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HYBRID POWER GENERATION USING NON-CONVENTIONAL ENERGY SOURCES AND SEA WATER BY ELECTROLYSIS PROCESS

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ABSTRACT

In this paper we explore hybrid power sources which uses solar, wind and sea- water batteries that are not only instructive, but which can be used to drive low-power devices. It is considered only to be placed near sea-shore area as the concept involves the basic way of producing energy and converts that into electrical energy by burning metals and gets electricity (or electrical energy) by a condition for oxidation which by itself is the same as slow burning and stored in a battery storage system to provide continuous power supply when combined with hybrid power sources(solar and wind). This paper explores the electrochemistry behind an air battery using copper cathode, aluminum anode, and saltwater. If we have exact solution of saltwater and some metals we were able to generate small voltage. This on a higher generation of voltage will give another non-conventional source of energy for generation of power. This system proposes a new idea to generate hybrid power more effectively with sea water activated battery which injects an uninterrupted power supply for the load demand under all necessary conditions. The advantages, disadvantages, biological impacts and applications are also presented.

Keywords: Electrolysis, Distributed Generation, Non-conventional sources, Generation of Electricity.

I INTRODUCTION

World energy consumption is continuously rising, especially in the developing countries, to meet their energy requirements we need to expand the use of renewable sources. Sea water is one of the most upcoming renewable energy sources used now a day's. Sea water power generation is not affected by daylight, storms and earth quake, and can function 24 hours per day year round. Further, seawater power generation does not take up large piece of land, with no carbon dioxide production and can desalinate seawater. Seawater power generation is the best new energy solution for coastal regions and countries with oceanic climate, as it makes effective use of

natural resources. In addition to that sea water air batteries can also be employed with solar panel and wind turbines to ensure power quality, stability, reliability without degrading the environment. By keeping this in mind in this paper we explore some simple experiments involving homemade sea- water power generation that are not only instructive, but which can be used to drive low-power devices. We are producing a condition for oxidation which by itself is the same as slow burning. If we have exact solution of saltwater and some metals we were able to generate small voltage. This on a higher generation of voltage will give another non-conventional source of energy for generation of power[11] and then cascading this set-up with the indigenous technology of hybrid Solar -Wind Power system that harnesses the renewable energies in Sun and Wind to generate electricity. Here, electric DC energies produced from photovoltaic, wind turbine systems and sea water batteries are transported to a DC disconnect energy Mix controller. The controller is bidirectional connected to a DC-DC booster for storing in storage bank of Battery to serve dc loads. In the proposed scheme, a solar PV module along with a wind turbine and home-made sea water battery, the small prototype to generate power is developed. The hybrid setup could be operated in manual and automatic modes. The former mode consists of a single axis solar tracking setup and the latter is effectively controlled by means of a microcontroller. The entire setup can be extended for larger loads in order to electrify remote and inaccessible areas. Further, the proposed scheme can be implemented in industrial and domestic sectors on a larger scale.

II BLOCK SCHEMATIC OF THE PROPOSED HYBRID SCHEME

The proposed model consists of different units comprising of PV array, wind power resource and sea water air battery integrated together as indicated in Fig1.1.

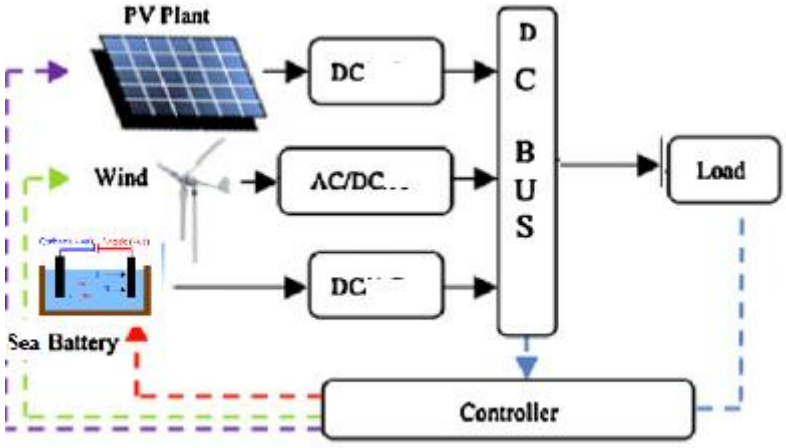

Fig1.1: Block Diagram of Proposed System

The solar wind salt water systems is to design a system that tracks the sun for a solar panel, utilise as much as solar energy to generate electricity and the same way, using the wind power for power generation and sum the combined power together using voltage boosters to save in battery cells.

Firstly considering the solar panel,tracking is achieved through using light sensors that are able to detect the amount of sunlight that reaches the solar panel. The values obtained by the LDRs are compared and if there is a

significant difference, there is actuation of the panel using a servo motor to the point where it is almost perpendicular to the rays of the sun.

This was achieved using a system with three stages or subsystems. Each stage has its own role. The stages were;

- An input stage that was responsible for converting sunlight to a voltage.
- A control stage that was responsible for controlling actuation and decision making.
- A driver stage with the servo motor. It was responsible for actual movement of the panel.

The input stage is designed with a voltage divider circuit so that it gives desired range of illumination for bright illumination conditions or when there is dim lighting. This made it possible to get readings when there was cloudy weather. The potentiometer was adjusted to cater for such changes. The LDRs were found to be most suitable for this project because their resistance varies with light. They are readily available and are cost effective. Temperature sensors for instance would be costly.

The control stage has a microcontroller that receives voltages from the LDRs and determines the action to be performed. The microcontroller is programmed to ensure it sends a signal to the servo motor that moves in accordance with the generated error.

The final stage was the driving circuitry that consisted mainly of the servo motor. The servo motor had enough torque to drive the panel. Servo motors are noise free and are affordable, making them the best choice.

Secondly considering the wind turbine, with the ample amount of wind available during the afternoon hours, the power generation is low but in the peak hours during the evening, the power generation reached to the expected value.

With the use of ball bearings the shaft movement became free colliding with the air to rotate. Selection of the best aerodynamic design for the wind blades, are able to take huge amount of wind to make in contact paved for the increase in efficiency.

Testing the wind turbine at different heights also delivered that with the increase in the altitude, the efficiency is directly proportional. Gears with the ratio of 1:15 ie, with the one rotation of the main shaft the generator shaft rotates up to 15 rotations.

Finally considering sea water electrolysis which uses the process of splitting up substances that conducts electricity when in the molten state or in solution. Pure water is very poor conductor of electricity because there are so few ions in it. To enable water to conduct electricity better, some dilute sodium chloride solution is added. When the power is turned on the electrical current flows through this solution, gases can be seen to be produced at the copper electrodes (cathode) and they are collected in the side arms of the apparatus which is aluminum (anode). The reactions at each electrode are called half equations. The half equations are written so that the same number of electrons occurs in each equation as shown in Fig.1.2 [12].

$2Na^+ + 2e^- \longrightarrow 2Na$ (sodium metal at the (-)cathode).

$2Cl^- - 2e^- \longrightarrow Cl_2$ (chlorine gas at the (+)anode).

Sodium ions gain electrons (reduction) to form sodium atoms. Chloride ions lose electrons (oxidation) to form chlorine atoms.

The chlorine atoms combine to form molecules of chlorine gas. The overall reaction is

$$2Na^{+}Cl^{-}_{(l)} \longrightarrow 2Na_{(s)} + Cl_{2(g)}$$

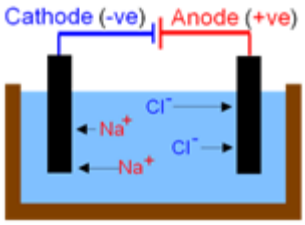

Fig. 2: The Electrolysis Process

III HYBRID ENERGY SYSTEM

Solar tracker used for generation of solar energy includes phototransistors, photodiodes, LDR and LLS05 and a servo motor which runs through rhe embedded software design having the C code loaded into the ATmega328P is a low-power CMOS 8-bit microcontroller

Fig 3 Solar Tracker

The algorithm gives the description of the general steps undertaken for the generation of electrical energy:

1. There is input of the voltages from the two LDRs.
2. The inputs are analog. They are converted to digital values that range between 0-1023.
3. The two digital values are compared and the difference between them obtained.
4. The difference between the values obtained is the error proportional angle for the rotation of the servo motor.
5. If the LDR voltages are the same, the servo stops. Otherwise, the servo rotates until the difference is the same.

Wind speeds are low in the summer when the sun shines brightest and longest. The wind is strong in the winter when less sunlight is available. Because the peak operating times for wind and solar systems occur at different times of the day and year, hybrid systems are more likely to produce power when you need it. Many hybrid systems are stand-alone systems, which operate "off-grid" -- not connected to an electricity distribution system. For the times when neither the wind nor the solar system are producing, most hybrid systems provide power

through batteries and/or an engine generator powered by conventional fuels, such as diesel. If the batteries run low, the engine generator can provide power and recharge the batteries.

Fig 3 Wind mill base

In sea water electrolysis process the generation of power required only 3 major components and few connecting wires. These major components are Aluminum cans, Copper sheet, Ocean water (salt water). Aluminum cans are used to store salt water in it. It also acts as cathode (negative terminal). The copper sheets are made into strips. This copper strips is dipped inside the saltwater, which is placed inside the aluminum can. Now, the copper strips, once dipped, should have mechanical support such that there is direct contact between the copper strip and aluminum can. If the mechanical support is not properly adjusted and the copper strip is in direct contact with the aluminum can, then the electron from the reaction due to copper and saltwater will discharge through aluminum and there won't be any voltage appearing across the terminal.

A slight difference can be seen between natural ocean water and man-made ocean water, as the ocean water contains many minerals. Some of those minerals won't be present in the man-made saltwater. The ocean water salinity is 3.5% - 4.2%, keeping that in mind the salt is added to the water. For every 100ml of water, 4g of salt is added.[1]

Sea water composition (by mass) (Salinity=3.5%)			
Element	percent	Element	percent
oxygen	85.84	sulfur	0.091
hydrogen	10.82	calcium	0.04
chloride	1.94	Potassium	0.04
sodium	1.08	Bromine	0.0067
magnesium	0.1292	carbon	0.0028

Table.1: Sea water composition

IV OBSERVATION FROM SOLAR WIND SALT WATER HYBRID SYSTEM

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Testing the wind turbine at different heights also delivered that with the increase in the altitude, the efficiency is directly proportional. Gears with the ratio of 1:15 ie, with the one rotation of the main shaft the generator shaft rotates up to 15 rotations.

Lastly considering the sea water When a copper is place inside the saltwater, we get a potential difference. If we increase the area of cross-section dipped in the saltwater, the voltage does not change but the current value improves. By increasing the area of cross-section, the overall power generated is also improved.

The proposed model consists of different units comprising of PV array, wind power resource and sea water air battery integrated together

V APPLICATIONS

If generation of power from ocean water becomes successful then following will be the possible applications

- If generated in kilowatts and above then it can be used a base load plant for the cities situated near by the ocean.
- Mostly the beaches are tourist places, by using these shops and decoration lights can be powered, as it will be easily available.
- Seashore have seaport and nearby seaport we will have light house. The light house will have a bulb. This bulb can be given supply from the generation from ocean water.
- Just like the above few application, we can have many application from this kind of power generation.

VI MERITS AND DEMERITS

- The availability of Ocean/Sea water is huge and generation from it makes it renewable energy resource.
- The percentage of renewable energy resource will increase with implementation of the power generation from ocean/sea water.
- It is low installation cost.
- One of the electrode i.e., aluminum, which helps us to recycle aluminum products.
- The value of voltage and current will be increased by adding small amount of catalyst to the ocean/sea water so that we can increase the plant capacity.
- It is clean energy, therefore Diesel can be avoided.
- It can also be used as back up energy source.

Demerits:

- The copper electrode which is of the electrode will get eroded due to the formation of copper chloride, so we should replace the copper electrode which increases the cost.
- Due to the erosion of copper electrode the value of current will get decreased which affects the plant capacity.
- This project only benefits for the places near to the oceans/seas.
- Bleaching powder when used as catalyst has little effect on the copper as time increases, as they for a coating of copper chloride on it which is blue in color.

VII FUTURE SCOPE

Once it starts generation in kilowatt, the usage of this will increase at greater rate. This can not only used near seashore but also to the boats or yachts that needs electrical to run the motor in ocean. India has a high scope to generate power from this source as most part of land is next to ocean. As it will be one time investment, it will be of great significant in the future for India.

VIII CONCLUSION

The ocean water available in plenty can also be used for generation of power and utilizing them is great achievement. The ships on the ocean will be benefited most as diesel motor can be replaced by way of

generating power. On seashore, we can give supply to the near hotels or shops. As we know the decoration is very much necessary nowadays to attract people this energy can be used in the lighting up the decoration lights. The generation of power from ocean gave us to look the ocean as a new source of power generation at the time where we see the fossil fuels are slowly depleting. As near future will be only depending on renewable energy, this will be one of them.

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