharma, P. B., & Khan, E. (1995),Optimization of orientation for higher yield of solar still for a given location. Energy conversion and management, 36(3),175-181