

## “EXPERIMENTAL STUDY OF DESIGN AND FABRICATION OF HEXAGONAL REFLECTOR USING FLAT PLATE SOLAR COLLECTOR”

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### ABSTRACT

The motive of this thesis is to develop and fabricate the Hexagonal reflector solar collector or heater. The collector concentrates the solar energy and converts into the concentrated radiation without using the concave or convex mirrors for heating or heat transfer into the water. The Hexagonal type solar reflector concentrates together direct radiation of the sun toward the collector. For maximizing the intensity of radiation from reflector, which can be adjusted by varying its angle relevant position of sun. The radiation comes from sun's energy was changed into heat and then heat was transferred to the water. A design is proposed and carried out the experiments. As well identify the behaviour of heating through model against of different position of sun and combination of angle. The observation has also considered that the model temperature changes and taken into the part of heat transfer.

**KEY WORDS: Solar energy, solar water heating system, flat plate collector, Hexagonal reflector.**

### 1. INTRODUCTION

Physical energy has quantitative properties that must be attributed to the goal to complete or heat the task, the energy of the object is saved; The law on energy conservation states that energy can be reconstructed, but it cannot be formed or cracked. [1]

#### SOLARENERGY-

Sun is the preliminary place of all energy on the planet earth. It is a big nuclear reactor where hydrogen gas is continuously burning at high temperature and pressure. Solar energy come into being as of the thermonuclear fusion reactions taking place in sun. The energy generated by sun into the space is established on the earth as electromagnetic radiant energy.

### SOLAR WATER HEATER COMPONENT

Any hot item in the end comes back to thermal equilibrium with its condition, because of heat loss from conduction, convection and radiation. Effectiveness (this extent of warmth vitality held for a predefined time frame) is in a straight line identified with heat loss from the collector-surface

### FLAT PLATE

flat-plate collector are an augmentation of the plan to put an authority in a 'stove'- like box with glass straightforwardly confronting the Sun. Most level plate gatherers have two even pipes at the top and base, called headers, and numerous littler vertical channels associating them, called risers.

### 2. LITERATURE REVIEW

A complete review on sun based water heater. Sun powered water warming framework demonstrates to be an effective innovation for changing over sun based vitality into warm vitality. The capability of sun situated warm change is around 73% when appeared differently in relation to sun based electrical direct change system which has a viability of barely 17%.

**D.M. Whaley et al. [2]** This paper depicts the plan, development and starting trial execution testing of a novel incorporated sunlight based warm framework model for the arrangement of room cooling and dehumidification, space warming and residential water warming. The coordinated framework plans to supplant and copy the exhibition of traditional vapor pressure cooling and residential water warmers, and is intended to work adequately in hot and sodden situations, utilizing a fluid desiccant dehumidifier and aberrant/direct evaporative cooling system.

**Zhang Lei.et.al.[3]** That paper presents the sign of China's sunlight based water warmer industry. The portion of non-pressurized compacted SWHs is about 82%. Because of its little weight safe, the warm exhibition testing for non-pressurized SWHs isn't as straightforward as the pressurized framework. The weight for the flourishing water for the testing must be lesser enough to guarantee the tried SWH can't be harmed.

**Walaa Mousa Hashima.et.al.[4]** This paper portrays execution sun based water warming for level plate authority. The arrangement of warm execution intended for measurements  $125 \times 110$  cm and width 25 cm, so that liquid can spill out of bay to outlet through pipe with longer is 15.9 m, structured as lope square design, utilized the water as liquid stream working with two distinctive stream rate (5.3 and 6.51 L/min). The trials were done under the University of Technology, states of Baghdad, Iraq.

**M.Laour.et.al.[5]** Solar collectors are utilized for residential water temperate. They are utilized to gather and change over sun oriented radiation into warmth vitality, by warming fluid water. One of the most significant parts of the sunlight based authority is the safeguard, which must have selectivity in the wavelengths of the sun oriented range. This selectivity enables it to have a limit of absorbance with at least warm radiation discharged

### 3.RESEARCH METHODOLOGY

The test was led at LNCT COLLEGE OF ENGINEERING AND TECHNOLOGY, Bhopal (Madhya Pradesh) India on march and april 2019. The gatherer was looked toward the sun and changed its situations with time or the situation of sun. Be that as it may, the framework was trying in a few times in the day and the gatherer was changed its situation with the situation of the sun in multi day.



Figure:-2 Image of Four Reflectors are working



Fig:-2 Image of arrangement of flat plat solar collector housing Hexagonal reflector.

The test was directed to think about the presentation of the sun based warm gatherer with the reflector. A sun oriented vitality authority is utilized to gather direct brilliant vitality having parallel ways and diffused brilliant vitality from sun. The most extreme groupings of sun powered vitality gatherers gather diffuse and direct sun based radiation. A reflector concentrates direct radiation onto a first or mobile gatherer and mirrors a significant bit of the diffused radiation onto the Flat plate authority position close to a focal point of reflector. The Flat plate gatherer was situated so that it gets both the immediate and diffused radiation during the day time.

### 4. RESULT AND DISCUSSION

The framework was tried in ordinarily in the day and position of an authority was change with position of the sun

in a day. As the sun powered beams consistently strikes it opposite, the sunlight based radiation misfortunes or impression of vitality from an authority surface will be augment. The authority was painted with dark shading for which radiation discharged by safeguard plate of the gatherer can't get away. Consequently, expanding its temperature. The Hexagonal sort reflector then again made of a planar mirror/sun powered mirror utilized here to accomplished the focused sunlight based warmth on to the gatherer surface. Every one of these gets most elevated sunlight based water warming on the authority surface. This warmth was consumed by water which present in the authority. The most extreme water temperature was recorded at around 4pm as show in Graph . demonstrates the hourly temperature variety in a day of 9 may 2019.The figure demonstrates the variety of authority water temperature with Hexagonal type reflector.

In above Graph demonstrates the hourly temperature variety in multi day of first April 2019. Here just four reflector mirror glass is working in the middle of 10am to 2 pm and every one of the five hexagonal reflector mirror is working in the middle of 2 pm to 4 pm which is utilized to mirror the sun radiation and concentrate to the authority. In the 10 am the surrounding temperature is 32°C and water temperature is 34°C with working of just four reflector glass mirrors was set so that two rectangular mirrors are set at point 60 degree and one triangular mirror is set at edge 75 degree. The most extreme temperature of water in the authority at 4 pm is 47.7°C with working of five reflection of hexagonal reflector and it was set so that two rectangular mirrors are set at point 45 degree and two triangular mirrors are set at edge 30 degree.

**5.CONCLUSION AND FUTURE SCOPE**

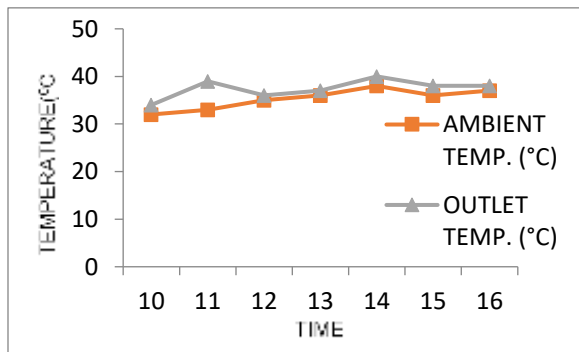
A model of a Flat plate gatherer with Hexagonal sort reflector was built and tried has been directed at LNCT Campus between 1 April 2019 to 30 June 2019. Here the Hexagonal kind reflector has been utilized for leading the all tests. It is seen that hen the surrounding temperature has 42 °C to 45 °C then the model temperature has been gotten between 70 °C to 72 °C it is acquired in the long stretch of June 2019. The warmth move rate and an authority effectiveness is emphatically relies upon sun powered radiation. In Fact, the radiation produced by the safeguard plate of the gatherer can't escape through a glass and the reflectors then again used to focus sun based warmth on an authority surface.

Although it is observed that in normal day's and at morning hours in the temperature range 30 °C to 40 °C the model temperature has been varied to 55 °C to 60 °C that will produce a warm water that may be used in the domestic purposes and commercial purposes also. That can be reducing the load on electricity also.

Design model has produced upto the 70 °C, the basic phenomena is increasing the temperature is when the ambient temperature increased or decreased with change of position of the sun with the time then the model temperature is also producing the differences. At the evening time warm water may be obtained 40 °C upto the 07:00 pm.

Sr no.	TIM E in (H)	AMBIENT TEMPERATU RE in. (°C)	OUTLET TEMPERATU RE in. (°C)
1.	10	32	34
2.	11	33	39
3.	12	35	36
4.	13	36	37
5.	14	38	40
6.	15	36	38
7.	16	37	38

Table- Data's of 1<sup>st</sup> April 2019.



Graph:-1- The variation of outlet temperature with solar time on 1<sup>st</sup> April 2019.

## FUTURE SCOPE

The present study can be extended in a following direction:

1. Design and fabrication of concave based reflector and experiments will be performed.
2. Comparison between results of flat and concave based design.
3. Experiments will be conducted in the whole year for getting the clear observation in the design experiments.
4. Roughness Size, geometry and orientation are better used for better efficiency.
5. Other material may also be used as reflector and suggested to the different demine according to the result. .
6. Solar tracking system may also be used in existing system that may also improve the Efficiency.

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