



THE HIDDEN GENIUS OF GEOTHERMAL - PART 2 WHAT IS THE RIGHT HVAC SOLUTION?

BY DOUGLAS ELBINGER
ENERGY SYSTEM FINANCE
NEWMAN CONSULTING GROUP, LLC

In Part 1 of my geothermal story (in the January 2016 issue of *CAM Magazine*) I discussed how geothermal HVAC systems work and why they are so efficient. Now I am going to describe what decisions are required to size and cost a system to suit your purpose.

Geothermal Heating and Cooling is often referred to as Geoexchange, Geothermal, or Ground Source Heating and Cooling. They all mean the exact same thing, so don't get confused by these names being interchanged. Just for the record, we are not talking about geothermal power involving power plants generating electricity from the hot core of the earth.

Geothermal works because ground temperatures are a constant 55° all year, no matter what the weather is like. Geothermal works because the ground beneath our feet is warmer than the outside air in the winter and cooler in the summer. Inserting a series of small pipes into the ground allows heat to be transferred to and from your home or commercial building. In this process, heat is not created, it is *transferred*... therefore no fuel is burned.

THE TWO MAIN COMPONENTS OF THE GEOTHERMAL SYSTEM

First there's the **Heat Pump** - the inside unit known as the heat pump which transfers heat either into or out of the building; and secondly

there's the **Ground Loop** - underground pipes which connect to the heat pump.

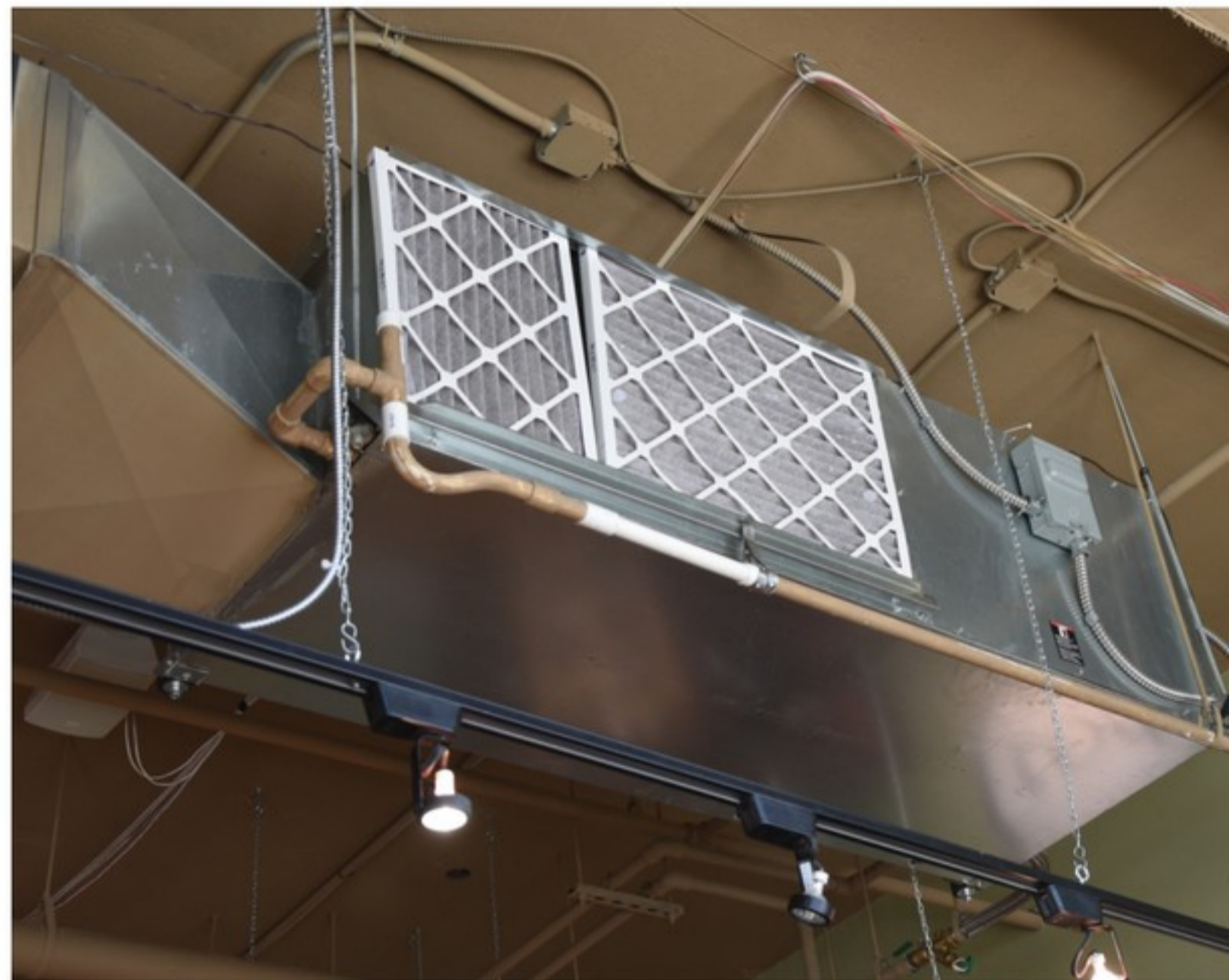
Winter Operation: The underground pipes, the ground loop, circulate water which absorbs the heat from the earth and returns it to the indoor heat pump. The heat pump extracts the heat from the liquid then distributes it throughout your home as warm air. With the heat removed, the water is re-circulated to collect more heat from the ground. In this case, the loop water is warmer when it comes into the home than when it goes back into the earth, since the heat is being removed.

Summer Operation: The indoor heat pump takes the hot air from your home and removes the heat. This leaves behind cool air to be distributed through your vents as air-conditioning. The removed heat from the air is

injected into the earth through the ground loop. In this case the water is warmer leaving the home then when it returns since heat is rejected into it. It is worth repeating here that the Environmental Protection Agency (EPA) has acknowledged geothermal systems as the most energy efficient, environmentally clean, & cost-effective space conditioning systems available.

SIZING A GEOTHERMAL HEAT PUMP

Geothermal heat pumps vary in size depending on the size (Square Feet to heat and cool) of the home or commercial building. There are a number of factors that determine how big of a pump is needed. Since sizing a geothermal heat pump is an intricate process, you'll need to contact a qualified geothermal heat pump contractor or engineer. They will



▲ The Lafayette Market in Pontiac relies 100 percent on geothermal HVAC. You are looking up at a ceiling-mounted heat exchanger that fits onto a conventional ventilation system.

start with an energy audit or analysis of the heating and cooling demand of your building. From there, they will be able to calculate the right size system. The size of the system will dictate the size of the loop field. It is very important to contact an experienced geothermal professional before choosing a heat pump size because there can be problems with under-sized and over-sized systems. An experienced contractor will know how to design the system accurately which ensures a long lifespan and low operating costs.

WHAT GOES INTO PRICING A GEOTHERMAL SYSTEM?

If you're thinking about installing a geothermal system, the initial cost is certainly one of the factors that plays a role in the decision-making process. Although geothermal heating and cooling will save you money in the overall cost of ownership, it is typically more expensive to install than conventional electric or gas fired systems. Keep in mind there may be special



▲ This is an example of the typical apartment size geothermal heat exchanger that fits into a utility closet that would otherwise contain gas or electric HVAC.

financing (such as PACE) to keep this on an even field. The indoor equipment isn't much more expensive, it's the underground portion known as the loop-field which adds to upfront cost. Consumers should first become acquainted with the geothermal installation process to understand how the cost is derived.

The short answer to how cost is calculated is: *Indoor Portion + Underground Loop Field = Total System Cost*. The inside portion is composed of the price of the geothermal heat pump, its installation, and possible duct work modification. This is done by an HVAC contractor properly trained in geothermal. The Underground Loop Field involves drilling (or sometimes excavating) and materials. This is usually done by a well driller. The loop field is approximately 50 percent of the total cost, although many factors affect this estimate.

For your particular situation the following variables are considered:

1. Size of the Home or Building

The first factor that we'll take a look at is the size of the home or other building for which you'd like to install geothermal. Look at it like this. A 2,000-square-foot home isn't going to require the same amount of heating and cooling as a 6,000-square-foot church. The larger the area covered, the more heating and cooling it is going to demand. That said, a major variable of pricing is the insulation factor, which has a direct effect on how much heating and cooling is needed. Do you live in a well-insulated home?

2. Size of the Heat Pump

Based on the size of the home, insulation and climate, the amount of heating and cooling needed is calculated, which in turn enables a contractor to calculate the size of the heat pump for the job. Needless to say, a larger heat pump is going to be a little pricier than one that's smaller in comparison.

3. Size of the Loop Field

Next, the size of the loop field that's to be installed in the ground comes into play. The

size of the system (3-ton, 4-ton, etc.) along with the climate in which you're located will dictate the amount of pipe that needs to be inserted into the earth. A loop field contractor will usually charge a price per foot; therefore, the larger the system, the more pipe that needs to go into the ground, the more expensive the loop field becomes. The loop field cost can vary by region because of the availability of contractors, the ground conditions, and also the price of fuel.

4. Usability of Current Ductwork

In most cases, this shouldn't be too large of a factor, as most existing ductwork requires little to no adjustment to be suitable for geothermal heating and cooling. That said, if you don't have existing ductwork, then you will have the full expense of installing it. However, it's important to consider that this is a cost for which you are going to be responsible for regardless of what type of heating and cooling you install. Ductwork is simply a necessity of almost all HVAC systems - not an exclusive monetary addition to your geothermal system pricing.

These are some of the main players as far as the cost of your geothermal heating and cooling system goes. There are more minute components of pricing, of course, but we feel that these four (and all that they encompass) are the most important for consumers to grasp. **Bottom line: Size of Home, Climate and Labor dictate total system price; it depends on your situation.**

Remember, all geothermal is NOT created equal. A quality contractor, with the right training and experience, is the key to a happy geothermal system customer. For this reason, it's important to never choose your contractor based solely on price. An inexperienced contractor can undersize your system, producing a lower quote. However, the system will not produce the efficiencies you desire.

To get an actual quote for your next project, start by contacting CAM Members: Brent Westberg, CEO, West Construction Services, Pontiac, MI; and Steve DiBerardine, PE, LEED AP, CEO, Strategic Energy Solutions (aka SES) www.sesnet.com. ♡