Performance Evaluation of Parabolic Dish Solar Steam Generation for Low Cost Industries - A Review

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Abstract- **Solar Energy is a renewable source of energy. Its uses do not contribute to emission of greenhouse gases and other pollutants to the environment. It is sustainable since it cannot be depleted in a time relevant to the human race. Concentrating solar power (CSP) is a unique renewable energy technology. Concentrated solar power has an ability to generate electricity, refrigeration and water purification in a single unit. This technology will be extremely helpful in improving the quality of life for many people around the world who lack the energy needed to live a healthy life. Solar parabolic dish is used for water heating and cooking application. In this paper, a comprehensive review is carried out studing the various types of collectors used for utilising solar thermal power and also their thermal performance and efficiencies. This review contains much amount of information regarding how the solar energy is captured or concentrated and utilised with the help of various types of collectors/reflectors and receivers. Conclusion has been made for which type is suitable for our application.**

Index Terms- **Focal point, Temperature, efficiency, concentrator, receiver, concentrated solar power.**

1. INTRODUCTION

With the growing population and fast pace of development, energy is becoming more expensive and our cities and towns face a major power crisis. The reality is that resources like coal, oil and natural gas will not be around forever. We all realize today, that we need alternatives sources of energy that are renewable. Renewable energy is derived from natural resources such as sunlight, wind, tides and geothermal heat. Solar energy is one of the most promising future renewable energy sources as reflector. Solar energy consists of light and heat emitted by the sun, in the form of electromagnetic radiation. Technology now a day helps to catch this radiation and turn it into usable forms of solar energy for eg. heating or electricity.

The parabolic solar steam generation is an emerging device which has a great potential in India. However parabolic solar steam generation technology has to compete with prevalent steam generation devices in the country. The parabolic solar steam generation rest on the principle of the concentration of the rays. It is well known that parallel beam of rays of sun is reflected on the parabolic mirror and the ray of sun is reflected on the parabolic mirror and the rays converge at the same point, the hearth of the parabola. While running up against the dark plate placed at this point, the rays released their energy in the form of heat. Determination of the exact receiver size and the arrangement to provide insulation at the receiver are of prime importance to avoid thermal losses from the absorber to the environment. One or more transparent cover is employed to reduce the convective and radiative heat losses from the absorber to the environment.

Heat losses from a parabolic concentrator steam generator depend on the water tank temperature, the surface area of the absorber, the wind speed, and the orientation of reflectors. The heat losses are classified as optical losses and thermal losses. Optical losses are those which occur in path of the incident solar before it is absorbed at the surface of the absorber. While thermal losses are due to convection and radiation from the absorber. The thermal and optical performance of the parabolic concentrator was evaluated by carrying out thermal tests by generating steam adjusting flow rate of water at different day timing.

In an attempt to find alternate sources of fuel, solar energy utilization is a big milestone as it is available

for free everywhere and it cost nothing. The only things we need to do are to collects it in efficient way and convert in to required form. Solar steam generator is one which collects the light and concentrate at small area so all thermal energy is utilized uniformly over blackened copper plate and pipe spiraled over plate which is specially designed for it. The advantages of using solar stream generator are, it emits no harmful gasses, nor reason for global warming, clean energy, less maintenance, renewable source of energy, cost less operation. Mainly it is freely available and inexhaustible energy source. When a three dimensional parabola is aimed at sun, all the lights that fall upon its mirrored surface is reflected to appoint known as focus. If a copper plate with spiral pipe attached both black colored is placed at its focus it will absorb the light's energy and become very hot. A satellite dish is an example of a parabolic that can be made into a steam generator. Parabolic steam generator heats up quickly and are used for positive steam generation, vacuum steam, steam for cleaning, for moisturization in paper industries, pellets mill, humidification of air in confined space. They can also be used for power sterling engines, crack water to produce H_2 and even plasma matter. It is easy to see in today's world that this shape is successful in its use. The parabolic shape can be seen in satellite dishes, radio towers, solar cooker and yes, even in steam generators around the world. It is simple to say it works, and as just as simple to understand how it works.

ENERGY CRISES

When talking about the energy crises, we should talk about the electrical energy and the other sources of energy which are responsible for the production of energy like, hydraulic, petroleum and natural gas, coal, etc., but for but for getting over this we need to use renewable energy and non-convention source of energy. An energy crises is one of the great bottleneck (or increase cost) in the supply of energy resources to an economy. In popular literature though, it often refers to one of the energy sources used at a certain time and place, particularly those that supply national electricity grids or serve as fuel for vehicles. Because of industrial development and population growth their has been an enormous increase in demand for energy world wide. Supply of energy is, therefore, far less than actual demand.

Recent energy crises

South African electrical crisis. The South African crises led to large price rises for platinum in February 2008 and reduced gold production. At the end of 2005 and also in early 2008 severe energy shortages has been experience by china. During the latter crisis they suffered severe damage to power networks along with diesel and coal shortages. Supplies of electricity in Guangdong province, the manufacturing hub of china, are predicted to fall short by an estimated 10 GW of shortage of electricity supplies has been predicted in manufacturing hub of china, the Guangdong province. In 2011 China was forecast to have a second quarter electrical power deficit of 44.85 – 49.85 GW. It has also been predicted by economist that 2009 afterword's the United Kingdom will suffer an energy crisis due to the commitments for reducing coal-fired power stations, unwillingness of politicians to set up nuclear power stations to replace those that will be de-commissioned and unreliable sources and sources that are running out of oil and gas. like South Africa it has also predicted that UK will suffer regular blackouts. The July 2012 India blackout was the largest power outage in history, occurring as two separate events on 30 and 31 July 2012. Over 620 million people has been affected, the world population of about 9%,around half population of India, Northern, Eastern, and Northeast states of India spread over 22 states.

NEED OF SOLAR ENERGY

Solar energy, radiant light and heat from the sun, has been harnessed by humans since ancient times using a range of ever-evolving technologies. solar energy problem world now facing was solar heating , solar photovoltaic, solar thermal electricity, solar architecture and artificial. Solar technologies are broadly characterized as either passive solar or active solar depending on the way they capture, convert and distribute solar energy. Active solar techniques now a days uses photovoltaic panels and solar thermal collectors for harnessing energy. Passive solar techniques include orienting a building to the sun, selecting materials with favorable thermal mass or light dispersing properties, and designing spaces that naturally circulate air. In 2011, it is said by international agency that "the development of affordable, inexhaustible and clean solar energy technologies will have huge term benefits". It will

increase country energy security through reliance on an indigenous, inexhaustible and mostly import-independent resource, enhance sustainability, reduce pollution, and lower the cost of mitigating climate change, keep fossil fuel price lower than otherwise. These things lead us to the idea of solar operated refrigerator, solar steam generator, and solar cooker and further took the form of a good and useful product for human being.

ADVANTAGES OF LOW PRESSURE SOLAR STEAM GENERATION

Using a free source. Sunshine is free and always will be free. By using a solar steam generating, you are saving fuel as well. Clean energy. Less maintenance. Renewable source of energy. Cost less generation. Not contribute to global warming.

APPLICATION OF SOLAR STEAM GENERATOR

First of all you may have realized that the energy from the sun is free. It uses none of our limited natural resources that are currently being used for other energy application in our modern world. One of the most important reasons for using solar steam generation: It is giving people around a world a hand up. It is a vital instrument for a more comfortable, better way of life by giving them feasible way of alternative to a costly Of Course, Solar steam generation is just a one choice in a multi-faceted field of alternative and options that comprise a solar energy domain. Below are some of the applications of low pressure steam generation-Steam for Heating –

Positive Pressure Steam-Steam is typically generated and distributed at a positive pressure that means it is supplied to equipment at pressures and temperatures above 0 MPaG (0 psig)and higher than 100°C (212°F) respectively. Positive pressure steam can be used in food processing factories, refineries, and chemical plants to name a few. Saturated steam can be used for heating process fluid heat exchangers, reboilers, reactors, combustion air preheaters, and many of heat transfer equipment.

Vacuum Steam-The use of steam for heating at temperatures below 100°C (212°F), traditionally the temperature range in which hot water is used, has grown rapidly in recent years. In the same manner as positive pressure saturated steam when vacuum saturated steam is used, by adjusting the pressure the temperature of the steam can be quickly changed, such that precise temperature control of steam can be acheieved. However, it is required to use vaccum pump with the equipment, as only reducing the pressure will not drop the pressure below atmospheric pressure.

Steam for Moisturization –

Steam is sometimes used to add moisture to a process while at the same time supplying heat. For example, steam can also be used in the paper industry, so that paper moving over rolls at high speed gets soften and does not suffer tears or microscopic breaks. Another example is pellet mills. Often mills that produce animal feed in pellet form use direct-injected steam to both heat and provide additional water content to the feed material in the conditioner section of the mill.

Pellet Mill Conditioner-

Due to moisturization the feed gets softens and firmer pellets can be obtain as the starch content of the ingredients gets partially gelatinized.

Steam for Humidification –

Many large commercial and industrial facilities, especially in colder climates, use low pressure saturated steam as the predominant heat source for indoor seasonal heating. HVAC coils, most commonly used with steam humidifiers, can be used for conditioning the air for indoor comfort, preservation of books and infection control, and records. When the cold air is heated by the steam coils, the relative humidity of the air drops, which must be taken to normal levels and downstream is injected with the proper amount of dry saturated steam.

AIMS AND OBJECTIVES –

Now a day's non renewable energy sources are depleting day by day and there is need to focus more attention on renewable energy sources such as sun, tide, wind etc. the aim is to design and fabricate Parabolic Dish Solar Steam Generator which operates on Solar energy. It should utilize renewable energy from sun during day and hot season. This parabolic Dish Solar Steam Generator should also be portable to operate in moving vehicle. The following are the

aims and objective of this project. The average cost of solar steam generator decreases day by day on the contrary their power output and efficiency considerably increases. According to the global renewable energy scenario, proportion of the solar thermal applications will be about 480 million tons oil equivalent by 2040. Nowadays, solar steam generator are also available to use in the areas with limited solar radiation depending on the developments in solar power concentrating systems and material technology. In addition, the most challenging point of solar steam generator, unavailable to use when sun goes away, is overcome with thermal energy storage techniques. Briefly, it is anticipated that solar steam generated technology will be demanded by a huge group of people in the near future because of its outstanding features. To achieve energy security. To reduce carbon emission. To encourage indigenous solar manufacturing facilities in the state. To promote R & D in the solar energy sector and hybrid systems. To create skilled man power and employment in a new industry.

2 . TYPES OF CONCENTRATORS

There are varieties of geometry developed for the solar concentrator depending on the application addressed. The simplest one like SK14 which is intended for household cooking to the solar tower employed for MW level power generation plant have been demonstrated the capability of the solar concentrating technology. Adhering to the scope of the present article, the types of the solar concentrator that can be used for low pressure steam generation are listed in the Table 1.1 Each of the type can be employed in the process of solar concentrator system best suited for requirement of the application. Parabolic Concentrator, Hyperboloid concentrator, Fresnel lens concentrator, Compound parabolic concentrator, quantum dot concentrator are some of the types of the concentrators that can be used for the steam generation application.

Table 1: Types of solar concentrator, their advantages and disadvantages

Type of Concentrator	Advantages	Disadvantages
Parabolic Concentrator	High concentration	Requires larger field of view.
		Need a good tracking system.
Hyperboloid Concentrator	Compact	Need to introduce lens at the entrance aperture to work effectively.
Fresnel Concentrator lens	Able to separate the direct and diffuse light - suitable to control the illumination and temperature of a building interior.	Imperfection on the edges of the facets, causing the rays improperly focused at the receiver.
	Requires less material than conventional lens.	
	Thinner than conventional lens.	
Compound parabolic concentrator	Higher gain when its field of view is narrow.	Need a good tracking system.
Quantum Dot Concentrator	No tracking needed.	Restricted in terms of Development due to the requirements on the luminescent dyes.
	Fully utilize both direct and diffuse solar radiation	

3. LITERATURE REVIEW

Nazir (2004) reported the experimental study of the performance of a parabolic cylindrical trough solar air heater. In this experimental work solar air heater was a double-flat-plate collector type, constructed with galvanized square pipes and assembled into a parabolic cylindrical trough solar collector, capable of generating heat after being reflected and concentrated on the absorber. A centrifugal fan was used to provide air circulation through the solar collector. The solar air heater was fixed doubled flat-plate parabolic cylindrical trough collector type with tilt angle of 20° designed with locally available materials to produce hot air up to 120°C for domestic, industrial heating and drying processes. The experimental test conducted on the solar air heater produced an optimum performance of 65% overall thermal efficiency and attained 97°C maximum temperature.

Sarangi et al (2009) presented to bring forward the concept of concentrated solar power (CSP), its relevance and importance in today's context, the various solar field technologies being practiced and solar projects being established worldwide. The paper also examined its economics, government's intervention to promote CSP for the present and future developments of technology. It also scans the

Indian environment for identifying the potential and future CSP in India.

Liu Qi Bin et al (2010) experiment platform of a parabolic trough solar collector system (PTCS) was developed for thermal power generation, and the performance of the PTCS was experimentally investigated with synthetic oil as the circulate heat transfer fluid (HTF). The solar collector's efficiency with the variation of the solar flux and the flow rate of the HTF was identified. The collector efficiency of the PTCS can be in the range of 40%–60%. The heat loss effect on collector efficiency was also analyzed, which was about 220 W/m for the receiver with a 180°C temperature difference between the collector temperature and the ambient temperature, amounting to about 10% of the total solar energy incident, on the collector and provided fundamental data for developing the parabolic trough solar thermal power plant.

Kaushika (1992) in his development basic geometrical optics equations for multifaceted paraboloidal dish solar collectors, presented in the helpful form for engineering design. Trade-off strategies are discussed to establish a balance between many constraining factors related to system cost, survival, reliability and lifetime properties. Performance data for experimental dish collectors of 5 m diameter, involving undemanding accuracy of optical profile and short focal length (1.8 m), are recorded. In their situation modified cavity and the semi cavity receivers tend to have a higher efficiency than cavity designs and current research and application trends of dish collector systems are studied.

Joshua Folaranmi (2009) reported the design construction and testing of a parabolic dish solar steam generator. Using concentrating collector, heat from the sun is concentrated on a black absorber located at the focus point of the reflector in which water is heated to a very high temperature to form steam. It also describes the sun tracking system unit by manual tilting of the lever at the base of the parabolic dish to capture solar energy. Setup arrangement is mounted on a hinged frame supported with a slotted lever for tilting the parabolic dish reflector to different angles so that the sun is always directed to the collector at different period of the day. On an average during sunny and cloud free days, the test results gave high temperature above 200°C and the record 29th January 2009 results are presented in the Table 2.1

Table 2.1 Results on 29th January 2009

TIME	AMDIENT TEMPERATURE	FOCAL TEMPERATURE
9 am	30	98
10 am	30	102
11 am	30	132
12 am	31	178
1 pm	31	210
2 pm	31	196
3 pm	32	180
4 pm	31	141
5 pm	30	102

Ajay Chandak et al (2011), studied that the application of solar energy in food processing industry mainly focused for drying operations, solar vegetable-fruit dryers, operating below 55°C, they have used for the purpose. they studied the different solar concentrators for the various application such as excellent boiling, steaming, bleaching and roasting capabilities while solar air dryers/heaters, found that all are effectively removing moisture. Suggested that efforts to integrate knowledge of food processing with capabilities of available solar thermal gadgets. They have done field trials on a variety of solar gadgets like 'Parabolic Concentrators', box ovens and solar dehydrators they found that, it is not only used for huge fuel savings but also great value addition because of better quality produce in terms of color, aroma and taste and concluded that it was extremely low capital investment in this technology and makes it financially viable.

Riyad Abu-Malouh , Salah Abdallah , Iyad M. Muslih (2011) In their work, the effect of two axes tracking on a solar cooking system was studied. A dish was built to concentrate solar radiation on a pan that is fixed at the focus of the dish. The dish tracks the sun using a two axes sun tracking system. This system was built and tested. Experimental results obtained show that the temperature inside the pan reached more than 93°C in a day where the maximum ambient temperature was 32 °C. This temperature is suitable for cooking purposes and this was achieved by using the two axes sun tracking system. This temperature is sufficient and safe for cooking purposes especially for sites that are far from any city.

Pandey et al (2012) devised a method of comparative study of solar cooker by paraboloid type and box type. The method of manual tracking of the sun in the north-south direction with manual tracking in the east-west direction was done. Found that 4.9% and 7.1% mean energy efficiency for one liter of water boiling and subsequently 7.9% and 10.1% in two liter of water boiling. Thermal conversion efficiency was obtained by 29.5%. The PDC is fixed at solar noon time. The inside surface of the PDC was covered with aluminum foil, which serves as the reflecting surface. Inlet temperature of water is taken at 36°C, it observed that the outlet temperature was 90°C.

Ibrahim ladan mohammed (2012) developed application on domestic hot water application (bathing, washing, cleaning and cooking) 10 liters of water. This paper explains the method of automatic tracking using electronic control circuit, linear actuator (super jack) of the sun in the northsouth direction and the east-west direction and thermal conversion efficiency was obtained 52% - 56%. PDC was designed to have open mouth diameter 1.67 m, depth 301 mm and focus 0.579 m. The PDC is fixed at solar noon time. Absorber diameter was 0.234 m. The inside surface of the PDC was covered with glass mirror 2mm thick and reflectivity 0.95, which serves as the reflecting surface. Water at 25°C and the mass flow rate of 9 kg/hr was passed through the tube. It was observed that the outlet temperature was 100°C for the average beam solar radiation of 716.6 W/m2. The PDC concentration ratio was obtained as 10.

Eswaramoorthy et al (2013) in their work on experimental study on solar parabolic dish thermoelectric generator, studied applications of solar dish and thermoelectric generator of research potential of green and clean energy generation from solar thermal route were analyzed. In their work, an attempted has been made to conduct an experimental study on small scale solar parabolic dish thermoelectric generator. The solar parabolic dish collector was fabricated using an unused satellite dish antenna fitted with polished aluminum sheet as concentrator surface. The concentrated solar radiation and water cooled heat sink is the driving potential to generate electricity, various operating parameters like receiver plate temperature, power output and conversion efficiency with respect to solar radiation were studied. They found that the receiver plate temperature is significantly affecting the power output. Also, in their studies it is identified to reuse the unused dish antenna for solar collector and coupled with commercial thermoelectric module is simple fabrication method easy to adopt in the rural techno craft for small scale power generator to meet the isolated energy demands.

K.S. Reddy , G. Veershetty (2013)The solar parabolic dish collector is one of the most efficient energy conversion technologies among the concentrating solar power (CSP) systems. The design and implementation of solar parabolic dish power plants will result in sustainable energy generation. In this article, techno-economic feasibility analysis of a 5MWe solar parabolic dish collector field is carried out for entire India covering 58 locations. The solar parabolic dish power plant configuration is investigated based on various parameters such as the spacing between dish collectors, land area required, percentage of the shadow and energy yield. The shadow profile around the dish throughout the year at various latitudes (8–35N) for various plant-operating hours is determined. In-line arrangement of the solar dish collector arrays is found to be a better choice in terms of the minimum land area required for setting up the power plant. The generalized correlations are developed for both east–west and north–south spacing distances as the function of latitude and plant operating hours. It is found that the configuration corresponding to the plant operating from 1 h after sunrise to 1 h before sunset with spacing distance in east–west direction equal to the shadow length after 2 h sunrise and in north–south direction equal to shadow length at noon for winter solstice gives the highest energy output with optimum land use. The minimum and maximum average annual power generation at Panaji and Tiruchirapalli are 7.25 GW h, and 12.68 GWh respectively. The minimum levelised electricity cost (LEC) for a stand-alone solar parabolic dish power plant with the clean development mechanism (CDM) is found to be INR 9.83 ($ 0.197, 1$ = INR 50) at Indore with payback period of 10.63 years with cost benefit ratio of 1.48. Based on the financial performance, most of the northern region locations and some of the western and southern region locations are found attractive for power generation by the solar parabolic dish power collector based on the direct steam generation, where direct normal irradiation (DNI) is more than 5 kWh/m2 day.

Ayush Khare, Sachin Saxena, C H Tyagi and Sanjeev Kumar(2014), Solar Energy is a renewable source of energy. Its uses do not contribute to emission of greenhouse gases and other pollutants to the environment. It is sustainable since it cannot be depleted in a time relevant to the human race. In this paper, the potential for a solar thermal system for hot water generation has been studied. A parabolic trough concentrator is made of an aluminum sheet which is covered by a cloth on which rectangular mirror strips (1.20mx0.05m) are pasted. Two different absorber tubes were taken and the efficiencies of the PTSC
where compared without glass cover on the absorber tubes. They were designed with principal focus at 0.3m so that the receiver heat loss was minimized the microstructure and a low amount of defects.

A. Jamar, Z.A.A. Majid, W.H. Azmi, M. Norhafana , A.A. Razak(2016), Solar energy is one of thewidely used renewable energy that can be harnessed either by directly deriving energy from sunlight or indirectly. Solar water heating system, on the other hand, is one of the applications of solar energy that has drawn great attention among researchers in this field. Solar collectors, storage tanks and heat transfer fluids are the three core components in solar water heater applications, which are reviewed in this paper. This paper discusses the latest developments and advancement of a solar water heater based on the three basic components thatmay affect the thermal performance of the system. It also reviews the development of various types of solar collectors in solar water heater, including both the non-concentrating collectors (flat plate collector, evacuated tube collector) and the concentrating collectors (parabolic dish reflector, parabolic trough collector). All these are studied in terms of optical optimization, heat loss reduction, heat recuperation enhancement and different sun tracking mechanisms. Among the non-concentrating and concentrating collectors, the parabolic dish reflector collectors show the best overall performance. The use of nanofluids as a heat transfer fluid was also discovered in this paper.

K. Srithar, T. Rajaseenivasan, N. Karthik, M. Periyannan , M. Gowtham, A stand-alone triple basin solar desalination system is experimentally tested and the results are discussed in this paper. This system mainly consists of a triple basin glass solar still (TBSS), cover cooling (CC) arrangement, parabolic dish concentrator (PDC) and photovoltaic (PV) panel. Four triangular hollow fins are attached at the bottom of the upper and middle basin in order to increase the heat transfer rate and place the energy storing materials. The performance of the system is studied by, conventional TBSS system, integrating the TBSS with CC, TBSS with PDC, and TBSS with CC and PDC. Also, each configuration is tested further by using fins without energy storing material, fins filled with river sand, and fins filled with charcoal. The results of the test reveal that, TBSS with charcoal and TBSS with river sand enhance the distillate by 34.2 and 25.6% higher than conventional TBSS distillates. TBSS with cover cooling reduces the glass temperature to about 8 C compared to the conventional TBSS. The presence of concentrator increases the lower basin water temperature upto 85 C. The maximum distillate yield of 16.94 kg/m2.day is obtained for TBSS with concentrator, cover cooling and charcoal in fins.

Mr. S. D. Kulal, Prof. S. R. Patil (2016) in their work on experimental and performance analysis of parabolic solar dish collector carried out with use stainless steel, silver foil and aluminium sheet as reflecting Materials. In this work a Parabolic Dish Solar Collector system is fabricated for hot water production. Water is used as a working fluid and is recirculates from the storage tank to the absorber tank with the help of a pump. The main aim in the work is to increase the temperature of water in the storage tank to a maximum value. An analysis is mainly concentrated on the reflector material. The values of useful heat gain, overall thermal efficiency, instantaneous efficiency and hourly thermal efficiency are calculated and their variation with time and solar intensity are represented graphically. To begin with stainless steel sheet is used as reflector and performance is compared with using aluminium sheet and silver foil as reflector. Solar intensity is measured by solar power meter which is calibrated with pyrometer. Here we studied the useful heat gain, Instantaneous efficiency, hourly efficiency and overall efficiency (shown in graph) of all above three different reflecting materials. The overall thermal efficiency when silver foil is used as reflector is 26.89% which is highest amongst all the three cases.

$$\eta_{silver\ foil} > \eta_{aluminium} > \eta_{stainless\ Steel}$$

Mr. Shubham Shinde, Mr. Rahul Shinde, Mr. Ashish Patil, Mr. Chirag Desale(2017) in their work on Steam Generation by Using Solar Dish Collector four parabolic dish mounted on a stand kept helical coil at focal point of all four dishes. The performance of the concentrator is experimentally investigated with water circulated as heat transfer fluid. The system is fabricated with highly reflective aluminium foil sheet. The concentrated heat is absorbed by a copper tube which is made of coil in curved shape and the experimental results are taken on summer and cloud free days .the dish is equipped with tracking system and measurement of temperature is done. The experimentally calculated maximum temperature of receiver is 1300c which is actually equal to double of point focusing cavity receiver. Heat loss from the coil receiver will decrease 20-30% compared to cavity receiver. Tracking system will increase the efficiency upto 30 to 40%. The system is more efficient for helical coil which is black coated.

4. DISCUSSION

By studying this we can conclude that parabolic solar collector can be used for low pressure solar steam generation at small application. The parabola can be used as the curve for Solar Steam Generator because of its ability to reflect incoming light with an incoming angle of 90 degrees to a single focus point. However, because of this very specific property, the Parabolic Solar Steam Generator must constantly be realigned with the orbit of the sun for maximum effectiveness. Solar Steam Generator concentrate light to a larger surface, so it is slightly more tolerant for marginal errors of alignment.When the focal height is fourth of the diameter, or level with the boundaries of the concentrator, we found that the solar concentrator always has the largest tolerance for error. The percentage of light reflected to the target is at 100% for a small range of angles, and promptly completely misses the target at angles outside this range. mirrors / reflectors are employed In Parabolic dish type solar steam generator to concentrate the total solar energy incident on the collector surface, so the collector surface is usually very large and the higher temperature can be achieved. There are no losses in fully steerable dish system so Parabolic Solar Steam Generator has the highest efficiency in terms of utilization of reflector area. Also the radiation losses are small due to small area of absorber at the focus. Additional advantage includes short heat-up times. In the present work a Parabolic Solar Steam Generator was designed and constructed. The parabolic solar steam generator rest on the principle of the concentration of the rays. It is well known that the parallel beam of ray of the sun is reflected on the parabolic mirror and the rays converge at the same point, the hearth of the parabola. While running up against the dark copper plate placed at this point, the rays are released their energy in the form of heat. It is obvious that when the parabola is larger, the steam generator will be powerful.

4. CONCLUSIONS

By studying this we can conclude that parabolic solar collector can be used for low pressure solar steam generation at small application. So, we can use the low pressure steam generator for application in small industries for eg. Paper industry , cotton industry, pellet mill and can also be used for instant hot water application .

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