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TECHNOLOGIES FOR DESALINATION OF SEA WATER IN OCEAN THERMAL ENERGY COVERSION SYSTEM

P.SIDDU JAGANNADHA NAIDU
19341A0268@gmrit.edu.in
GMR Institute of Technology

ABSTRACT

Recently, electrical power generation from oceans is becoming very popular, as it is prospective, predictable, and highly available compared to other conventional renewable energy. Ocean thermal energy conversion (OTEC) is a process or technology for producing energy by harnessing the temperature differences between ocean surface waters and deep ocean waters. Energy from the sun heats the surface water of the ocean. In tropical regions, surface water can be much warmer than deep water. This temperature difference can be used to produce electricity and to desalinate ocean water. Ocean Thermal Energy Conversion (OTEC) systems use a temperature difference (of at least 77 degrees Fahrenheit) to power a turbine to produce electricity. OTEC systems using seawater as the working fluid can use the condensed water to produce desalinated water. Desalination is a process that takes away mineral components from sea water. In this review we shall focus on generation of electricity and desalination of water using OTEC.

INTRODUCTION

Differential between the warm surface waters of the oceans, heated by solarradiation, and the deeper cold waters to generate power in a conventional heat engine. The difference in temperature between the surface and the lower water layer can be as large as 50 °C (90 °F) over vertical distances of as little as 90 meters (about 300 feet) in some ocean areas. To be economically practical, the temperature differential should be at least 20 °C (36 °F) in the first 1,000 meters (about 3,300 feet) below the surface. In the first decade of the 21st century, the technology was still considered to be experimental, and thus far no commercial OTEC plants have been constructed. Ocean thermal energy conversion (OTEC), form of energy conversion that makes use of the temperature

Desalination can be defined as any process that removes salts from water. Desalination processes may be used in municipal, industrial, or commercial applications. With improvements in technology, desalination processes are

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becoming cost-competitive with other methods of producing usable water for our growing needs. During World War II, it was felt that desalination technology - 'desalting' as it was called then - should be developed to convert saline water into usable water, where fresh water supplies were limited. Subsequently, "The Saline Water Act" was passed by Congress in 1952 to provide federal support for desalination. The U.S. Department of the Interior, through the Office of Saline Water (OSW) provided funding during the 1950s and 60s for initial development of desalination technology, and for construction of demonstration plants. Desalination is a relatively new science that has developed to a large extent during the latter half of the 20thcentury, and continues to undergo technological improvements even at the present time. It is interesting to note that one of the first seawater desalination demonstration plants to be built in the United States was at Freeport, Texas in 1961. Dow, in cooperation with the U.S. Department of the Interior built a 1 million gallons per day (mgd) long tube vertical distillation (LTV) plant at a cost of $1.2 million, that produced water for the City of Freeport and for Dow operations. The plant was officially opened on June 21,1961 by then President John F. Kennedy, by pressing a button from the White House. Vice President Lyndon Johnson attended the inaugural event in Freeport. During his speech to dedicate the desalination plant, President Kennedy said "No water resources program is of greater long-range importance than our efforts to convert water from the world's greatest and cheapest natural resources – our oceans – into water fit for our homes and industry. Such a break-through would end bitter struggles between neighbors, states and nations".

A desalination process essentially separates saline water into two parts - one that has a low concentration of salt (treated water or product water), and the other with a much higher concentration than the original feed water, usually referred to as brine concentrate Thermal technologies, as the name implies, involve the heating of saline water and collecting the condensed vapor (distillate) to produce pure water. Thermal technologies have rarely been used for brackish water desalination, because of the high costs involved.

LITERATURESURVEY

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S.NO	TITLE OF THE PAPPER	CONTENT IN THE PAPER
1	Ocean thermal energy conversion by deliberate seawater salinization	• The possibility to run an OTEC plant by the deliberate salinization of surface seawater has been discussed
2	Maximum efficiency point tracking for an ocean thermal energy harvesting system	• In this paper, a new ocean thermal energy conversion system which using phase change material as energy storage medium was designed
3	An Assessment of Ocean Thermal Energy Conversion as an Advanced Electric Generation Methodology	• The operation of an OTEC power plant may be organized into the steady state and transient modes
4	Ocean thermal conversation	• This paper reviews about different aspects of OTEC generation, the trend of new OTEC technologies, advantages and disadvantages of OTEC cycle.

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Ocean thermal energy conversion by deliberate seawater salinization

- Consideration is given to the possibility of ocean thermal energy conversion (OTEC) by the deliberate salinization of surface seawater. The proposed technique is similar to traditional OTEC, with one important exception: rather than cold water being brought from the bottom to the surface, the warm surface water is circulated to the bottom, cooled there, and lifted back to the surface. The entire process is driven by the induced salinity gradient at the surface. As a result, there is no need for a pumping system to bring the cold bottom water to the surface. Two methods are explored for surface salinity enhancement, namely solar evaporation and the direct addition of salt to the seawater

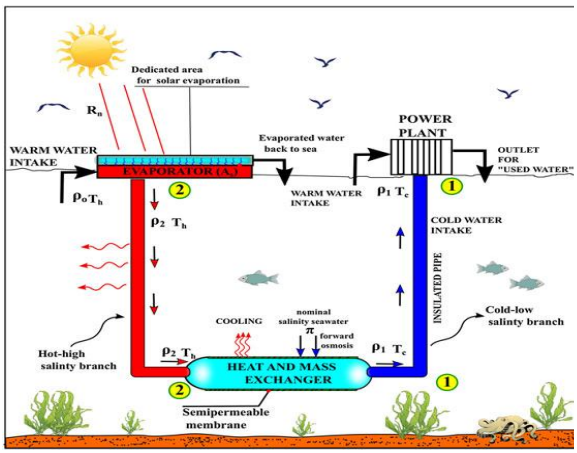

Figure 1. Sketch of the proposed OTEC concept where the salinization ofseawater is generated by enhancing solar evaporation

- FIGURE 1 Sketch of the proposed OTEC concept where the salinization of seawater is generated by enhancing solar evaporation
- Now, the salinized water, after falling to the deep ocean and after passing through a mass and heat exchanger, is cooled at temperature Tc and recovers its initial salinity so by mixing with the surrounding deep seawater, then arrives at point, with temperature Tc and salinity so.
- The assumption of recovering initial salinity in the mixing is justified because, first,the osmotic pressure favors the low concentration of the surrounding seawater passing through a semipermeable membrane to mix with the saltier water coming from the surface, and second, the ocean can be seen as an infinite reservoir.
- Under this simple principle, we can proceed to analyze the feasibility of gaining extractable energy using induced salinity for OTEC.

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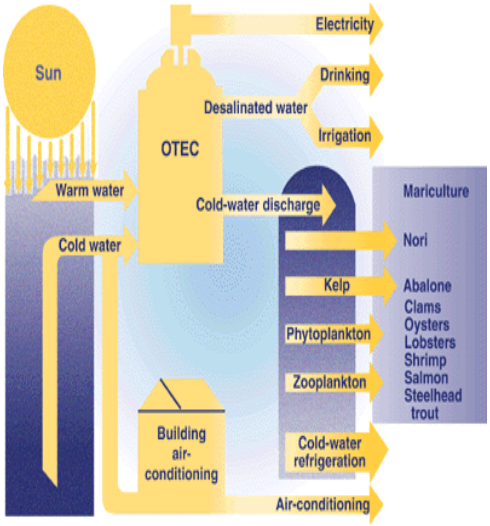

Figure 2. Process Of Desalination Of Sea Water By Using OTEC

- Because the salinized water isheavier, it is gravitationally transported to the bottom,where it is cooled and desalinated by mixing with thesurrounding seawater in a dedicated heat and mass exchanger.
- The mixing is favoured by the forward osmoticpressure, which pushes the surrounding bottomwater with low or nominal salinitythrough a semipermeable
- membrane.
- After mixing in the mass exchanger, and considering that the volume of water recovered its initial nominalsalinity, thus the density of the water volume becomes
- Where isthe difference between the surface temperature and thebottom temperature is the variation of density with temperature.
- To move a quantity of water around the system against friction, the hydrostatic difference between the hot and cold water column should at least compensate for the friction losses.

Desalination water used for harvesting

- Development of alternative energy resources having low carbon emissions is critical to mitigating the increasingly devastating impacts of climate change.
- Our oceans have the ability to provide that energy source to meet energy demand around the world.

- This resulting surface energy is the energy that is available for harvesting and conversion into electrical energy by specialized WEC systems.
- This two-dimensional surface energy phenomenon becomes important to the design and scaling up of WEC systems.
- To understand wave energy harvesting, it is helpful to have a basic understanding of wave formation and how waves achieve maximum size.

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- Wind is the movement of air caused by air pressure differences over different areas of the ocean.

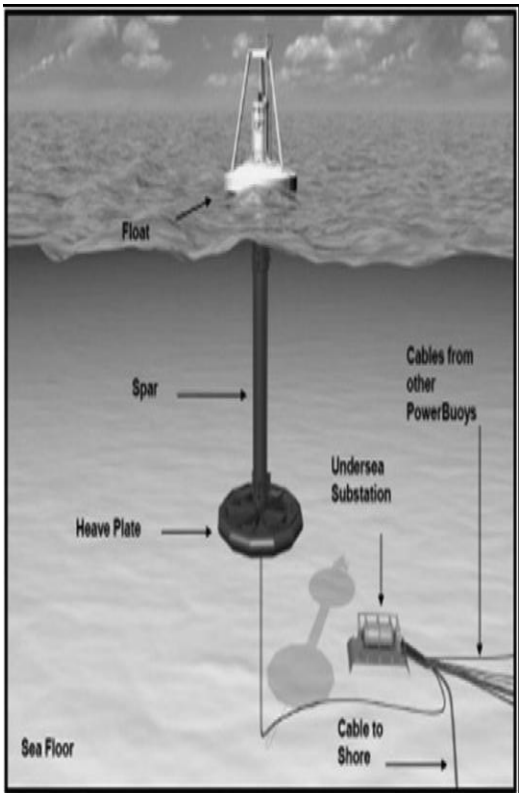

Figure 3. Movement of Water Molecules in Decreasing Depth

Control scheme of the power generation system:-

- The control scheme of the power generation system is shown in Fig.
- The energy stored in the accumulator will be converted into electrical energy by the hydraulic motor and generator
- Electricity is stored in a supercapacitor through a buck-boost circuit, which is controlled by a PID controller.
- In this scheme, the RBFNNis the fitness evaluation function, it's input variables are the pressure and current, and it's output variable is the efficiency.
- Besides, PSO algorithms are used to calculate

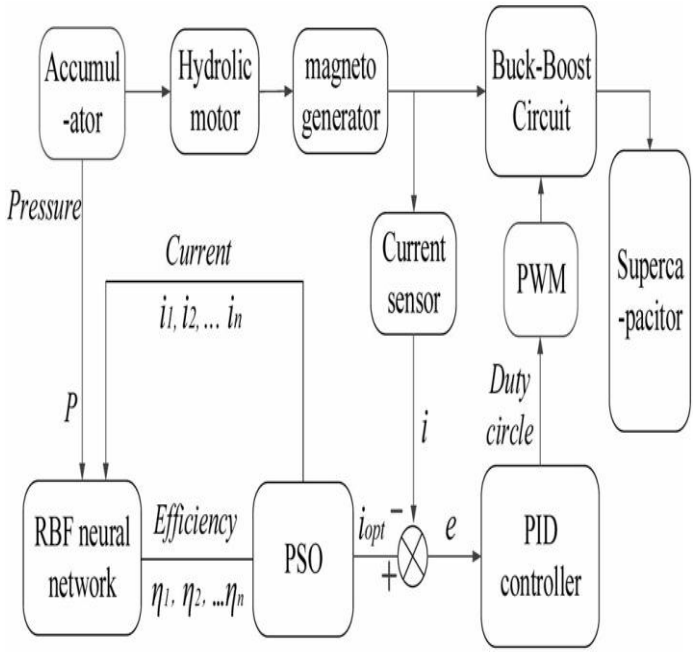

FIGURE 4: Control scheme of the power generation system

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CONCLUSION

Ocean thermal energy conversion has been demonstrated as a technically feasible means for generation of electricpower.The main advantages are that the method is fuelfree,it has low environmental impact, and there are useful side benefits of desalinated water production and novelaquaculture.Disadvantages include high construction cost potential for susceptibility to the hostile ocean environment, and lack of experience with thistechnology.An underlying disadvantage is that the small temperature difference between surface and deep oceanwater translates to the need for very large volumes of oceanwater and special care in the design of large heat exchangers.The seriousefforts of the heat and mass transfer experimental apparatsand net power producing experiment at the Natural EnergyLaboratory of Hawaii should be recognized as potentially solving some of the problems encountered in OTEC.OTEC electrical energy generation in the IO-MW class maybecome a reality. The main application appears to satisfy base load requirements.

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