

# “Increase Efficiency of Solar Cooking By Using Different Materials”

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## **ABSTRACT**

*Energy storage has been a long-standing issue for solar cookings due to their inability to cook at night. The Solar Cook Stove is a solar cooking that seeks to address this issue in developing regions of India by using Latent Heat Material(LHM). Since present cooking methods, such as biomass, in these regions are inefficient and raise health concerns, the Solar Cook Stove aims to provide an easy, relatively inexpensive and sustainable of cooking. The Solar Cook Stove consists of two major components a cooking unit and a solar reflector. The cooking unit contains the Latent Heat Material(LHM) that can store as well as transfer energy to the cooking surface. The reflector is a parabolic mirror that helps focus the sunlight onto the cooking unit and track the solar ray according to its movement. The Solar Cook Stove has been designed to be sustainable as well as useful for cooking after sunset.*

**Keyword:-Efficiency,Solar Energy,Reducing Cost.**

## **INTRODUCTION**

Different types of solar cooking namely; box-type, panel-type and parabolic solar cooking were designed and constructed using locally available materials. Cooking with the sun has become a potentially viable substitute for fuel-wood in food preparation in much of the developing world. Energy requirements for cooking account for 36% of total primary energy consumption in India.

The rural and urban population, depend mainly, on non-commercial fuels to meet their energy needs. Solar cooking is one possible solution. Therefore here is the classification of the different types of solar cookings and all the major components are to be discussed in briefly. There is also a study about the different types of LHMs materials and their properties.

## **AIMS AND OBJECTIVE**

1. To gain the maximum efficiency than previous invention.
2. To avoid limitations of cooking at night.
3. To reduce the use of fossil fuels.

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## PARABOLIC DISH CONCENTRATION TYPE SOLAR COOKING

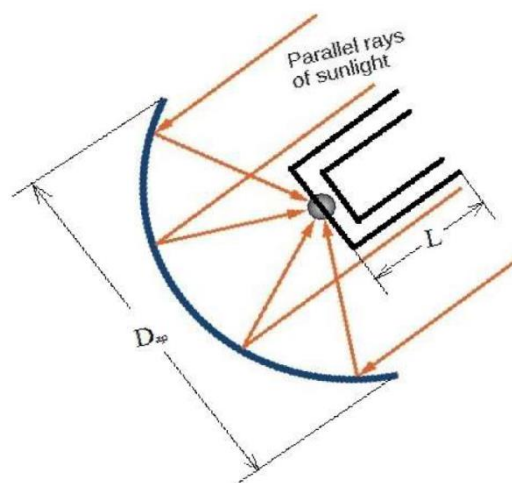
Parabolic Dish concentrator type solar cooking consist of parabolic reflecting surface. The cooking vessel is placed at the focus of the parabolic surface and heated. This cooking is referred to as a parabolic dish solar cooking. Temperature well above 200°C, maximum 450°C is obtained in it and it can be use for cooking food items requiring roasting, frying to or boiling. It saves fuel up to 10 LPG cylinders per year for family having 10-15 persons. Cooking time approximately 20-30 minutes approx. cost 6000 to 7000/- Rs. (Manual Tracking) Parabolic dish is made of single unit by pressing a sheet on a die because it is quite difficult to made with paraboloidal curves is thus directly.

### EXPERIMENT SETUP-

The experiment going to perform or investigate the thermal performance of solar cooking with phase change thermal storage unit. The test section of solar cooking is based on parabolic dish collector. This system consists of parabolic dish collector, solar cooking, and insulator box as shown in figure and thermocouple and temperature indicator as measuring device. The Latent Heat Materialand it is filled in between the annular space of inner and outer wall of solar cooking. The experimental setup consists of following component:

### PARABOLIC DISH COLLECTOR-

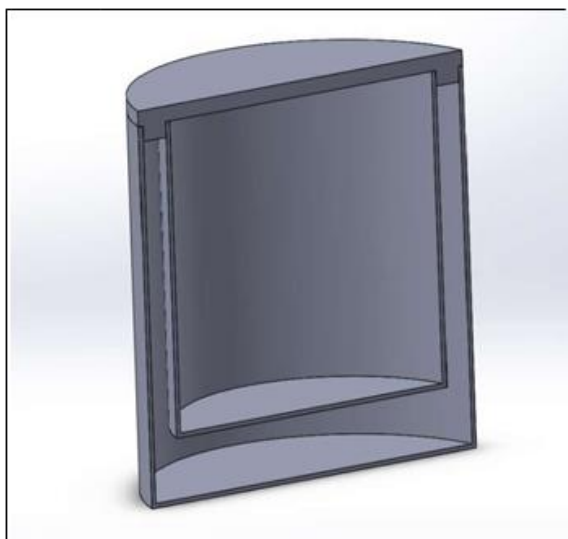
A parabolic dish type collector is receiving the direct solar radiation from the sun and reflects to the receiver or cooking. A material used for collector is Mild steel on which the solar reflective films rectangular segments are stacked. It will move due to tracking mechanism at Supportive arms.



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## SOLAR COOKING CONTAINER

Solar cooking is a device which heat up or cook the food inside it by the focal point concentrate at the bottom of cooking by means of conversion of solar energy to heat energy. The material for the cooking is Mild Steel black surface painted. Heat storage material filled in space between the annular space of two walls.



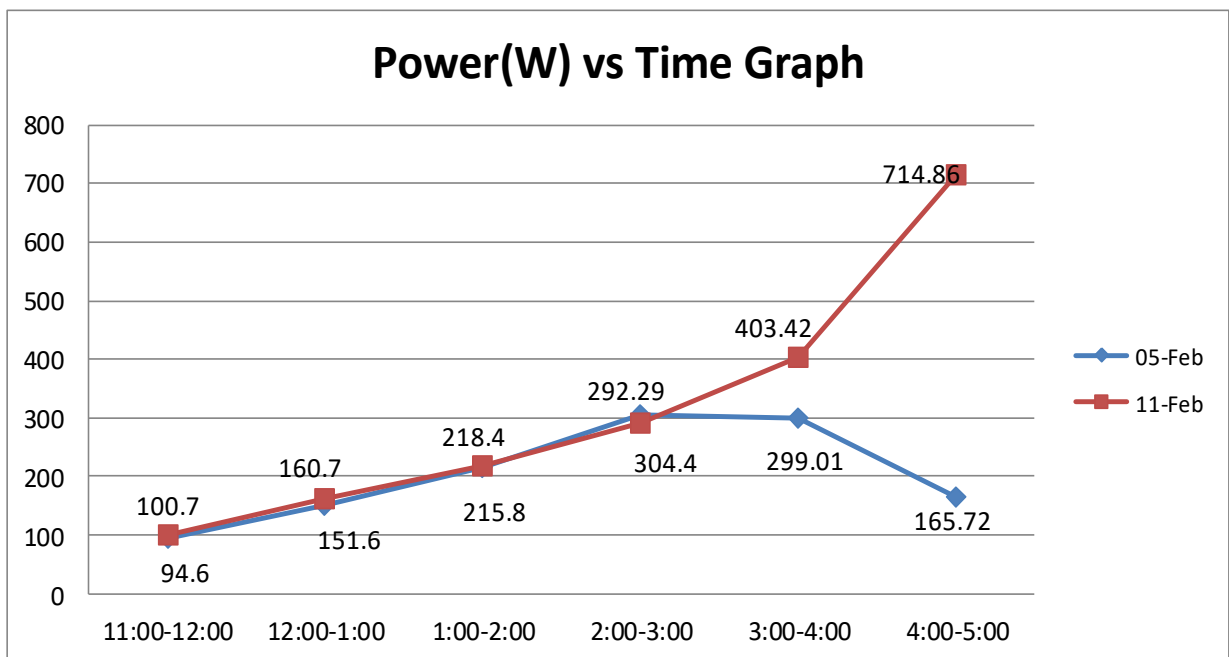
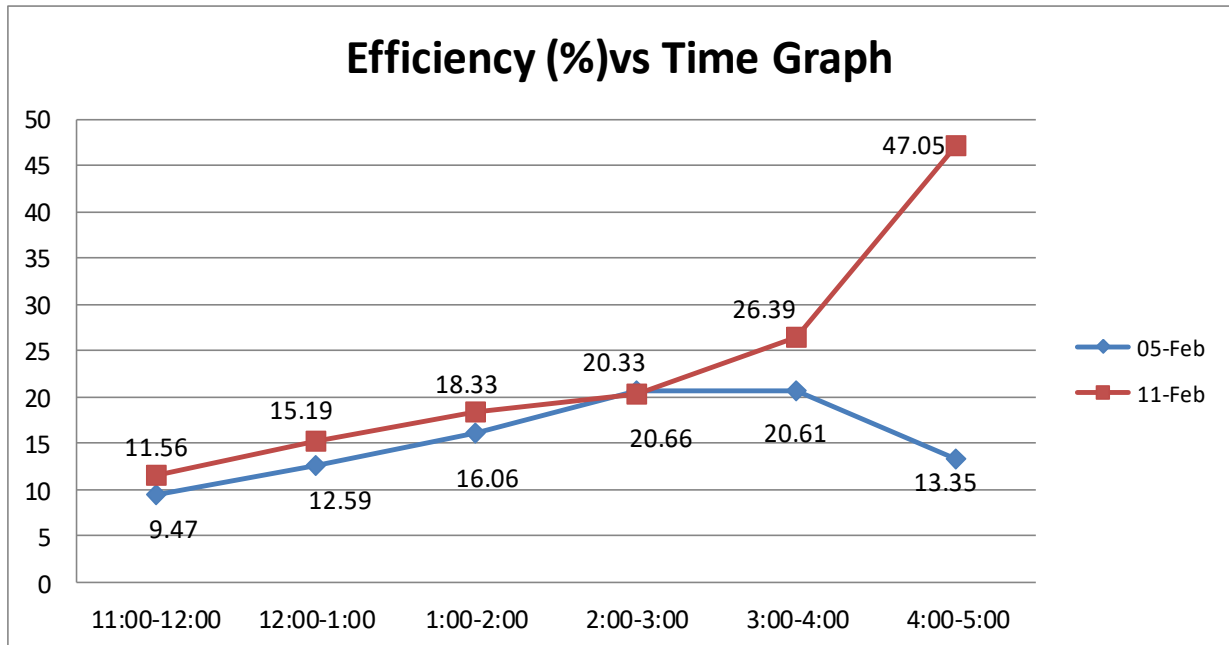
### DIFFERENT PROPERTIES OF LATENT HEAT MATERIALS-

LHM	Melting Point (°C)	Heat of Fusion(KJ/ Kg)	Specific heat Solid/liquid (KJ/Kg °C)	Density Solid/Liquid (Kg/m <sup>3</sup> )
Capric acid	30.1	150-158	1.95/1.60-1.72	-
Myristic acid	53.8	192	1.7/2.4	-
Pentadecane acid	52.5	158.6	-	-
Palmitic acid	59.9	197.9	1.9/2.8	-
Stearic acid	55.1	160	1.6/2.2	965/848
Acetamide	82	263	1.94/1.94	1159/998
Magnesium nitrate hexahydrate	89	162.8	1.84/2.51	1636/1550
Acetanilide	118.9	222	2/2	1210/1020
Erythrol	118	339.8	1.38/2.76	1480/1300
Lauric acid	41-43	211.6	1.76/2.27	1007/862
Hydrated salt	48	201.206	3.83 (l)	-

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**ANALYSIS WITH HYDRATED SALT-**

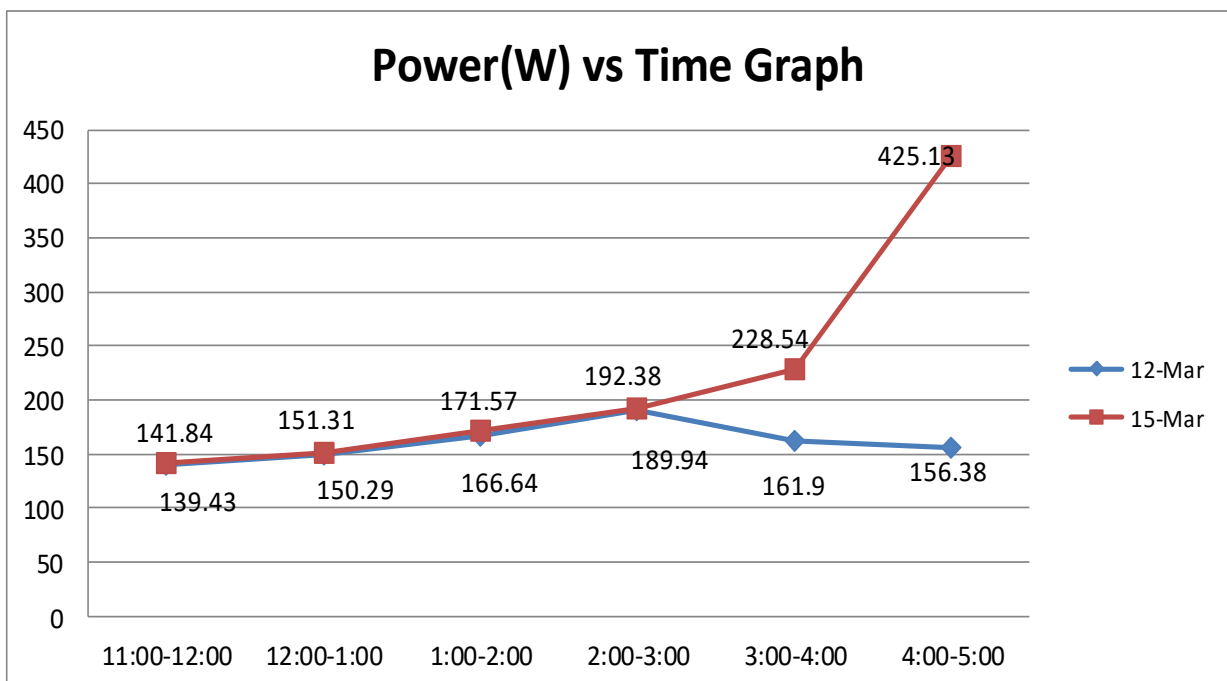
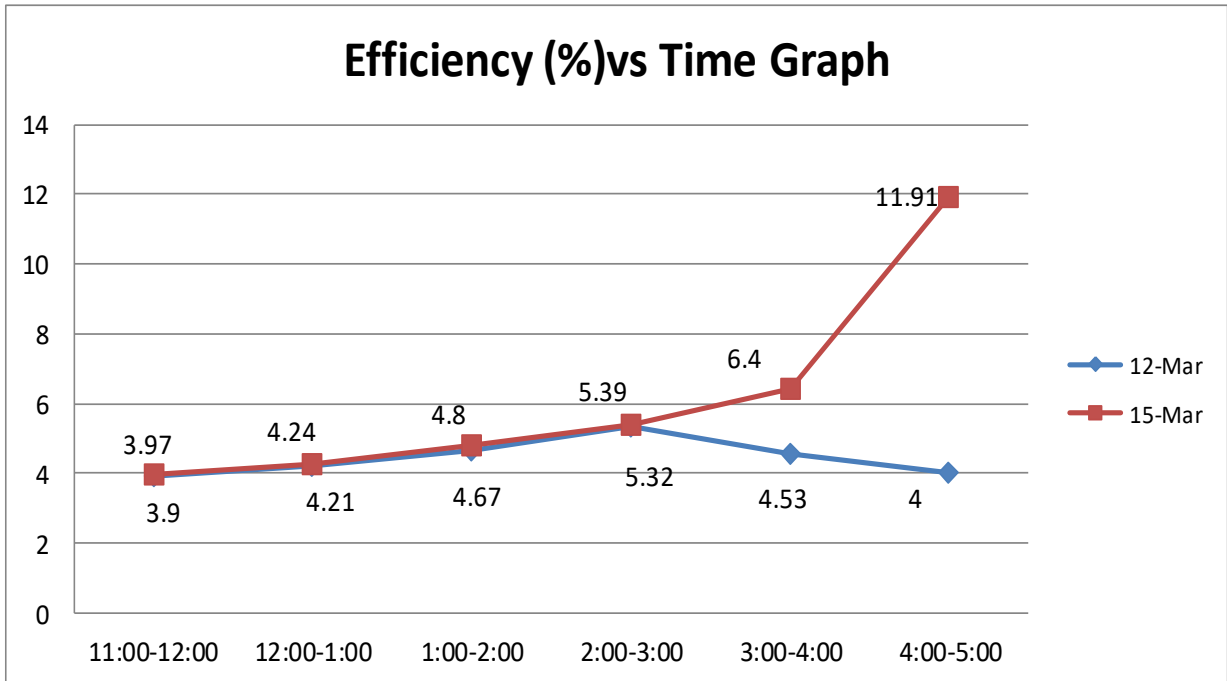
**On 5<sup>th</sup> Feb without LHM and 11<sup>th</sup> Feb with LHM(HYDRATED SALT)**



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**ANALYSIS WITH ACETAMIDE-**

**On 12<sup>th</sup> Mar without LHM and 15<sup>th</sup> Mar with LHM(ACETAMIDE).**



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## LATENT HEAT MATERIALS

A Latent Heat Material(LHM) is a substance with a high heat of fusion which, melting and solidifying at a certain temperature, is capable of storing and releasing large amounts of energy.

LHMs are storing the heat energy by changing its phase. i.e. Solid to Liquid, Solid to Gas and Liquid to Gas.

Considering the suitability we going to use solid->liquid latent heat material.

Many researchers have worked on solar cooking based on evacuated tube solar collector, flat plate collector with phase change thermal storage unit but none of them worked on solar cooking based on parabolic dish collector in climatic conditions. The objective of this paper is to study the thermal performance enhancements of a solar cooking based.

The selection of Latent Heat Material depends upon its properties such as melting temperature, latent heat of fusion, toxicity, etc. Such type of Latent Heat Material is described with its thermal properties in given table.

### ACTUAL SETUP



## CONCLUSION

Design of solar cooking has been done for cooking purpose with provision of space for latent heat material. Experimental performance is done with and without LATENT HEAT MATERIAL, which shows that heat storage capacity was increased and more power is developed to be used during off-shine. While using latent heat material, maximum achievable temperature has been lower about 2°C during 2PM to 3PM. Result shows that more cooking power was obtained by using latent heat material.

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