

# THE GEOCOLUMN 'Geothermal made easy'

#### **ADVANCED ENERGY 2010**

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# THE ENERGY BALANCE

- ORNL study claims that Geothermal Heat Pumps have the ability to offset 35-40% of the projected growth in building energy consumption between now and 2030
- DOE is tasking its teams with facilitating the deployment of 1,000,000 geothermal heat pumps per year by 2016 – as compared to the current roughly 100,000 unit installed base
- The primary barriers to broad acceptance are high installed cost, uncertainty of scope of cost, and errors in design and installation.
  - ORNL study also sites the *"lack of new technologies and techniques to improve GHP system cost and performance".*



## **STATE OF THE ART**

- All heat pumps work on the principal of the Carnot cycle and have essentially the same four components:
  - Compressor
  - Condenser
  - Evaporator
  - Expansion Device
- The vast majority of heat pumps in the market are Air-to-Air systems which suffer from the outdoor location of the evaporator or condenser coils.
  - Efficiencies of Carnot systems with freon as the working fluid decrease as the condensing / evaporating temperatures go to the extremes.



### **GEOTHERMAL**

- Geothermal heat pumps utilize the natural tendency of subterranean environments to maintain a temperature of 55-65° F
  - "Outdoor" coil operates in this environment



- Can operate year-round in an optimal temperature range yielding higher overall efficiencies
- Traditionally, there have been two types of geothermal heat pumps:
  - Water source (open or closed loop)
  - Direct expansion





# **PRODUCT DIFFERENTIATION**

- Open Loop Water Source
  - Requires water source (deep well, river, lake) for intake and discharge
  - Utilizes pumping system to move water
  - Each installation is designed to fit the specific site characteristics
- Closed Loop Water Source
  - Typically utilizes glycol solution cycled through a network of HX piping
  - Requires pumping system to move glycol
  - Each installation is designed to fit the specific site characteristics
  - Requires water source or large excavated land mass
- DX (Direct Exchange)
  - Standard heat pump compressor is used to move Freon through copper heat exchanger tubing to interact directly with a land mass
  - Requires large physical footprint and excavation
  - Each installation is designed to fit the specific site characteristics
- GeoColumn
  - Standard heat pump compressor is used to move Freon to interact with water bath which in turn interacts with a land mass
  - Requires minimal footprint and excavation
  - Pre-engineered equipment ordered from stock
  - HDPE rigid in-ground containment, proprietary copper tube HX



#### • The GeoColumn is a hybrid water source / DX system

- Freon is pumped through coils submerged in water baths
- Water bath "columns" act as buffers to the earth and store energy as a fluid mass
- Systems sized at 1-2 columns per ton depending on soils
- Targets 1-5 ton residential and light commercial systems
- Requires drilling to only 23' depth at 2.5' diameter



- All columns are tied back to a common distribution manifold before returning to the home
- Componentized and pre-engineered requiring no on-site design work and installing often in 1 day











GeoColumn containment being installed at Habitat for Humanities





## **COMPETITIVE ADVANTAGES**

#### Designed to overcome traditional barriers to entry:

- Ease of installation
  - Componentized system
  - All work can be performed by the local HVAC contractor
  - No design and engineering required
  - Typically can be installed in one day
  - A legitimate "retrofit" for aging heat pumps
- Land Use
  - Small footprint required with little excavation
  - Usable in shallow soils and high water tables
  - No risk of finding a well: operational or financial
  - Salinity and pH are not issues
- Serviceability & Long Life
  - Failed HX can be serviced without mass excavation
  - Fewer moving and exposed parts (fans, pumps, coils)
  - Lower compressor stresses and amp draws
- Greener than 'just geothermal'
  - Does not utilize or consume groundwater
  - Does not interact with or pollute the aquifer or water source
  - Municipal tap water used instead of antifreeze solutions
  - Freon leaks are largely contained to the enclosures



# THE GEOGRAPHICS UNIN 'Geotoernal made easy'