Need Identification and Problem Statement

Feb 2, 2022

By Group 3.1

Introduction:

While current heating and cooling systems for your home are effective, they are not very good for the environment. Conventional systems use a furnace and an air conditioner. Furnaces work nicely, but they release a lot of greenhouse gasses into the atmosphere. Furnaces burn fossil fuels to create heat that is then blown throughout a house. The other part of the conventional system is the air conditioner. This uses a compressor and refrigerant line to a heatsink on the outside of the house to cool it in the summer. The refrigerant that is used to transfer heat from the inside to the outside is a greenhouse gas. If the refrigerant pipe leaks it will cause damage to the ozone layer. Both the furnace and the air conditioner use the same blower to circulate air around the house. This blower uses a lot of electricity. The conventional heating and cooling systems that are used at the moment are unacceptable in their production of pollutants. This document will explore one alternative system that can save up to 90% of yearly energy costs.

Client needs	**Ranking(1-not important, 5-very important)**
1. Maintenance costs should be made low so homeowners can save money.	Rank 3: Lowering maintenance cost will make more people choose this system over something with a high maintenance cost.
2. Pipes to get air to the house.	Rank 4: Pipes are important because they let the air travel to the house.
3. Small fan to blow air around.	Rank 3: Without a fan the air will not move around.
4. Can switch between solar panels and other energy sources.	Rank 2: It's environmentally friendly and cost effective.
5. Thermal storage medium (water + clay).	Rank 3: Water and clay are easily collected without any extra cost.
6. The device should be able to raise its temperature to about 20°C during winter.	Rank 4: 20 °C can ensure that the room is warm and human body doesn’t feel cold in winter,
7. You will not need a solar water heater in summer.	Rank 4: Water heaters are important to us and solar heaters are cheaper.

8. When operating as a closed loop the box will need to get fresh air without opening the air inlet.	Rank 2: Without fresh air the air in the system will become stale.
9. Large box(Heat Exchange chamber) to hold air underground. Must be at least 6 ft under ground.	Rank 4: The Heat Exchange Chamber is important because it is where the air mixes.
10. Box requires a sump pump.	Rank 2: The sump pump is important to get rid of water in the system.
11.Cheap and recycled materials can include Aluminum, Plastic, and Concrete.	Rank 4: The materials will decide what properties the system has.
12. Be small enough to be installed in a "Standard townhouse yard."	Rank 5: It is one of the major problems preventing GCHEs from becoming widespread.
13. When operating as a closed loop the HEC will need to get fresh air without opening the air inlet.	Rank 4: Very important for operating during the winter.

Problem statement:

"The current HVAC systems create a lot of greenhouse gasses which contribute to global warming and current GCHE systems take up too much space."

Current systems:

Current conventional HVAC systems use a furnace which burns hydrocarbons creating greenhouse gasses. They also use air conditioners which use refrigerant, refrigerant is also a greenhouse gas. These gasses contribute to depleting the ozone layer. Current GSHP systems use refrigerants and compressors which pollute and use a lot of electricity.

Conclusion:

Newer GCHE underground heat exchange systems can reduce the yearly costs of heating and cooling in the average home. While these systems have many parts, they will require less maintenance because the system as a whole is less mechanically complex. Instead of using refrigerant they use the surrounding solid to balance the temperature of the air circulating the system. These systems are needed to reduce pollution and the release of greenhouse gasses. With these systems installed the average house can save 90% of their yearly energy costs.