International Journal of Scientific Research in Engineering and Management (IJSREM)
Volume: 06 Issue: 05 | May - 2022 Impact Factor: 7.185 ISSN: 2582-3930

DESIGN AND FABRICATION OF SOLAR 360 AIRCOOLER CUM HEATER

Mr. Abdullatif Zubair Khot
Mechanical Engineering
Department Alamuri Ratnamala
Institute of Engineering and
Technology

Mr. Hamza Arif Haidry
Mechanical Engineering
Department Alamuri Ratnamala
Institute of Engineering and
Technology

Under the Guidance of
Prof. Raja Ram Bhagat
Mechanical Engineering
Department Alamuri Ratnamala
Institute of Engineering and
Technology

Mr. Mohd Yaseen Sarosh Kharbe
Mechanical Engineering
Department Alamuri Ratnamala
Institute of Engineering and
Technology

Mr. Huzaifa Rais Ahmed Ansari
Mechanical Engineering
Department Alamuri Ratnamala
Institute of Engineering and
Technology

ABSTRACT

In our project, solar power is captured and stored in a battery. This power is used to run the air cooler whenever required. Solar energy means the radiation energy that reaches the earth from the sun. It provides daylight makes the earth hot and is the source of energy for plants to grow. Solar electric systems are suitable for plenty of sun and are ideal when there is no main electricity. Solar electricity is the technology of converting sunlight directly in to electricity. It is based on photo-voltaic or solar modules, which are very reliable and do not require any fuel.

The idea is to produce a **"DESIGN & FABRICATION OF SOLAR 360 AIR COOLER CUM HEATER"** that changes from its maximum temperature to its minimum temperature

by simply adjusting a simply operated switching button. This type of equipment can find wide variety in medicinal, food and beverage transport commercially and for domestic purposes.

Travellers can make the better use of it. The main objective of our project is to design and analyse a heating and cooling system that uses a non-conventional energy source (i.e., solar power). It will be a suitable and economical system for people living in remote areas of India where load shedding is a major problem. The main difference between our system and existing system is that our project works without heavy mechanical devices and also without refrigerant. As the module is compact in size, one can design the system as per his requirement (i.e., size, capacity).

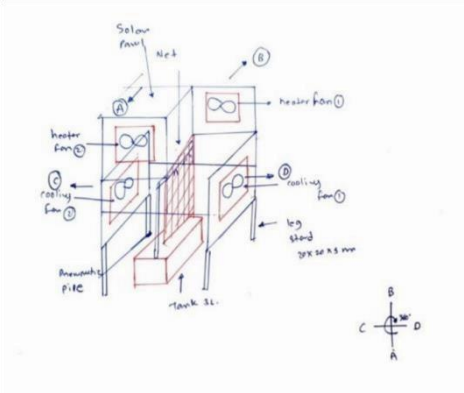
INTRODUCTION

Our idea 'DESIGN AND FABRICATION OF SOLAR 360 AIR COOLER cum HEATER' which equipped by solar panel, heating coil etc. It is the system which is designed to produce cooling and heating but the main objective behind project is to use solar energy which is a renewable source of energy. This means that cooling and heating is done without the use of greenhouse gases which would ultimately reduce global warming which are usually caused by refrigeration system.

Our project Solar 360 Air Cooler Cum Heater work on solar energy and electricity. Solar energy which is store in battery which use to run cooler. We can switch between battery and main line. It consists 4 Fan which give cool and hot air in a 4 different direction. Pump with the help of nozzle spray cooled water in the direction of fan which provide cool air. For hot air we are using heating coil.

Solar energy basically means the radiation energy that reaches to the earth from the sun. It provides daylight that warms the earth and is a source of energy for plants to grow. Sunlight can converted into electricity using solar technology. It is based on photo-voltaic effect, which are very reliable and is not require any fuel. We aim to design and develop a solar power system, namely solar-powered thermo-electric heating and cooling as one of these innovative technologies. Solar energy is the lowest cost, competition free, universal source of energy, as is full sunlight. by using photovoltaic technology this energy can be easily converted into useful electrical energy. Based on the working principle refrigeration principle, refrigeration system can be classified as vapor compression systems, vapor absorption systems, gas cycle systems etc. In 90% of applications in the world, vapor compression system is used. Air cycle and vapor absorption refrigeration covers 5% and is covered using systems like thermo electric, magnetic, gas cycle, acoustic and other refrigeration methods. In recent years, conventional refrigeration systems have become a major concern with increased awareness of environmental degradation caused by the production,

use and disposal of heat carrier liquids (CFCs and HCFCs). The major threats to the atmosphere are the depletion of the stratospheric ozone layer and the greenhouse effect due to the presence of CFCs and HCFCs in the troposphere. In addition, this type of refrigeration system has limits on the use of grid power and cannot be used for remote applications. Due to the advancement of technology and science



Circuit Diagram of Solar 360 Air Cooler cum Heater

LITERATURE REVIEW

In India (Roy, 1989) the drip evaporative cooling method was manufactured from simple materials and used for the preservation of fruits and vegetables etc. It contains simple low-cost cavity wall evaporative cooler made of bricks and is called an "improved zero-energy cool chamber" in India (Lisa and Kadar,

[1] Akhilesh Yadav, Rajatkumar Bachan, Dattaprasad Tendolkar, Sankesh Torashkar (2018),"Design & Fabrication of 360 Cooler Cum Heater", as we are in there are a lot of practical application which require the functions of both cooler and heater, that is cooling and heating. Here, we demonstrate a novel cooler cum heater which works on the principle of thermoelectric effect. Being driven by thermoelectric holds a lot of advantages like elimination of mechanical components, light in weight, noise and vibration less operation, precise temperature control etc.

need of heating and cooling simultaneously in many of the rural area in India. We understand the process of evaporative cooling using this paper. In this they have created a 360 simple evaporative air cooler in which cooling is achieved by direct contact between the water particles and air stream. In which the minimum outdoor temperature required for successful 360 evaporative cooling is about 35˚ C and even lower than that. The 360 evaporative cooler depends on the outdoor temperature as well as relative humidity, dry bulb temperature and low wet bulb temperature. It cannot be used where the relative humidity is high. This system does not dehumidify the air but on the contrary makes the air more humid.

[2] Vijay Kumar Kalwa, R Prakash, 2012, "Design & development of solar power air cooler". This paper gives information about the problems caused by overuse of non-renewable resources. Living rooms also add warmth to the room as the normal body temperature is much higher than the room temperature itself. Hence the problem can be solved by the need of those sources which are available in abundance in

nature i.e. solar energy. He provided information, calculations, analysis on solar energy conversion.

The components used are:

- Solar Panel
- Battery
- charge controller
- Inverter
- blower
- Ceramics Slabs

The converted energy is used to drive the centrifugal fan. The blower is surrounded by a cooling pad through which water is supplied continuously. When the blower is turned on, it absorbs the atmospheric air into the cabin through the cooling pad, thereby creating a cooling effect in the room. They choose solar panel of 40W &

Battery of 40Ah.

[3] Manish Bhardwaj (2012), "Solar Air Cooling", he states the major disadvantages of solar coolers; The high cost of fabrication, low conversion efficiencies and the need for continuous streams of photons for power generation. The maximum output from solar panel can be obtained in noon hours.

[4] S.A.Abdalla, Kamal N. (2016), "A radiant air-conditioning system using solar driven liquid desiccant evaporative water cooler", he described how a solarpowered liquid "desiccant" evaporative cooling system and the method used to investigate its performance is providing cooling water for the radiant airconditioning system in Khartoum. For more than decades, the popularity gained by vapour compression machines has led to air-conditioning being considered a reliable and efficient source of energy. But air conditioners cause harmful effects on the ozone layer due to the presence of hydrogenated hydrocarbons. In the liquid desiccant evaporate cooling process, air is used. Water is cooled by direct evaporative cooling to be dehumidified by desiccant solution. It is considered a modified version of direct evaporative cooling that can meet different climatic conditions. They concluded that the system is environmental friendly as it requires low high grade input & improves indoor air quality substantially in energy efficient manner radiant airconditioning.

[5] R.Sai.Lavanya, Dr. B.S.R.Murthy (2008), "Design of solar using aquaammonia absorption refrigeration system", the system invented here operates on an ammonia absorption system that provides a refrigeration effect by using two liquids and some amount of heat input, rather than electrical input as in the more familiar vapor compression cycle. In absorption systems, Secondary fluid is used to circulate the refrigerant as the temperature requirement for the cycle falls in the low to medium temperature range.

OBJEVTIVE OF WORK

- To provide cooling and heating system in single unit.
- To reduce the overall cost.
- To investigate methods to increase the efficiency in order to conserve power
- To make it portable.
- To improve the efficiency of cooler and heater.
- The main objective of the heating & cooling system service is to be suitable for use by the people who live in the remote areas of country where load shading is a major problem.
- The material used to model is low graded and economical because the cost of product will less as possible as which will play an advantage should this product roll out in large.

DESIGN AND CALCULATION

➢ Fan Specification

Fan :- 12Voltage , 0.35Ampere

Quantity :- 4 Nos

Power = Volt x Ampere

= 12 x 0.35

Power Required for 1 Fan = 4.2Wh

For 4 Fan = 4.2 x 4

= 16.8Wh

Total Power Required for 4 Fan is 16.8Wh

➢ Pump Specification

Pump :- 6Voltage, 0.5Ampere

Quantity :- 1

Power = Volt x Ampere

= 6 x 0.5

= 3Wh

Power Required For Pump is 3Wh

➢ Heat Coil Specification

Heat Coil :- 12Voltage , 0.6 Ampere

Quantity :- 2 Nos

Power = Volt x Ampere

= 12 x 0.6

Power Required for 1 Heat coil = 7.2Wh

For 2 Heat Coil = 7.2 x 2

= 14.4Wh

Total Power Required for 2 Heat Coil is 14.4Wh

Total Power Required For Whole System = 16.8 + 3 + 14.4

= 37.2 Wh

➢ Battery Specification

Voltage: 12V

Current: 12A

We required 37.2Wh for system for one hour consumption so we have taken Battery of 12V and 12A

which can store power of 144Wh. This store power can run System for 3 hours 52 min without Solar Panel

- **Panel Specification**

  Voltage: 12V

  Power: 50Wh

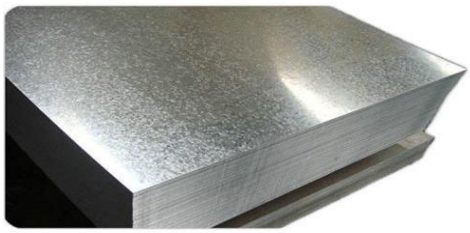
We are using solar panel to run the system which required 37.2Wh power and to store the energy in battery which can store power of 144Wh. The Battery will take 2hours 52min to fully charge and can run the System up to 3hours 52min . So we have taken 50Wh Solar Panel

COMPONENTS

- **Frame:-** A portal frame is also a type of structural frame, characterized as a beam in its simplest form(or rafter) supported at either end by columns, however, the joints between beam and columns are made 'rigid' so that the bending moment in the beam is transferred to the columns. This means that the beam can be reduced in sectional size and can also span large distances.

FRAME

- **G.I. Sheet:-** Galvanized G.I. sheet metal of 32 gauge are used to cover the frame.



- **Solar Panel:-** A photovoltaic (PV) module is a packaged, connected assembly of typically 6x10 photovoltaic solar cells. Photovoltaic modules constitute the photovoltaic array of a photovoltaic system that generates and supplies solar electricity in commercial and residential applications.

  Solar modules provide the energy source to keep battery(s) charged. Solar electric modules convert the sun's energy into direct current (DC) electricity. The systems contain a matrix of high performance mono-crystalline or multi-crystalline modules.

Photovoltaic solar panels absorb sunlight as a source of energy to generate electricity.

Specifications:-

- Maximum Power (Pmax)
  50w
- Maximum Power Tolerance
  ± 3%
- Maximum Power Voltage (Vamp)
  18.5V
- Maximum Power Current (Imp)
  2.71A
- Cell Technology
  Poly- Si

Solar Panel

- **Battery:-** Batteries store direct current electrical energy in chemical form for later use. In a solar power system, the energy is used at night and during periods of cloudy weather. Since a solar module system's power output varies throughout any given day, a battery storage system can provide a relatively constant source of power when the module is producing minimal power during periods of reduced insolation. Batteries can even power the loads when the solar array is disconnected for repair and maintenance.

Specifications:-

- Type Lead-Acid Battery
- Volts 12V
- Capacity 12Ah

Battery

- **Fan:-** A 12V fan blows air through one end of the channel to cool the inverter and the tubes. A fan is a device with spinning blades that create a flow of gas.DC axial fans are widely used in the air-vent exhaust, electronic device cooling, computer ventilation, etc. Total 4 fans of 4.2 volts input each are used at 4 sides of the frame installed vertically to cover 360 Area.

Fan

- **Pump:-** DC water pump is a machine that transports liquid or pressurizes liquid. The main advantage of DC (direct current) pumps over AC (alternating current) pumps is that they can operate directly from a battery, making them more convenient and portable.Pumps of 6 volts input are installed for water supply to provide cool air.

Pump

- **Nozzle:-** Single nozzle are used to spray the water inside with discharge capacity of 180 ml/min.

Nozzle

- **Heating Coil:-** 2 heating coils of Nickel material are placed near 2 fans to supply hot air during winter season.

Heating Coil

- **Adapter:-** A 12-volt 2-amp adapter are used to run the project from power grid.

Adapter

- **Connecting Wheel:-** Four wheels are used at each end to support the body and hold it above ground.
- It is also used to propell the body and make the system portable.

Connecting Wheel

- **Selector Switch:-** An electric switch that selects a particular circuit or group of circuits (as on a Battery And Adaptor)

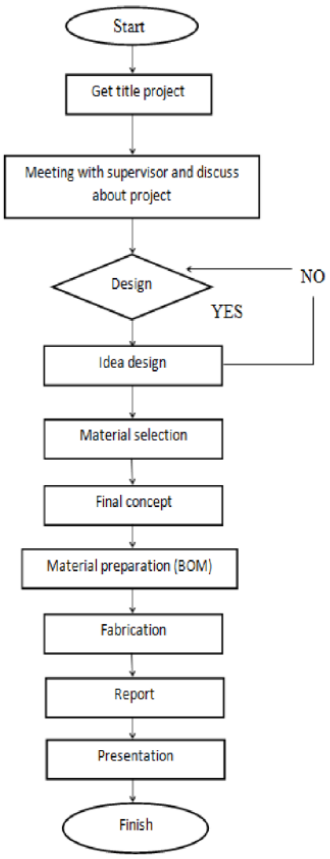
Selector Switch

- **ON OFF Toggle Switch :-** A Push Button switch is a type of switch which consists of a simple electric mechanism or air switch mechanism to turn something on or off.

ON OFF Toggle Switch

METHODOLOGY

In the construction process, overall progress is planned to ensure that the project can be completed on time.



From the above flow chart the project started with a discussion about the design with HOD of our Mechanical Department Prof. Rajesh Kumar Sir and our guide Prof. Raja Ram Sir. This discussion covering the project overview and the title and the supervisor's related opinions and instruction given by the supervisor to propose a certain design and concept before moving on to the next step. Then start making and deciding the best idea about the title. Before that, literature review and research about the title is the key point to get the best idea. Then study about the different cooling and heating machines and do a lot of research. It includes a study about the concept of 360 aircooler combine with heating element, its process of making and materials. These works have been done through studies, books and other information on the Internet. After all relevant information has been collected and collected and new ideas and knowledge about the title have been acquired, the project than continued with the design process. In this stage, knowledge and thought must be thrown into the sketching process. After several designs are sketched, the best design was selected from the previous designs so that we can proceed with the designing process. The selected design was then transferred to an engineering drawing using Solid Work software for the analysis process. After that collected the material which has been confirmed in the beginning. The purpose of this process is to determine the appropriate and adhere to product and design requirement. This process includes the purchased material, measurement of the material and cutting it based on the requirement. Here, this process is important because the ingredients will determine whether our product is on its way to success or failure. The next process after all the drawing and material preparation is a manufacturing process. This procedure is determined from the drawing, depending on the dimension. During this process, all manufacturing processes that are appropriate, such as drilling process, welding process and cutting material using disc cutter can be used. The analysis phase is implemented before the construction phase. The evaluation is done by considering strength, portable, durability, safety and more. After all above process all material is collected to write report without any problem, such as product defect. The report writing process covers and covers all manners from 2 weeks to the end. This process also included the submission to the final presentation of the project.

CONCLUSION

The paper covered almost all relevant aspects of a portable solar cooler and heater. The thermo-electric (Peltier) module which has been used covers a wide spectrum in the generation of power and space heating and cooling applications. The system is not widely accepted for commercial use due to the high initial cost, but as the study suggests, using waste heat and storing electricity from solar cells, this system becomes most efficient compared as compared to that

of its traditional counterpart. After studying the prototypes and the experimental observation, it can be concluded solar thermoelectric cooling and heating is a technology of the future. It is an ecofriendly initiative, thus promoting green technologies for the future. The idea is more appealing as the high cost of an air conditioner and high electricity bill of a refrigerator unit is eliminated as the system works on completely different mechanics which can easily run on DC supply that too using solar power. By using This portable technology when marketed will surely prove to be a boon for rural part of India.

REFERENCES

- Jonathan Michael Schoenfeld, Master of Science,2008 "Computational Model for Refrigerators Based on Peltier Effect Application", Applied Thermal Engineering, Vol. 25, No. 13, pp. 3149- 3162.
- GauravMaradwar," Fabrication And Analysis Of Problems In Thermoelectric Refrigerator" International Journal Of Core Engineering & Management(IJCEM) Volume 1, issue 2, May 2014, ISSN:23489510
- By C.P.Arora," Refrigeration & Air Conditioning" 2nd Edition, TMH
- Publication, ISBN 0-07- 463010-5 http://www.ijmerr.com/currentissue.php397.
- http://www.wikipedia.org.
- http://www.electronicsforyou.com.