

Study on Solar Powered Air Conditioning System

Aniket Anil Mhatre¹, Bhagwat Yashwant Dhalpe², Nikhil Naresh Patil³, Satyam Ashok Dahiphale⁴,
Pooja Abhiman Pethe⁵ K. D. Thanekar⁶

¹Professor in Anantrao Pawar College of Engineering and Research, Pune, Maharashtra, India.

^{2,3,4,5,6} Students of Anantrao Pawar College of Engineering and Research, Pune, Maharashtra, India.

Abstract: Increase in demand on high oil process and energy, development in renewable energy is on rise. In recent years, solar air conditioning has increased in growth; almost in every building, for indoor comfort air conditioning is used. Therefore, in this paper we concentrate on study of air conditioning system based on Photovoltaic system (PV) which has photovoltaic (PV) panels, inverter, charge controller and charge battery. This system can be used in non-electrified areas. The main reason behind using this energy is, because solar energy is cost effective, renewable and environmental friendly.

Keywords: Solar energy, Working of solar air conditioning, Component parts.

INTRODUCTION

Most universal and primary measure of all form of work done by human being and nature is energy. The most critical input in process of social development, industrial development and economic is energy. Energy consumption is rapidly increasing in day-today life.

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". From one place to another place energy can be transported. To develop future energy requirement, alternative or non-conventional or renewable

In primary part of world, air conditioning working on electrical energy has many consumers which usually causes shortage of energy required to run the air condition. Due to change in working times, increased in comfort expectations & global warming.

Day by day demand of energy is increasing due to increases in population, transportation and industrialization.

Solar air condition is nothing but, use of solar power on any air conditioning. This process can be done by converting solar passive, solar thermal energy and photovoltaic. Solar air conditioning may play a beneficial role in zero-energy and energy-plus buildings design. Solar air conditioning can reduce electricity demand. To eliminate the need for CFC, HCFC or HFC refrigerants many solar air conditioning systems are constructed.

Solar Energy: -

The sun is the most important feature in our solar system. The great energy release by sun's is nothing but the result of an elaborate chemical process in sun's core of thermonuclear fusion. The radiation generated by this energy comes in all direction of sun and a very small fraction of that energy reaches to the earth.

The sun's outer visible layer which have around 6000°C temperature is known as photosphere.

Solar energy can be large source of power. It has 178 billion MW potential, which is 20,000 times the world's demand. Large scale development is not possible. Energy obtained from sun's can be utilized not only as thermal as well as photovoltaic.

OBJECTIVES

1. Our focus is on implementation of measures for an accelerated market introduction of solar air conditioning and refrigeration with focus on improved components and system concepts.
2. Development of pre-engineered system concepts for small and medium size systems and development of optimized and standardized schemes for custom made systems so that this system can be easy to install and to use.
3. The use of solar air conditioning can be encouraged and fortify by explaining beneficiary points of use of solar air conditioning over conventional air conditioning.
4. To create awareness regarding various benefits of solar air conditioning system over conventional air conditioning system. This can be achieved by explaining consumers the cost of maintenance of solar air conditioning system and conventional air conditioning systems.
5. To help conserve our environment by implementation of solar powered air conditioning system. As solar air conditioning system makes use of replenishable energy source it helps to reduce direct effect on our environment.

ADVANTAGES

1. Solar air conditioning provides us a great pack of benefits, which lead us in many ways in our life. Installation of solar air conditioning expenses required is much less than normal installation of air conditioning which can be reduce through tax credits, deductions and refunds.
2. In solar air conditioning the use of harmful chemicals like Freon or other chemicals are not used which further avoids release of harmful chemicals in the environment. Solar air Conditioning system eliminates the need for CFC, HCFC or HFC refrigerants.
3. Solar air condition system proves economical on long run as electricity is generated using solar panels. As we don't have to pay for sun rays generation of electricity is very affordable resulting in low running cost.
4. Solar air condition system doesn't cause any pollution. As environment friendly refrigerants such as R22-Hydro chlorofluorocarbon & R410-Hydro fluorocarbon are used, it prevents from causing pollution. As emission of harmful chemicals like CFC & HCFC which cause ozone depletion is reduced pollution causing is eliminated.
5. Sunlight is free of cost. Of course, there is the initial investment for system's equipment. After that initial investment paid, you won't receive any bill for rest of your life from this electrical utility.
6. No matter how large area is as long as sun shines in that particular area, electricity can be generated from solar power. Areas where electricity power cable is inaccessible, electricity can be produce with help of solar power. Solar panels are used to generate electricity effectively so need of other pollution causing ways to generate electricity are avoided.
7. At night batteries are charge with help of solar power so that solar powered devices can be used. Electricity generated using solar panels can be stored in batteries in form of DC (Direct current). This stored electricity can be used during night, during cloudy condition, etc.

FLOW CHART OF METHODOLOGY

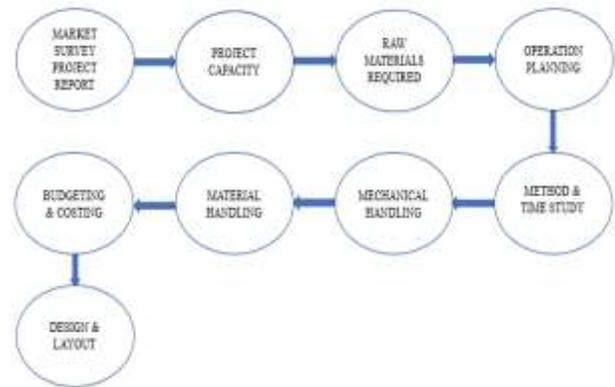


Fig no. 1: - Flow Chart of Methodology

COMPONENTS

1. Solar Panel: -

On supporting structures solar panel refers to either of photovoltaic module, solar thermal energy panel or set of solar photovoltaic modules are electrically connected and mounted. A photovoltaic module is a clot, it is nothing but connected assembly of solar cells. To generate and supply electricity solar panels can be used as an integrant of bigger photovoltaic system. Electrical connections are made in series to accomplish desired output voltage and when it is placed in parallel it gives desired current capability.

Types of Solar Panel: -

- i. Monocrystalline Silicon PV Panel
- ii. Polycrystalline Silicon PV Panel
- iii. Thin film PV Panel



Fig no. 2 Solar Panel (Source – Purelivingforlife.com)

2. Battery: -

Battery plays a vital role in the solar air conditioning system. Electrical power stored in battery is in chemical reaction form. This system can only run on power which is obtained from sun shine and generator, if we don't place battery. Types of batteries available are lead acid battery, lithium ion battery and nickel cadmium battery.



Fig no. 3 Battery (Source – Renewableenergysolar.net)

1. Inverter: -

The power of inverter is heart of the system. Inverter is an electronic device which converts D.C. to A.C. so that one can get uninterrupted power. Design of specific device depends on the input voltage, the output voltage and overall power handling. The power is provided by the D.C. source to inverter, independently inverter does not produce any kind of power.

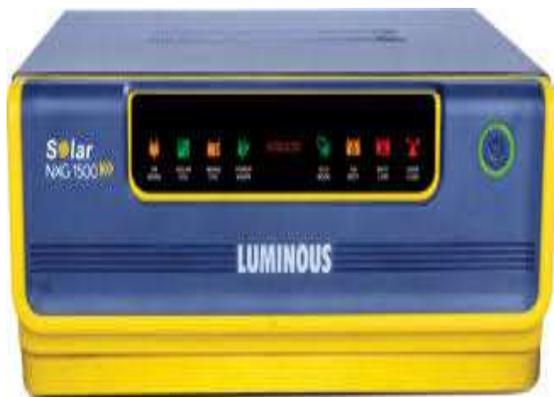


Fig no. 4 Inverter (Source – Amazon India)

1. Refrigerants: -

A substance or mixture usually in fluid condition is used in heat pump and refrigeration is known as refrigerant. In most process refrigerant undergoes in state of transformation from liquid to gases and comes back to liquid again. For working purpose may fluids have been used. In

20th century, because of ozone depletion fluorocarbons, especially CFC (chlorofluorocarbons) are completely removed. Other common refrigerants used in various applications are hydro chlorofluorocarbon and hydro fluorocarbon.

Types of Refrigerants: -

- i. R22- Hydro chlorofluorocarbon
- ii. R410- Hydro fluorocarbon
- iii. **Charge Controller: -**

To regulate limit of at which electrical current is added or withdraw from electrical batteries is known as charge controller. Overcharging can be prevented and it may protect battery from overvoltage, which can cause on batteries performance and its lifespan, and may pose a safety risk. To protect battery life, complete draining of battery or perform controlled discharge which is depending on the battery technology can be prevented. The charge controller or charge regulator term can be referring to either a stand-alone device to control circuits integrated within a battery-powered device or battery charger.

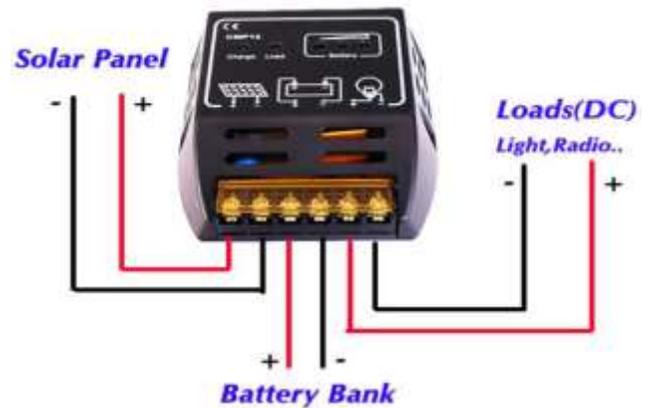


Fig no. 5 Charge Controller (Source – www.adverts.ie)

1. Air Conditioner: -

A process of treating air so as to control simultaneously its temperature, humidity, cleanliness and distribution to meet requirement of the conditioned space is called as Air Conditioner. It is process in which removing heat from the interior of an working space, to improve the comfort of occupants.

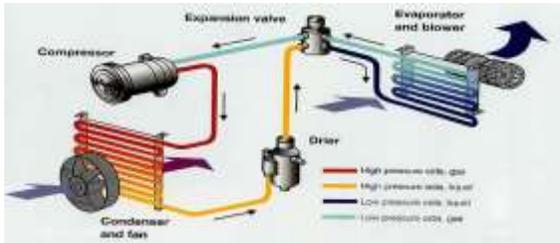


Fig no. 6 Air Conditioner (Source – www.amae.net.au)

1.5.1. Parts of Air Conditioner:

i. Compressor: -

The main function of a compressor in ac system is to transfer and compress gas from lower side of pressure to higher side pressure of closed system.

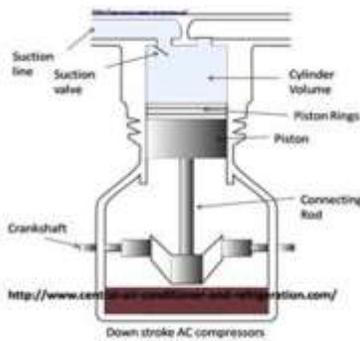


Fig no. 7 Compressor (Source – www.central-air-conditioner-&-refrigeration.com)

i. Condenser: -

The compressor generates compressed gas and sends it along to the top of the condenser, where the gas begins to cool. In condenser gas condenses and cools.

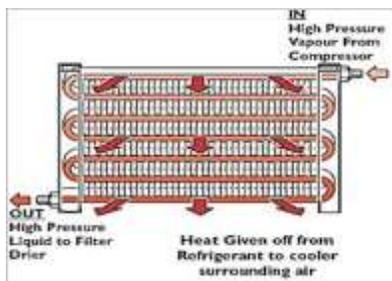


Fig no. 8 Condenser (Source – www.techchoiceparts.com)

i. Expansion Valve: -

Expansion valves regulate the amount of liquid refrigerant flowing from the condenser to the evaporator based upon the evaporator pressure. A thermal expansion valve will include a temperature

sensor and meters the amount of refrigerant flowing into the evaporator.



Fig no. 9 Expansion Valve (Source – www.indiantradebird.com)

ii. Evaporator: -

The ac evaporator serves in multiple capacities, but its function is to absorb heat which may have built up on a hot day. The ac blower fan is located behind the evaporator and blows air across it and that cold air travels through ac ducts.



Fig no. 10 Evaporator (Source –www.skandix.de)

iii. Receiver Drier: -

Air conditioning systems utilize a receiver drier to remove moisture from the system. The receiver drier is used on ac systems, to control refrigerant flow expansion valve are used and it is located in between compressor and condenser, exactly on high pressure side of the system.

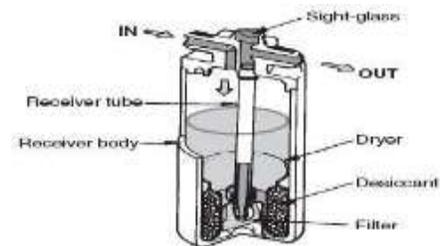


Fig no. 11 Receiver Drier (Source – www.industrialcorner.com)

i. Condenser Fan: -

To assist in cooling hot compressed gasses supplied by the compressor as they come through the condenser, this is condenser fan's job. To supply additional cooling to radiator located just beneath the condenser, this is one of the function of the condenser fan.

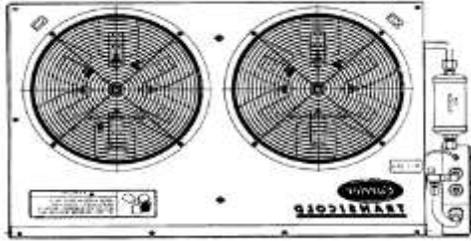


Fig no. 12 Condenser Fan (Source – www.mcicoach.com)

ii. A.C. Blower Motor: -

The ac blower motor works in conjunction with the evaporator to remove heat. It is usually located near the ac duct.



Fig no. 13 A.C. Blower Motor (Source – www.carid.com)

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