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HYBRID AIR CONDITIONING FOR BETTER ENERGY ECONOMIC CONSUMPTION

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ABSTRACT

The demand of air –conditioning system makes the consumption of energy very largely. According to world energy report it shows that from the total available energy the total energy consumption in different buildings in metro city only by air-conditioning system is around 46.1% while by restaurant it is found to be 40.5%. Other than this commercial building and hospital building used 49.7% and 30.3% respectively of their useful energy on air conditioning system. So in this project the main concept is to investigate the performance of hybrid air conditioning system. Also to determine the heat load to maintain 22 to 25^{0}C temperature in the closed volume. Another point is comparison between different available system and also the performance and testing of different system with different combination.

Keywords: Air conditioning, HVAC System, Earth Heat Exchanger, Heat pipe, Economic.

I. INTRODUCTION

Air conditioner equipment power is often described in terms of "tons of refrigeration." A "ton of refrigeration" is defined as the cooling power of one short ton (2000 pounds or 907 kilograms) of ice melting in a 24-hour period. This is equal to 3517 watts. Residential central air systems are usually from 1 to 5 tons (3 to 20 kilowatts (kW)) in capacity. The use of electric/compressive air conditioning puts a major demand on the electrical power grid in hot weather, when most units are operating under heavy load.The effect of air-conditioning demand makes the energy consumption has been increasing quickly. The investigation report shows that of the total energy consumption in buildings in Metro city, the energy amount used by air-conditioning system is 46.1% in restaurant building, 40.5% in commercial building, 49.7% in office building, and 30.3% in hospital building. The ever increasing energy requirement puts a great burden on the further economical development as India is poor in energy resources. How to reduce the energy consumption by using new energy saving technologies and equipment is an important task now days. In order to reduce the energy consumption in air-conditioning building, apparatus dew-point air supply is usually used in air-Conditioning systems. But as the moist air leaving the cooling coil is usually too high in relative humidity (about 95% Rh) and too low in temperature to be used in occupied spaces directly, people usually feel uncomfortable.

II. RELEVANCE

When the warm air flows across the evaporating section, the heat is absorbed by the liquid refrigerant and at the same time, the liquid refrigerant boils into refrigerant vapor and then travels at high speed to the condensing

section of the pipe. The pre-cooled air passes through the cooling coil. After being further cooled and dehumidified, the moist air with lower temperature and humidity ratio passes through the condensing section of heat pipe, where the air is reheated to the supply air state by using the free reheat recovered from the warm incoming air at the evaporating section. At the same time, the refrigerant vapor is condensed into liquid refrigerant by giving up heat and returns to the evaporating section by gravity or by capillary action. By means of the heat pipe action, less sensible cooling is required by the cooling coil so that the cooling coil can provide more latent capacity and superior dehumidification ability, and lower relative humidity supply air is obtained, which can improve the indoor air quality and thermal comfort. This experimental work will helps to designers and manufacturers to achieve performance improvements and the hybrid air conditioning system for the improvement. By adopting proper design of Earth heat exchanger and modifying domestic refrigerator with Peltier Module can improve the COP as the best interesting alternative compared to other refrigerator system, for energy efficient applications.

III. LITERATURE REVIEW

Kumar Rawat et al studied experimentally that, Thermoelectric Refrigeration system and they have been designed and developed an experimental thermoelectric refrigeration system having a refrigeration space of 1 liter is cooling by four numbers of thermoelectric cooling module (Qmax=19W) and a heat sink fan assembly (Rth=0.50 ºC/W) for each thermoelectric module used to increase heat dissipation rate. A temperature reduction of 11º C without any heat load and 9º C with 100 ml of water in refrigeration space with respect to 23º C ambient temperature has been experimentally found in first 30 minutes at optimized operating conditions. The calculated COP of thermoelectric refrigeration cabinet was 0.1. Also compatibility of thermoelectric cooling systems with solar energy made them more useful and appropriate for environment protection. **C. K. Loh, Danie** studied experimentally, that characterize the heat sink performance is often performed under different procedures and apparatuses specifically catered to the knowledge of the individual in the thermal testing laboratory. When simulating the heat load of the electronics package, the conventional practice is to use resistance heating elements such as cartridge resistive heaters or flexible thin film heaters. Recently, thermoelectric devices (TED) are also being used as the heat source in heat sink laboratory experiments. The primary benefit of using a TED as a heat source in laboratory testing is that the TED is a unidirectional heat pump. All input electrical power is discharged to the TED hot side when properly used. This unidirectional heat pump process provides a more conservative experimental result, especially when calculating the experimental heat sink resistance. Contrarily to a TED, the resistance heater is a heat diffusion device, where the heat is dissipated to the surroundings by conduction. Even when the heater is fully insulated on all sides but the heat sink, a portion of heat is still lost to the ambient through the insulation. The effect is less energy passes to the heat sink than is inputted to the resistive heater.

Lakhi Nandlal Goenka studied experimentally that, the HVAC system including at least one thermoelectric device for providing supplement heating and cooling for air supplied to compartment. The first circuit can configure to remove the heat from an electric side of a hybrid vehicle. The second circuit can configure to remove heat from a fuel-fed of a hybrid side

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Daniel A. Spurgeon studied experimentally that, a heating and cooling system is provided for use on a work machine. The system include one or more temperature sensors configured to collect environmental temperature information and a compressor based HVAC unit having a compressor and providing in cabin climate control based on circulation. The system also include a thermoelectric HVAC unit to supplement the compressor based HVAC unit

IV. CONCLUDING REMARKS

Above literature review reveals that.

1) Most of the research work has been carried on hybrid air conditioning with conventional VCC and thermoelectric cooling (Peltier Module) provide supplemental heating and cooling for air supplied to conditioned space. And enhance COP of the system.

2) Some of the research has been carried on conventional VCC and Earth heat exchanger indicates that air-conditioning system can significantly reduce its energy consumption and improve both the indoor thermal comfort and air quality when a heat-pipe air-handling coil is employed in the air-conditioning process, enhancement the dehumidification of the system From above, it is clear that most of the work is carried out by using only VCC with Thermoelectric system and VCC with Earth heat exchanger. Keeping in this mind, individually these ideas do not stand good but by combination of two or more concepts in a collaborative manner stands a possibility to develop an energy efficient method of air conditioning. Thus there is beneficial to use the conventional vapor compression cycle in conjunction to thermoelectric cooling and earth heat exchanger technique to reduce the power consumption of the air conditioner and thereby increase the COP of system by refrigeration as the heat load is reduced by non-conventional earth heat exchanger cooler. It can be applied to low cost domestic cooling, commercial installations, and industrial installation. By adopting proper design of Earth heat exchanger and modifying domestic refrigerator with Peltier Module can improve the COP as the best interesting alternative compared to other refrigerator system, for energy efficient applications.

V. OBJECTIVE

The main objective of this investigation is to study the performance of the Hybrid Air Conditioning System. The proposed work includes the determination of Determination of heat load, to maintain 22 to 25ºC temperature in the cabinet of volume close to 1800 liters.

- Determination of compressor power and specification of parts of conventional Vapor compression cycle to take 100 % of rated load
- Determination of Peltier modules 12 V dc , to take 30 % of heat load
- Selection of heat pipe system for earth heat exchanger module to take 20 % of heat load
- Design and development of cabinet space with the evaporator coil of conventional AC with integrated with peltier modules Design & Development of improvised spiral fin heat exchanger with heat pipes for heat transfer enhancement with peltier modules
- Test & Trial on hybrid peltier air conditioner determine temperature gradient , cooling ability (tonnage) and COP of system, under given conditions

- Vapor Compression Air Conditioning unit and derive performance characteristic
- Vapor Compression Air Conditioning unit with Earth heat exchanger unit and derive performance characteristic
- Vapor Compression Air Conditioning with Peltier module unit and derive performance characteristic.

Vapor Compression Air Conditioning with Earth heat exchanger and Peltier module unit and derive performance characteristic.

VI. CONCLUSION

By adopting proper design of Earth heat exchanger and modifying domestic refrigerator with Peltier Module can improve the COP as the best interesting alternative compared to other refrigerator system.

VII. ACKNOWLEDGEMENT

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