Review of Solar Dish-Stirlling Engine Technology

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***Abstract*- Sunlight based innovation offers incredible potential as far as providing the world's vitality needs. Anyway its commitment to the vitality showcase is extremely restricted. The primary factor for it is its high beginning expense and low effectiveness of framework. Along these lines, with the end goal to energize and encourage contemplates about the sunlight based concentrator this paper is worried about the detail investigation of Dish-Stirling Solar framework. Sunlight based vitality is a sustainable power source and can be utilized as an information hotspot for the warmth motors. Stirling motors are mechanical gadgets working hypothetically on the Stirling cycle, in which compressible liquids, for example, air, hydrogen, helium, nitrogen or even vapour's, are utilized as working liquids. When contrasting and the inner ignition motor, the Stirling motor offers plausibility for having high effectiveness motor with less fumes emanations. Be that as it may.**

Index Terms- control system, Stirling Cycle, parabolic Dish-Stirling (PD) system.

I. INTRODUCTION

In the recent year, energy consumption has been increased significantly with the increases of population. According to the World Energy Outlook, energy demand is estimated to be increased more than one third for the period between 2012 & 2035.[1]. Energy and water are the two main issues in this century. All efforts are done to tap the solar energy and make it viable. In current scenario, a need exists to develop alternative energy sources which can fulfil the increasing energy needs of the world. The primary sources of alternative energy which have potential in future are as classified as follows:

1. Solar energy
2. Nuclear energy
3. Biomass energy
4. Other sources like geothermal energy, tidal energy etc.

The power from the sun received by the earth is approximately 1.8 x 1011 MW which is many times more than the present consumption rate.

Various methods are used to convert solar energy into useful heat energy directly or indirectly. In this paper, we will study about the solar energy conversion.

Solar high temperature designs need concentration systems, such as parabolic reflectors. Solar thermal power plants with concentration technologies are important thing for providing the bulk solar electricity needed within the next few decades.

Four concentrating solar power technologies are developed:

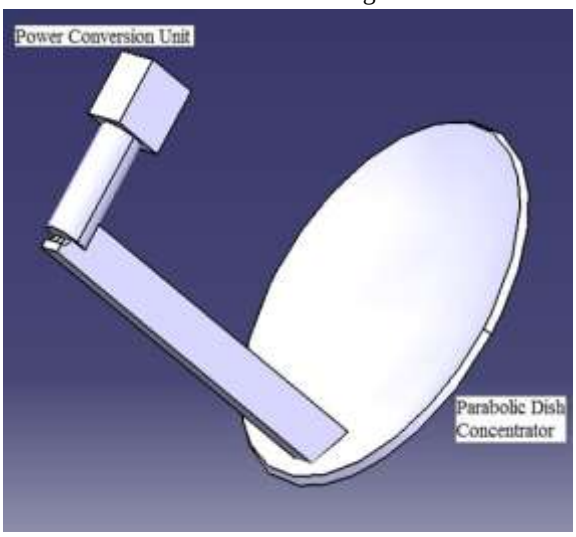
1. Parabolic trough collectors (PTC)
2. Linear Fresnel reflector systems (LF)
3. Dish engine systems (DE)
4. Power towers or central receiver systems (CRS)

A solar dish engine system is an electric generator that "burns" instead of conventional fuel. Solar concentrator and the power conversion unit are the main component of this system.

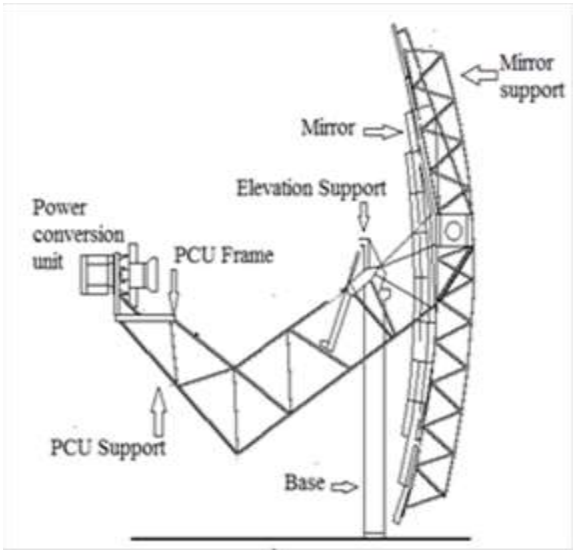
The DISH (concentrator) is one of the most primary parts of the system. It collects the solar energy coming direct from the sun and concentrate on a small area. The resultant solar beam has all of the power of the sunlight hitting the dish but is concentrated in a small area so that it can be more efficiently used.

THE POWER CONVERSION UNIT includes the thermal receiver and the engine/generator. The thermal receiver is the interface between the dish and the engine/generator. It absorbs the concentrated beam of solar energy, converts it to heat, and transfers the heat to the engine/generator. A thermal receiver can be a bank of tubes with a cooling fluid, usually hydrogen or helium, which is the heat transfer medium and also the working fluid for an engine. Alternate thermal receivers are heat pipes wherein the

boiling and condensing of an intermediate fluid is used to transfer the heat to the engine.



Fig(1.1): Dish Stirling solar system



Fig(1.2): frame work of DSE System

II. LITERATURE REVIEW

The conclusion result are obtain by analysis of following research paper

Milad Tajik Jamal abad et al. (2017, [1])

In the present work the efficiency of a solar parabolic trough has been investigated experimentally. An observer filled with metal form is used in order to improve the heat transfer and increase the efficiency of PTC (parabolic trough collector). The porosity of copper form is 0.9 and the port density is 30 PPI (pores per inch). The experiments were perform in different volume flow rate from 0.5 to 0.15 Lit/m and the standard of ASHRAE 93 was used to test the solar collector performance. Friction Factor and Nu Number have been investigated for both cases. It was found that by increasing the mass flow rate, the efficiency of the collector was enhanced and the same pattern can be seen when absorber filled with copper form. When absorber filled with metal form the overall loss coefficient UL decreases by 45% and is cause to increase efficiency less energy is lost.

Khaled Bataineh1 et al. (2017, [6]), this article investigates the performance of standalone solar Stirling dish system used to electrify rural houses. The yearly performance which depends on location is simulated using software developed by The National Renewable Energy Laboratory's SAM (Solar Advisor Model). Direct normal insolation, ambient temperature, density of air (altitude), sun elevation angle, and the wind speed are included in the simulation model. The model analyzes the performance of the parabolic mirror, receiver, Stirling engine, and the parasitic power consumption to predict the net power produced. The proposed model is validated against experimental data and found in very good agreement. The effect of major parameters such as; heater head temperature, receiver geometry, and cooling pump speed on the maximum power output and the corresponding overall efficiency are investigated.

Simulations results indicate that the net global system efficiency is around 21% and can be improved by 3% at optimized condition. The annual energy output can be increased by 19% at optimal design conditions. Levelized cost of energy is around 0.115 $/kWh which can be lowered by 0.013$/kWh at optimal design conditions. The yearly average receiver thermal losses are found to be 13 % of the total solar radiation entering the receiver and increases at early morning and late afternoon.

Liaw Geok Pheng et al. (2015, [3]), Solar energy is a renewable energy and can be used as an input source for the heat engines. Stirling engines are mechanical devices working theoretically on the Stirling cycle, in which compressible fluids, such as air, hydrogen, helium, nitrogen or even vapors, are used as working fluids. When comparing with the internal combustion engine, the Stirling engine offers possibility for having high efficiency engine with less exhaust emissions. However, this paper analyzes the basic background of Stirling engine and reviews its

existing literature pertaining to dynamic model and control system for parabolic dish-stirling (PD) system.

Vanita Thakkar et al. (2015, [2]), Solar Energy Technology has an important role to play in the present Energy and Environment crises. Solar Concentrator Technology has good potential for various applications, including power generation and process heating applications. Scope of Research and Development is ample in this area, as very little work has been done on it. Most of it has been done in the US and Europe, in solar thermal power systems, such as solar concentrators coupled to a Stirling engine or to a single or double circuit Rakine Cycle system. Parabolic Solar Dish Concentrators (PDSCs) can be very useful in Industrial Process Heat applications, which use about 20% of total oil consumption in India. If only 25 to 30% of this can be saved by putting up Solar Concentrators, it will save import of 4.5 MT oil per year, which is about 6% of our oil imports. So, solar concentrator for process heat requirements of community, industrial and commercial establishments is an emerging and exciting opportunity in India, which is gaining attention from scientists, engineers and developers. The present paper presents a Performance Analysis Methodology developed for a PDSC system used for heating thermic fluid for process heating application.

Salem Ghozzi et al. (2014, [4]), traditionally, off-grid power generation and supply in remote and inaccessible areas is provided by fossil fuelled technologies such as diesel gensets. Currently the emphasis however has shifted towards deploying renewable energy technologies which are becoming increasingly an important part of many countries power generation infrastructure. Small scale solar energy projects are mainly dominated by PV technology whereas large schemes use Concentrated Solar Power (CSP). This paper gives an insight into current solar energy technologies that can be deployed for power generation either as stand-alone or connected to the main power grid. Then an alternative technology using Stirling Cycle will be described giving its potential application and limitation.

SUNNY TAK et al. (2014, [7]), Today worldwide concerns about the best way of utilization of the natural energy and developing technique to reduce pollution. Stirling engine is one of the best examples of heat engine which convert heat energy into mechanical work. Stirling engine is based on Stirling cycle. Stirling engine is also operated by heat from sunrays. The solar Stirling have better efficiency than that of other solar device like photovoltaic cell, solar panel etc. the aim of this paper is to focus on the comparison between solar dish stirling engine and solar panel and photovoltaic cell in order to generate electricity. Solar dish Stirling is efficient to convert 1/3rd of sunlight into electricity. Ripasso energy, a solar technology company designed a new Stirling dish modules that set a new record of 31-32% efficiency. In this paper I review the new upcoming plans related to solar Stirling engine that bring our generation into new world. I also try to explore the future use of Stirling engine and how it is better, effective and efficient than other solar devices. Many companies work in this field to make solar Stirling engine as a less expensive product for customers. In the coming world solar dish Stirling engine replace the photovoltaic cells and other solar devices.

Dustin Howard et al. (2010, [5]), Dish-Stirling solar power generation has emerged as an efficient and reliable source of renewable energy. As the technology moves into commercialization, models become necessary to predict system behaviour under various operating conditions. Current literature on dish-Stirling modelling is scattered, focusing on individual components within the system. This paper establishes a background of the individual component models, and provides a method for integration of the various component models to form a comprehensive model. The thermal, electrical, and control systems of the dish-Stirling system are presented, along with a method for simulation. Typical results are provided for the instantaneous working gas temperature, pressure, and torque, along with results indicating how these parameters vary with solar irradiance in steady state.

III. WORKING PRINCIPAL

The principle part of this framework comprises of beneficiary, concentrator, Stirling motor and generator. A Stirling Engine and generator are inner piece of transformation unit (PCU), or, in other words the point of convergence. The concentrator is utilized for centring the sunlight based radiation into

the collector. After that the warmth from the sun based radiation is exchange to the working gas.

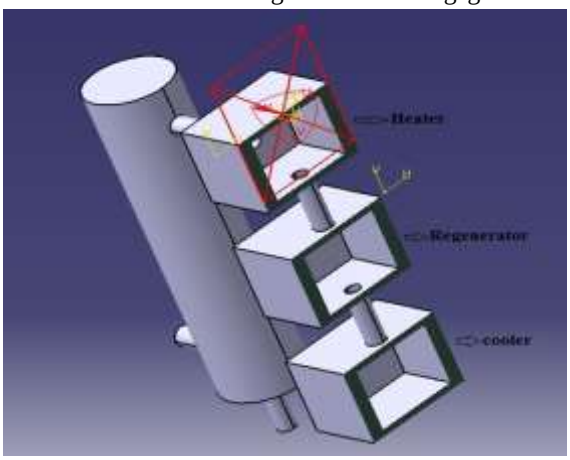


Fig (3.1): Main part of Stirling system

A high-temperature and high-weight Stirling motors are utilized in these frameworks. The hydrogen or helium is utilized as a working gas. The working gas is on the other hand warmed and cooled by consistent temperature and steady volume forms. The greater part of the power is delivered by extending the hot gas than is required to pack the cool gas. Stirling motors generally fuse a proficiency improving regenerator that catches warm amid consistent volume cooling and replaces it when the gas is warmed at steady volume.

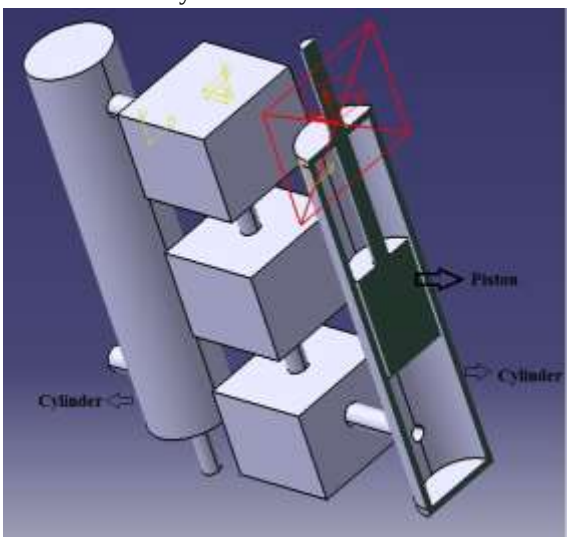


Fig (3.2): Main part of Stirling system

Most include the utilization of cylinders and piston. In some places the displacer is used instead of the piston. A displacer used to carry the working gas forward and backward from the hot area to the cool area. At the point when the gas goes from the heater to cooler, the regenerator assimilate warm in the working gas, in another insightful will be discharge into the air, when the gas stream once more from the cooler to heater, the regenerator will then restore the put away warm vitality to the working gas. From that point forward, control is extricated kinematically by a pivoting crankshaft. The best of the Stirling motors accomplish warm to-electric change efficiencies of around 40%.

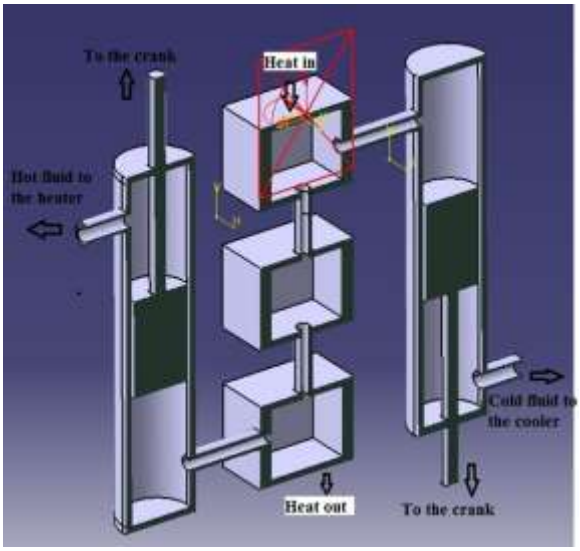


Fig (3.3): Working principal

IV. CONCLUSION & DISCUSSION

In this article, many empowering thinks about were accounted for about the utilization of sun based gatherer to deliver electrical power. Execution contemplates were identified with geometrical and working parameter. If the two pressure control units are fitted to the heater and cooler and the working fluid is changed, the efficiency of the system can be increased. The present examination gives a survey of (Dish Stirling Engine Technology) DSET innovations. A scientific model was utilized to evaluate the power yield under various geometrical and warm conditions.

V. FUTURE DIRECTION OF RESEARCH

In the wake of concentrate all examination papers it is discovered what are littler than the biggest plant, Have just a little commitment to the entire power produced. Here, there is economy, in the feeling of proficiency for power creation, to be picked up on a bigger scale.

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