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Experimental Study of Solar Water Heater and Steam Generator Using Cylindrical Concentrator with Active Tracking and Data Update

Shyamali V. Thakare[1], Vijay Gore[2], Prakash Ingle[3]

[1]PG Student, Dept. of Mechanical Engineering(Thermal Engg.), P.R.Pote(Patil) college of engineering & management, Amravati, Maharashtra, Amravati
[2]Professor, Dept. of Mechanical Engineering(Thermal Engg.), P.R.Pote(Patil) college of engineering & management, Amravati, Maharashtra, Amravati
[3]Professor, Dept. of Mechanical Engineering(Thermal Engg.), P.R.Pote(Patil) college of engineering & management, Amravati, Maharashtra, Amravati

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Abstract -Steam generation with low-cost and excellent energy efficiency is of great significance for an energy crisis, reducing water pollution. However, there are still numerous challenges for solar steam generation system to practical energy utilization. In this review, Our systematic investigation provided a clearer understanding of how to improve the steam generation rate, energy conversion rate, including improving light absorption, reducing heat loss, and optimizing water supply. This article aims to make a comprehensive review of Solar Water Heater and Steam Generator Using Cylindrical Concentrator with active tracking and data update device. By using active tracking device the solar radiation can be incident directly on the cylindrical reflector which is connected to water reservoir. Electronic control unit will give accurate and real time readings. Further by using Data updater device will keep previous recordings accurately. Concentrating collectors absorbs solar energy and convert it into heat for generating hot water, steam at required temperature, which can be further used for solar thermal applications. The developing countries like India where solar energy is abundantly available; there is need to develop technology for harnessing solar energy for power production.

***Key Words*:** Active Tracker, Battery panel, Cylindrical reflector, Copper wire at collector, Display, Gravity flow fluid, Manual Data, Micro-controller, Motor driver, Photo sensor.

1.INTRODUCTION

- In recent years the world is concerned about end lasting energy supply problem. If the world goes on using the traditional fuels only. It is most likely that the world will have all development activities and the human civilization will come to a stagnant position aftersome days. Undersuch circumstances, solar thermal technology can make a major contribution towards the replacement of fossil fuels with solar energy. Solar radiation is a promising source of renewable energy, as the hourly incident solar flux on the surface of the earth is greater than annual global energy consumption. Efficient harvesting of solar energy for steam generation is a key factor for a broad range of applications, from large-scale power generation, absorption chillers and desalination systems etc. to compact applications such as water purification, sterilization, and hygiene systems in remote areas where the only abundant energy source is the sun. Current methods of generating steam using solar energy rely on a surface or cavity to absorb the solar radiation and transferring heat to the bulk liquid directly or via an intermediate carrier fluid, which require high optical concentration and the steam thus generated is usually in thermal equilibrium with the bulk liquid. Local generation of steam in a cold bulk liquid can be achieved through high concentrations or illumination of nanofluids by electromagnetic waves (generally, lasers) with high power intensity. Like current methods Solar Hot Water Heater and Steam Generator Using Cylindrical Concentrator with Active Tracking and Data Update.
- device will work more efficiently. Medium temperatures, solar heat can be used in industries involved in chemical, paper, textiles, and food preparation, in processes such as drying, sterilizing, cleaning, evaporating, steaming, and conditioning (heating and cooling) of industrial buildings. Hot water or low-pressure steam at medium temperatures (80-25) can be used either for pre-heating water (or other fluids), for household processes (washing, dyeing, etc.), for steam generation, or by direct coupling of the solar system, for individual process in which working temperatures are lower than that of the central steam supply. In recent years, research on solar heating for industrial processes has addressed the development of new devices, new applications, control methodologies, thermodynamic and technical-economic analysis, as well a s the development of

components, support structures, reflective materials, materials for the receiver, and absorber surfaces. In the literature, there exist diverse methodologies for the design and optimization of the integration of these systems to industrial processes

2. PROBLEM STATEMENT

Solar radiation can be widely used for the generation of electricity and water heating purpose, as well as a supporting energy source for central heating installations. Commonly, water heating integrated systems for buildings have two parts: a solar energy collector and a water storage tank. The solar collector is the key component of solar heating systems. They collect the energy from the sun, transform its radiation into heat, and then transfer that heat to a fluid. Solar water heating mechanism can be either active or passive, but the most commonly used is an active mechanism. The active mechanism relies on pumps to move the liquid between the collector and the storage tank, while the passive mechanism relies on gravity and the tendency for water to naturally circulate as it is heated. The performance of this solar system depends on the collector. The collector absorbs the maximum amount of heat from the sun and this energy is used for heating the water. But in our recent research project, we can obtain both water heating and steam generation system. Now a day's many compact design of solar water heater is available but optimize this technique it may very useful for future application. Thermal energy from a large amount of Total energy requirement at household and industrial purposes. By conventional means of getting thermal energy causes of air pollution breakout, also cost of such energy is higher. So the problem with conventional ways of thermal energy convention are pollution and limited availability of non-renewable energy sources and thus the cost of fuel. This project work deals with the fabrication and development of a system that will be able to convert Solar energy into usable form of thermal energy using water / liquid as a medium to convey energy for future uses. Also to increase efficiency of project two things are adopted one a semi cylindrical reflection and second the active solar tracking system. This could be the problem solution over the realized problem

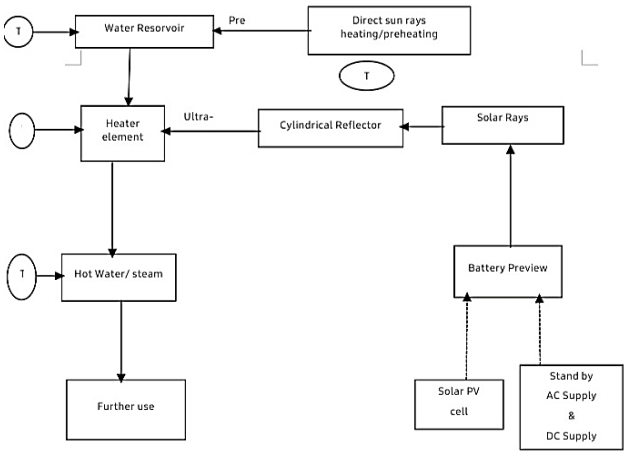
3.LITERATURE SURVEY

- In addition to this work, researchers in Japan and Germany have published articles concerning similar fluids 0. Their results showed that the suspension of a slight amount (less than 0.5%) of nanoparticles improves remarkably the efficiency. However, for a volume fraction higher than 0.5%, the efficiency remains constant and even begins to decrease with 12 increasing volume fractions. They also found that the efficiency increases with decreasing size of nanoparticles [13]. absorption solar parabolic trough collector. They used aluminium nanoparticles at the volume fraction of 0.05% suspended in the base fluid TherminolVP1. Their results showed that thermal efficiency increases compared to a conventional PTC by 10 % at low temperatures and by 5% at high temperatures. [14] Concentrated solar energy collection control has been studied using both parabolic trough collectors and parabolic dishes in the last decades. Camacho et presented a survey on control schemes for distributed solar collector fields [3].
- The authors have commented on different modelling and basic control approaches for parabolic trough collectors. The techniques discussed have mostly been used to heat thermal oil, which is then used to produce steam. A similar model of using thermal oil as heat transfer fluid has been presented by Odeh et al. [1].For DSG, dynamic modelling of a steam collector. has been studied using several method solved the ordinary differential equations using Euler's method. The collector has also been modelled using Lumped System Approach.
- Valenzula et al. have used experimental data to estimate low-order transfer functions for the system [5] [6]. The modelled system has been able to estimate response of the plant very accurately. Modelling of parabolic trough collector at 'DISS project'- A solar thermal power plants with DSG- has been presented by Zarza et al. [7]. For Direct Steam Generation with dish concentrators, researchers at Australian National University have been working since the last three decades [8]. They have presented two transient models for the concentrator. The above-mentioned models have been used to design system controllers. Eck et al. have worked on a control strategy using feed forward control and contrasted it with the use of only PI control to reduce set point deviations [12]. This work was, however, only produced in a simulated environment using
- Modelica. Alguacila et al. have presented some results from parabolic trough collectors in power plant but the control strategy has not been well documented [13]. Zapata has also presented a controller technique for full state feedback control of steam temperature at direct steam generator output [14]. In this work, a state-space representation of the receiver is created by linearizing his model presented earlier [11].

4. OBJECTIVE

- To study the available literature and report on required topic,
- To study effectiveness of hot water generation using cylindrical reflector or collector.
- To Study Effectiveness of steam generator,
- To Study active tracking system for experimental model.
- To Study the efficiency by conducting testing on experimental model
- .To analyze above objectives using real time data update.

5. BLOCK DIAGRAM



6. WORKING

- In this project solar energy from the sun rays can be used in the form of thermal energy for the provided requirement points and uses. In this project system there will be a a semi cylindrical reflector use to direct incident solar rays to a concentrator.
- This concentrator in a simple copper pipe or tube. The project incorporates a water liquid reserve wire which will alone act as preheater. Liquid from this reservoir its provided to the copper concentrator via regulator value for volume or flow regulation as per requirement.
- The incident solar rich are reflected by the semi cylindrical reflector to the copper concentrator which heat up the copper concentrator to very high extent.
- The liquid is regulated and allowed to flow through the concentrator copper pipe where heat is exchanged to the preheated liquid where the liquid aur water gets hot and does the hot liquid or water can be optimised through the project by regulating the flow the same water can be converted to steam as well.

1. During day time the Sun rays and direction is continuously changing and these rays are incident on the reflector which its always perpendicular to the base time where the efficiency of the system varies is through out the day.
2. In this project we are using AC to tracking device which will attract the sunrise throughout the day and make it fall on the reflector which trap the Sun rates to the system more efficiently. For the purpose of copper photo sensor is made this photo sensor data is analysed by a electronic control unit and directions of this reflector is manage accordingly.
3. Temperature reading at various point in the system will display.
4. This is how the system will work. This solar water heater and steam generation using active tracking device can be use in various purpose.

7. ADVANTAGES

1. The working fluid can achieve higher temperature in a concentrator system when system of the same solar-energy collecting surface area. This means that a higher thermodynamic efficiency can be achieved.
2. It is possible with a concentrator system to achieve a thermodynamic between temperature level and task.
3. The thermal efficiency is greater because of the smaller heat-loss area relative to the receiver area.
4. Comparatively low counter weight.
5. Since we are using number of units installed for industrial purpose even if one system fails we can it will not affect our use or work will not get affected.
6. To improve the steam generation rate and energy conversion rate, including improving light absorption, reducing heat loss, and optimizing water supply.

8.DISADVANTAGES

1. As we are using number of smaller systems for any purpose handling is costlier compared to other collector.

2. Since we are using number of smaller units the working is possible only for high capacity load.

9. APPLICATIONS

1. Chemical, paper, textiles, and food preparation, in processes such as drying, sterilizing, cleaning,evaporating, steaming, and conditioning (heating and cooling) of industrial buildings.
2. Hot water at low-pressure steam at medium temperatures (80-25) can be used either for pre-heating water (or other fluids).
3. For household processes (washing, dyeing, etc.), for steam generation, or by direct coupling of the solar system, for individual process in which working temperatures are lower than that of the central steam supply.

10. CONCLUSION

1. At present, in most of the cases fossil fuel are use to produce superheated steam, but solar energy that renewable energy, can be a great source of heat in this purpose.
2. The use of renewable energy provides our environment clean and comfortable without the cost of electricity.But this concentrator is capable of producing superheated steam from water of ambient temperature.
3. A cylindrical collector can be used to produce sufficient amount of superheated steam that can be use for Industrial purpose.
4. This collector also facilitated with active tracking device to get the maximum input from the sun.
5. Besides these, to keep the construction cost low,the cylindrical solar collector is constructed using locally available materials.

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