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IMPORTANCE OF SOLAR POND

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ABSTRACT

The sun is the largest source of renewable energy and this energy is abundantly available in all parts of the earth. It is in fact one of the best alternatives to the non-renewable sources of energy. One way to tap solar energy is through the use of solar ponds. A solar pond is a pool of saltwater which acts as a large scale solar thermal energy collector with integral heat storage for suppling thermal energy. Solar ponds appear to be economical for large area applications and it is likely that they will be used extensively in the future as problems connected with their operation and maintenance are resolved.

KEYWORDS: Solar pond, Halocline, Desalination, Production of power, Solar energy, Refrigeration.

INTRODUCTION

The approach is particularly attractive for rural areas in developing countries. Very large area collectors can be set up for just the cost of the clay or plastic pond liner. The evaporated surface water needs to be constantly replenished. The accumulating salt crystals have to be removed and can be both a valuable by product and a maintenance expense. No need of a separate collector for this thermal storage system.

Solar ponds in India:

Location	Area (m2)	Depth (m)	Main Objectives	Achievem-ents
Bhavnagar	1210	1.2	Operating experience and behaviour of materials	Maximum temperature 80 in 1972. Worked for two years.
Bhavnagar	1600	2.3	Operating experience and applications for power production.	Getting heated, designed to supply 20 KW, Rankine cycle turbines.
Pondicherry	100	2.0	Experience, material behaviour, monitoring & modelling.	Built in 1980.
Bhuj	6000	3.0	Operating experience, material behaviour and possible applications.	Supplying process heat to a dairy.

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METHODOLOGY

- The saltwater naturally forms a vertical salinity gradient also known as a "halocline", in which low salinity water floats on top of high salinity water. The layers of salt solutions increase in concentration (and therefore density) with depth. Below a certain depth, the solution has a uniformly high salt concentration.
- There are three distinct layers of water in the pond.
- An intermediate insulating layer with a salt gradient, which establishes a density gradient that prevents heat exchange by natural convection.
- The bottom layer, which has a high salt content.
- If the water is relatively translucent, and the pond's bottom has high optical absorption, then nearly all of the incident solar radiation (sunlight) will go into heating the bottom layer.

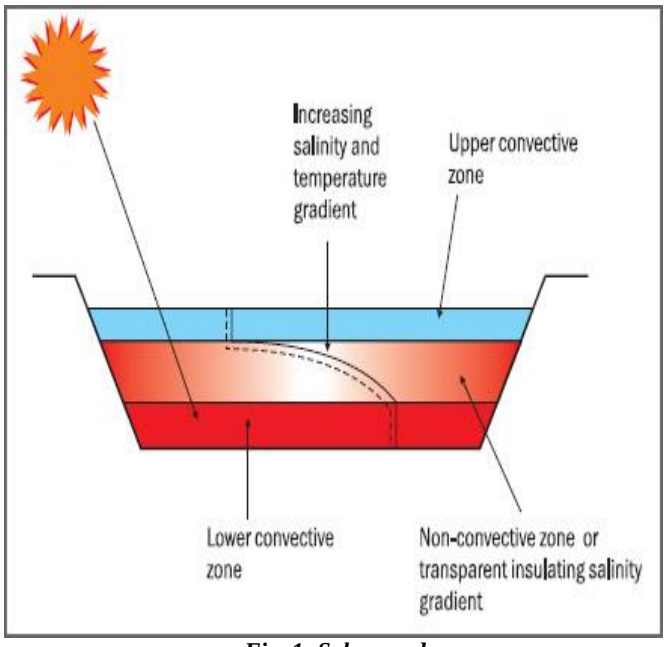

Fig. 1: Solar pond

- When solar energy is absorbed in the water, its temperature increases, causing thermal expansion and reduced density. If the water were fresh, the low density warm water would float to the surface, causing a convection current. The temperature gradient alone causes a density gradient that decreases with depth. However the salinity gradient forms a density gradient that increases with depth, and this counteracts the temperature gradient, thus preventing heat in the lower layers from moving upwards by convection and leaving the pond. This means that the temperature at the bottom of the pond will rise to over 90ºc while the temperature at the top of the pond is usually around 30ºc.

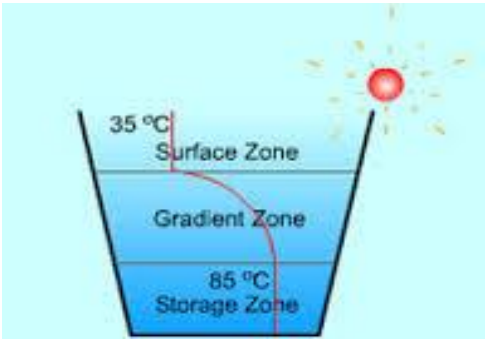

Fig. 2: Temperature difference between two zones

RESULT

- The heat trapped in the salty bottom layer can be used for many different purposes, such as the heating of buildings or industrial hot water. Because of the large heat storage capability in the lower convection zone of the solar pond, it has ideal use for heating even at high latitude stations and for several cloudy days. Many scientists have attempted and sized the solar pond for a particular required heating load for house heating.
- A solar pond can be used to generate electricity by driving a thermoelectric device or an organic Rankine cycle engine. Even low temperatures heat that is obtained from solar pond can be converted into electric power. The conversion efficiency is limited due to its low operating temperatures (70-100 c). Because of low temperature, the solar pond power plant (SPPP) requires organic fluid which have low boiling points such as halo-carbons (like Freons) or hydrocarbons (such as propene).
- Another very interesting application of the solar ponds is to get potable water. Several towns and villages in India are facing acute water shortages. Many such villages are situated in coastal areas or in locations where salt/bittern is available at low costs. Also, in most of the salt works, there is a scarcity of drinking water for the staff and workers. The solar pond based desalination system offers a cost-effective solution for production of sweet water from brackish/sea water. The total system comprises the solar pond, a low temperature multistage flash distillation unit, heat exchanger, condenser, pumps etc.
- Used for space heating and cooling of buildings.

CONCLUSION

The low efficiency of solar ponds is usually justified with the argument that the ‘collector’, being just a plastic lined pond, might potentially result in a large scale system that is of lower overall levelised energy cost than a solar concentrating system.

REFERENCES

[1] G. D. Rai, “Non Conventional Energy Sources”, Khanna Publishers
[2] Bansal Keemann, Meliss, “Renewable Energy Sources and Conversion Technology”, Tata Mc Graw Hill.
[3] Ashok V. Desai, “Non Conventional Energy”, New Age International Publishers Ltd.
[4] D. P. Kothari, “Renewable Energy Resources and Emerging Technologies”, Prentice Hall of India Pvt. Ltd.
[5] D. S. Chauhan, S. K. Srivastava, “Non Conventional Energy Resources”, New Age International Publishers.
[6] R. K. Rajput, “ Non Conventional Energy Sources and Utilisation”, S. Chand.
[7] S. Hasan Saeed, D. K. Sharma, “Non Conventional Energy Resources”, Katson Books.
[8] S. A. Abbasi, NaseemaAbbasi, “Renewable Energy Sources and Their Environmental Impact”, PHI.