

A Review on Solar Powered Air Conditioning System

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ABSTRACT

Now days, mankind faces one of the greatest challenges is energy. The available fossil fuels such as coal, petroleum, LPG and CNG are the important resources for human society. But, use of these fossil fuels is directly affected on the environment such as environmental pollution, ozone layer depletion and global warming. For reducing this pollution we have to use solar energy. Solar energy is the most abundant energy available on the earth for human society and least used. This paper provides overview on solar powered air conditioning system to reduce the use of electricity as well as the use fossil fuels.

Keywords: Solar energy, air conditioning system, PV module etc.

1. INTRODUCTION

In twenty first century, solar energy plays important role in energy system. Solar energy is classified into two categories i.e. thermal system and photovoltaic system. Thermal system convert solar energy into thermal energy and photovoltaic system convert solar energy into electric energy. In summer season the use of electricity increases because of high use of air conditioning system. For producing electricity the burning of fossil fuels increases, which contributes CO₂ in environment causing pollution and global warming. Day by day, the cost of the fossil fuels increases, which is not affordable for the human kind. By using solar energy the use of fossil fuels decreases and it is eco-friendly also.

Air conditioning system is necessary for the humankind for comfortable, which maintain room temperature as compare to atmospheric temperature. Air conditioning reduces the temperature of the air inside the room as compare to the outer temperature of the air by using solar energy. The air conditioning (AC) system is operated on the solar energy and it is also used in rural areas where electricity is not reached.

2. LITERATURE REVIEW

Daut, M. Adzrie, M. Jrwanto, P. Jbranim and M. Fitra (2013) analyzed that, there are several characteristics about the PV module and AC system which are the important for the increasing the efficiency and performance of the air conditioning system. Some of the important characteristics in PV modules are electrical equivalent, IV characteristics curve and factor affecting on output of the PV cell. By considering these characteristics the stability and efficiency of the system will increases [1].

Anas. Farraj, Mohammad Abu Mallouh, Abdul-Rahim Kalendar, Abed Al-Rzag, Al-Shqirate and Mahmoud Hammd study the performance of the one tone of split air conditioning system. In split air conditioning system they use R-22 used as a refrigerant with replacement of LPG mixture of 30% propane, R-290 and 70% butane, R-600. It was found that R-22 has high COP and capacity than the LPGM as a refrigerant [2].

Guo J and Shen H G (2009) studied lumped method. In this method they used dynamic model and find the performance and solar fraction of a SERS using R134a. Also they found that, during working time the COP and solar fraction of the system. It is found that 0.48 and 0.82 at temperature of the generator and evaporator is 83° and 8° respectively and temperature of the condenser is varying with atmospheric temperature. This system saves 80% electrical energy [3].

Ma Q, Wang R Z, Dai Y J and Zhai X Q studied the performance of hybrid AC system is 44.5% more than convectional VCRS [4].

Jawad and Ali studied the performance of domestic refrigerator. It was found that 15% energy save when R12 is replaced with a mixture of 50% propane and 50% butane. It also found that system gave high COP than that of R12 with replacing mixture of propane and butane [5].

3. SYSTEM DISCRPTION

Fig-1 Shows the diagram of PV module and air conditioning system. It consists of photovoltaic (PV) module, solar controller, batteries, inverter and AC system. The sun rays fall on the PV module. The function of the PV module is convert solar energy into electrical energy. The electrical energy regulates by charge controller and stored in the batteries. The function of the inverter is to convert Direct Current (DC) to Alternating Current (AC). This AC supply runs the air conditioning system.

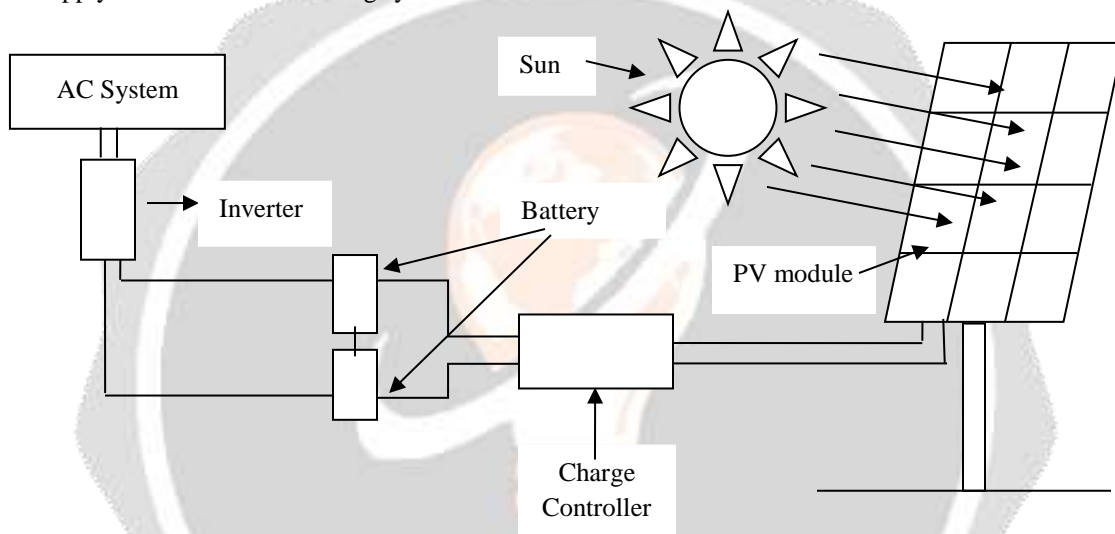


Fig-1: PV module and AC system

4. SYSTEM OPERATION

Fig-2 Shows the window air conditioning system. It is divided into two parts i.e. indoor and outdoor parts. Indoor parts consist of evaporator, expansion device, fan, air filter etc. outdoor parts consist of compressor (Hermetically Sealed), condenser, fan and a tray. This system works on a simple VCR system.

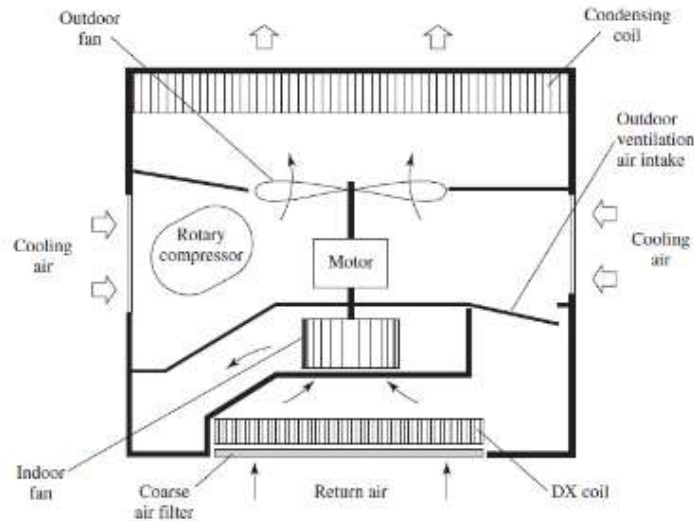


Fig-2: Window Air Conditioning System

The low pressure and low temperature refrigerant is sucked by compressor from the evaporator. Compressor compresses and increases the temperature and pressure of the refrigerant. This high pressure and high temperature refrigerant is supply to the condenser where they condense it and reject latent heat. After this liquid refrigerant enters the expansion valve, where it is throttle and then passed to the evaporator coil at low pressure. The fan drives the air from the room and flow over the evaporator coil. The temperature of the cooling coil is less than the temperature of the room air.

The refrigerant inside the evaporator absorb the heat from the air and circulated back into the conditioned space. Due to this the temperature of the air inside the room is reduced.

4.1 Advantages

- 1) Solar energy system saves money.
- 2) They are easy to maintain and affordable.
- 3) Produce least amount of greenhouse gas emission.
- 4) Solar energy system is eco-friendly.

4.2 Application

Some of the applications of solar air conditioning system are-

- 1) Commercial buildings including, malls, offices, restaurants, etc.
- 2) Institutional buildings including, schools, colleges, hospitals, etc.
- 3) Residential buildings including, single family house, duplexes, apartment, etc.
- 4) Transportation area including, buses, aircraft, cars, ships, etc.
- 5) Chemical and biological laboratories
- 6) Textile & food industries etc.

5. COCLUSIONS

This paper concludes that the usage of solar energy is more important and helpful for developing rural area. The main objective of solar air conditioning system is reduces the use of electricity and fossil fuels. It also concludes that solar energy is eco-friendly and pollution free method.

6. ACKNOWLEDGEMENT

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