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Parabolic Solar Dish Collector: A Review

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ABSTRACT

In the world the requirement of energy is continuously increases due to increase in population and development of new technologies.For fulfillment of the requirements research is running on the renewable energy. Solar collectors are also a method to generate heat energy by solar radiation. Heat from solar energy can be used for both domestic and industry purpose. In domestic, heat from sun can be used for heating, drying and cooking. Parabolic dish solar collectors have high concentration ration and efficiency. In this paper different types of solar collector have discussed and the best collectors also suggested.

Keywords: Parabolic solar dish collector, Receiver, Reflectivity.

I. INTRODUCTION

Energy demand increases with improvement in lifestyle of the people. And with growing population the cost of energy also increases. Thus the need of less expensive energy arises and researcher moves towards the renewable energy. In renewable energy, Solar is a major form of energy source. In present different types of research are going on for maximum utilization of solar energy. Different types of collectors are developed for the use of heat from sun, for example; flat plate collector, evacuated tube collector, compound parabolic collector, Fresnel lens, heliostat field collector,parabolic trough collector, parabolic dish collector etc.

Parabolic dish collector are a point concentrator collector thus, it have high concentration ratio. Parabolic solar collector has maximum aperture area among all collectors and produces high temperature, thus its efficiency is also high. In this maximum temperature is high in comparison to other collectors for the same aperture areas.

II. LITERATURE REVIEW

I. The literature review has been done on the various experimental researches whose main consideration is to enhance the performance of the parabolic dish collector. In this , following literature,

El Ouederni et al. [1] created parabolic solar collector. Test estimations of solar flux and temperature circulation on the collector have been done on the receiver. The solar flux focused on receiver has been practicallyestimated. The acquired outcomes portray effectively the anticipated physical phenomenon. The temperature in the focal point of the dish achieves an esteem which is around 400 °C. So that, a great quality of high temperature equipment's, can be acquired utilizing this innovation of solar concentrator. The second outcome was the great effectiveness of the concentrated sun oriented concentrator which can be expanded by various inventions. In another term, utilizing this solar model we can extricate in the end 27 % of direct solar

energy and can be utilized straightforwardly for a few applications, for example, water heating, Stirling engine, steam production, and so forth.

Lifang Li et al. [2] built up another idea for planning and creating large parabolic dish. Thin metal flat plates with high reflective surface were used as reflector. Connected to the back surface of the mirror petals were a few thin layers whose shapes advanced to reflective petals frame into a parabola when their one end were pulled toward each other by links or cables..

Ibrahim et al. [3] announced the outline and advancement of a water heater with parabolic dish for residential water heating application. He found that the water heater is giving 40 liters of heated water a day for a group of four individuals, accepting that every individual from the family requires 10 liters of high temp water every day. At first he expected the warm efficiencies of 50% by the outline however he got warm efficiencies of 52% - 56% and this scope of efficiencies is higher than the normal planned esteem.

Fareed. M. Mohamed et. al [4] examined Versatile Solar Dish Concentrator and revealed plan and fabrication of 1.6 meter diameter solar dish collector for water heating application and solar steam was produced . Galvanized steel was used in the fabrication of dish, and its inside surface is secured by a reflecting layer with reflectivity up to (76 %), and a receiver is situated on the focus. The dish outfitted with tracking mechanism and estimation of the temperature and solar power .Water temperature expanded up to 80^0C, and the framework productivity expanded by30% at mid noon.

Eswaramoorthy et al. [5] led an experiment on little scale parabolic solar dish thermoelectric generator. They manufactured parabolic solar dish reflector utilizing an unused satellite dish receiving wire fitted with cleaned aluminum sheet as concentrator surface. The concentrated radiation and water cooled warm sink was the driving potential to produce power; they considered different working parameters like collector plate temperature, control yield and transformation productivity regarding sun based radiation. From the examination it was discovered that the collector plate temperature was essentially influencing the power output. Parabolic type dish thermal cooker was composed and built by Ibrahim Ladan Mohammed (6). The cooker was intended to cook food like 12 kg of dry rice every day, for a generally medium size family. For compelling execution, the plan required that the parabolic cooker track the sun regularly and a direct actuator (super jack) were embraced for this reason. Preparatory test outcomes demonstrate that the general execution of the solar thermal cooker was acceptable. The cooker was fit for cooking 3.0 kg of rice in 90 – 100 minutes, and this firmly concurs with the anticipated time of 91minutes .

Yadav et al. [7] studied a solar based air heatersystem utilizing parabolic trough collector withvarious reflectors. In this test, the reflected radiations were centered around absorber tube which was set at central length of the parabolic trough. In this setup, air was utilized as working fluid for collecting heat from absorber. He utilized three unique reflectors for investigation and they found that execution of Aluminum sheet is astounding in comparison with steel sheet and Aluminum foil as a reflector.

Vardhan et al. [8] examined performance of parabolic dish collector under various seasons in Bhopal (M.P) India. They also announced the impact of meteorological parameters, (for example, Direct Normal Irradiance (DNI), wind, ambient air temperature and humidity and so on.) on the execution of parabolic dish collector. In this system conventional design is adopted for parabolic concentrator and the receiver is situated in the line between focal and sun. For this system, collector is theoretically able to reach the temperature 65^0C. By this study the deployment of small scale solar collectors influenced in the different parts of Bhopal.

Sakhare et al. [9] developed a line focus collector with a copper tube receiver which turns in form of helical coil on the focus position. They studied the performance of collector with experimental setup for water as working fluid. In this system reflector is made up of aluminium foil sheet (highly reflective) with 0.8 reflectance factor. This experimental is carried out in open environment and the efficiency of collector is noted. The result for this system gives better sign for generation of steam in rural application. Diameter of receiver (copper tube) helix is 22cm and has 15 number of turns. The receiveris placed in the solar trace path , thus the solar tracking in the east-west direction is eliminated. This experiment is carried out in summer and cloud free days. The result gives a maximum temperature of 215^0C and 60-70% steam conversion efficiency.

Sonal C Yogi et. Al [10] constructed a parabolic solar dish with dual axis solar tracking system. The circular iron ring is used to provide two axis motion to the dish. For tracking sun in both axis electro chemical systems is used with Programmable Logic Control. A C program is used, which gives required results for the incident radiations. PLC are widely used on the place of photo sensors for the sun- tracking. For each day in whole year azimuth angle from sun rise to sun set is examined at 23.59 latitude and 72.38 longitudes in North hemisphere for Mehsana. According to the above azimuth angle the signals are sends to the PLC which controls the system and keep the dish vertical to the sun rays. The results were recorded and the further calculations had done.

Arunachala U. C. et. Al [11] investigated solar cooker and analyze the performance for night cooking. They uses Solar cooker which is based on CPC and this setup is examined for six days regularly. In this oil is used as working fluid and it attains the maximum temperature of 110^0C. When the sun-shine is off the temperature of oil was recorded 35^0C. The maximum efficiency is not achieved by the system due to various limiting conditions. It is found that oil temperature is able to cook rice in noon and able to warm food in evening.

Parthipan et. Al [12] gives a design for parabolic solar dish collector for water heating purpose in low cost. In this an aluminium cylinder with spherical cavity is installed at the focus of dishas receiver. There are many parameters which is responsible for the temperature of water running in the receiver. An efficiency of 45-70% is attained for solar to heat for given solar collector in open test.

Vanita Thakkar et. Al [13] investigated the Process Heating by using Thermic Fluid and analyzes the performance of solar dish. They gives a performance assessment model for process heating. By considering various factors of system the theoretical and actual efficiencies are found. And by this influencing of performance and detection of faults become easy, and also provided an idea about errors and losses which are not in considerations.

Himanshu et. Al [14] investigated a solar cooker with a storage unit which store sensible heat. They uses sensible heat storage substance (like sand, iron grits, stone pebbles and iron balls) for evening cooking with parabolic dish type cooker theoretically. In this theoretical analysis the heat input and output were calculated by the use of thermodynamic equations and various losses are measured.. This theoretical data were compared with experimental data and the error was calculated. The theoretical and experimental efficiency was found only with a difference of 9%.

Manav et. Al [15] gives a design of a helical receiver with varying pitch and fabricated this for analysis on the parabolic dish collector. In this setup the reflective surface is prepared with galvanized aluminium sheet with reflectivity of 92.5% and the outer diameter of the dish is 1.4m and built up by galvanized steel. In this the receiver is made up of copper and situated at focus. Water is used as working fluid and the main focus of research is to study the variation in temperature achieved by changing the receiver geometry. The maximum temperature is achieved with non-zero pitch on helical receiver with having black paint coating and capped was nearly 43% more than the bare tube helicalreceiver having zero pitch.

Gavisiddesha et. Al [16] developed a parabolic solar cooker and analyzed experimentally and found that the low efficiency of parabolic solar cooker is only due to losses in the reflector and the receiver. This solar cooker has variation in exergy efficiency because in exergy radiation is high and may be utilize at low temperature. Cylindrical shape aluminium or copper vessel painted with black is better for high cooking efficiency.This type of parabolic solar dish cooker is very useful in the dealing with deforestation. The use of this type of energy also decreases the pollutions the use of conventional sources of energy for different types of domestic and industrial applications.

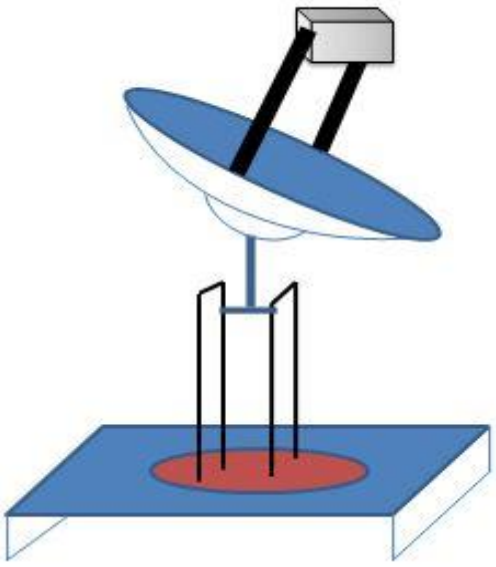

Figure:1 (Dish type solar collector with automatic dual axis tracking)

III.APPLICATIONS

Parabolic Solar APPLICATIONS Dish Collector can be used in following applications:

- In Air Heating System
- In Water Heating System
- In Desalination Process
- In Refrigeration System
- In Desiccant Regeneration
- In Industrial Process
- In Power Plants

IV.CONCLUSION

From the above literatures, it is found that some researchers increasing the performance of the parabolic dish by influencing its geometry and fabrication techniques. Some of them enhance its performance by using sun-tracking mechanism. Some of them concentrated their research on the design of the receiver. Few researchers focus on the reflecting materials and absorber coating. But from the above literature it is concluded that the parabolic dish collector having high reflecting material as reflector and also by using automatic sun tracking technology with a helical absorber coated y black paint may attain higher temperature and efficiency for the same aperture areas (Figure 1).

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