IJNRD.ORG ISSN : 2456-4184
INTERNATIONAL JOURNAL OF NOVEL RESEARCH AND DEVELOPMENT (IJNRD) | IJNRD.ORG
An International Open Access, Peer-reviewed, Refereed Journal

DESIGN AND FABRICATION OF SOLAR COOKER

Dr.N.Gayathri[1], S.P.Barath[2], D.Arun[3], MD Fyazuddin[4]

[1,2,3,4]*Department of Mechanical Engineering, VelTech HighTech Dr.Rangarajan Dr.Sakunthala Engineering College ,Chennai ,Tamilnadu.*

ABSTRACT

Energy demand gets increasing owing to increase in population and industrialization. To meet out this hiked energy demand, the recent technologies has been developed using renewable energy sources, such as solar energy. A solar cooker is one of the main applications of renewable solar energy, which can be used to boil water and to cook food at high temperature in the specified time limit. This work aimed to design, fabricate and analyze the performance of parabolic solar cooker. Also it is focused to compare the performance with charcoal, firewood, kerosene and electricity with reference to cooking time period and energy cost. The parabolic solar cooker is being constructed with old satellite dish, steel frame, solar panel and aluminum foil. The specifications such as aperture diameter, depth of the parabola, focal length, surface area have been designed and calculated based on our requirements and standards. This solar cooker can trail the sun light from north to south and east to west. The outcome of the solar cooker is being evaluated by calculating the efficiency, average upcoming solar radiation and power. The efficiency of this parabolic solar cooker is evaluated as 11.25% and the power output of this cooker is being calculated ads 0.33 kW/hr. It is also observed that the newly designed and fabricated parabolic solar cooker has showed relatively better performance with other energy sources in terms of cooking energy cost. Accordingly, this type of parabolic solar cookers can be enormously utilized in the developing countries.

Key words: Energy Cost, Focal Length, Renewable Energy, Solar Cooker, Utilization efficiency.

1.1 INTRODUCTION

Solar cooker works on solar energy. As the name suggest it uses solar power to meet its energy requirements. Solar cooker is a device which is used to direct sunlight to cook the

food and it can be used for heating the water and pasteurization of water. Nowadays, 90% percentage from all over India used LPG to cook the food. In olden days, according to Indian government survey the rural holds 45% uses fire woods and sticks for cooking in urban areas 86% uses LPG (Liquefied Petroleum Gas) for cooking.

One of the important advantages in this solar cooker is there is no harmful gas and it is environmental friendly and another important of solar energy is freely available and inexhaustible energy source. Solar energy has been used for different purposes for cooking or drinking safe water without causing any pollutant particles. It doesn't create any pollution and it is easily to handle and safer. To control the deforestation solar cooker has been used and thus control deforestation. In village firewood has been used and thus cause air pollution and this contributes climate change. Solar cooker works in summer season because the sunlight is more power and thus passes sunlight. There are so many benefits and it leads to normal and active life. The solar power is highest in the between 11:30 am to 3:00 pm, hence it is note easier to use solar Panels to generate electricity. On the other hand solar energy can be used for cooking in the afternoon. Solar cookers are simple, cheap and good efficiency.

2.1 OBJECTIVES

- To design a solar cooker which is safer, reliable and generally used for cooking or heating water in indoor and outdoor locations?
- The reduction in use of traditional stove increases fuel security in regions where fuel is scarce and reduces the exposure to smoke, which can lead to chronic respiratory disease.

3.1 SCOPE

- It is alternative way of cooking to prevent pollution
- It is easier to cook for lower income people
- 100%solar powered
- To control deforestation and using of fossil fuel
- Low cost
- It can be used as a substitute for electricity and LPG based cooking

4.1 DESIGN OF PARABOLIC DISH:

4.1.1 Calculation of Focal Length of the Parabola:

Width of a parabola = 30 centimeters

Depth of the parabola = 15 centimeters

Focal Length of the parabola,

$$f = \frac{x^2}{4a} = \frac{15^2}{4*15} = \frac{225}{60} = \mathbf{3.75\ cm}$$

4.1.2 Density of the Material:

Mass of the Aluminium Parabolic Dish, M = 14.2 kg = 14200 g

Diameter of the Parabolic Dish = 30 cm

Thickness of the Parabolic Dish = 0.2 cm

Length along Axis, a = 15 cm

Radius from Axis, b = 15 cm

Volume of the Parabolic Dish,

$$\mathbf{V = \frac{1}{2}\pi b^2 a} = \frac{1}{2} * \frac{22}{7} * 15 * 15 * 15 = \mathbf{5301.44\ cm^3}$$

Density of the Parabolic Dish,

$$\rho = \frac{M}{V} = \frac{14200}{5301.44} = \mathbf{2.67\ g/cm^3}$$

4.1.3 Cooking Time at Various Time of the Day:

Table 4.1 Cooking Time at Various Time of the Day

S.NO	SIZE (CM)	TIME OF DAY	TIME TAKEN FOR COOKING
1.	5CM	10 AM	2 HOURS
		1 PM	1.5 HOURS
		3PM	1 HOURS 45 MIN
2.	10CM	10AM	1.5HOURS
		1PM	1 HOURS
		3PM	2 HOURS
3.	15CM	10AM	1 HOURS
		1PM	55 MINUTES
		3PM	45 MINUTES
4.	20CM	10PM	55 MINUTES
		1 PM	40 MINUTES
		3PM	45 MINUTES

5.1 FOCAL LENGTH AND 2D VIEW OF THE PARABOLA

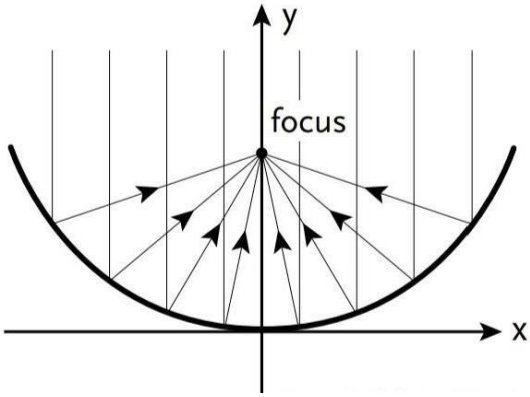

Fig 5.1 Focal Length of the Parabola

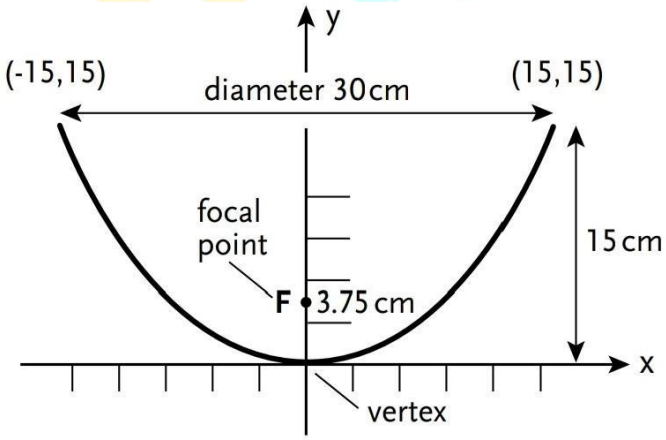

Fig 5.2 2D View of the Parabola with Dimensions

6.1 RESULTS AND CONCLUSION

This work has discussed the importance of using solar energy, how to use in solar cookers etc., We have learnt from this is to use the solar energy in anywhere and a it is also used in various applications like cooking etc., This is one of the method to reduce the usage of fossil fuels, deforestation etc., the main advantage is to control the green house gases.

A reduction in greenhouse gas will reduce pollution and will save our life. The period of solar energy in India is 10.00am to 2.00 pm. Day by day the cost of electricity and the cost of fossil fuel are increased due to the limitation.

During the peak level of solar energy it contributes to cook easily within the time.

In summary the importance of solar energy to generate heat from the sun through the use of aluminium foil sheet. The cost of solar energy is lesser than that of LPG. It helps in cooking, heating and pasteurization of milks in indoor and outdoor locations. The sun rays doesn't help to cook but it converting sun rays into the heat and helps to cook or heating .

Solar energy is defines as the conversion of renewable energy from sunlight into electricity either directly using Photo Voltaic (PV) using concentrated solar power or a combination. The advantage of solar energy is low maintenance costs and it is get freely from the sun from 7.00am to 6.00pm. Solar energy is technology development and it improves well in future. A solar cooker has no fuel this saves costs as well as environmental damage caused by fuel use. Since 2 billion peoples are cooked using biomass fuels. There is economically development in solar cookers. To overcome these defects solar cooker has been used.

REFERNCE

[1]. C Z M kimambo "Development and performance testing of solar cookers", Journal of solar energy in southern Africa, vol.8 pp.41-51, 2007.

[2]. Prof.viral k pandya et al, "Assessment of thermal confidence of box type solar cookers under Gujarat climate conditions in midsummer", vol.1 issue 4, pp.1313-1316, 2011.

[3]. S.Mahavar et al., "Design development and performance studies of a novel single family solar cooker", renewable energy, vol.47, pp. 67-76, 2012.

[4]. Pia piroscheka otte, "Warming Up to Solar Cooking – A Comparative Study on Motivations and the Adoption of Institutional Solar Cookers in Developing Countries", Elsevier, Energy Procedia, Vol 57, pp. 1632-1641, 2014.

[5]. Elamino.M.Akoy, AbdallaI Ahmed, "Design, construction and performance evaluation of solar cookers", Journal of Agricultural Science and Engineering, Vol. 1, No. 2, pp.75-82, 2015.

[6]. Chinnumol Francis, Vicotor Jose, "A review on performance improvements in box type solar cookers", International Journal of Current Engineering and Scientific Research (IJCESR), ISSN (Print): 2393-8374, (Online): 2394-0697, Vol-2, Issue-7, 2015.

[7]. Piyushkumar M. Mistri, Kedar A. Pathak, "A scientific pore over solar cooking systems", International Journal of Recent Technology and Engineering (IJRTE), ISSN: 2277-3878 (Online), Vol-8, Issue-6, 2020.