

Will Geo Work For Me?

Geographically and Building Type?

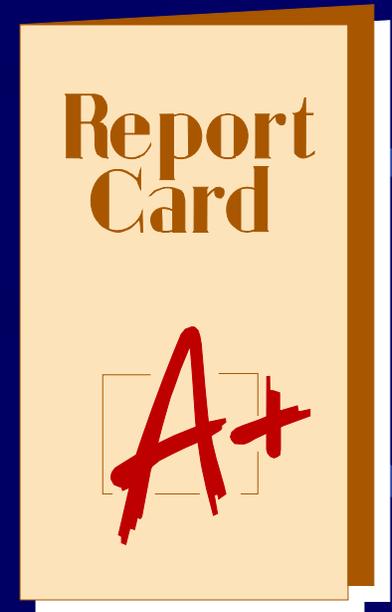
- | Successful Installations in 23 countries
- | 1 Degree Off Equator
- | 117 Miles North of Arctic Circle
- | List of 88 + Types of Applications
- | Project Size: 1/2 Ton to ~ 18,000 Tons

Systems Tailored For

- | Hotel/Motel
- | Restaurants
- | Health Care
- | Educational Facilities
- | Government Buildings
- | Office Buildings
- | Yachts/Boats
- | New Construction or Retrofit

The Perfect HVAC System:

- Reliable
- Easy To Install
- Applicable To Most Building Types
- Simple To Maintain
- Isolated From Extreme Environments
- Energy Efficient
- Utilize Energy in Building (Diversity)
- Long System Life
- Environmentally Sound



WSHP Features and Benefits

- | High EER
- | High COP
- | Emission Free
- | 25 + years Service Life
- | Reduced Use of Refrigerants
- | Refrigerants: Phasing in R410A
- | Quiet Operation
- | Many sizes and configurations available

Earth - Heat Sink and Heat Source

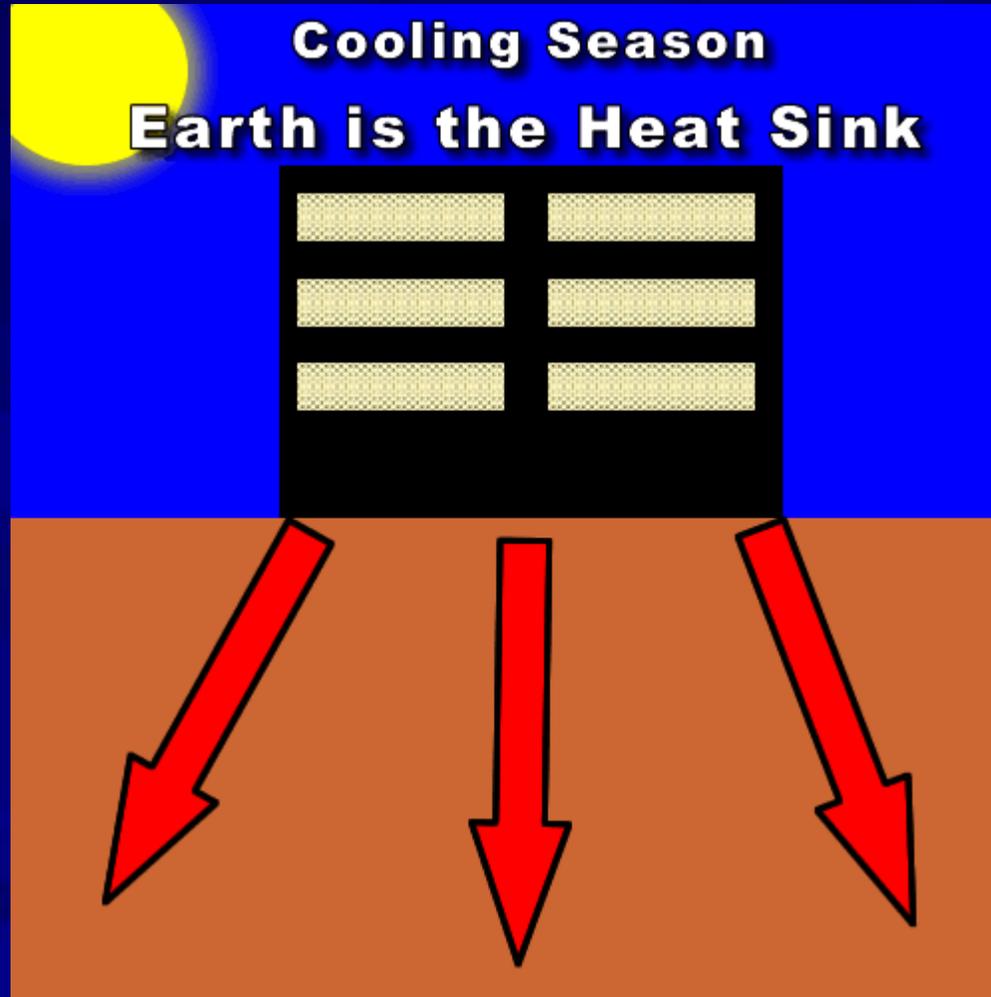
Heat Sink - Summer

- Geothermal systems use the ground as a heat sink in the summer – excess energy is rejected into the ground via a water loop

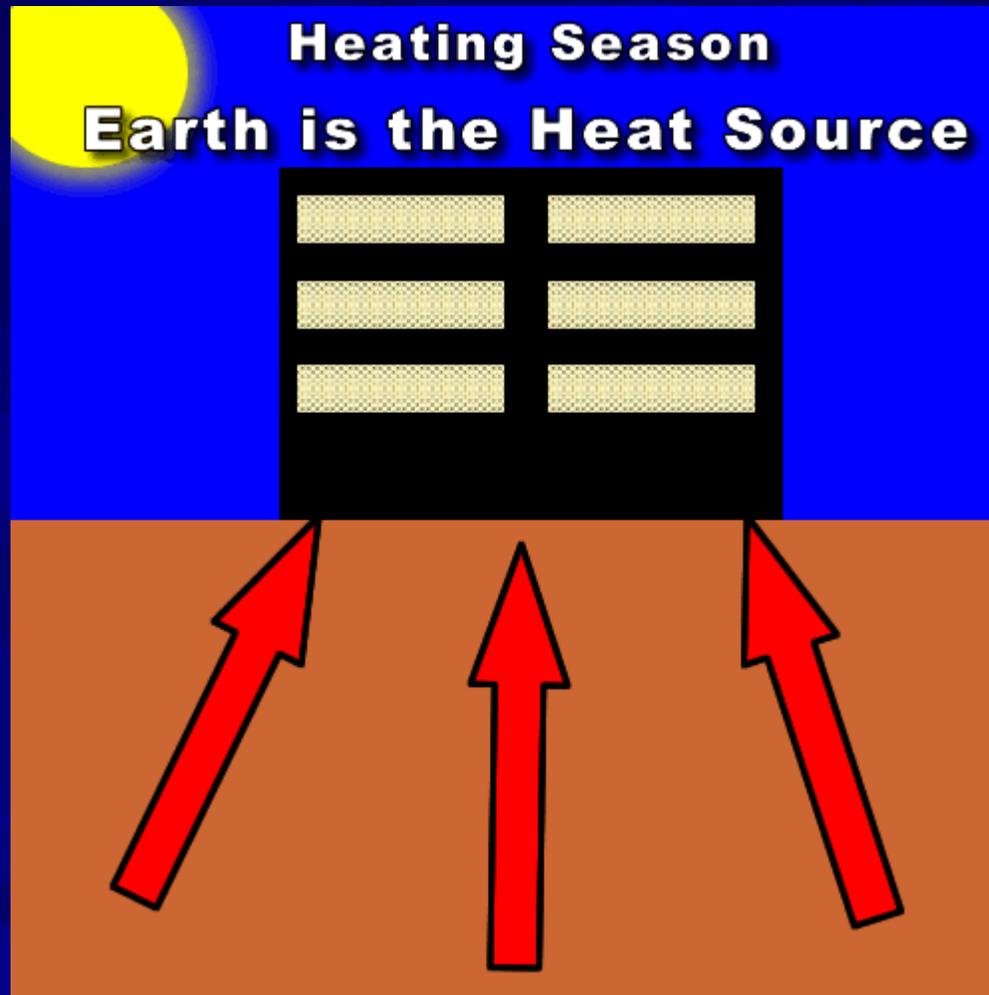
Heat Source - Winter

- Geothermal systems use the ground as a heat source in the winter– energy is added to the building via a water loop

Ground is Heat Sink



Ground is Heat Source



What is a Heat Pump?

A heat pump is a traditional compressor driven air conditioner with a refrigerant reversing valve. When engaged the reversing valve reverses the flow of the refrigerant through the liquid line changing the evaporator into the condenser and vice versa.



Device 9005 Data

File Select Options Edit Help

Monday, 12/22/1997 10:48:40.69PM

Unit Fan

Operating Mode

- 1 -- Continuous
- 2 -- Cycle Heating Only
- 3 -- Cycle Heating and Cooling

Previous

Text

Runtimes

OSA Temp.
72.0 °F

Loop Water Temp.
72.0 °F

Zone Control

Disable Unit

Command Mode

Space Temperature 65.5 °F

Occupied Setpoint

Current Microtouch Bias 0.0 °F

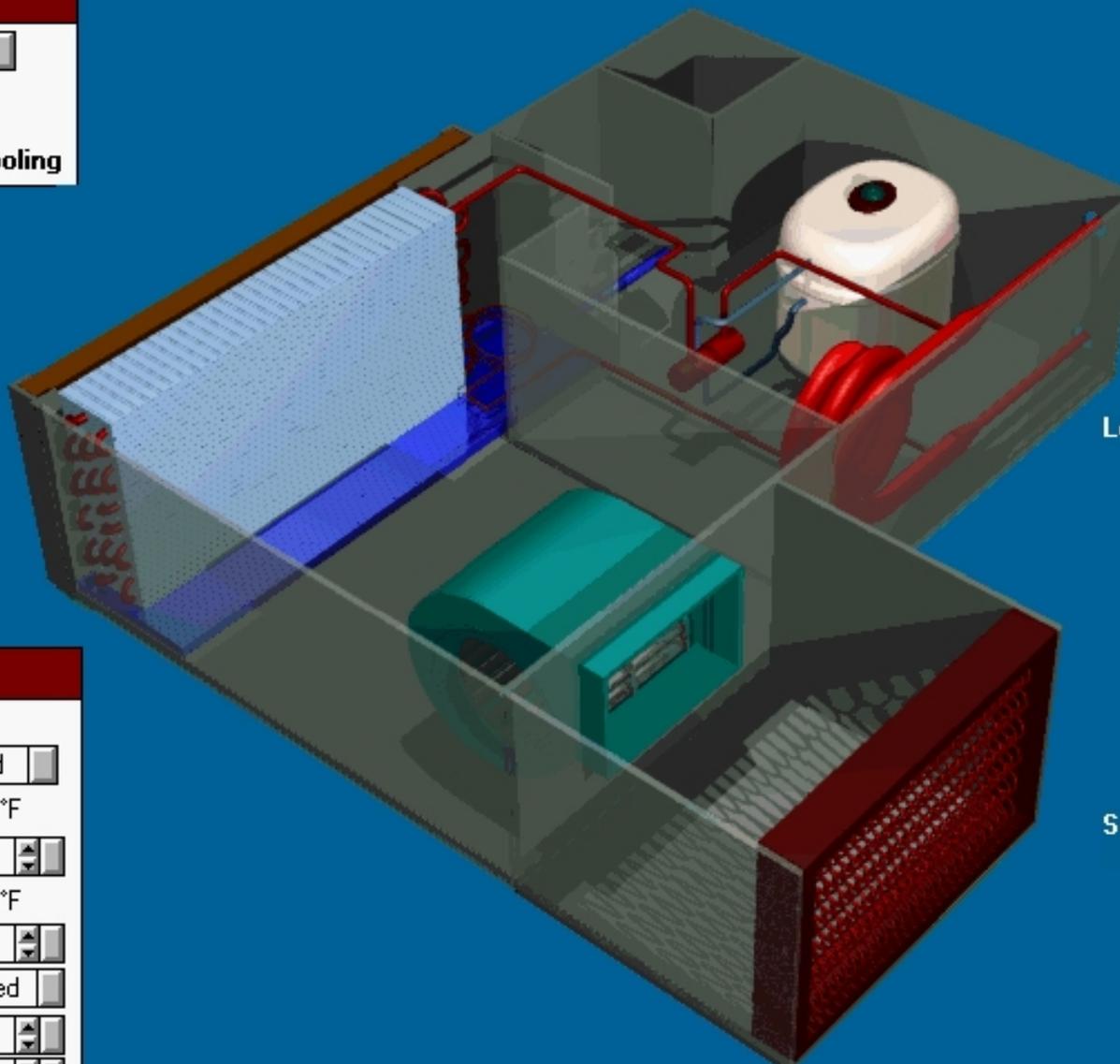
Microtouch Bias Limit

Microset OFF Button

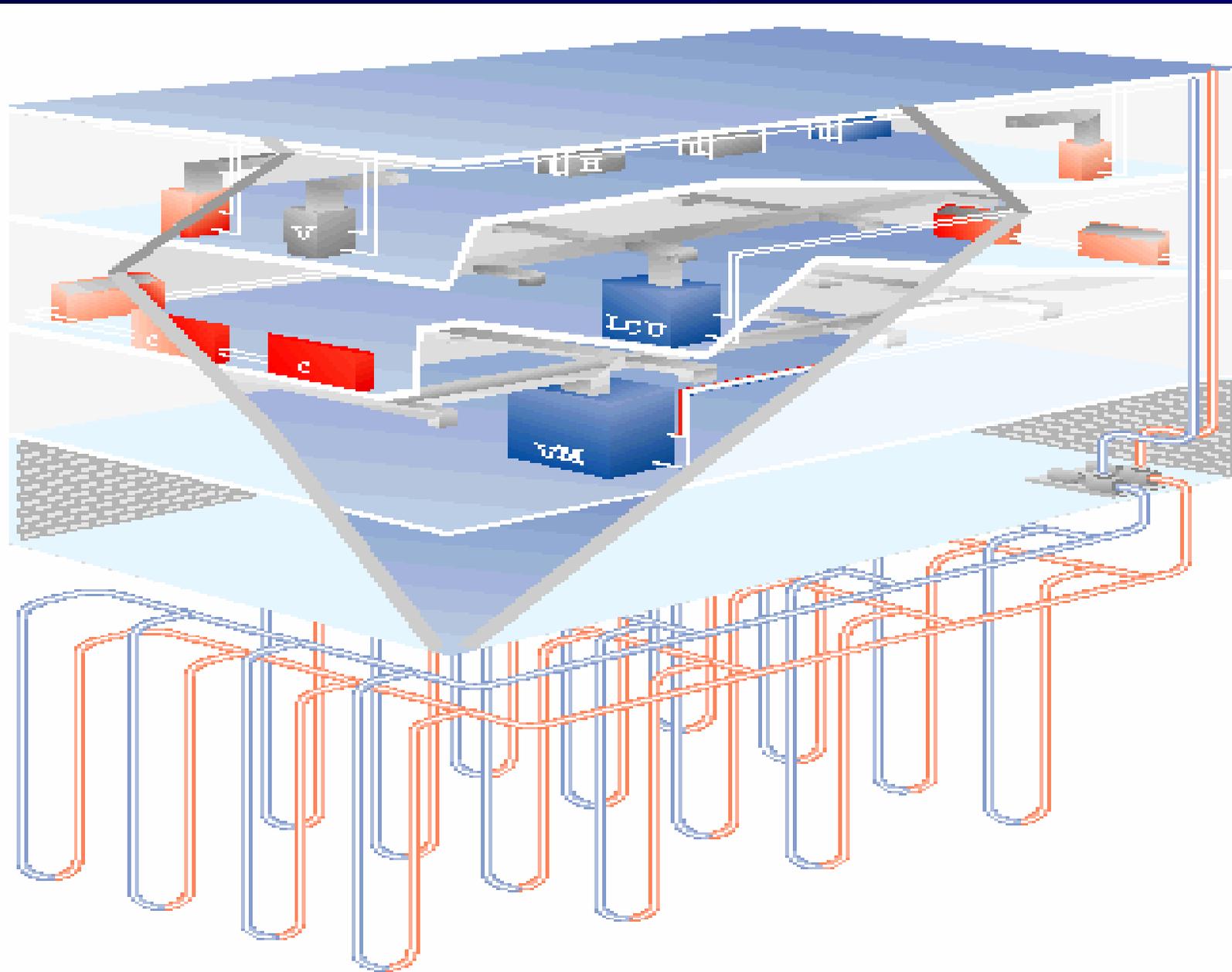
Heating Offset

Cooling Offset

Supply Temp.
75.0 °F



Unit Placement



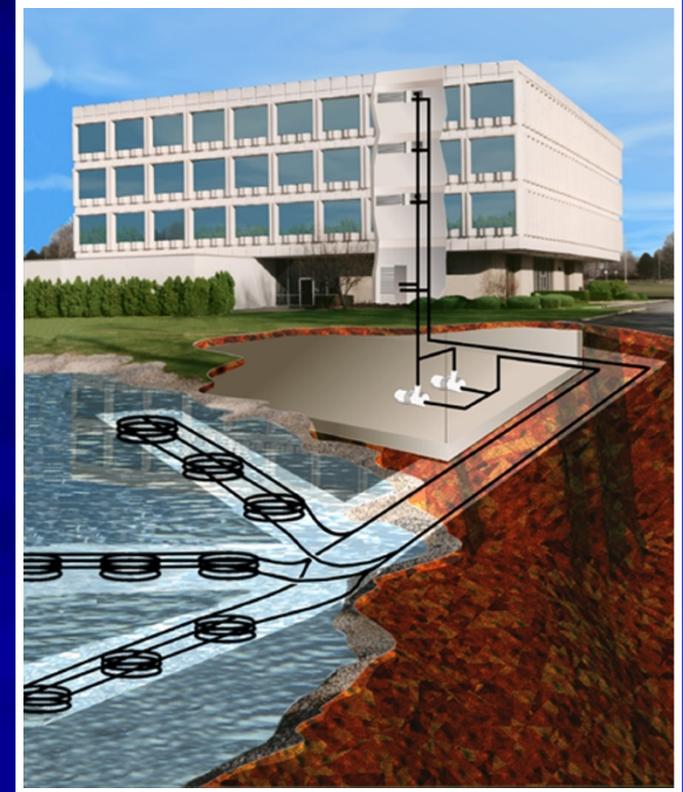
Vertical Loops

Most common for large commercial projects



Closed Pond/Lake

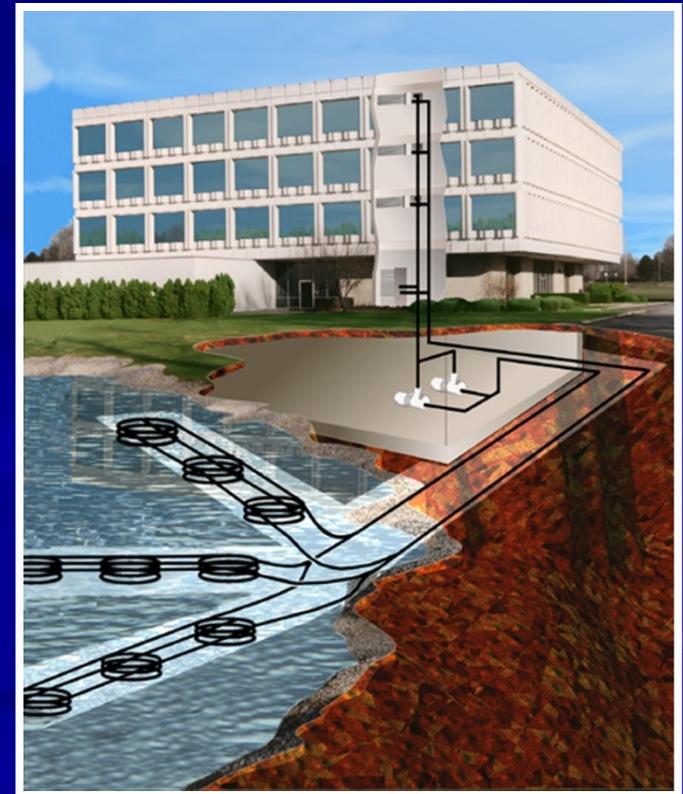
- Ground Water
- Pond or Lake
- Man made or natural
- 8 to 12 feet minimum
- 10 to 50 tons per acre
- Average Water Temperature 35 to 87
- Evaporative effect of water in summer
- Thermal conductivity of the earth in the winter



Closed Pond/Lake

Traditional Plastic Pipe on Pond Floor

- 300 to 350 feet of plastic pipe per ton
- Pipe coils separated by spacers
- Reverse Return piping
- Float out the pipes and then fill them with water to sink to the floor of the pond
- Labor intensive



Closed Pond/Lake

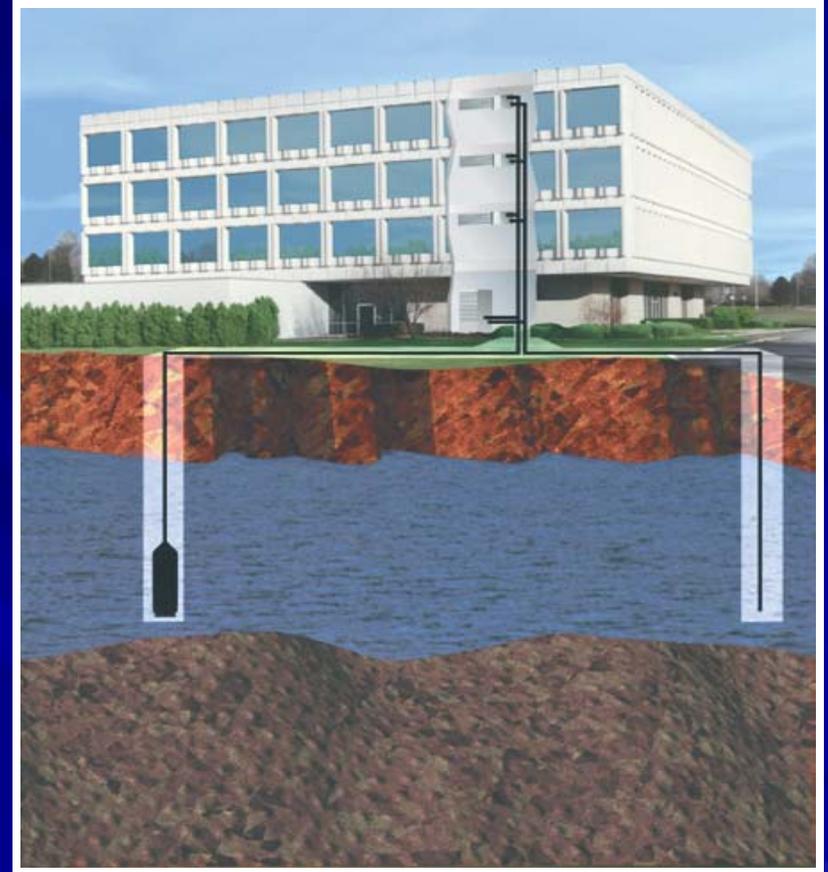
Geo Lake Plate

- **Stainless steel plates connected to building**
- **Mounting**
 - Feet
 - Skids
 - Floating



Closed to the Aquifer System

- Constant supply water temperature
- Lower first cost
- Intermediate heat exchanger



• *Garrett Office Buildings*



• *Garrett Office Buildings - Highway View*



• ***GeoThermal Building - 20,000 Sq. Ft.***



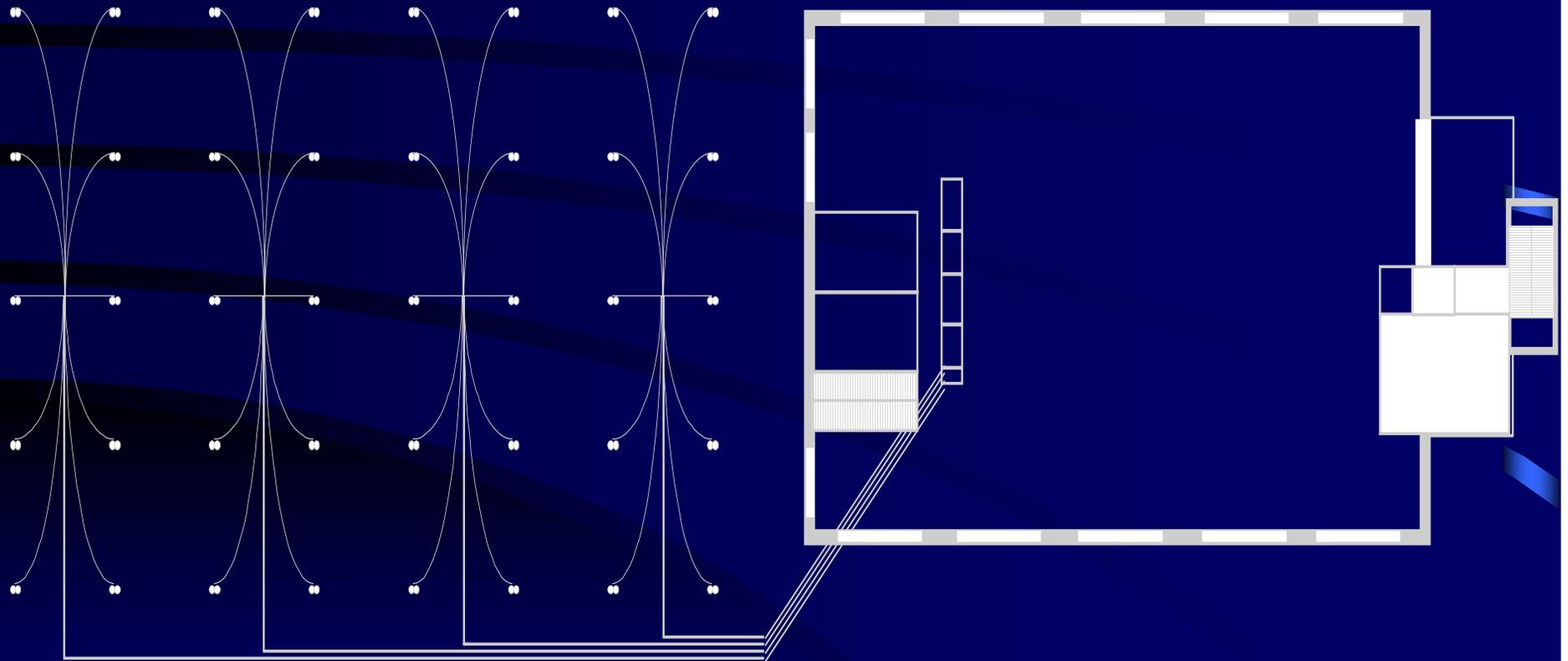
- ***VAV Building - 15,000 Sq. Ft.***



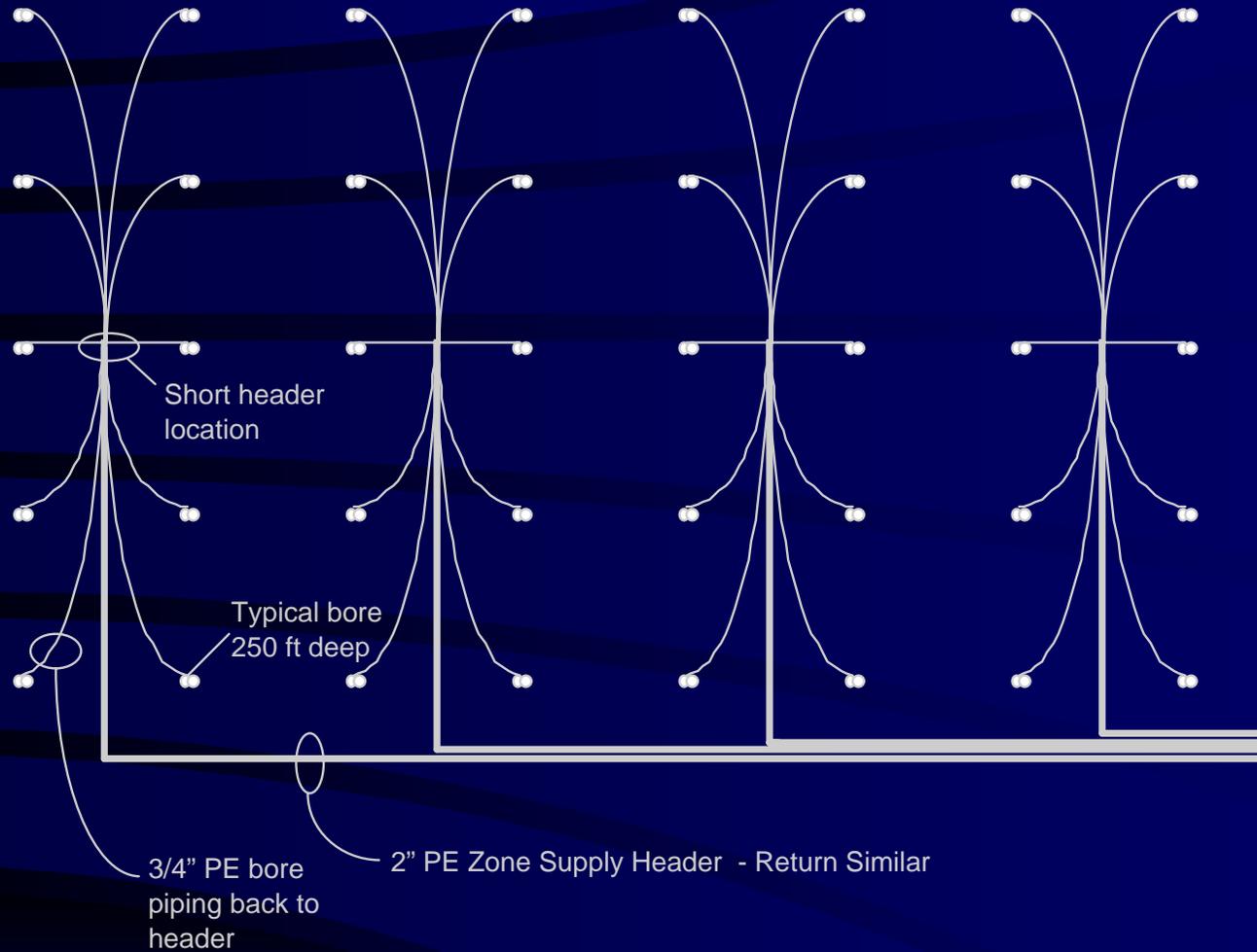
• *Loop Field Overview*



GeoThermal Building Loop Field Site Plan



Loop Field Details



Notes:

- 40 bores on 20 foot centers each with 3/4" PE pipe
- Short header manifold in center of each loop zone of 10 bores
- Each bore must have the same overall pipe length for balanced flow
(Coil excess piping in the header trench)
- Loop zone supply and returns done in same fashion
- Bores must be grouted when completed

• *GeoThermal Building - Roof View*



• *VAV Building - Roof View*



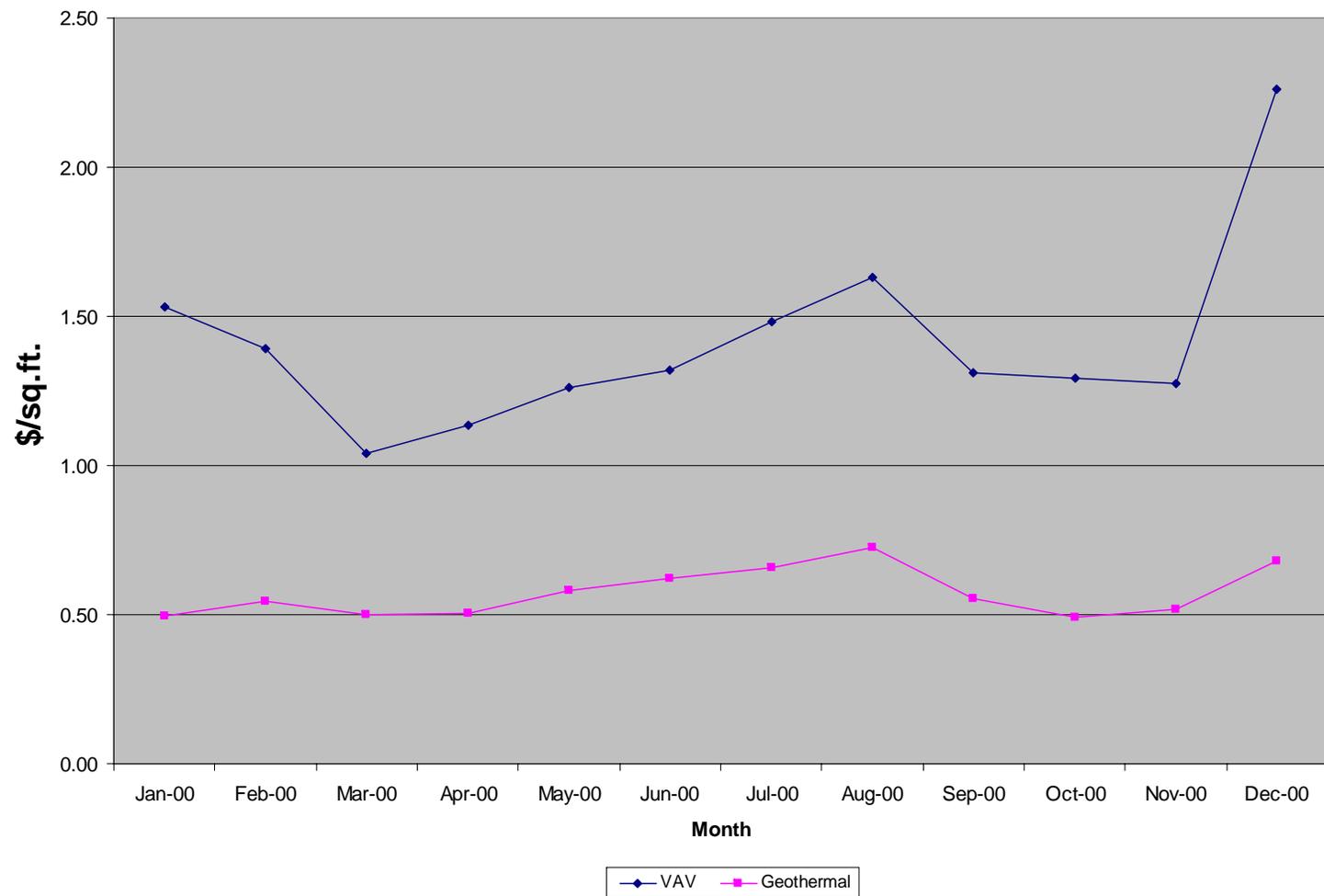
- *VAV Building*
- *Central Air Handler*



• **Garrett Office Buildings**
 • **2000 Energy Consumption**

Month	VAV 15,000 ft ²		Geothermal 20,000 ft ²	
	Gas Mcf	Elec kWh	Gas Mcf	Elec kWh
Jan-00	36.2	12,400	0.0	9,920
Feb-00	21.0	14,720	0.0	10,880
Mar-00	6.9	13,600	0.0	9,960
Apr-00	4.3	15,760	0.0	10,120
May-00	3.5	17,920	0.0	11,600
Jun-00	4.2	18,560	0.0	12,400
Jul-00	3.2	21,280	0.0	13,120
Aug-00	3.2	23,520	0.0	14,480
Sep-00	3.2	18,720	0.0	11,120
Oct-00	11.2	16,080	0.0	9,840
Nov-00	21.9	12,720	0.0	10,360
Dec-00	69.4	13,600	0.0	13,600
Total	188.2	198,880	0.0	137,400
\$ Cost	\$ 1,882	\$ 17,899	\$	\$ 10,992
\$/ft²	1.32		0.55	

- **Garrett Office Buildings**
- **2000 Energy Consumption Profile**



Trinity River Vision Authority Projects

- *Tarrant County Community College*
- *New Downtown Campus*
- *Geothermal Cooling, Solar Energy, Wind Energy*
- *Trinity River Area Parks*
- *Solar Lighting for park trails & public areas*
- *Long Term*
- *Potential for a variety of new construction projects.*



Renewable Energy Solutions

Fort Polk Project - US Army Base

- | 4003 Living Units
- | 1,000 to 2,700 sq/ft
- | 1296 buildings
- | Replaced: 80% a/c heat pump, 20% a/c with gas heat
- | Service Calls: 90/day reduced to 18/month
- | 32 Million kWh/year savings
- | 20,000 MMBtu gas savings
- | \$3.3 Million savings in operating costs annually

Oklahoma State Capitol Building

- | 855 Nominal Tons
- | 1/2 Ton to 30 Ton Equipment
- | Horizontal, Vertical, Console, WWHP
- | Improved IAQ
- | Replaced 138 Different HVAC Units
- | Reduced HVAC Maintenance Staff (16 to 3)
- | Reclaimed 15,000 sq.ft. of Office Space
- | Operating Savings: \$ 1/4 Million/yr..

Western Heights School District

High School:

- 410,000 sq/ft
- Mechanical System:
 - RTU's
 - 4-Pipe Fan Coils
 - Air Cooled Chiller
 - Cooling Tower & Boiler
- Annual operating costs: \$689,640
- Operating Costs per sq/ft: \$1.68

Middle School:

- 440,200 sq/ft
- Mechanical System:
 - GSHP's, WWHP's
 - ERV's
 - GHEX: Vertical loops under soccer field
 - BacNet BAS System
- Annual Operating Cost: \$242,110
- Operating Costs per sq/ft: \$0.58

Hale Irwin Golf Course Community-Briar Creek

- Emissions saved over system life (20 yrs), 1100 units
- SO₂ Sulfur Dioxide 680,000 pounds saved
- NO_x Nitrogen Oxide 246,200 pounds saved
- CO₂ Carbon Dioxide 66,500,000 pounds saved

- The above savings in pollution is equivalent to:
 - Planting 12840 acres of trees or
 - Removing 5860 cars from our roads
 - By utilizing our system, approximately 232,000 tons of coal, need not be burned to generate energy.
 - Equals 3220 railcars of coal

Comments on Good Renewable Stewardship

- | Focus has been on utilizing PV/Solar and Wind in order to provide renewable energy – Great!
- | Due to cost – only about 25% of building energy can be provided with PV or Wind
- | When combined with GeoThermal – 50% to 60% of required energy to operate building can be provided with same amount of PV or Wind
- | We seem content with efficiently filling a leaking bucket but not fixing the leaks.