Design and Manufacturing of Solar Air Conditioning

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Abstract

In the home and industries air-conditioning is a major consumers of electricity and already today air conditioning causes lack of energy storage. The demand can be expected to increase because of changing working times, increased comfort expectations and global warming. Because of this is continuously increasing. Air- conditioning systems in use are most often built around vapour compression systems driven by grid-electricity. However, most ways of generating today, as well as the refrigerants being used in traditional vapour compression systems.

Solar air-conditioning is a one way of reducing the demand of electricity. An purpose of the paper is to explain the detail working principles of the components and subsystem in such general terms that the paper is usable not only to those specifically interested in the solar air conditioning, but to anyone interested in air -conditioning. In this paper we are using peltier module which is works on the principle of peltier effect and solar system for conditioning. The uniqueness of the paper is use of peltier module instead of using vapour compression systems.

Keywords-Air conditioning, solar energy, Heat sink.

CHAPTER 1

1. Introduction

An environmental control system utilizing solar energy would generally be more cost effective if it were used to provide both heating and cooling requirements in the building it serves. Various solar powered heating and cooling systems have been tested extensively, but solar powered air-conditioners have received little more than short-term demonstration attention. Solar cooling technologies collect the thermal energy from the sun and use this heat to provide cold air for residential, commercial, institutional and manufacturing buildings. These technologies displace the need to use electricity or natural gas. Today, Countries across the globe are at work manufacturing and installing solar heating and cooling systems that significantly reduce our dependence on imported fuels. We need smart policies to expand this fast growing, job producing sector. It uses solar energy to produce cold or hot air. This technology can be used to reduce the energy consumption environmental impact of mechanical cooling system. A significant advantage of this system is, it has no moving parts consequently they are noiseless, non- corrosive, cheap to maintain, long lasting in addition to being environmentally friendly with zero ozone depletion as well as global warming potentials. The use of solar energy for cooling can be either to provide refrigeration for food preservation or to provide comfort cooling. There is less experience with solar cooling than solar heating. Several solar heated buildings have been designed, built, operated for extended periods but only a few short time experiments have been reported on solar cooling. However, research work is expected to close the gap between the two within few years. Solar air conditioning systems have used two basic approaches in an attempt to capture the sun's energy for cooling thermal and photovoltaic.

The photovoltaic systems use photovoltaic panels to convert solar radiation directly into DC electricity. Photovoltaic systems have two major advantageous attributes. First, they can use conventional electrically driven air-conditioning equipment, which is widely available and inexpensive. Second, they can use the utility grid for backup power during dark or cloudy periods. Unfortunately other attributes: the high cost of manufacturing, the low conversion efficiencies, and the need for a continual stream of photons to produce power, create three major disadvantages. First electricity from solar cells is very expensive because of the high cost of the solar panels. Second the space needed for powering the air conditioning units is large. And third the panels provide no energy storage, which creates a need for use of grid-based electricity at night and on cloudy days.In fact, the peak output from the solar panels occurs around solar noon, while peak air- conditioning loads occurs several hours later, resulting in a significant mismatch between supply of needed power and demand. This mismatch greatly reduces the value of the system in reducing peak power demand to the utility. Recently deregulated markets are demonstrating that these demands are much more expensive to meet than had been previously apparent. Batteries have a high first cost, require periodic replacement, and normally use toxic and/or corrosive materials. These problems have prevented the use of photovoltaic systems in other than a few high-cost demonstration systems. Thermally driven systems are another approach; they use heat from the sun to drive an air conditioner. Typical approaches from the past used a high-temperature flat-plate collector to supply heat to an absorption system. Systems with concentrating collectors and steam turbines have also been proposed.

Natural gas or other fuel is used for backup heat. While thermal systems have the advantage of eliminating the need for expensive photovoltaic panels, the existing systems have attributes that produce major disadvantages. As used in the past, thermal systems are based on single-effect absorption chillers or other cooling systems that are designed to use natural gas, steam or other high- temperature heat source. They require a very high collector temperature to drive the cooling system. The high collector temperature and relatively poor efficiency, greatly increases collector size and cost. In addition, there is no economically viable way of storing solar energy with this approach. The result of these problems is that thermal systems have been very expensive and have relied primarily on natural gas or other fuel for their thermal energy. For this reason they have seen very little use.

Solar energy is the light and radiant heat from the Sun that influences Earth's climate and weather and sustains life. Solar power is sometimes used as a synonym for solar energy or more specifically to refer to electricity generated from solar radiation. Since ancient times, solar energy has been harnessed for human use through a range of technologies. Solar radiation along with secondary solar resources such as wind and wave power, hydroelectricity and biomass account for most of the available flow of renewable energy on Earth. Solar energy technologies can provide electrical generation by heat engine or photovoltaic means, space heating and cooling in active and passive solar buildings; potable water via distillation and disinfection, day lighting, hot water, thermal energy for cooking, and high temperature process heat for industrial purposes. Sunlight can be converted into electricity using photovoltaic (PV), concentrating solar power (CSP), and various experimental technologies. PV has mainly been used to power small and medium-sized applications, from the calculator powered by a single solar cell to off-grid homes powered by a photovoltaic array. The term "photovoltaic" comes from the Greek φώς (*phos*) meaning "light", and "voltaic", meaning electrical, from the name of the Italian physicist Volta, after whom a unit of electrical potential, the volt, is named. A solar cell, or photovoltaic cell (PV), is a device that converts light into direct current using the photoelectric effect. The first solar cell was constructed by Charles Frits in the 1880s. Although the prototype selenium cells converted less than 1% of incident light into electricity, both Ernst Werner von Siemens and James Clerk Maxwell recognized the importance of this discovery.

1.1Problem Statement

In previous condition air conditioning consumes the more electricity and it directly impact on the cost for electricity and reducing in source of electricity. So need to develop the renewable energy source as like solar energy.

1.2 Objectives

Solar cooling technologies collect the thermal energy from the sun and use this heat to provide cold air for residential, commercial, government institutional and manufacturing buildings. These technologies displace the need to use electricity or natural gas. Today, Countries across the globe are at work manufacturing and installing solar heating and cooling systems that significantly reduce our dependence on imported fuels. We need smart policies to expand this fast growing, job producing sector. It uses solar energy to produce cold or hot air. This technology can be used to reduce the energy consumption environmental impact of mechanical cooling system. A significant advantage of this system is, it has no moving parts consequently they are noiseless, non- corrosive, cheap to maintain, long lasting in addition to being environmentally friendly with zero ozone depletion as well as global warming potentials.

1.3 Scope

Air conditioning systems are mainly for the occupant's health and comfort. They are often called comfort air conditioning systems. The project involves the development of a suitable cooling module designed with a Solar AC to cool the surrounding air. This cooling system needed to be powered up by a DC power supply, which is designed or using a suitable off-shelf power supply.

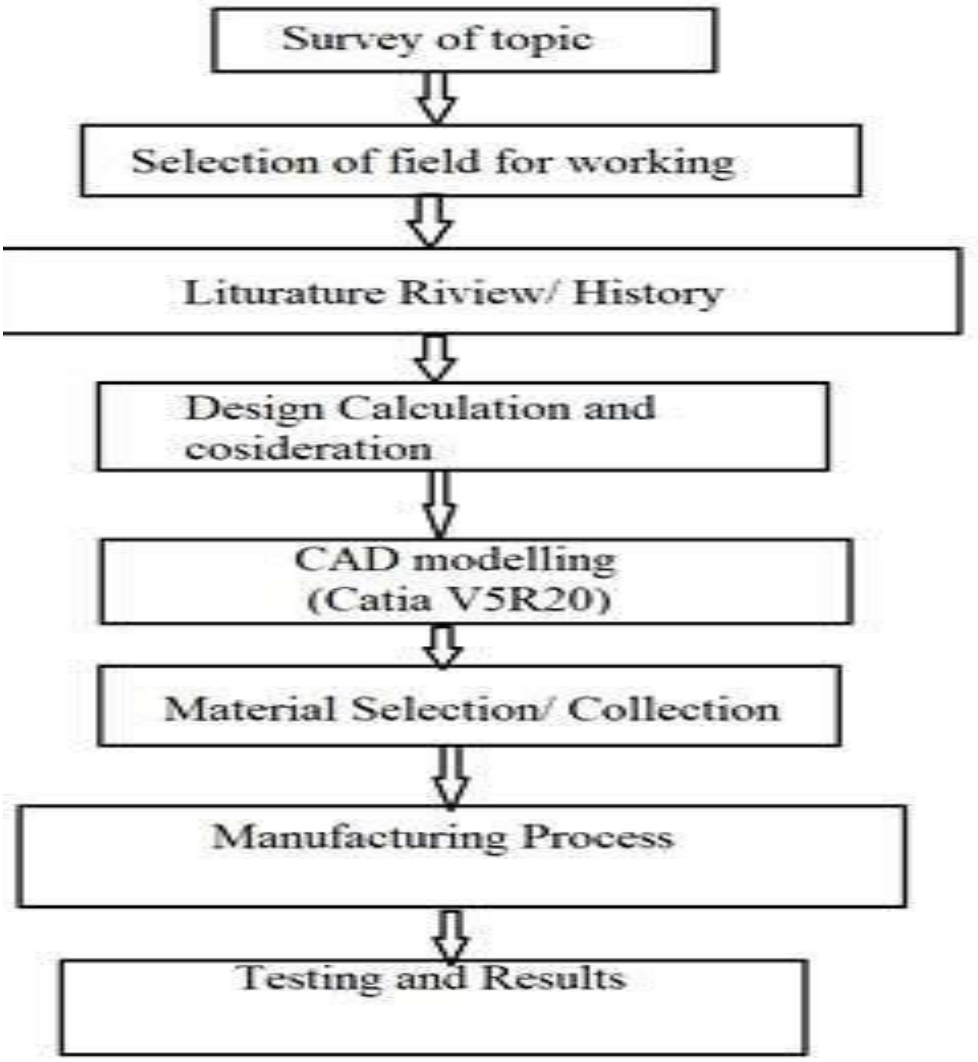
The project scope involves the following elements:

- Sizing and Designing of the Solar AC
- Selection of the TECs
- Selection of Fans and Heat sinks
- DC power supply design with temperature control.
- Prototype Assembly and Fabrication.
- Temperature measurements for testing.
- Power supply testing and troubleshooting.

1.4Methodology (Basic Principle involved)

The project implemented a structured system analysis and design methodology approach to achieve the project objectives. Ambient air is blown out by the blower through a duct to the TECs. TECs are sandwiched in between heat sinks. Cold air is blown out from one end of the cold heat sinks. The TECs were powered by a power supply. Thermoelectric cooling uses the Peltier effect to create a heat flux between the junctions of two different types of materials. A Peltier cooler, heater, or thermoelectric heat pump is a solid-state active heat pump which transfers heat from one side of the device to the other, with consumption of electrical energy, depending on the direction of the current.Such an instrument is also called a Peltier device, Peltier heat pump, solid state refrigerator, or thermoelectric cooler (TEC). They can be used either for heating or for cooling (refrigeration), although in practice the main application is cooling.

It can also be used as a temperature controller that either heats or cools. This technology is far less



commonly applied to refrigeration than vapor-compression refrigeration. The main advantages of a Peltier cooler (compared to a vapor-compression refrigerator) are its lack of moving parts or circulating liquid, near-infinite life and invulnerability to potential leaks, and its small size and flexible shape (form factor). Its main disadvantage is high cost and poor power efficiency. Many researchers and companies are trying to develop Peltier coolers that are both cheap and efficient. A Peltier cooler can also be used as a thermoelectric generator. When operated as a cooler, a voltage is applied across the device, and as a result, a difference in temperature will build up between the two sides. When operated as a generator, one side of the device is heated to a temperature greater than the other side, and as a result, a difference in voltage will build up between the two sides (the Seeback effect). However, a well-designed Peltier cooler will be a mediocre thermoelectric generator and vice-versa, due to different design and packaging requirements

CHAPTER 2

2. Literature Review

Vipin Das, et.al.[2016], discuss the cooling process is very important to maintain the foods, fish and many items at constant temperature to avoid the effect of viruses. Cooling process employs the different methods to cool the air. But considering the lower application and cost effective the water cooling system is considered for our project. The main aim of our project is to supply the cooled air with the help of water circulation. It consists of Solar panel, Battery, Fan, Water tank and Pump. The present air cooling methods are evaporative coolers, air conditioning, fans and dehumidifiers. But running these products need a source called electricity. The producing of electricity is ultimately responsible for hot and humid conditions i.e. global warming. In hot and humid conditions the need to feel relaxed and comfortable has become one of few needs and for this purpose utilization of systems like air-conditioning and refrigeration has increased rapidly. These systems are most of the time not suitable for villages due to longer power cut durations and high cost of products. Solar power systems being considered as one of the path towards more sustainable energy systems, considering solar-cooling systems in villages would comprise of many attractive features. Despite increasing performance and mandatory energy efficiency requirements, peak electricity demand is growing and there is currently no prevalent solar air cooling technology suited to residential application especially for villages, schools and offices.[1]

Solar energy is the light and radiant heat from the Sun that influences Earth's climate and weather and sustains life. Solar power is sometimes used as a synonym for solar energy or more specifically to refer to electricity generated from solar radiation. Since ancient times, solar energy has been harnessed for human use through a range of technologies. Solar radiation along with secondary solar resources such as wind and wave power, hydroelectricity and biomass account for most of the available flow of renewable energy on Earth. Solar energy technologies can provide electrical generation by heat engine or photovoltaic means, space heating and cooling in active and passive solar buildings; potable water via distillation and disinfection, day lighting, hot water, thermal energy for cooking, and high temperature process heat for industrial purposes. Sunlight can be converted into electricity using photovoltaics (PV), concentrating solar power (CSP), and various experimental technologies. PV has mainly been used to power small and medium-sized applications, from the calculator powered by a single solar cell to off-grid homes powered by a photovoltaic array. The term "photovoltaic" comes from the Greek φώς (*phos*) meaning "light", and "voltaic", meaning electrical, from the name of the Italian physicist Volta, after whom a unit of electrical potential, the volt, is named.A solar cell, or photovoltaic cell (PV), is a device that converts light into direct current using the photoelectric effect. The first solar cell was constructed by Charles Fritts in the 1880s. Although the prototype selenium cells converted less than 1% of incident light into electricity, both Ernst Werner von Siemens and James Clerk Maxwell recognized the importance of this discovery

Mohan Kumar G.,et.al.[2017], Air-conditioning is one of the major consumers of electrical energy in many parts of the world today and already today airconditioningcauses energy shortage in for example China. The demand can be expected to increase because of changing workingTimes, increased comfort expectations and global warming. Air-conditioning systems in use are most often built around vapour compression systems driven by grid-electricity. However, most ways of generating the electricity today, as well as the refrigerants being used in traditional vapour compression systems, have negative impact on the environment. Solar air-conditioning might b1e away to reduce the demand for electricity. In addition many solar air-conditioning systems are constructed in ways that eliminate the need for CFC, HCFC or HFC refrigerants. An aim of the report is to describe and explain the working principles of the component sand subsystem in such general terms that the report is usable not only to those specifically interested in solar air conditioning, but toanyone interested in air conditioning, heat driven air-conditioning and solar energy. The last section of the report briefly deals with how the components can be combined to form a complete solar air-conditioning system.

Energy is the primary and most universal measure of all kinds of work by human beings and nature. Energy is a crucial input in the process of economic, social and industrial development. Day by day the energy consumption is increasing very rapidly. The rate of energy consumption is increasing. Supply is depleting resulting in inflation and energy shortage. This is called the energy crisis. According to law of conservation of energy "energy can neither be created nor be destroyed but can be transformed from one form to another form. Energy can be transported from oneplace to another place." Alternative or non-conventional or renewable energy resources are very essential to develop for future energy requirements. The energy demand increases day by day because of population increasing industrialization increases and transportation increases etc. with increasing gas and electricity tariffs, solar energy becomes attractive once the system has been installed. As one of the sources of renewable energy. Solar energy is likely the most suitable system for installation in sub-tropical countries. The demand of air conditioning is increasing due to the effect of climate change and global warming. If we still rely on the conventional electric air conditioning but electricity is generated form fossil fuels ,the greenhouse gas emission would continuously worsen global warming.[2]

Safwan Kanan, et.al.[2015]In hot dry climates, due to the high demand for space air conditioning during summer and the abundance of solar radiation, solar air conditioning is a promising approach to reduce the energy consumption and negative environmental impact of buildings. Solar cooling systems have used various types of collectors to drive chillers. In this paper, a salinity gradient solar pond is suggested as a collector to drive an absorption chillers, to provide cool air for a house during hot and dry weather. A coupled simulation between MATLAB and TRNSYS has been used to solve the problem. MATLAB code was written to solve the governing equations for the salinity gradient solar pond and the ground underneath it. TRNSYS software was used to model the solar cooling system including the absorption chillers and building. The weather data used was for Baghdad in Iraq. It was found that the salinity gradient solar pond could be used to drive the absorption chillers and produce cool air for a single family house during the summer period. Different solar pond areas were tested with the same chillers capacity. It was found that a solar pond area of approximately 400 m2 was required to provide satisfactory cooling for a typical house with a floor area of approximately 125 m2.[3]

Tarik El Rhafiki,et.al.,[2015],In addition to their harmful impact on the environment, air-conditioning applications account for a significant percentage of total energy utilization; thinking about clean resources becomes a world priority. Solar cooling systems using either adsorption or absorption technologies show a great potential since they can use a permanent energy and operate with environmentally safe working pairs. This paper investigates the potential of solar air-conditioning systems in Morocco (enjoying different climates) through a comparative study between conventional and solar closed cycle processes based on economic and environmental indicators. Accordingly, annual simulations in 6 climatic zones were performed to estimate cooling loads for a typical Modern Moroccan House. The major finding of this work is that solar air-conditioning systems in hot climates must be an attractive alternative to mitigate CO2 emissions and increase energy savings. However, the high installation cost is a main obstacle facing their implementation. & 2015 Elsevier Ltd. All rights reserved.[4]

The use of fossil fuel has raised significant concerns worldwide. Reports (World Energy Council, 2016; International Energy Outlook, 2016.) revealed that fossil fuels, including coal, oil, and natural gas, continue to account for approximately 85% of the present primary energy consumption, while the energy consumed by the buildings sector accounts for 20.1% of the total delivered-energy consumed worldwide. To reduce the consumption of fossil fuels in the building sector, interest in solar cooling has been increasing dramatically. The concept of solar cooling arose from the assumption that solar energy could adequately match the building cooling demand in hot summer, when the solar radiation and ambient temperature attain their peaks during the year. The coincidence of solar power and cooling load could significantly contribute toward reducing the high electricity demand of utility grids and confronting the challenge of global warming. For the moment, solar cooling mainly consists of solar photovoltaic (PV) driven vapour compression cooling (Li et al., 2015; Bilgili, 2011), solar mechanical compression cooling (Zeyghami et al., 2015; Abdulateef et al., 2009), solar absorption cooling (Zhai et al., 2011),

B.Y. Zhaoa, et.al. [2015],Photovoltaic air-conditioner (PVAC) exhibits the advantages of high energy efficiency and convenient building integration, among solar cooling and heating technologies. The objective of this study is to propose a universal and straightforward method for performance evaluation of PVAC. Sixteen scenarios are simulated by TRNSYS to compare the performance of PVAC in different climates and building types defined by the Chinese national standards. Indicators such as solar fraction (SF), self-consumption ratio (SCR), solar COP, and return of in- vestment (ROI) are used for evaluating energy and economic performances. The results demonstrate that the performance of PVAC is significantly affected by climatic conditions and building types, and thus, the feasibility of PVAC can be conveniently estimated based on the data provided by the Chinese national standards. A PVAC exhibits higher SF and SCR in areas subjected to high temperatures during summer and in office buildings, business malls, and hospital buildings, which mainly operate in the daytime. The building types in the order of decreasing ROI are business mall, hospital buildings, hotel, and office buildings. A comprehensive evaluation indicator is proposed to optimize the PV capacity and is useful to evaluate both the energy and economic performances of PVAC.[5]

VijayKumar Kalwa, et.al. [2014], The present air cooling methods are evaporative coolers, air conditioning, fans and dehumidifiers. But running these products need a source called electricity. The producing of electricity is ultimately responsible for hot and humid conditions i.e. global warming. In hot and humid conditions the need to feel relaxed and has become one of few needs and for this purpose utilization of systems like air-conditioning and refrigeration has increased rapidly. These systems are most of the time not suitable for villages due to longer power cut durations and high cost of products. Solar power systems being considered as one of the path towards more sustainable energy systems, considering solar-cooling systems in villages would comprise of many attractive features. This technology can efficiently serve large latent loads and greatly improve indoor air quality by allowing more ventilation while tightly controlling humidity. Despite increasing performance and mandatory energy efficiency requirements, peak electricity demand is growing and there is currently no prevalent solar air cooling technology suited to residential application especially for villages, schools and offices. This project reviews solar powered air cooler for residential and industrial applications.[6]

Ravinder Goyal, et.al. [2016], To save the precious environment one of the major steps taken is development of solar powered run vehicle which not only shall save us only but will save our coming off springs, which has been disturbed day to day by the high level increase in the pollution being emitted by all the vehicles having internal combustion engines. Not only limited to vehicles pollution is also emitted by industries. While the solar vehicle is based on the concept of utilizing solar energy in to the mechanical energy, the design of this vehicle allows for fewer moving parts which lead to higher efficiency in terms of mileage and reliability. As we all are in a need for eco-friendly environment which is a basic necessity not only for us but for our coming next generations also. Hence by gaining a lot from the past polluted environment design and development of solar car was a mandatory step. In lieu of that solar vehicle was developed having many features like one can use as a passenger vehicle, as an load carrier also, even teenagers can also use it who are not having licence to run an Internal combustion engine powered vehicles. One can have its use in hospitals also where zero noise zones are there. To reduce the weight of the vehicle rectangular hollow pipes are considered.[7]

Mr. Amitkumar Gupta1, et.al.[2016],As a kind renewable energy solar energy is paid more and more in the world. Solar system can be classified into two categories; those are thermal systems which convert solar energy to thermal energy and photovoltaic systems which convert solar energy to electrical energy. However more solar radiation which falling on photovoltaic cells is not converted to electricity, but either reflected or converted to thermal energy. This method leads to a drop of electricity conversion efficiency due to an increase in photovoltaic cells working temperature [1]. In the past century, scientific community has devoted much effort to procure energy sustainability of housing in two main direction; those are reducing external energy supply and using renewable energy for the remaining. In both ways, solar resources are gaining popularity because they increase energy independence and sustainability at the same time offering nearly zero impact to the environment [1]. The earth's surface receives a daily solar dose of 10E+8KW-hr, which is equivalent to 500,000 billion oil barrels that is one thousand times any oil reserve known to man. And the solar energy is collector area dependent, and is a diluted form of energy and is available for only a fraction of the day[6]. A lot of research is being conducted where there is high availability of solar energy just like in India. Solar energy is abundant in summer months where there is no heating load, but instead of cooling is required.[8]

R. Prakash, et.al. [2012], This paper reveals the comfort conditions achieved by the device for the human body. In summer (hot) and humid conditions feel uncomfortable because of hot weather and heavy humidity. So it is necessary to maintain thermal comfort conditions. Thermal comfort is determined by theorem's temperature, humidity and air speed. Radiant heat (hot surfaces) or radiant heat loss (cold surfaces) are also important factors for thermal comfort. Relative humidity (RH) is a measure of the moisture in the air, compared to the potential saturation level. Warmer air can hold more moisture. When you approach 100% humidity, the air moisture condenses – this is called the dew point. The temperature in a building is based on the outside temperature and sun loading plus whatever heating or cooling is added by the HVAC or other heating and cooling sources. Room occupants also add heat to the room since the normal body temperature is much higher than the room temperature. Need of such a source which is abundantly available in nature, which does not impose any bad effects on earth. There is only one thing which can come up with these all problems is solar energy.[9]

Prof. R. D.Gorle, et.al.[2016], This paper reveals the comfort conditions achieved by the device for the human body. In summer (hot) and humid conditions feel uncomfortable because of hot weather and heavy humidity. So it is necessary to maintain thermal comfort conditions. Thermal comfort is determined by the room's temperature, humidity and air speed. Radiant heat (hot surfaces) or radiant heat loss (cold surfaces) are also important factors for thermal comfort. Relative Humidity (RH) is a measure of the moisture in the air, compared to the potential saturation level. Warmer air can hold more moisture. When you approach 100% humidity, the air moisture condenses—this is called the dew point. The temperature in a building is based on the outside temperature and sun loading plus whatever heating or cooling is added by the HVAC or other heating and cooling sources. Room occupants also add heat to the room since the normal body temperature is much higher than the room temperature. The present air cooling methods are evaporative coolers, air conditioning, fans and dehumidifiers. But running these products need a source called electricity. The producing of electricity is ultimately responsible for hot and humid conditions, i.e., global warming. Need of such a source which is abundantly available in nature, which does not impose any bad effects on earth. There is only one thing which can come up with these all problems is solar energy.[10]

Rashmi Patil, et.al.[2018], King Fahd University of Petroleum and Minerals of Dhahran, Saudi Arabia conducted a survey on solar air cooler [1]. They concluded that throughout the history of the human race, major advances in civilization have been measured by the increase in the rate of energy consumption. Today, energy consumption seems to be related to the life standard of the population and the degree of industrialization of the countries. However, the world today is facing unfavourable condition of atmospheric pollution on a much greater scale which has not been faced earlier in human history because of huge revolution in human use of fossil fuel in all activities. To avoid this unfavourable impact, we need to reduce the harmful emission which resulting from burning fossil fuel as a source of energy. This can be achieved using renewable source of green energy. Among these energy sources, solar energy is the most important and attractive source because of its universal abundance and unlimited nature unlike many other renewable energy sources. The main characteristic of solar energy is continuous source being unending also it is an intermittent source during the day and night. Moreover, solar energy does not cause air pollution or affect the earth's surface as fossil fuel. Solar energy is easy to collect unlike the extraction of fossil fuels. [11]

Salman Tamseel, et.al.[2016], Solar energy is one of the most available forms of energy on the earth's surface. The main purpose of using solar energy is to reduce the emissions of CO_2 and other harmful gases that are responsible for global warming and ozone layer depletion. The air conditioning is an attractive field for the application of solar energy because of the availability of maximum solar radiation during summer season when we need cooling. This research program addresses the need for the development of new air conditioning. Now days we need such technologies that have lower operational cost and minimum impact on the environment.

Solar photovoltaic system and solar power is one of renewable energy system which uses PV modules to convert sunlight into electricity. The electricity generated can be stored or use directly, fed back into grid line or combined with one or more other electricity generator or more renewable energy sources. Solar PV system is very reliable and clean sources of electricity that can suit a wide range of application such as residential, industry, agriculture, livestock, etc. [12]

Rishikesh P, et.al.[2016], Solar energy is the light and radiant heat from the Sun that influences Earth's climate and weather and sustains life. Solar power is sometimes used as a synonym for solar energy or more specifically to refer to electricity generated from solar radiation. Since ancient times, solar energy has been harnessed for human use through a range of technologies. Solar radiation along with secondary solar resources such as wind and wave power, hydro electricity and biomass account for most of the available flow of renewable energy on Earth. Solar energy technologies can provide electrical generation by heat engine or photovoltaic means, space heating and cooling in active and passive solar buildings; potable water via distillation and disinfection, day lighting, hot water, thermal energy for cooking, and high temperature process heat for industrial purposes. Sunlight can be converted into electricity using photovoltaic (PV), concentrating solar power (CSP), and various experimental technologies. PV has mainly been used to power small and medium-sized applications, from the calculator powered by a single solar cell to off-grid homes powered by a photovoltaic array. The term "photovoltaic" comes from the Greek φώς (*phos*) meaning "light", and "voltaic", meaning electrical, from the name of the Italian physicist Volta, after whom a unit of electrical potential, the volt, is named.A solar cell, or photovoltaic cell (PV), is a device that converts light into direct current using the photoelectric effect. The first solar cell was constructed by Charles Fritts in the 1880s. Although the prototype selenium cells converted less than 1% of incident light into electricity, both Ernst Werner von Siemens and James Clerk Maxwell recognized the importance of this discovery. [13]

CHAPTER 3

3. Construction and Working

Figure 3.2.1 and 3.2.2 show the construction and working of the solar powered air conditioning system as follows.

3.1 Construction

3.1.1 Peltier Module

Peltier module is a device which works on the principle of Peltier effect. Its one side is heated and one side can be kept cold by using electricity. In our project we use 12 volt and 3 ampere current rating Peltier module though in market there are different types of Peltier module is available .It is one of the important part of our project. By applying a low voltage DC power to a TE module, heat will be moved through the module from one side to the other. One module face, therefore, will be cooled while the opposite face is simultaneously heated. It is important to note that this phenomenon may be reversed whereby a change in the polarity (plus and minus) of the applied DC voltage will cause heat to be moved in the opposite direction. Consequently, a thermoelectric module may be used for both heating and cooling thereby making it highly suitable for precise temperature control applications. A thermoelectric module can also be used for power generation. In this mode, a temperature differential applied across the module will generate a current.

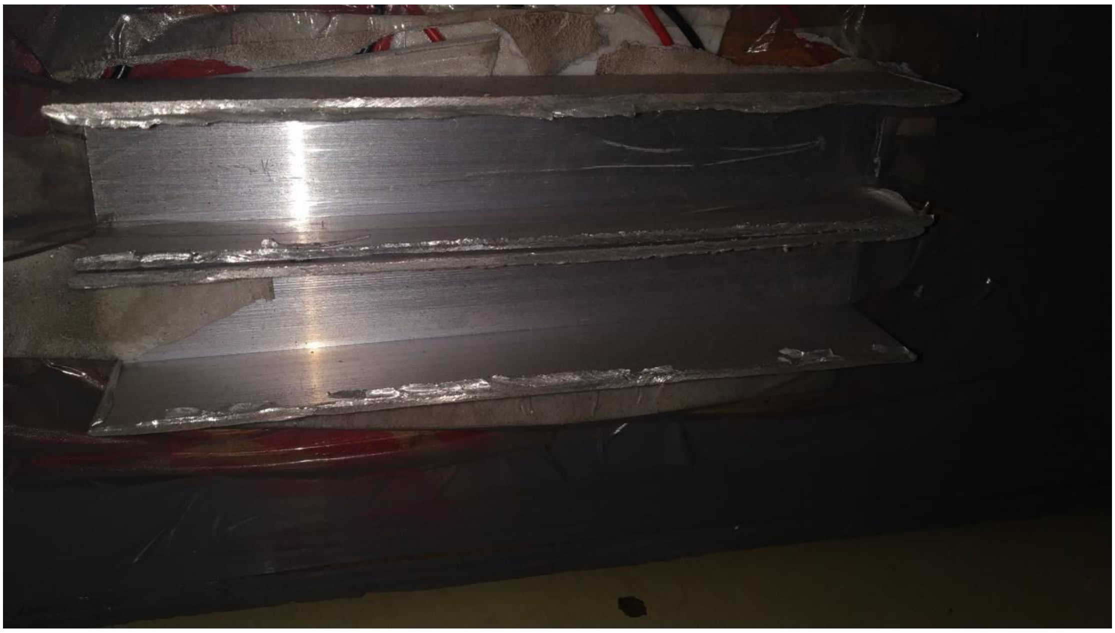


Fig.3.1.1 Peltier Module

A practical thermoelectric module generally consists of two or more elements of n and p- type doped semiconductor material that is connected electrically in series and thermally in parallel. These thermoelectric elements and their electrical interconnects typically are mounted between two ceramic substrates. The substrates hold the overall structure together mechanically and electrically insulate the individual elements from one another and from external mounting surfaces. Most thermoelectric modules range in size from approximately 2.5-50 mm (0.1 to 2.0 inches) square and 2.5-5mm (0.1 to 0.2 inches) in height. A variety of different shapes, substrate materials, metallization patterns and mounting options are available.Typical thermoelectric module assembly both N- type and P-type Bismuth Telluride thermoelectric materials are used in a thermoelectric cooler. This arrangement causes heat to move through the cooler in one direction only while the electrical current moves back and forth alternately between the top and bottom substrates through each N and P element.

N-type material is doped so that it will have an excess of electrons (more electrons than needed to complete a perfect molecular lattice structure) and P-type material is doped so that it will have a deficiency of electrons (fewer electrons than are necessary to complete a perfect lattice structure). The extra electrons in the N material and the “holes” resulting from the deficiency of electrons in the P material are the carriers which move the heat energy through the thermoelectric material.

Most thermoelectric cooling modules are fabricated with an equal number of N- type and P-type elements where one N and P element pair form a thermoelectric “couple.” For example, the module illustrated above has two pairs of N and P elements and is termed a “two-couple module”. Cooling capacity (heat actively pumped through the thermoelectric module) is proportional to the magnitude of the applied DC electric current and the thermal conditions on each side of the module. By varying the input current from zero to maximum, it is possible to regulate the heat flow and control the surface temperature.

3.1.2 Solar Panel

Solar panel is a panel which basically converts solar energy into electric energy with the help of photovoltaic material. There are different types of solar panel available in the market but for our project we will use 12 volt and 500-800 mA rating solar panel. Solar panel refers to a panel designed to absorb the sun's rays as a source of energy for generating electricity or heating. Solar panels are devices that convert light into electricity. They are called "solar" panels because most of the time, the most powerful source of light available is the Sun, called Sol by astronomers. Some scientists call them photovoltaic which means, basically, "light-electricity." A solar panel is a collection of solar cells. Lots of small solar cells spread over a large area can work together to provide enough power to be useful.

The light that hits a cell, the more electricity it produces, so spacecraft are usually designed with solar panels that can always be pointed at the Sun even as the rest of the body of the spacecraft moves around, much as a tank turret can be aimed independently of where the tank is going. Solar panel refers to a panel designed to absorb the sun's rays as a source of energy for generating electricity or heating. A photovoltaic (in short PV) module is a packaged, connected assembly of typically 6×10 solar cells. Solar Photovoltaic panels constitute the solar array of a photovoltaic system that generates and supplies solar electricity in commercial and residential applications.

Each module is rated by its DC output power under standard test conditions, and typically ranges from 100 to 365 watts. The efficiency of a module determines the area of a module given the same rated output an 8% efficient 230 watt module will have twice the area of a 16% efficient 230 watt module. There are a few solar panels available that are exceeding 19% efficiency. A single solar module can produce only a limited amount of power; most installations contain multiple modules.

A photovoltaic system typically includes a panel or an array of solar modules, a solar inverter, and sometimes a battery and/or solar tracker and interconnection wiring. Solar modules use light energy (photons) from the sun to generate electricity through the photovoltaic effect. The majority of modules use wafer-based crystalline silicon cells or thin-film cells based on cadmium telluride or silicon. The structural (load carrying) member of a module can either be the top layer or the back layer.Cells must also be protected from mechanical damage and moisture. Most solar modules are rigid, but semi- flexible ones are available, based on thin-film cells. Electrical connections are made in series to achieve a desired output voltage and/or in parallel to provide a desired current capability.

Fig.3.1.2 Solar Panel

The conducting wires that take the current off the modules may contain silver, copper or other non-magnetic conductive. The cells must be connected electrically to one another and to the rest of the system. Externally, popular terrestrial usage photovoltaic modules use MC3 (older) or MC4 connectors to facilitate easy weatherproof connections to the rest of the system. Bypass diodes may be incorporated or used externally, in case of partial module shading, to maximize the output of module sections still illuminated. Some recent solar module designs include concentrators in which light is focused by lenses or mirrors onto an array of smaller cells. This enables the use of cells with a high cost per unit area (such as gallium arsenide) in a cost-effective way.

3.1.3 Battery

Battery is used to store energy which will be further used in Peltier module. We will use 12 volt lead acid rechargeable having 6.8 amp rating. The storage battery or secondary battery is such battery where electrical energy can be stored as chemical energy and this chemical energy is then converted to electrical energy as when required. The conversion of electrical energy into chemical energy by applying external electrical source is known as charging of battery.

Whereas conversion of chemical energy into electrical energy for supplying the external load is known as discharging of secondary battery. During charging of battery, current is passed through it which causes some chemical changes inside the battery.This chemical change absorbs energy during their formation. When the battery is connected to the external load, the chemical changes take place in reverse direction, during which the absorbed energy is released as electrical energy and supplied to the load.

Fig.3.1.3 Battery

Now we will try to understand principle working of lead acid battery and for that we will first discuss about lead acid battery which is very commonly used as storage battery or secondary battery. The main active materials required to construct a lead-acid battery, Lead peroxide (PbO2), Sponge lead (Pb), Dilute sulfuric acid (H2SO4) Lead Peroxide (PbO2).

The positive plate is made of lead peroxide. This is dark brown, hard and brittle substance. Sponge Lead (Pb): The negative plate is made of pure lead in soft sponge condition. Dilute Sulfuric Acid (H2SO4): Dilute sulfuric acid used for lead acid battery has ration of water: acid = 3:1. The lead acid storage battery is formed by dipping lead peroxide plate and sponge lead plate in dilute sulfuric acid. A load is connected externally between these plates.

3.1.4 DPDT Switch

A Double Pole Double Throw (DPDT) switch is a switch that has 2 inputs and 4 outputs; each input has 2 corresponding outputs that it can connect to. Each of the terminals of a double pole double switch can either be in 1 of 2 positions. This makes the double pole double throw switch a very versatile switch. With 2 inputs, it can connect to 4 different outputs. It can reroute a circuit into 2 different modes of operation. A Double Pole Double Throw Switch is actually two single pole double throw (SPDT) switches.10 Amp rating Double Pole Double Throw (DPDT) Switch

3.1.5 Aluminium Sheet

Aluminum is a soft and ductile material, which is reasonably priced and readily available. However, aluminum is an excellent heat conductor so care would have to be taken to insulate the container. So the container in which we keep water is made of aluminum.

3.1.6 Heat Sink with Cooling Fan

It is used to increase heat transfer rate. The cooling fan is having 12 volt motor and is 200 mA rating. A heat sink (also commonly spelled heat sink) is a passive heat exchanger that transfers the heat generated by an electronic or a mechanical device to a fluid medium, often air or a liquid coolant, where it is dissipated away from the device, thereby allowing regulation of the device's temperature at optimal levels. In computers, heat sinks are used to cool central processing units or graphics processors. Heat sinks are used with high- power semiconductor devices such as power transistors and optoelectronics such as lasers and light emitting diodes (LEDs), where the heat dissipation ability of the component itself is insufficient to moderate its temperature. A heat sink is designed to maximize its surface area in contact with the cooling medium surrounding it, such as the air. Air velocity, choice of material, protrusion design and surface treatment are factors that affect the performance of a heat sink.

Fig.3.1.6 Cooling Fan

Heat sink with cooling fan Heat sink attachment methods and thermal interface materials also affect the die temperature of the integrated circuit. Thermal adhesive or thermal grease improve the heat sink's performance by filling air gaps between the heat sink and the heat spreader on the device.

A heat sink is usually made out of copper and/or aluminium. Copper is used because it has many desirable properties for thermally efficient and durable heat exchangers. First and foremost, copper is an excellent conductor of heat. This means that copper's high thermal conductivity allows heat to pass through it quickly. Aluminium is used in applications where weight is a big concern.

3.1.7 PCB

A printed circuit board (PCB) mechanically supports and electrically connects electronic components using conductive tracks, pads and other features etched from copper sheets laminated onto a non-conductive substrate. PCBs can be single sided (one copper layer), double sided (two copper layers) or multi- layer (outer and inner layers). Conductors on different layers are connected with via. Multi-layer PCBs allow for much higher component density. FR-4 glass epoxy is the primary insulating substrate. A basic building block of the PCB is an FR-4 panel with a thin layer of copper foil laminated to one or both sides. In multi- layer boards multiple layers of material are laminated together. Printed circuit boards are used in all but the simplest electronic products. Alternatives to PCBs include wire wrap and point-to-point construction. PCBs require the additional design effort to lay out the circuit, but manufacturing and assembly can be automated. Manufacturing circuits with PCBs is cheaper and faster than with other wiring methods as components are mounted and wired with one single part. PCB 4.1.10 Power Supply 12V–1 Amp rating for battery charging.

3.1.8 Temperature Sensor

Fig.3.1.8 Temperature Sensor

Temperature sensor is used to sense the temperature air conditioning system.

3.2 Working

Fig. 3.2.1 & fig. 3.2.2 shows the working of the solar powered air conditioning.

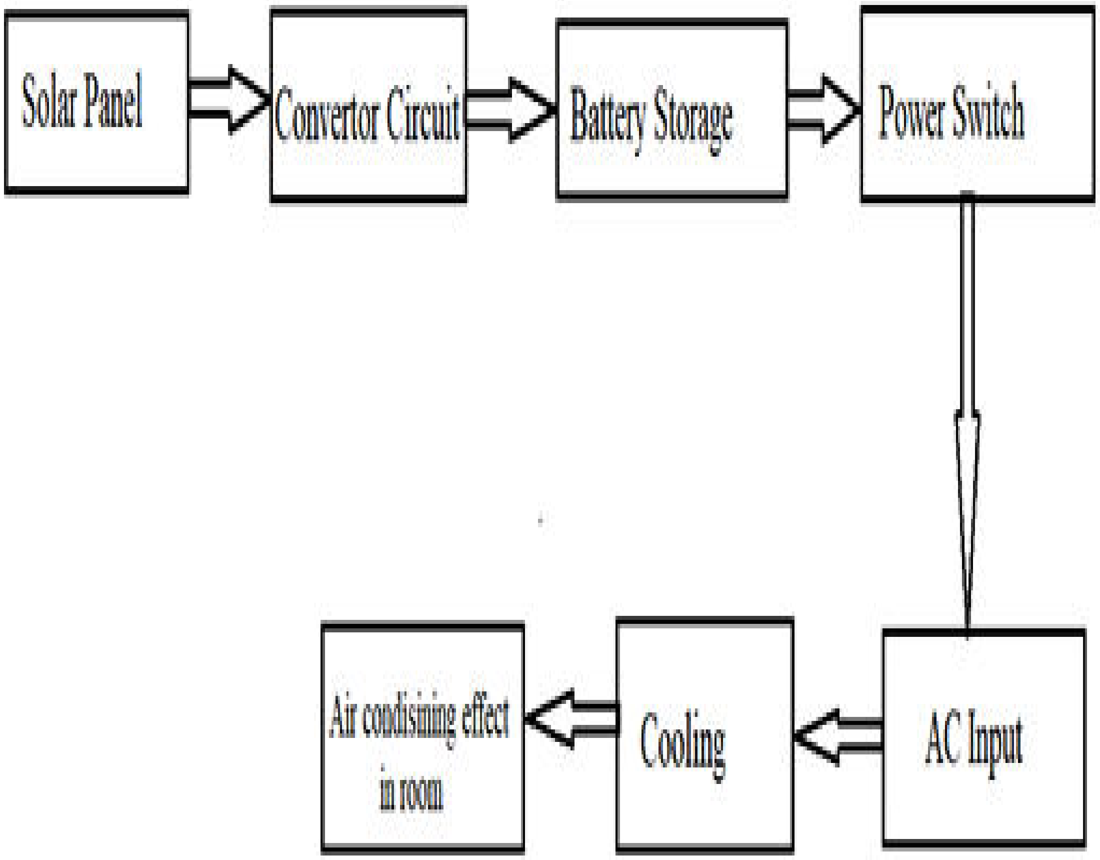


Fig. 3.2.1Block diagram of solar air conditioning

The solar energy is received by the PV module and transform into electrical energy. The electrical energy is then being regulated by charge controller either by supplies it directly into the load or charges the batteries. As the electrical energy coming from the PV module is in DC, inverter will convert it into AC as the compressor needs AC to operate. The most common type of air conditioning is technically referred to as direct expansion, mechanical, vapour compressionrefrigeration system. The goal with air conditioning is to capture heat in the cooling space and throw it outside.

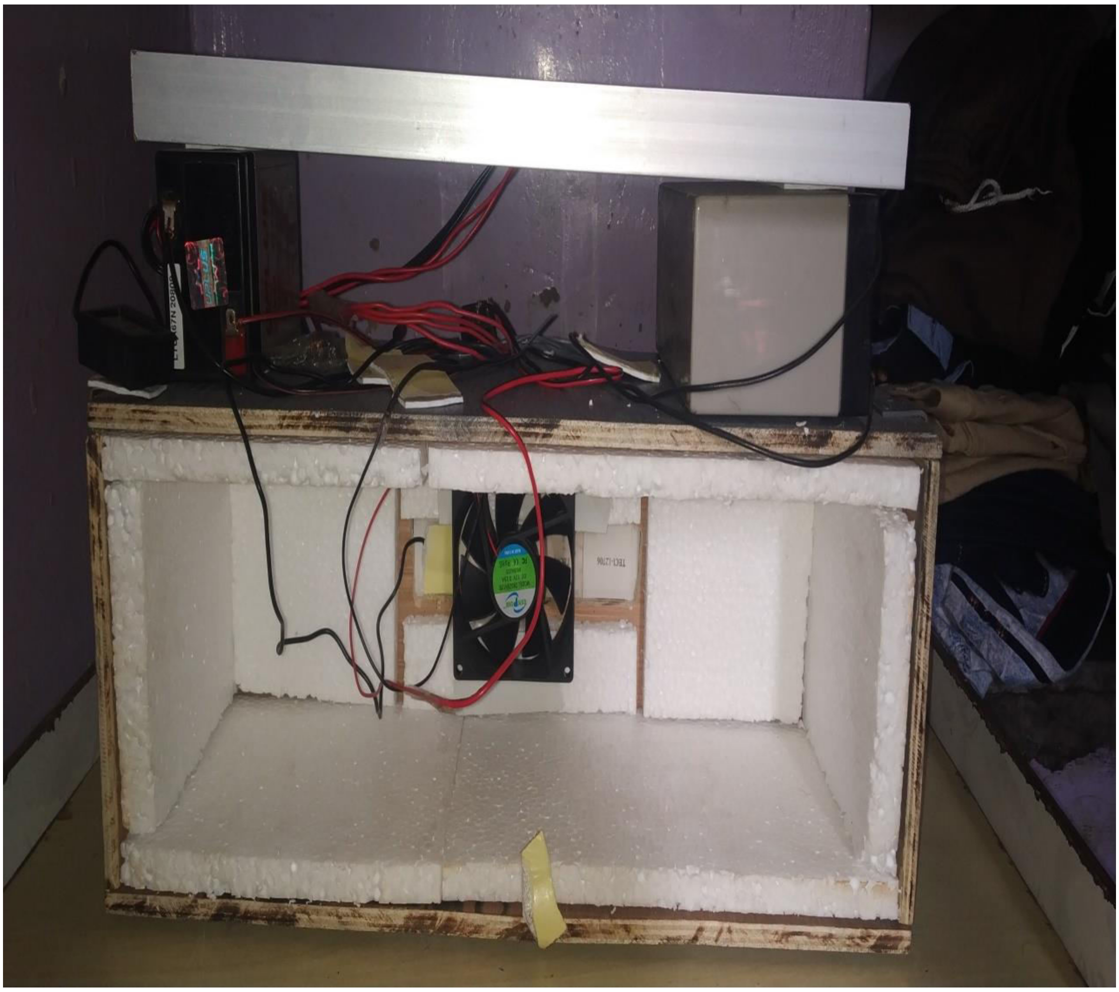


Fig. 3.2.2 model of solar air conditioning

The operation of the system starts when the cold, low pressure liquid flows across the evaporator coil inside the cooling space to absorb heat. The cold liquid that went into the evaporator coil comes out as a low pressure gas. Then, the cool, low pressure gas is taken outside and compressed by the compressor to become a hot, high pressure gas. Next, the hot gas is passed through the condenser coil and gives off some of its heat as outdoor air is blown across the coil.

This cause the hot gas to condense back to into a warm liquid. The warm liquid is carried back to the evaporator by passing through the expansion device which decreases the temperature and pressure of the liquid. Figure 4 shows the basic air conditioning operation. It works on the principle to run air conditioner by solar energy. Solar energy received from the sun is concentrated on the solar panel to convert it into electric energy. It is connected to the battery to store the converted electric energy in it. Then the battery is connected to the inverter and inverter is connected to air conditioner. When the necessary connections are made the air conditioner starts and give desired. A prototype of the compact solar air conditioner specifically developed for residential application is presented.

CHAPTER 4

4. Design Calculations for conventional air conditioning system

1. Room Area (British Thermal Unit)

Area (m^2)	Sq. ft.	BTU/ hr
9-14	100-150	5000 BTU/hr
-	80	2000 BTU/hr

2. Size of room AC

a) Calculate basic cooling capacity

Total floor Area	Basic cooling Capacity
150	5000 BTU/hr
80	2000 BTU/hr

- Worksheet

Additional size consideration	Add or subtract from basic cooling capacity	
	5000	2000
If the space is heavy shaded subtract 10%	-500	-200
If the space is extremely sunny add 10%	+500	+200
If the space is poorly insulated add 15%	750	300
Persons in the room more than two	(Assume 6 person)	(Assume 6 person)

add 600 BTU/hr per person	6*600 =3600	6*600 =3600
Total other	4350	3900
Approximate size of full air conditioner	5000 + 4350= 9350 BTU/hr	2000+ 3900 = 5900 BTU/hr

1 RT = 12000 BTU/hr

1 BTU/hr = $8.333*10^{-5}$ RT

$$\text{Ton} = \frac{\text{BTU/hr}}{12000}$$

Ton = 9350/12000 or Ton = 5900/12000

Ton = 0.7791 or Ton = 0.4916

Assume 1 Ton AC is required to cool the room area 9-14 m^2 or 100-150 sq. ft.

Assume (energy efficiency ratio) EER for 3 star AC 2.7

1 ton = 3.517 KW

EER = cooling capacity of ac/ power consume by ac

Power consume by ac = cooling capacity of ac/ EER

= 3.517/2.7

Power consumption by ac = 1.3025 KW

For 24 Hour = 1.3025*24 = 31.26 KW

1 KW = 3412.142 BTU/hr

1.3025 KW = 4444.318 BTU/hr

1 Ton AC consume 1.3025 KW power and 4444.318 BTU/hr

i. Cooling cost calculation = $\frac{\text{operating hour * BTU/hr* 0.293}}{1000}$

For 24 hour operating = (24*4444.318*0.293)/1000

= 31.25 KWh

For 365 days = (365*4444.318*0.293*24)/1000

= 11407.14212 KWh

As per the Indian electricity domestic rate per unit

Unit	0.100	101.300	301.500
Price	3.00	6.73	9.75

For day

Rs = cooking cost*9.75(unit price)

31.25*9.75

Rs = 304.6875

For 365 days or year

Rs = cooling cost*9.75

= 11407.142*9.75

Rs = 111219.6357

For 8 hour running

For a day = 1.3025*8 = 10.42 KWh

For a month = 1.3025*30*8 = 312.6 KWh

For a year = 1.3025*360*8 = 3751.2 KWh

For a rate of Rs. 9.75

Then

For a day = 9.75*13.42 = 101.575

For a month = 9.75*312.6 = 3047.95

For a year = 9.75*3751.6 = 36574.2 Rs

Total cost = initial cost + running cost

= 20,000 + 36574.2

= 56574.2 Rs

4.1 Design Calculation for Solar Air Conditioning System

Initial cost = 75,000 Rs

Battery = 20,000 Rs

Solar Panel = 20,000 Rs

Inverter = 25,000 Rs

AC = 20,000 Rs

Solar AC running cost,

The typical air conditioner of 1 ton,

Capacity if used 8 hour per day input power is 1302.5 watt will consume electricity at the rate 10.42 KWh per day in composition the solar air conditioner will use only 900w which is about 40% of electricity.

For a day = 900*8 = 7.2 KWh

Hence the saving will be per day

= 10.42 – 7.2

= 3.22 KWh per day

For per month saving will be

= 3.22*30 = 966 KWh per month

Saving in rupees = 96.6*9.75

= 941.85

For per year saving will be,

= 3.22*360 = 1159.2 KWh

Saving in Rs = 1159.2*9.75 = 11,302.2 Rs

4.2 solar AC running Cost

Per month = 3047.85 – 941.85 = 2106.6 Rs

Per year = 36574.2 – 11302.2 = 25272 Rs

Total Cost = initial cost + running cost

= 75000 + 25272 = 1 lakh Rs

4.3Solar Panel Specifications

Maximum Power (Pmax) 5watts Tolerance =10/-10%

Maximum Power Voltage 12 volts Maximum Power Current .71 amps Open Circuit Voltage (Voc) 10.8 volts Short Circuit Current (Isc) 0.57amp Temp coefficient of Voc -0.37x102 A/C° Temp coefficient of ISC 0.08x102 A/C° NOC 47 C°

Max System Voltage 600 Volts Dimensions 12.5 - 7 – 1 (LxWxD - inches)

Weight 2.2 lbs

Cells - 36

Cell Technology - Polycrystalline Cell Shape - Rectangular Temperature Coefficient

Power Pmax/°C – minus 0.44%

4.4 Solar Panel Calculation

VOLT = 12 V WATT = 5 W W = V X I

5 = 12 X I I = 5/12

I = 420ma

4.5 Battery Calculation

B_{AH} /C_I = 8 ah/420ma

= 19 hrs.

To find the Current Watt = 18 w

Volt = 12v Current =? P= V x I 18 =12 x I I = 18/12

= 1.5 AMPS

4.6Fan Calculation

Fan (condenser fan =12‖ x 10B) Motor in put = 80watts

Weight =1000gms Speed =2300rpm

Max current =6.7amps (12 v dc) Blade = nylon glass filled

Air flow = 1400m3/h @17 Pascal fan inlet pressure

4.7Peltier Module

Heat Sink Calculations With the increase in heat dissipation from electronics devices and the reduction in overall form factors, thermal management becomes a more a more important element of electronic product design. Heat sinks are devices that enhance heat dissipation from a hot surface, usually the case of a heat generating component, to a cooler ambient, usually air. For the following discussions, air is assumed to be the cooling fluid. In most situations, heat transfer across the interface between the solid surface and the coolant air is the least efficient within the system, and the solid-air interface represents the greatest barrier for heat dissipation.

A heat sink lowers this barrier mainly by increasing the surface area that is in direct contact with the coolant. This allows more heat to be dissipated and/or lowers the device operating temperature. The primary purpose of a heat sink is to maintain the device temperature below the maximum allowable temperature specified by the device manufacturers. Before discussing the heat sink selection process, it is necessary to define common terms and establish the concept of a thermal circuit. Notations and definitions of the terms are as follows.

Where,

Q: Total power or rate of heat dissipation in W.

T_j = maximum junction temperature of the device in °C.

T_c = case temperature of the device in °C.

T_s: sink temperature in °C.

T_a: ambient air temperature in °C.

Allowable T_j values range from 115°C in typical microelectronics applications to as high as 180°C for some electronic control devices. In special and military applications, 65°C to 80°Care not uncommon. Since the case temperature of a device depends on the location of measurement, it usually represents the maximum local temperature of the case.

Again, this represents the maximum temperature of a heat sink at the location closest to the device.. Using temperatures and the rate of heat dissipation, a quantitative measure of heat transfer efficiency across two locations of a thermal component can be expressed in terms of thermal resistance

R, defined as: $R = \Delta T/Q$….. (4.2.1)

Where,

T = the temperature difference between the two locations.

The unit of thermal resistance is in °C/W, indicating the temperature rise per unit rate of heat dissipation. This thermal resistance is analogous to the electrical resistance Re, given by Ohm's law.

Re =ΔV/I ….. (4.2.2)

With V being the voltage difference and I the current The thermal resistance between the junction and the case of a device is defined as:

Rjc = (Tjc)/Q = (Tj- Tc)/Q ….. (4.2.3)

This resistance is specified by the device manufacturer. Although the Rjc value of a give device depends on how and where the cooling mechanism is employed over the package, it is usually given as a constant value. It is also accepted that Rjc is beyond the user's ability to alter or control. Similarly, case-to-sink and sink-to-ambient resistances are defined as:

Rcs = (ΔTcs)/Q = (Tc- Ts)/Q Rsa = (ΔTsa)/Q = (Ts- Ta)/Q ….. (4.2.4)

Rcs represents the thermal resistance across the interface between the case and the heat sink and is often called the interface resistance. This value can be improved substantially depending on the quality of mating surface finish and/or the choice of interface material. Rsa is heat sink thermal resistance.

To begin the heat sink selection, the first step is to determine the heat sink thermal resistance required to satisfy the thermal criteria of the component. By rearranging the previous equation, the heat sink resistance can be easily obtained as:

Rsa = ((Ts – Ta)/Q) – Rjc- Rcs …… (4.2.5)

Tj, Q and Rjc are provided by the device manufacturer, and Ta andArea of aluminium enclose-80 cm*cm*cm Voltage-12 V Time- 25 min Temperature Difference-10 Degree C.

4.8 Temperature Sensor Specification

- Temperature range: -50~ +70Â°C
- Temperature display resolution: 0.1
- Temperature measurement accuracy: Â±1Â°C

4.9 Annual Solar Output of Panel

The global formula to estimate the electricity generated in output of a photovoltaic system is:

E = A * r *H * PR …….. (4.1.1)

Where,

E = Energy (kWh)

A = Total solar panel Area (m^2)

r = solar panel yield (%)

H = Annual average solar radiation on tilted panels (shadings not included)

PR = Performance ratio, coefficient for losses (range between 0.5 and 0.9, default value = 0.75)

4.10 Cost Estimation of Project

Sr. no.	Name of component	Qty.	Cost
1	Solar panel	1	2500 Rs
2	Battery	1	1100 Rs
3	Battery	1	700 Rs
4	Circuit	-	1000 Rs
5	Tag Module	4	3000 Rs
6	Cooling Fan	1	500 Rs
7	Plywood	1	500 Rs
8	Temperature Sensor	1	500 Rs
9	Wire	-	100 Rs
10	Thermocole	-	20 Rs

Circuit development charge = 1000 Rs

Cutting, fitting and other charges = 1000 Rs

Travelling charge = 500 Rs

Total cost = total cost of component + circuit development charge + cutting, fitting and other charges + travelling cost.

Total cost = 9920 + 1000 + 1000 + 500 = 12420 Rs.

CHAPTER 5

5. Comparison between Solar Air Conditioning And Electric Air Conditioning System

Sr. No.	Solar Air Conditioning System	Electric Air Conditioning System
1	Installation cost is high	Installation cost is less
2	Operating cost of solar air conditioning system is low.	Operating cost of solar air conditioning system is high.
3	Solar air conditioning systems are eco-friendly due to solar energy.	Electric air conditioning systems are not eco-friendly due to use of refrigerants.
4	Efficiency of solar air conditioning is depends on climatic conditions.	Efficiency of electric air conditioning system is high and it is not depends on climatic conditions.
5	Cost of power consumption is negligible due to solar energy.	Cost of power generation is high due to consumption of electrical energy.
6	Cooling efficiency of solar air conditioning system is low as compared to electric air conditioning system.	Cooling efficiency of electric air conditioning system is high as compared to soar air conditioning system.
7	High space required as compared to the electric air conditioning system.	Low space required as compared to the solar air conditioning system.

CHAPTER 6

6. Advantages, Disadvantages and Applications

6.1 Advantages

1. Solar air conditioning saves the electricity consuming
2. Provide the night time energy when its charge in day condition.
3. It reduces the billing cost by using the solar energy.
4. Highly reliable.
5. Simple in design.

6.2 Disadvantages

1. High initial investment cost.
2. System is bulky.

6.3 Application

1. This system applicable for home, offices, industries, colleges for air conditioning the rooms, halls.
2. Solar energy is very useful for the use in different type of appliances.
3. As same as air conditioning solar energy use for solar car, solar street light
4. It can be used in the rural areas where power cut is a problems.

CHAPTER 7

7. Future Scope

Solar air-conditioning has the attractiveness of using a free and a clean energy source to insure the cooling needs in the hottest periods, since cooling demand coincides most the time with the availability of solar radiation. Furthermore, solar technologies can employ environmentally safe refrigerants like water.From the above results we can conclude that the reliability of the solar air conditioner available in India is less with unsatisfactory level of cooling. Thus more research is required in the cooling module design with high quality Peltier modules to be made available from U.S or Europe. If such changes are made than the rate of satisfactory results will surely increase with reliability. The general system is simple to design yet performance of the entire system is yet to be realized. Due to certain abnormalities we were unable to successfully interface the regulator circuit with the TEC and the solar panel. Furthermore, other factors like shading and effective mounting also hinder the performance of the PV system.

CHAPTER 8

8. Results

Room temperature = 35^0 C

Sr. no.	Temperature in ^{0}C	Time in seconds
1	36.2	14
2	36	120
3	35.8	240
4	35.6	300

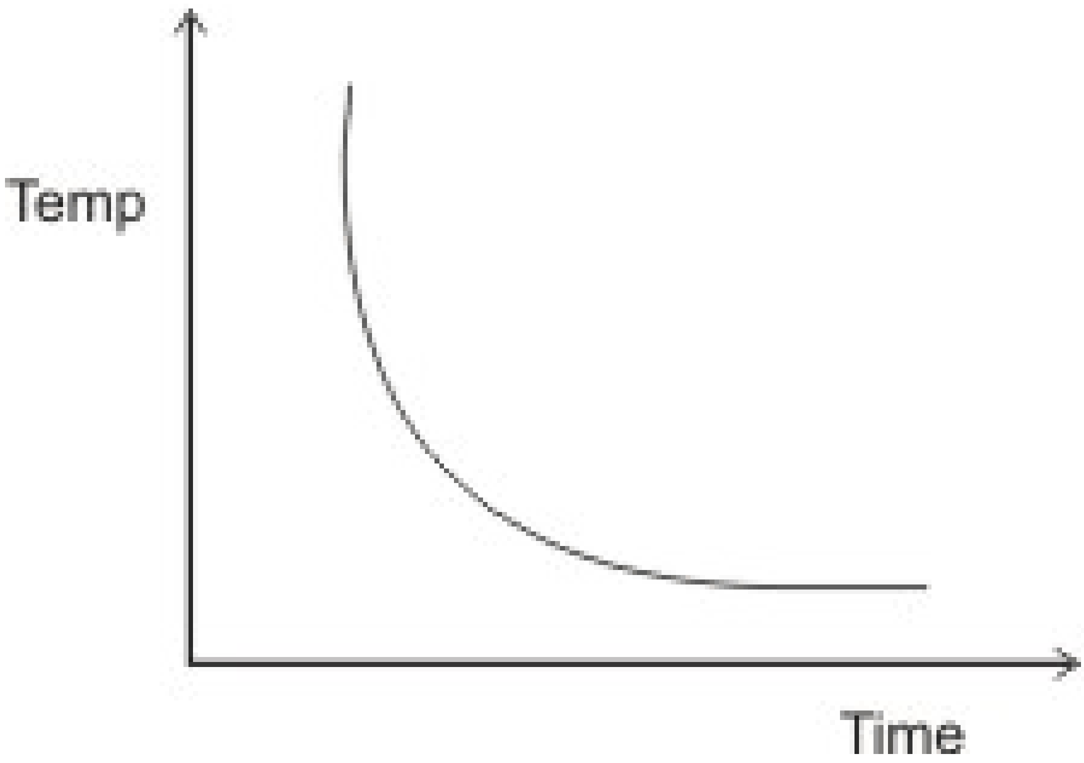


Fig.8.1 Graph of temp vs. time

From the above graph we can conclude that temperature of solar air conditioning system decreases with increase in time

CHAPTER 9

9. Conclusion

This paper concludes that the system design needs to consider both air conditioner and PV system in order to achieve the space cooling. There are several characteristics that are needed to know either on the PV system or air conditioning system. Factors affect the output of PV cell is an important characteristic in photovoltaic. As for the air conditioning, cooling capacity must be determined first as it will give a rough idea on how to design and construct the system with enough electrical energy supplied to it. With considering of these several factors, it will help to improve the stability and efficiency of the system for greener solutions to the world's energy needs. The project carried out by us made an impressing task in the field of Cost of generation of power is very less so the source of power is free and available in plenty and then is no power interruptions. This project has also reduced the cost involved in the concern. Project has been designed to perform the entire requirement task which has also been provided.

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