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A Review Paper on Earth Tube Heat Exchanger

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Abstract-The aim of this work is to investigate by modeling the possibility of reducing the operational energy of a typical house without negatively affecting its embodied energy. This is done through consideration of different building materials coupled with the use of an earth to air heat exchanger (EAHE) for fresh air supply and cooling.It is found that the use of an optimal wall configuration in each zone coupled with the EAHE results in 76.7% energy savings compared with the reference case with conventional cooling.A single pass earth-tube heat exchanger (ETHE) was installed to study its performance in cooling and heating mode. ETHE is made of 50 m long MS pipe of 10 cm nominal diameter and 3 mm wall thickness. ETHE is buried 3 m deep below surface. Ambient air is pumped through it by a 400 w blower.Air velocity in the pipe is 11 m/s. Air temperature is measured at the inlet of the pipe, in the middle (25 m), and at the outlet (50 m), by thermistors placed inside the pipe. Cooling tests were carried out three consecutive days in each month..
KeyWords:-earth tube heat exchanger ,air tunnel, investigation, cooling air.

I. INTRODUCTION

The Energy consumption of buildings for heating and cooling purpose has significantly increased during the decades. Energy saving are of major concern everywhere is a particular challenge in desert climates. The desert climate can be classified as hot and arid and such condition exists in anumber of areas throughout the world. In general most people feel comfortable when the temperature is between 20 °C and 26 °C and relative humidity is within the range of 40 to 60%.These condition are often achieved through the of air conditioning. Air conditioning system is widely employed for the comfort of occupant as well as the industrial productions. It can be achieved effectively by vapour compression machines, but due to the depletion of ozone layer and global warming by using chlorofluorocarbons and the need to minimize high grade energy consumption various passive techniques are now a day's introduced, one such method is earth air heat exchanger. An earth air heat exchanger consist in one or more tubes lied under the ground in order to cool in summer or pre-heat in winter air to be supplied in building.

II. WORKING PRINCIPAL OF EARTH TUBE HEAT EXCHANGER

The principal of using the principle of using ground inertia for heating and cooling is not a new concept, but rather a modified concept that goes back to the Ancients. This technology has been used throughout history from the ancient Greeks and Persians in the preChristian era until recent history (Santamouris and Asimakopoulos, 1996). For instance the Italians in the middle Ages used caves, called colvoli, to nprecool/preheat the air before it entered the building. The system which is used nowadays consists of a matrix of buried pipes through which air is transported by a fan. In the summerthe supply air to the building is cooled due to the fact that the ground temperature around the heat exchanger is lower than the ambient temperature.

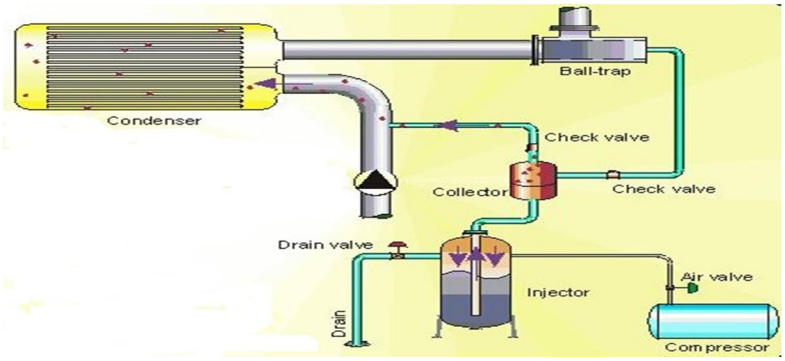

Figure1: earth tube heat exchanger

III. EARTH TUBE HEAT EXCHANGER

ETHE consists of a 50 m long 10 cm diameter MS pipe with wall thickness of 3 mm. made fins have been installed on the outer surface of the pipe, all along the 50m length. Fins are made of thin GI strip spirally wound over the pipe and then spotwelded at several points. There are 40 fins per meter length. Strip that makes the fins is2 cm wide, 2 mm thick. A 1 m wide, 3 m deep and 50 m long trench was firstexcavated by a bucket excavator. Trench floor was properly leveled and a 15 cm thickbed of sand placed on it. ETHE was then placed on it and covered with sand up to about15 cm above it. After that trench was back-filled with the original soil. The inlet andoutlet of the ETHE rise 0.5 m above ground.

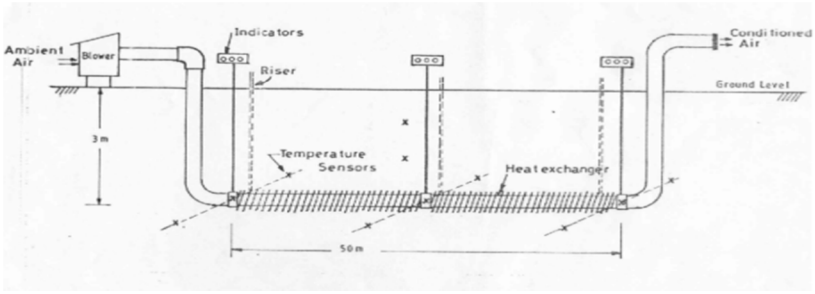

Figure 2: Earth tube heat exchanger

let is IN connected to the delivery end of 5blower and outlet is open to atmosphere. A 90 elbow at the end makes the outlethorizontal to the entry of rain water.Earth-Tube Heat Exchanger (ETHE) is a device that enables transfer of heat fromambient air to deeper layers of soil and vice versa. Since the early exploration of its use incooling commercial livestock buildings (Scott et al 1965) there has been considerableincrease in its applicationETHE is used to condition the air in livestock

IV. TYPES OF EARTH TUBE HEAT EXCHANGER

Open type Earth tube heat exchanger

Closed type Earth tube heat exchanger

A. Open System

in open system ambient air passes through tubes buried in the ground for preheating or pre-cooling and then the air is heated or cooled by a conventional air conditioning unit before entering the building.

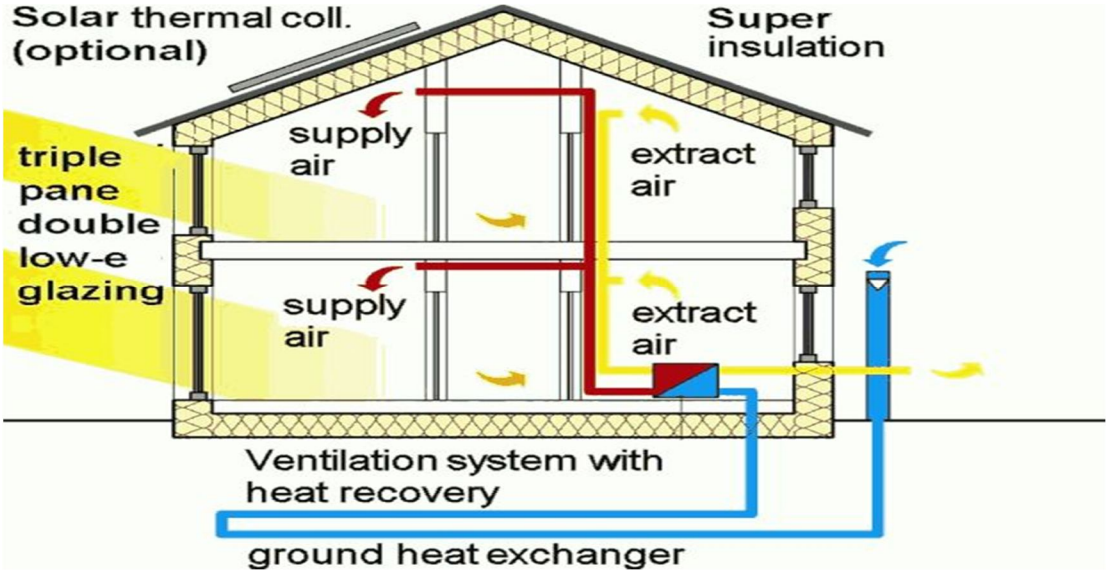

Figure3: Open type earth tube heat exchanger

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B. Closed System

In this case heat exchangers are located underground, either in horizontal, vertical or oblique position, and a heat carrier medium is circulated within the heat exchanger, transferring the heat from the ground to a heat pump or vice versa.

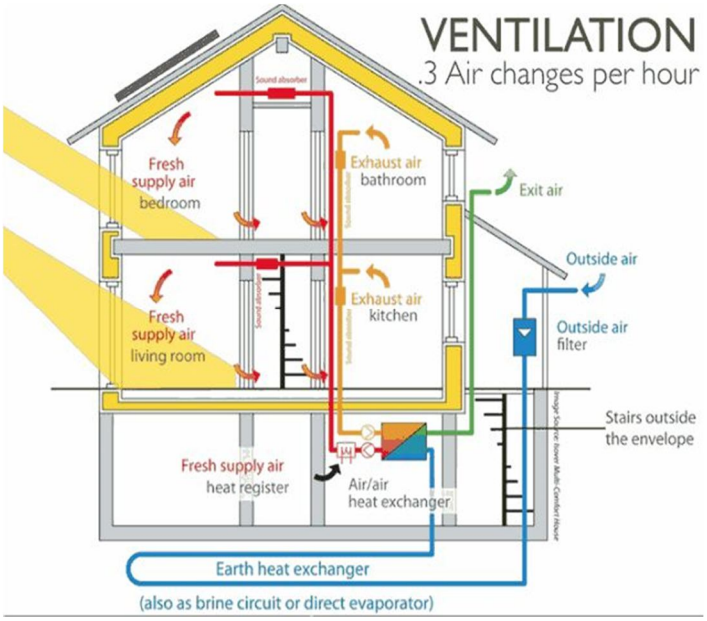

Figure 4: Closed type earth tube heat exchanger

V. SUMMARY AND CONCLUSION

In this paper the performance of earth air heat exchanger system was investigated and we have observed the following.

If the length of the pipe is so small and the blower is high voltage then the system is useless because the temperature difference between inlet and out let is very less.

The material of pipe is not affected in the output result.

If cooling or heating rate is more achieve, then the length of pipe kept at least 100 m and blower some around 400W.Based on the results it can be stated that ETHE holds considerable promise as a means tocool or heat ambient air for a variety of applications such as the livestock buildings andgreen houses.

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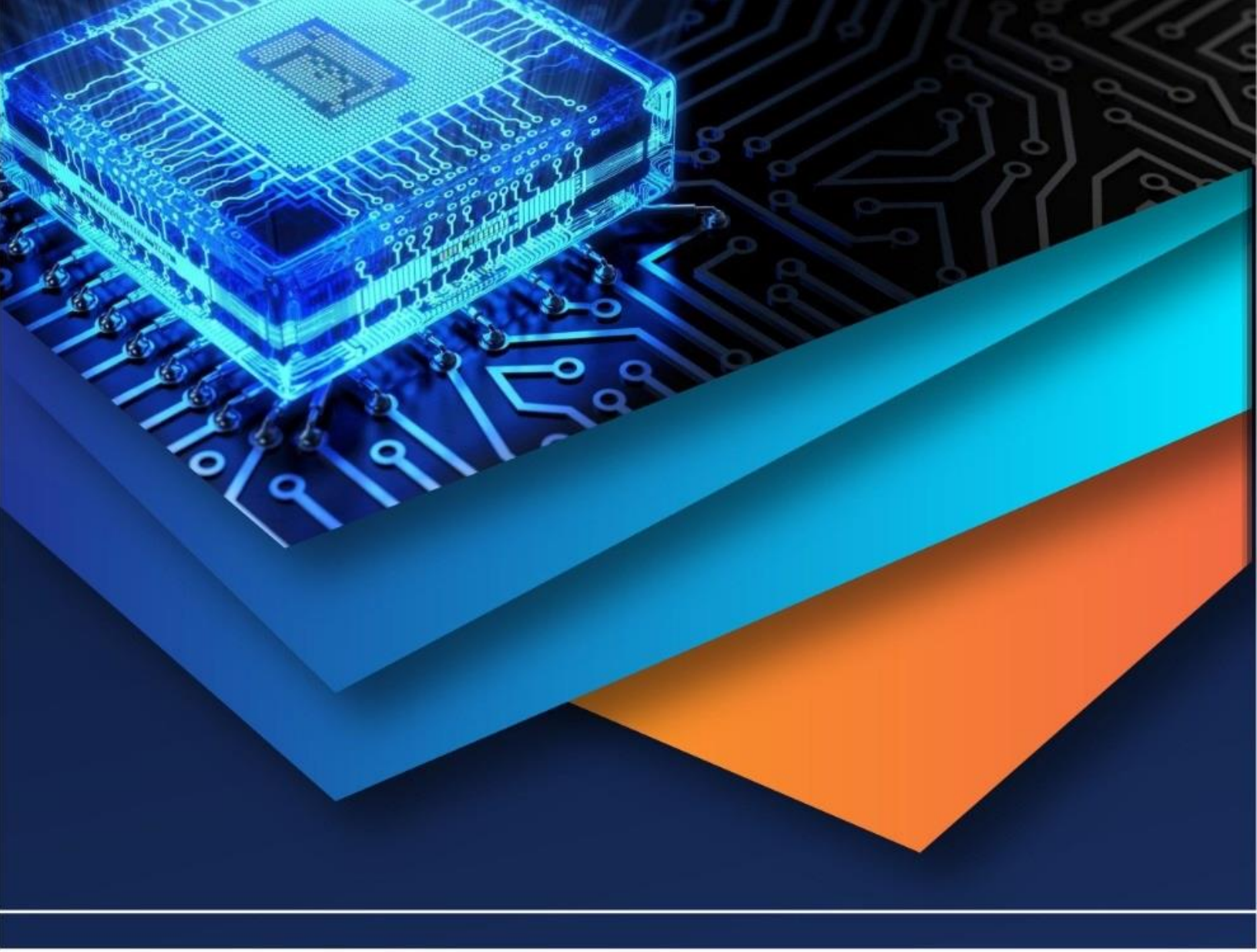

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