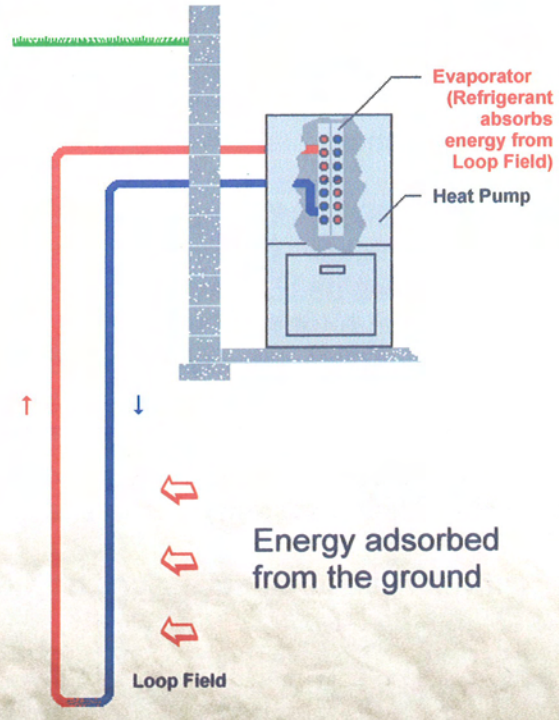
GEOTech Bulletin

How can something operate at 400% efficiency?
or
How can 50° dirt keep me warm?

Far as we know there are no perpetual motion machines, if you want something, you have to pay the price, and there is no free lunch. Yet when we talk about the heating efficiency of a Geothermal Heat Pump (or GeoExchange) system it sure sounds unbelievable.

As described in the GeoTech Bulletin, **How does a Geothermal Heat Pump work?**, the refrigeration cycle and refrigerants, the substance circulating in a Heat Pump, were discussed. As the liquid refrigerant moves through the Evaporator, the refrigerant absorbs energy from the water circulating through the Evaporator from the loop field. The water temperature is warm enough to cause the refrigerant to boil (change to a vapor). Changing to a vapor allows the refrigerant to move a tremendous amount of energy from the loop field.

At this point, most of the work is done; 70% of the energy needed to heat the space has been moved from the 40° circulating water of the loop field. The job of the compressor is to simply pressurize the vapor. Remember gases readily compress, so the compressor does not have to work very hard. As the refrigerant vapor is compressed the temperature increases, providing the required temperature (120° to 140°) for effective space heating. The hot vapor moves to the condenser, where it changes to a liquid, giving up its heat to the ductwork, or other heating distribution system, serving the space.



The *key point* is, if the compressor uses one unit of electricity to operate and the heat pump produces four units of heat, the heat pump is said to have a **Coefficient of Performance (C.O.P.)** of **4**. Saying it another way, the system is **400%** efficient in using an electrical energy input to produce a heating energy output.

Continued on page 2

GEOTech Bulletin

Continued from page 1

GeoExchange systems are not always 400% efficient, sometimes the C.O.P. is higher or lower, depending on a number of factors. The Air-Conditioning & Refrigeration Institute (ARI) provides performance standards for Geothermal Heat Pumps.

ARI Standard 13256-1 is the name of the rating for all Geothermal Heat Pumps, which the ARI tests for heating and cooling efficiency. ARI charts listing heat pumps from various manufacturers show the C.O.P. the Institute has assigned to each model. This independent testing is one of the ways consumers know that the GeoExchange system will provide the expected performance.

Loop field sizing, making sure there is sufficient ability to move heat from the earth to the Geothermal Heat Pump, is critical for maintaining peak operating efficiency. If the loop field is too small, it will not have the ability to maintain temperature as the refrigerant removes heat from the circulating water. If the loop field temperature drops, GeoExchange system efficiency drops.

Consumers installing a GeoExchange system for their home or business will benefit from years of research to perfect loop field sizing methods. Scientific-based calculations help make certain of optimum GeoExchange system performance.

While 400% efficiency deserves some explanation, cooling efficiencies for GeoExchange systems are remarkable as well. ARI standards list cooling efficiencies as **E.E.R.**, the same rating given for conventional cooling equipment. Removing heat from the space, during the heating season, and transferring that energy to the relatively cool earth, via the loop field, is considerably more efficient than conventional cooling. A conventional cooling unit must work hard to reject heat into the hot, humid air surrounding the exterior condenser. As outside air temperatures increase, more and more cooling is required by the space, the conventional system becomes less and less efficient.

If you have further questions on this GeoTech Bulletin please contact us toll-free

GEOEXCHANGE
Saving from the ground up.™

www.wisgeo.org
866-GEO-7757