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Reduction in LPG Consumption by Utilization of Waste Heat from A. C.

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Abstract: Energy is a basic requirement for the existence and development of human life. Primarily the commercial sources of energy are fossil fuels (coal, oil and natural gas). Fossil fuel generation of electricity is the largest single source of greenhouse-gas emissions worldwide, so for reduce this emissions we adopt different method of generating power that is utilization of waste heat from air conditioning and automobile vehicle into some beneficial work like heating of water, clothes dryer, electricity generation etc. In this paper the main stress is given on energy conservation by using technique of utilizing waste heat from Refrigerator/Air conditioning system
Keywords: Condenser, Compressor, Hot water, Liquified Petroleum Gas, Waste Heat

I. INTRODUCTION

Energy saving is one of the key issues not only from the view of energy conservation but also for the aegis of global environment. Waste heat is the heat generated all along most of the operations of system and then it is dumped into the surroundings even though it could be still utilized for some other beneficial and remunerative purposes. Waste heat is usually correlated with waste streams of air or water and it put into the environment. Recovery of waste heat is a important research area among majority of scientists. Air conditioner consumes lavish amount of electricity and so it rejects voluminous amount of heat in the condenser. There are millions and billions of Air conditioning system in the universe. So the heat rejected from the air conditioners would be the root cause for global warming. On concentrating in this issue, we came across the effective and expedient solution. The solution is that usage of waste heat which is repudiated from the condenser of the air conditioning unit. This solution uses the heat efficaciously for some other beneficial work and also bulwark the environment. This paper focuses on production of hot water for various applications using waste heat repudiated by the air conditioning system. We designed a system for effective apprehending of waste heat which goes to the surroundings. The purpose of this experimental apparatus is to develop a multi utility air conditioning system to produce air conditioning effect (cooling of space) and generation of hot water (by using extracted heat from cooling space) simultaneously. This project presents an experimental set up which uses waste heat from air conditioner to heat water for residential and commercial use. It is found that generally the coefficient of performance (C.O.P) of an air conditioner decreases about 2 to 4 % due to increase of each degree Celsius in condenser temperature. So C.O.P of air conditioner could drop down as much as 40% in hot weather condition. This large reduction of C.O.P means more power consumption for air conditioner in summer when the demand for electric power is high. This increase in power consumption of air conditioner creates more pressure on the power network which is not desirable.

II. PRINCIPLE OF REFRIGERATION

If you were to place a hot cup of coffee on a table and leave it for a while, the heat in the coffee would be transferred to the materials in contact with the coffee, i.e. the cup, the table and the surrounding air. As the heat is transferred, the coffee in time cools. Using the same principle, refrigeration works by removing heat from a product and transferring that heat to the outside air.

III. REFRIGERATION SYSTEM COMPONENTS

There are five basic components of a refrigeration system, these are:

A. Evaporator
B. Compressor
C. Condenser
D. Expansion Valve
E. Refrigerant; to conduct the heat from the product

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IV. EVAPORATOR

The purpose of the evaporator is to remove unwanted heat from the product, via the liquid refrigerant. The liquid refrigerant contained within the evaporator is boiling at a low-pressure. The level of this pressure is determined by two factors:

rate at which the heat is absorbed from the product to the liquid refrigerant in the evaporator The rate at which the low-pressure vapour is removed from the evaporator by the compressor To enable the transfer of heat, the temperature of the liquid refrigerant must be lower than the temperature of the product being cooled. Once transferred, the liquid refrigerant is drawn from the evaporator by the compressor via the suction line. When leaving the evaporator coil the liquid refrigerant is in vapour form.

V. COMPRESSOR

The purpose of the compressor is to draw the low-temperature, low-pressure vapour from the evaporator via the suction line. Once drawn, the vapour is compressed. When vapour is compressed it rises in temperature. Therefore, the compressor transforms the vapour from a low-temperature vapour to a high-temperature vapour, in turn increasing the pressure. The vapour is then released from the compressor in to the discharge line.

VI. CONDENSER

The purpose of the condenser is to extract heat from the refrigerant to the outside air. The condenser is usually installed on the reinforced roof of the building, which enables the transfer of heat. Fans mounted above the condenser unit are used to draw air through the condenser coils. The temperature of the high-pressure vapour determines the temperature at which the condensation begins. As heat has to flow from the condenser to the air, the condensation temperature must be higher than that of the air; usually between - 12°C and -1°C. The high-pressure vapour within the condenser is then cooled to the point where it becomes a liquid refrigerant once more, whilst retaining some heat. The liquid refrigerant then flows from the condenser in to the liquid line.

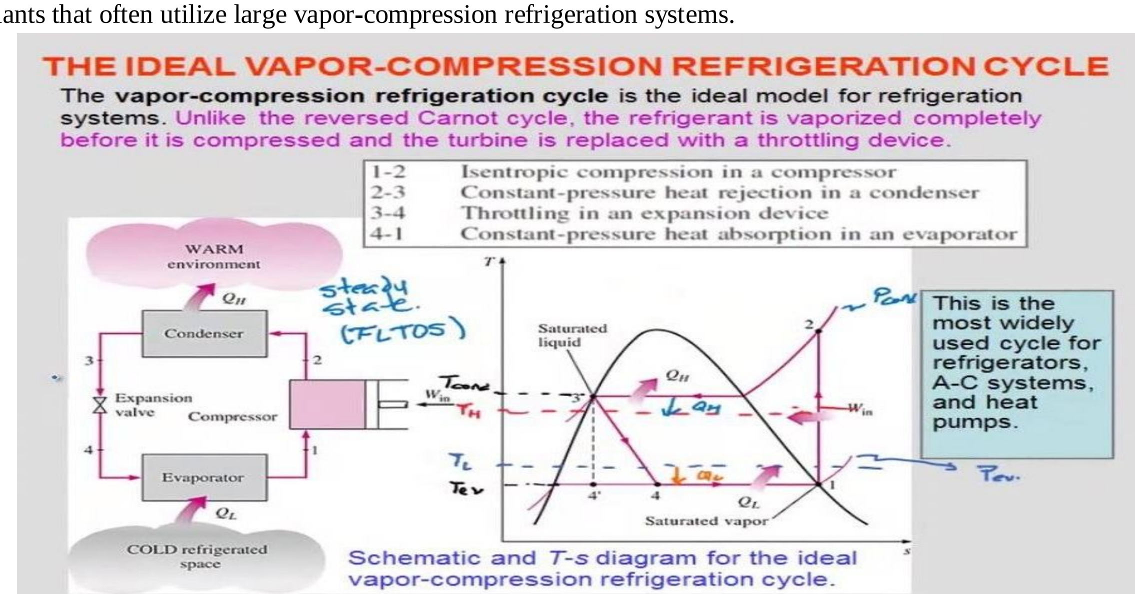
VII.EXPANSION VALVE

Within the refrigeration system, the expansion valve is located at the end of the liquid line, before the evaporator. The high-pressure liquid reaches the expansion valve, having come from the condenser. The valve then reduces the pressure of the refrigerant as it passes through the orifice, which is located inside the valve. On reducing the pressure, the temperature of the refrigerant also decreases to a level below the surrounding air. This low-pressure, low-temperature liquid is then pumped in to the evaporator.

VIII. VAPOUR COMPRESSION REFRIGERATION SYSTEM

It is one of the many refrigeration cycles and is the most widely used for air-conditioning of buildings and automobiles. It is also used in domestic and commercial refrigerators, large-scale warehouses for chilled or frozen storage of foods and meats, refrigerated trucksand railroad cars, and a host of other commercial and industrial services.

Oil refinerie s, petrochemical and chemical processing plants, and natural gas processing plants are among the many types of industrial plants that often utilize large vapor-compression refrigeration systems.



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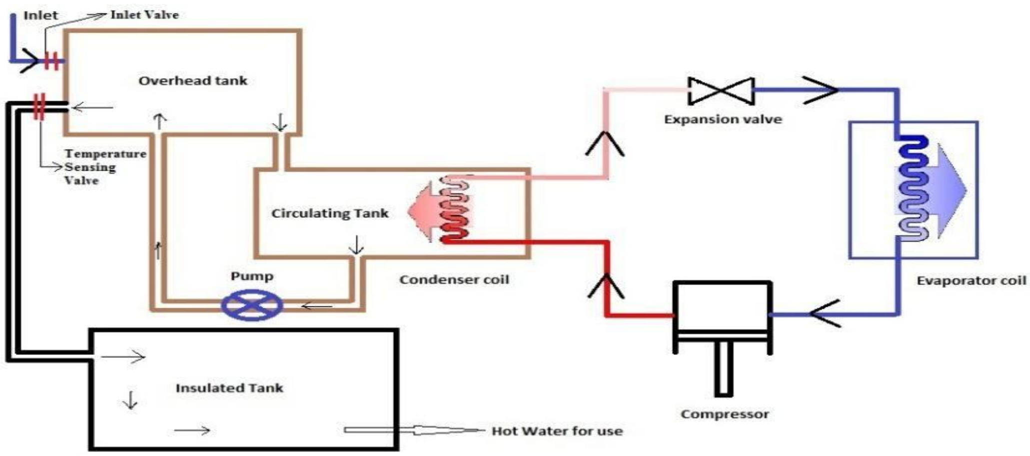
IX. METHODOLOGY

In this process we utilizing the waste heat by transferring its energy to water and the cold water is converted in to hot water. The water from the tank is then circulated in a circulating chamber. Condenser coil is placed in the circulating chamber. Circulating water absorbs the heat rejected by the condenser and the heat is added by constant volume process. The temperature of the circulating water increases to the calculated temperature. When the desired temperature is reached in the circulating water it is then drained into the separate insulated storage tank. Suddenly fresh water will be filled into the tank as mentioned in the first stage and this process continues as whenever the Air Conditioner operates. Thus this large quantity of water is stored in the storage tank. Pipes can be connected from the tank to the household appliances. Thus the vegetables and raw materials for cooking can be washed cleanly in the hot water.



In this firstly we take a gas Chula with LPG cylinder now we calculate the amount of gas needed for converting 6 litre of water from 20 degree celcius to 60 degree celcius.

X. CALCULATION FOR LPG GAS

By experiment, it was found that when cooking is done for 5 hours per day with 14 kg of LPG gas, it will be depleted in 30 days. By experiment,

Time to reach 60^{o}C for 6litre water = 14 min (840sec)

Mass of LPG gas consumed in 840 sec. = 21.08gram / 6L of water

For average of 4 cooking recipe is done per day then,

Mass of LPG gas saved = 84.32 g /day

In 30 days, Amount of LPG gas saved = 2.529 kg

Note:-So for this we approximately saved 2.5 LPG cylinder per year

Now ,we take some assumptions that is given below:

use the air conditioner system having COP is 2.25 and power input is 3.0 kw

Average usage of water per person is 50 litre

On an average running hours of air conditioning system is 9hours

Normally five persons in a family

Now, coefficient of performance i.e. COP = Refrigeration Effect/ workdone

$$COP = QL / QH-QL$$

$$QH = QL\times(1+ 1/COP)$$

Where,

QH = Quantity of heat rejected by Air Conditioner

QL = Total Capacity of Air Conditioner

$$QH = QL\times(1+ 1/COP)$$

$$QH = 3.0\times(1+ 1/2.25)$$

$$QH = 4.33kw$$

In Ideal case,amount of heat rejected = 4.33×9×3600
= 140.4kJ/day

For 5persons in a house,
Quantity of water needed = 250 L/day
In winter season temperature of water at inlet is 20 degree celcius and temperature of water at insulated tank is 60 degree celcius.Now the quantity of heat required to raise the temp .of water is Q = m×cp×dt

$$Q = m \times cp \times dt$$
$$= 250 \times 4.186 \times 40 = 41860 kJ$$

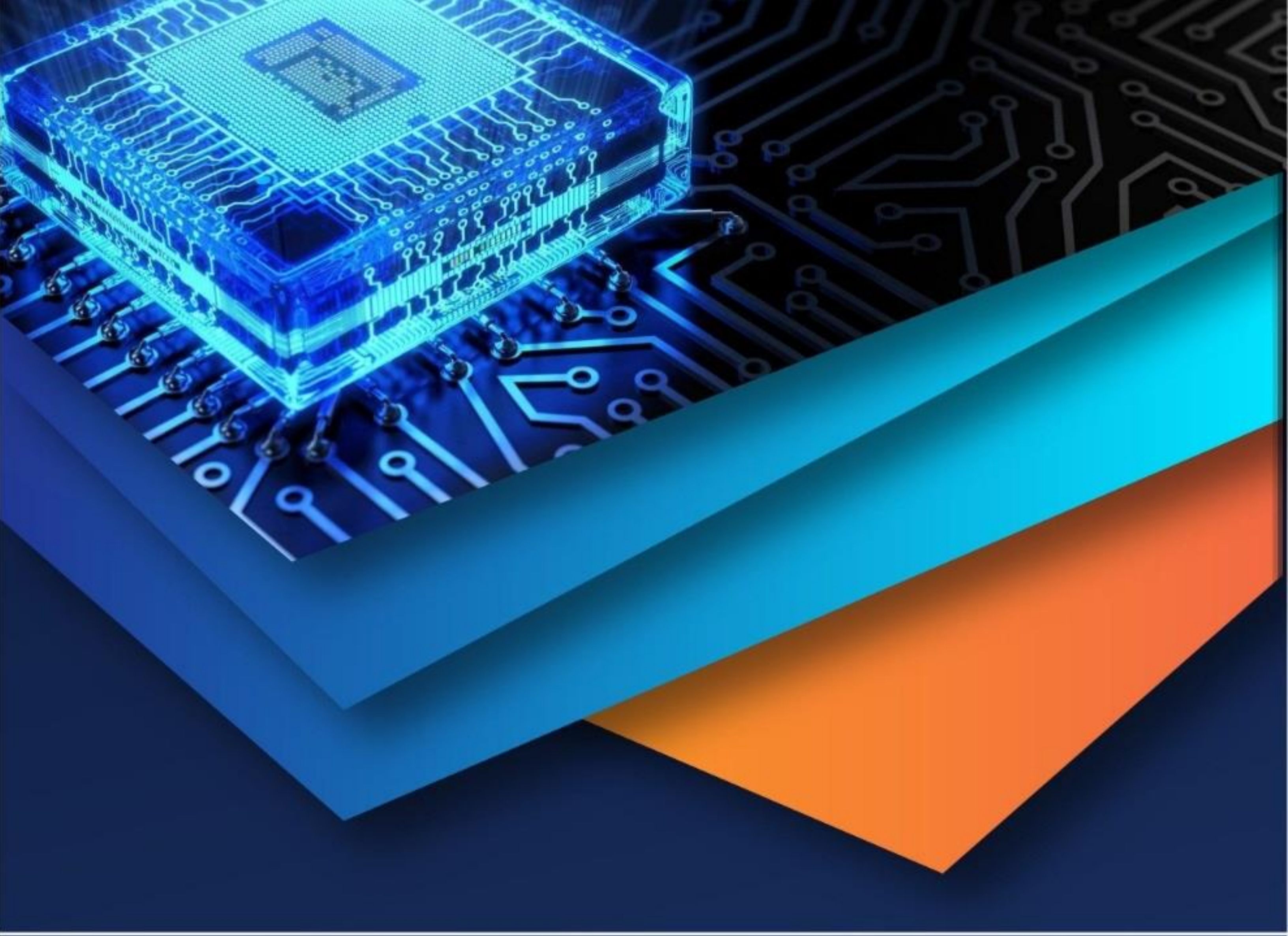
Heat rejection rate = 4.33 kJ/s
Time for 250L water to reach 60 degree celcius = 41860/4.33
Time = 2.68 hours

XI. CONCLUSIONS

In the analysis analysis of air conditioning system shows that large amount of energy is wasted at condenser. By doing heat recovery of the waste energy we obtained hot water for different purposes.In this analysis we save approximately 2.5 LPG cylinder per year ,and also it reduces the temperature of surrounding which decrease the level of global warming . Reduce temperature of surroundings also increase the COP of refrigeration and air conditioning system.

REFRENCES

[1] Colbourne, D., Suen, K.O., 2000. Assessment of performance of hydrocarbon refrigerants. In: Proceedings othe Fourth IIRGustav Lorentzen Conference on Natural Working Fluids, Purdue, USA.
[2] Colbourne, D., Ritter, T.J., 2000. Compatibility of Non-Metallic Materials with Hydrocarbon Refrigerant Lubricant Mixtures. IIF-IIR- Commission B1, B2, E1 and E2 – Purdue University, USA
[3] Maclaine-Cross, I.L., Leonardi, E., 1996. Comparative performance of hydrocarbon refrigerants. In: I.I.F. – I.I.R Commissions E2, E1, B1, B2, Melbourne, Australia
[4] Joudi, K.A., Mohammed, A.S.K., Aljanabi, M.K., 2003. Experimental and computer performance study of automotive air conditioning system with alternative refrigerants. Energ. Convers. Manag. 44, 2959–2976
[5] Ghodbane, M., 1999. An investigation of R152a and hydrocarbon refrigerants in mobile air conditioning. In: International Congress and Exposition, SAE Paper 1999-01-0874, Warrendale, PA
[6] Razmovski, V., 1994. Safety of hydrocarbon refrigerants for car air conditioning systems. B.E. thesis, School of Mechanical and Manufacturing Engineering, UNSW, Sydney.



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