WWW.IJRPR.COM

International Journal of Research Publication and Reviews

Journal homepage: www.ijrpr.com ISSN 2582-7421

Evaluation of Performance of Earth Tube Heat Exchanger Using Renewable Energy for Heating in Winter in Bhopal

Masroor Ahmad

All Saints College of Technology

ABSTRACT

This research includes the optimization and analysis of geothermal heat exchanger systems using renewable energy. The use of solar energy in room heating and cooling of photovoltaic systems and geothermal heat exchangers was evaluated and calculated with the help of an experimental setup.The experiment was comple ted in 2017. Heat transfer was investigated using different materials. Additionally, the system is hybridized with solar energy to calculate the payback period. For the calculation, the temperature is 50 °C in winter and 400 °C in summer. The results of various performance measures, such as the impact of electronic compone nts and physical activity performance, are discussed. The heat transfer rate is less. Therefore, the use of small metal is economical. How cold it is in summer is cal culated based on the actual temperature, around 130°C. Similarly, the temperature increase in winter is also based on cost calculation. This is around 120 degrees. The results show that the payback period of solar and solar power grid is 4.5 years. Then the system will work freely. The solar geothermal hybrid generator does not use fossil fuels for heating and cooling and eliminates the danger of accidents such as carbon monoxide poisoningIn order t o make the system more efficient or improve its future performance, the system can also help the fan generate electricity to run the machine, so the system messa ge can also work at night. Additionally, other renewable energy sources such as biomass can be used to power the machine.

Keywords: heat exchanger, geothermal energy, solar panels, payback period.

INTRODUCTION

People around the world have higher expectations for our millennium. The key to a high standard of living is access to clean energy. Energy affects every aspect of daily life. A person's energy consumption is related to life expectancy. Between 1990 and 2050, energy consumption is expected to increase by 50% based on real environmental protection and 27.5% based on industrialization. If the environment is protected, carbon emissions are expected to fall slightly from 1990 levels, when high economic growth caused carbon emissions to more than double. Predictions of energy shortages in the 1970s have not yet come true.

Economic development in the new century will not be affected by geological resources. By all accounts, the peak of fossil fuels is almost gone. Oil and gas are expected to be the main energy source, and renewable energy is also expected to increase (30 -80% by 2100) [1] . There is a lot of free energy in the ground. The sources of this energy are sunlight and rain. When viewed from approximately two meters below, the temperature of the water is approximately 210 degrees Celsius. Geothermal systems use this space to heat or cool our homes. In fact, geothermal energy can help you save up to 70% on your cooling/heating costs[2–8]. In short, since we will not have underground energy, we will invest in renewable energy. Our initial investment is not affected by increases in gasoline, oil, propane or electricity prices. We don't just save money, we also help reduce greenhouse gas emissions. Thermoeconomic or thermoeconomic analysis can be useful to researchers in engineering and other disciplines because the process is based on the amount of energy, cost, power, and size. [2-8].

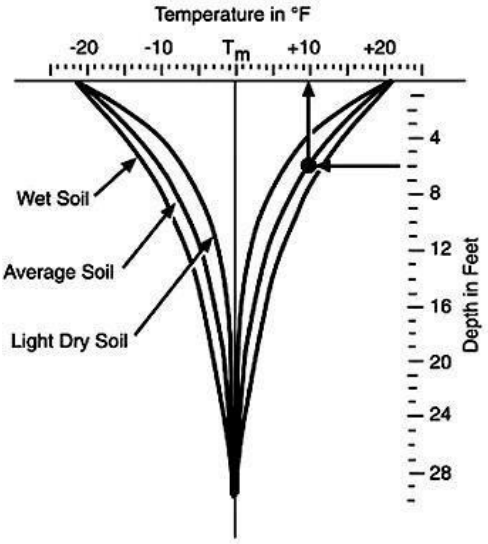
The aim of this research is to develop a solargeothermal hybrid energy conversion system that can better utilize underground resources and support solar energy. Our goal is to find hybrid systems that use a combination of solar thermal and geothermal energy.

The payback period (the number of years before annual operations saves more than the initial installation cost) is between 3 and 12 years, and in most cases problems with geothermal system installation can produce good results from the first month of operation. The advantage of the hybrid model is that the system uses renewable energy (solar and geothermal), does not use fossil fuels, and has a perfect combination of the two technologies that will benefit summer and winter. Leylaözgener and Önderozgener conducted studies and experiments on horizontal ground rotation and "ground wind" and concluded that the use of this system is possible. [9]

This experimental setup creates and creates an alternative to heat/heat. air conditioning system. Closed-loop ground source heating/cooling uses a ground temperature sensor to control the temperature of the home or building with great efficiency. The system does not produce electricity by passing electricity through resistors or burning it; It carries heat from the floor into the house to heat it, and in the opposite direction to the house to cool it. Generally speaking, the system needs to be close to the surface (up to a depth of 2-3 m) to reduce installation costs due to work, but this means its benefit will be reduced due to the higher ground temperature. That depth. In order to find the relationship between performance and cost, it is necessary to evaluate the effect of heat radiation coming from the surface, as well as the effects of air directed through buried water pipes on the temperature of the ground near the buried. water pipes. . Piping. [10] The ground heat of this system is provided by the sun and renewable energy is used. Underfloor heating and cooling is cost-effective because it uses energy very efficiently.

Soil Texture

The simple reason for this is that the thermal conductivity of air is approximately 100 times lower than the thermal conductivity of soil. Compared to coarse soil, fine soil has more connections and smaller insulating air spaces between particles and therefore has more electricity.



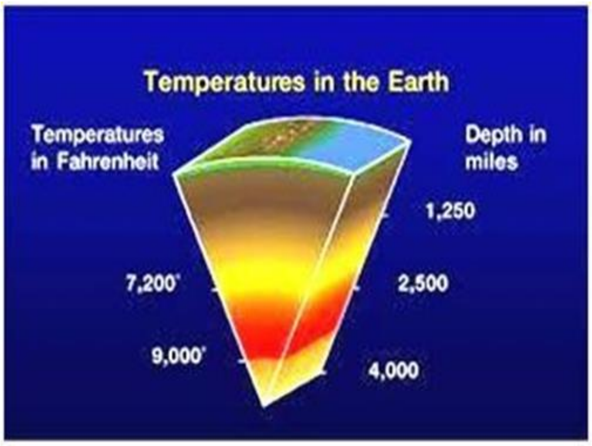


Figure 1.1: Temperature at different layers of soil

LITERATURE SURVEY

Jens Pfafferott et al (2003) reviewed the topic "Evaluation of floor-to-air heat exchangers using the energy efficiency calculation method": - This article discusses the performance of three EAHXs in use in central European office buildings, with the aim of determining their characteristics. competence. A method to compare operated EAHX will be presented. First, the temperature behavior is described with graphs and characteristic lines over time and compared with long-term curves. Second, the power gain is explained by the measurement model. Third, parametric models are used to provide general performance models. Thermal efficiency should be defined by dynamic temperature behavior and throughput. The thermal performance (temperature performance and power consumption) of EAHX was calculated using four different methods (RT, average, theta and COP). This results in pipe lengths of up to 100 m and pipe diameters of around 250 mm. Temperature control is important to prevent unnecessary heating in summer and cold in winter. Of course, better energy efficiency can be achieved with closed-loop control, but EAHX is difficult to operate due to its long dead time. Open-loop control works well, but its programs need to be adjusted, usually after the first year of operation, when the temperature behavior is known. [13]

R.J. Goldstein et al. (2003) "Heat Transfer - Literature Review 2003" study: - This article aims to cover the heat transfer literature published in English in 2003, including translations of some foreign literature codes. Although this research is comprehensive, it cannot cover all data; some options are required. Most of the literature reviewed in this article relates to energy transfer research and includes numerical, analytical and experimental studies. Other applications related to energy transfer play an important role not only in human products but also in natural processes. The data is divided into groups and then subfields within those groups. The grand prize began to be awarded in 2003 for the most popular books published that year. [14]

R.J. Goldstein et al. al (2004) study "Heat Transfer - Literature Review 2003": - This review covers the heat transfer literature published in English in 2004, including country translations of some different texts. Although the range is wide, some options are necessary. Only articles published in archival journals through the peer-review process will be reviewed. The data is content-oriented and divided into sub-domains. Many documents related to the study of energy transfer, including experiments, mathematics, and analysis; others deal with practices or natural processes. [15]

LeylaÖzgener et al (2010) worked on "Experimental research on heat release from underground air for greenhouse cooling":- This study demonstrates the heat release of ground air for greenhouse air conditioning. Features Greenhouse cooling, a 47 m horizontal, 56 cm nominal diameter U-shaped bent embedded galvanized ground heat exchanger. The system was designed and installed at Izmir Ege University Solar Energy Research Institute. Underground heating system, also known as floor-to-air transformer, is considered a good heating, cooling and heating system. Greenhouses are also an important business opportunity in Turkish agriculture. Greenhouses need to be cooled during summer or hot weather. To create a sustainable greenhouse, renewable energy sources need to be used everywhere. The effective use of underground ventilation with appropriate equipment in modern greenhouses should play an important role in Turkey in the future. The electrical transfer of components and damage to each part of the body is determined by the average value of the measurement obtained from the test results. The energy efficiency of electronic equipment was determined to evaluate their performance and improvement potential was also suggested. The system has the highest daily cooling coefficient of performance (COP) value of 15.8. The overall average COP during the trial was 10.09. System COP is calculated based on the amount of cooling air produced by the ducts and the energy required to move the air through the ducts,[18]RJ Goldstein et al. al (2005) reviewed "Heat Transfer - Literature Review 2003": - This review is designed to cover heat transfer literature published in 2005. Although comprehensive, some selections are not available in other languages. Although the meetings themselves can be evaluated in the introduction section, the information contained in the meeting is generally not included. Most of the literature reviewed in this article is related to energy conversion, including experimental, measurement and numerical studies. Other articles cover applications where energy transfer plays an important role not only in human products but also in natural processes. Information is divided into main topics and then sub-areas within these areas. In addition to the literature review, we also talk about the important conferences held in 2005, the major awards for the electronic revolution given in 2005, and the electronic version books published in 2005. [16] M. Kukumoete. al (2008) studied "a one-dimensional transient analysis model of ground-to-air heat exchanger, taking into account condensation phenomena and thermal effects from the upper white surface and around Buried pipes":

METHODOLOGY

Construction site

First of all, we need to weld all the low carbon steel pipes together in a closed loop. After that select the location where we want to install the device. Dig a foot hole (22*10*6) with the help of JCB machine and place the welded pipe horizontally in the hole. The soil in the pit will come out in abundance. The soil in the pit can be used for agriculture, construction (e.g. foundations), and more. The two ends of the pipe are connected to the room where we need to be sick. One end of the blower, the intake end, is connected to draw air into the house, and the other end remains open to discharge air into the cooling area. We should blow the teeth of small steel pipes according to the requirements of the blower. We can measure the temperature of the pipes with the help of thermocouples attached to the pipes.

Figure 4.1: Construction site.

INSTRUMENTATION

It is aimed to receive heat from nine places from the entrance to the exit in the horizontal closed circuit heat exchanger, which is mounted at different di stances from each of the nine places on the pipes. The end is attached to the pipe wall with glue. The thermocouple is placed in place and attached to th e surface of the strip using a thin layer of adhesive. Remove the thermocouple cable from the pipe by opening the 6 mm hole at the top of the pipe.

The hole is then sealed to make it airtight. The small pipe is 20.574 m long and is connected to the digital temperature sensor by passing a sensor cable t hrough it. The small metal was placed horizontally and opened above the floor to work, helping the room to be 34 fields white and not bad for the envir onment. The upper end of the riser (small steel tube) is usually covered with a cap. When placed in the sensor area, a backup riser is provided to allow h ot air to enter the pipes. The lead is tied to the outside of a small steel pipe, placed on the ground and connected to a digital measuring device. The tools are placed in a wooden box lined with stainless steel sheets to protect them from the weather. Nine of these products were produced. Thermal sensors a re mounted with a distance between two consecutive sensors from the input to the output. A horizontal closed-loop heat exchanger is mounted at the inlet, one in the middle and the other at the end. A vacuum is used to keep air moving through the tube. Since the air speed in the pipes is not very high, the air can be cooled through the pipes.

Figure 4.2: Measurement of soil temperature

WORKING

The working principle of solar-geothermal hybrid based on heat exchange is as follows: - The heat from the wind is blown into the pipes with the help of the wind turbine.

Energy produced with the help of solar panels. Solar energy from the sun is first converted into electricity and used to power the generator. The blower is used to blow high and hot air i.e. 400°C. It has a power of 0.75 hp and a speed of 2800 rpm. This hot air will flow along the pipe to a maximum height of 3 m. Due to the high temperature change, it cools down slowly when it comes into contact with the cold air coming from the soil. After cooling, the cold air flows back into the pipe, and the cold air flows into the 220°C room for curing. This process is reversed during the winter months. Thermocouples are also provided to measure the average pipe temperature in different seasons. In this way, solar-geothermal hybrid based heat exchanger system

RESULTS & DISCUSSION

Assumptions made during the calculation:-

The following assumptions were made during the cycle time of the body:-

1) The soil around the heat exchanger (underground air tunnel) is homogeneous. <br< b="" style="margin: 0px; padding: 0px;"></br<>> 2) The flow of soil conductivity along vertical and horizontal lines is constant.

3) Water flow is consistent according to the length of buried pipe.

4) Consider the heat exchange between the legs of the buried U-shaped pipe and finally

5) Assume that the ground is isotropic and there is good contact between the ground and the pipe

Table no. 5.1: Recorded temperature of ground:-

TIME	TEMPERATURE(Tsoi)
10:55AM	22.1 0C
11:05AM	22. 0C
11:15AM	22.5 0C
11:25AM	23.3 0C
11:35AM	22.9 0C

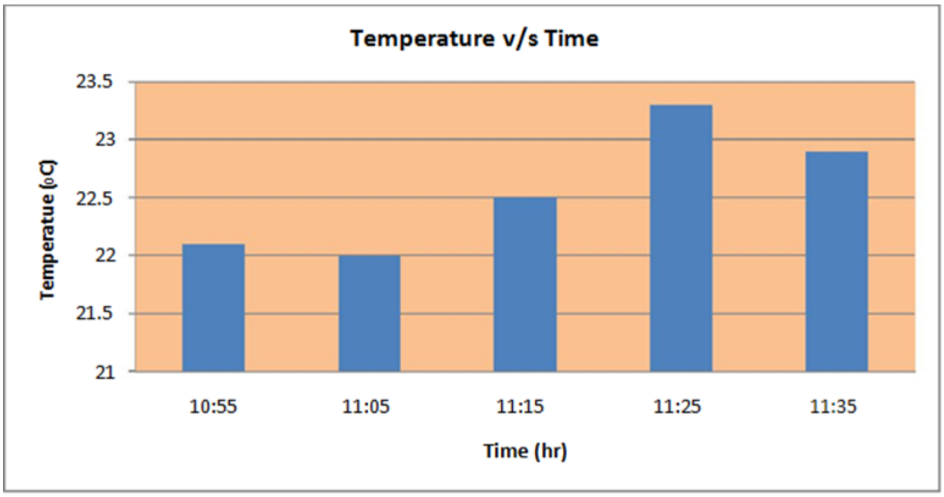


Figure 5.1: Graph plot between temperature of soil and time

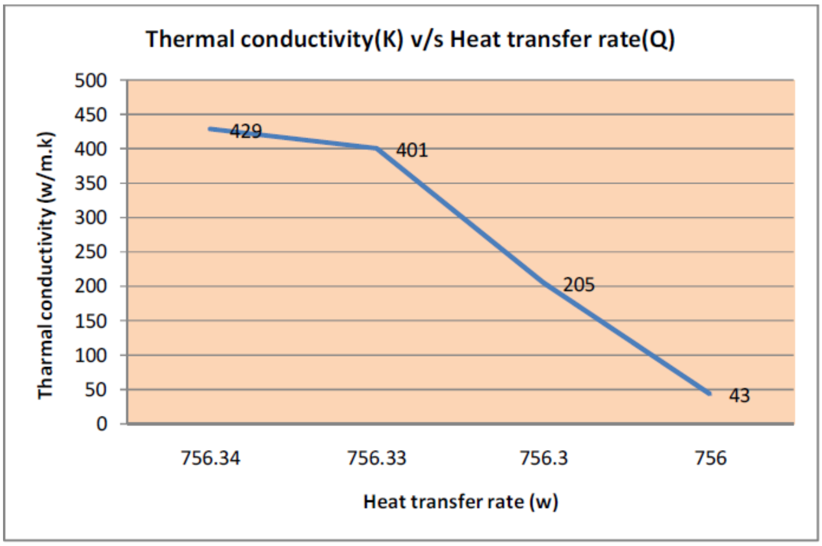
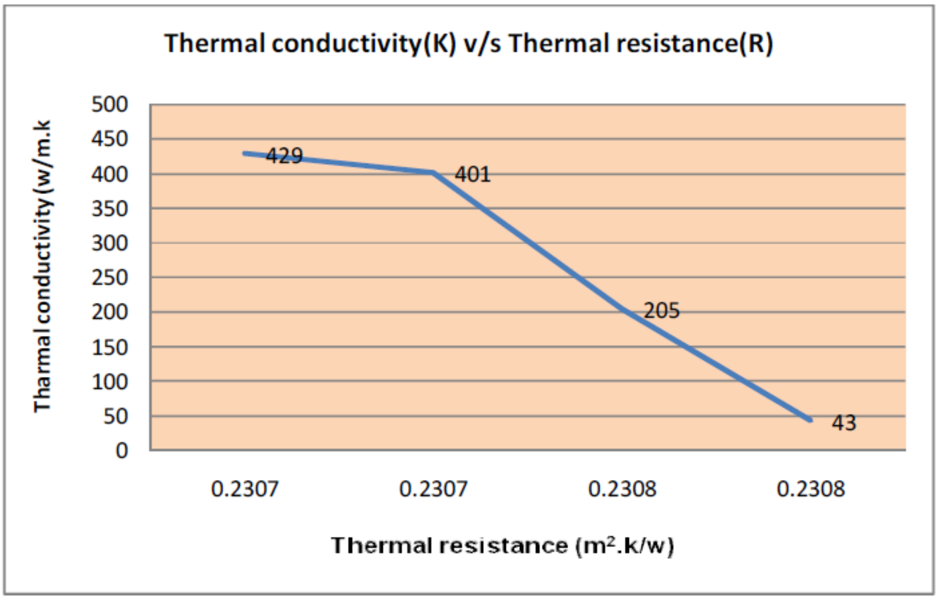


Figure 5.4: Graph shows the result between heat transfer rate and thermal conductivity different metals in summer



CONCLUSION & FUTURE SCOPE

1. Lower your annual electricity bill.
2. The use of low carbon steel pipe as a different electrical material is due to its economics and the incredible difference between the cost ratio for electr ical energy transfer and other information.
3. Reduce operating costs, thus saving money. 4. Hybrid solar-geothermal-
based generator converts heat into and out of the ground using free electricity.
5. Geothermal systems are environmentally friendly, non-polluting source of energy.

REFERENCES

[1] Feleja I., Blaga AC., Moldova V. Research on energy production in geothermal solar hybrid systems Journal of Sustainable Energy Vol. II, Issue 2, June 2011

[2] A. Rosen, I. Dicer, Exergoeconomic tsom xam ntawm fais fab nroj tsuag ua hauj lwm nrog ntau yam fuels, Applied Thermal Engineering 23 (2003) 643–658.

[3] M.A. Rosen, I. Dicer, Thermal economic analysis of power plant: Application to coal-to-red power plant, Energy Conversion and Management 44 (2003) 1633–1651.

[4] G. Tsatsaronis, M. Winhold, Exergoeconomic analysis and evaluation of energy conversion plant, Energy—The International Journal 10 (1–2) (1985) 69–94.

[5] L. Ozgener , Exergoeconomic analysis of pasta drying systems, Proceedings of the Institute of Mechanical Engineers, Part A: Phau ntawv Journal of Power and Energy 221 (7) (2007) 899– 906.

[6] O. Özgener, A. Hepbaşlı, L. Özgener, Economic evaluation of heat for vertical ground-connected (geothermal) heat pumps, Building and environment 42 (3) (2007) 1503 –1509.

[7] O. Özgener , A. Hepbaslı, Exergoeconomic analysis of solar supported ground source heat pump greenhouse heating system, Applied Thermal Engineering 2005) 1459-1471.

[8] L. Özgener, A. Hepbaşlı, İ. Dicer, M.A. Rosen, Exergoeconomic analysis of geothermal district heating systems: a case study, Applied Thermal Engineering (8–9) (2007) 1303–1310.

[9] LeylaÖzgener, ÖnderÖzgener AnderÖzgener AnderÖzgener AnderÖzgener AnderÖzgener AnderÖzgener AnderÖzgener AnderÖzgener AnderÖzgener AnderÖzgener AnderÖzgener Experimental study of the heat dissipation efficiency of greenhouse air conditioning (Murchanical air conditioning), Manisa University Faculty of Engineering, Turkey (B) Solar Energy Research Institute Eger University, 35100 Bornova, Izmir, Turkey 2010

[10] M. Cucumo, S. Cucumber. July 2007 International Journal of Heat and Mass Transfer 51 (2008) 506–516

[11] Sadik Kakaç and Hongtan Liu (2002). Heat exchangers: selection, measurement and thermal design (2nd ed.). CRC Press.ISBN 0-8493-0902-6

[12] P. Wang, X.H. Han, A. Sommers, Y. Park, C. T'Joen, A. Jacobi, Study of the use of carbonaceous materials and carbon matrix composites in heat exchangers and radiators, (a) Department of Faculty of Energy Refrigeration and Cryogenic Engineering, Zhejiang University, No. 38 Zheda Road, Hangzhou, Zhejiang Province, Zip Code: 310027

(b) Department of Mechanical and Manufacturing Engineering, University of Miami, 650

E. High Street, Oxford, OH 45056, United States (c) Department of Mechanical Sciences thiab Engineering, University of Illinois, 1206 West Green Street, Urbana, IL 61801, United States (d) Department of Flow, Thermodynamics and Combustion Mechanics, University of Gent -UGent, Sint -Pietersnieuwstraat 41, 9000 Ghent, Belgium 2012