

Study and Development of a Miniature Model of an Eco-Friendly Ground Source Cooling System

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ABSTRACT

This paper deals with the new model of creating the air cooling system which employs the natural air as a cooling source instead of using the artificial cooling systems which produces harmful effects on long use. The objective of this paper is to have a natural cooling system alternative to normal air conditioning systems actually used. From the observed result, we can identify the decrease in temperature between the inlet and outlet of the room. Due to the natural effect it is clear that no harmful gas and effects are produced as in the case of artificial cooling. The environment can be reduced from pollution by reducing the emission of carbon dioxide and acid rain. The cooling system using ground source controls the climate effectively and pollution free. Therefore in order to protect the eco system and for the preservation of the planet such friendly and safe measures have to be undertaken.

KEY WORDS: Pump, aluminium pipe, Fan, Thermocouple.

1. INTRODUCTION

Ground Source Systems use the ground water temperature in order to maintain the temperature inside the rooms effectively. In this system there is no need of heating and burning of fuels or electricity for cooling. The water passing through the rooms absorbs heat and reduces the heat to the ground source thus reducing emission. Jagadeesh and Subba Reddy (2013), in their research, gives the continuously increasing trend of energy consumption for cooling purposes, is absolutely necessary in order to take advantage of natural cooling which can offer to buildings while maintaining the living standards, health and comfort of the occupants. Matheos Santamouris & Athanassios Argiriou (2007), mentioned as Ground source acts effectively in reducing the emission and cooling is made contineously to prevent pollution for long years. Ingvar Fridleifsson (2001), said that the method of cooling can be utilised throughout the world as it use the available techniques with engineering technology for better future. Axelsson (2005), mentioned Sustainable development involves new technology compromising the generation of future in order to meet the expectations of developing technology. This issue is the utilisation of natural resources for the cooling source.

The air from the room out carries the heat and moves into the ground where the tranformation of heat takes place called as heat transfer and thus leaving the dissipated heat into the ground source and the cool air is then made to pass through the room to deliver the cooling effect to the room surroundings to make the temperature lowering down. This method is very simple as there are many types of cooling methods available in ground cooling systems. Based on the availability of space we can use horizontal loop or vertical loop system. vertical loop is used for less space and needs deep insertion whereas horizontal Loop is straight opposite as it needs only less insertion were the soil is hard and require large space. The ponds or the lakes nearby can be utilized to transfer the heat which can be referred as open or closed loop type of cooling methods. Gyu-Hyun Go (2015), noted Ground source cooling system has the attention for energy savings and reduced greenhouse effects and other economic benefits. Wenzhi Cui (2016). The ground source cooling system has higher cooling loads during the whole year both during winter and summer seasons. By employing this system of cooling systems the energy saving rate is higher as compared to the traditional system of cooling which is being employed. There are reports that states that the outlet temperature of the ground source remains decreased on the long source of work.

One of the main reasons that so many people dismiss the idea of using geothermal energy in their homes is because they think it is simply too expensive. This is actually a common misconception, and many people can actually save a lot of money by switching to geothermal cooling. Peoples do not implement or take this method of cooling as effectively because of lack of knowledge on this method and they think it as a costly method and requires complex methods to employ it. When they come to know its advantages of natural cooling the will be eager to use these methods as it reduces the cost and helps in global warming. Ayman Mohamed (2015), indicated that this method of cooling is easy to apply and the system is compact and less space is needed to utilise this method. The ground source cooling has the disadvantage of installation since cost of initial setting is high and lowering in its temperature takes longer time. Louis Gosselin, et.al, mentioned that it is suprising that the heat from sunlight is absorbed by earth and it keeps the surface cool based on location ranging from 10 degree celcius to about 25 degree celcius. Zafer Utlu (2016), noted that Ground source cooling system is cost effective because it uses energy efficiently. Energy savings must not only be the major idea but the environmental impacts should also be considered for the environmental frendiliness. Takeshi Saito, (2016), detailed that there are literatures that states that the substrate temperatures decreases towards original temperatures at different depth levels for longer periods.

2. METHODS AND MATERIALS OF PROPOSED SYSTEM

The constructed miniature model works on the principle of a closed pond loop system. We know that the ground surfaces are not uniform as it varies from the top surface towards the depth. There are different layers on earth where the first layer absorbs all the heat emitted from the sun and it stays warm ranging from 20-30 degree celcius. The next layer called as middle layer absorbs only the limited heat as the heat is dissipated to the first layer and it maintains the temperature of 10-20 degree celcius. The last layer is the lower one where the temperature ranges from 5-10 degree celcius since most of the heat is taken by the upper two layers. The advantage is that the heat from sun does not penetrate to the most deep layer as the temperature at the bottom remains cool which can be used for these type of cooling systems. In cold climates, most ponds and lakes do not freeze the soil due to the warmer surface by the heat from sun. During the winter months some creatures hibernate in the bottom of the ponds this is mainly because the temperature at the bottom is warmer when compared to the topmost layer.

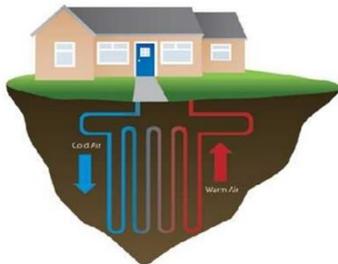


Figure.1. Model of cooling system

Aluminum tube: Aluminum is one of the material which has good weight reduction compared to copper. Aluminum is used in transmission lines since it has good heat conduction along with greater conductivity of electricity. Hence the same is selected for this method of cooling were as it can be replaced by copper also.



Figure.2. Aluminum tube

Fibertube: The fiber glass is made of plastic matrix binded by epoxy resins which is a thermosetting material. It sometimes can be a thermoplastic material based on its applications. These materials are widely used in different applications of automobiles and transport vehicles and house hold applications as it is stronger and has longer life.



Figure.3. Fiber tube

Centrifugal Fan: A centrifugal fan is a mechanical device for the movement of air. This fans increases the speed of air stream with the help of rotating impeller. A huge amount of air is induced with the help of this fan.

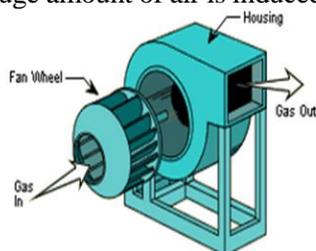


Figure.4. Centrifugal fan

Ground source cooling system use far less electricity than traditional air conditioning systems. Ground source cooling system does not employ costly parts and consists of less rotational parts and does not take any frequent maintenance systems as in normal air conditioning systems. The parts used in this type of maintenance system does not fail as their life is long and maintenance is negligible. These system has no wear of parts since outside parts are very less as that of traditional cooling system. The use of traditional system has the effect of spoiling the health due to the

gases in it as it is avoided or arrested in ground source cooling system. The use of electricity is also reduced as the cost effective is done to a larger extend.

Ground Source Cooling Vs Conventional Air Conditioning System: In ground source cooling all the parts made are simple and cost effective whereas in the conventional system the parts are complicated with costly and precise one. The health hazard due to conventional type is more as compared to that of ground source type or the natural or ground source cooling system has no health hazard factors. Mainly the cost of electricity is reduced to a greater extend in ground source cooling as it is comparatively very high in conventional cooling systems. With the point of maintenance the conventional cooling systems needs frequent checking and the cost of maintenance is high as these problems are avoided in ground source cooling system. Overall the ground source cooling system will be highly advantageous over the conventional air conditioning system in terms of pollution, electricity and maintenance.

3. RESULTS AND DISCUSSION

The results are obtained by the presence of thermocouple place at different stages. Observed results are being tabulated below.

Table.1. Experimental Observation

S.No	Source	Observed Temperature (°c)
1	Inlet temp of heat exchanger	28
2	Outlet temp of heat exchanger	32
3	Room temperature	32
4	Temperature outside room	34
5	Outlet air temperature from heat exchanger	27

It is proven that the government takes larger steps to reduce emission worldwide. It is necessary that governments implement a legal and institutional framework and fiscal instruments allowing geothermal resources to compete with conventional energy systems. Since geothermal energy is a natural source which is reduces the greenhouse effect can be easily implemented with no problem of governmental interference. There are various subsidy given for this type of systems which reduces the pollution and electricity which can be easily implemented in all areas on earth surfaces. Hence from the above result it is clear that there is decrease in the inlet and outlet temperature of the room. Due to the natural effect it is clear that no harmful gas and effects are produced as in the case of artificial cooling. Since all the components are employed in ground source the problem of space outside is reduced and utilization of space is effective. This type of cooling is safe and is time consumed for cooling the room as compared to artificial type of cooling. Ground source cooling system has no pollution, reduces the greenhouse effect. This cooling system needs only less space or there is no need of space since all the parts can be inside the earths surface and can be influenced in space utility also. There is no need of fuel to run any type of equipments as it also reduces pollution as well as emission of poisonous gases. This method of natural cooling shows gives us a great opportunity for savings in terms of cost and also towards health related issues. Ground source cooling system does not create heat as that of traditional cooling system. The power consumed by this method is also very less compared to traditional cooling system. Ground source cooling systems are remarkably long lasting as compared to traditional home cooling systems. A typical air conditioning system will work for about 20 years when it is maintained properly with recommended services, whereas the pipes installed with a ground source cooling system will be long lasting for about 50 years and more. Thus the replacement is not a big problem when switching to ground cooling system. The initial investment seems to be more as there is no problem of emission, rust and corrosion formation.

4. CONCLUSION

Based on all this we can come to conclude that the principle of operation in Ground source cooling systems is very simple. This system does not bother about the temperature in its surroundings and keeps the room at a constant temperature at earths inner temperature. There is no problem of summer or the winter since the system maintains itself based on the climatic conditions. The utilization of Ground source cooling systems for cooling can benefit the user by reducing the greenhouse effect, health hazards and in terms of cost. Ground source cooling takes the use of natural resources to control the temperature very efficiently, towards lowering emissions. Overall the ground source cooling system will be highly advantageous over the conventional air conditioning system in terms of pollution, electricity and maintenance. Therefore in order to protect the eco system and for the preservation of the planet such friendly and safe measures have to be undertaken. This method of cooling remains efficient for very long years promoting pollution free atmosphere without disturbing the ecosystem.

Scope for Future Work: This study can be further developed in real time use for a house hold purpose were some problems can be identified and rectified. Further there is a problem of temperature loss during the entire process and the idea of eliminating these can be made for successful operations.

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