

Geothermal Heat Pumps

Geothermal 101

Understanding the Mystery

Geothermal Topics

- **Geothermal Concepts**
- **System Components**
- **Moving Heat with Geothermal**
- **Residential Case Study**

The Basic Concept

Geothermal **Moves** Heat

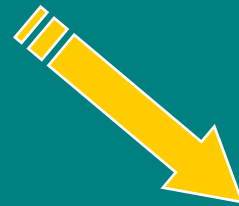


Naturally

Geothermal Concepts

Heat **moves:**

From **Warm**



To **Cool**

Geothermal Concepts

- **Geothermal uses the Earth's natural heat as a renewable reliable energy source**
- **It uses refrigeration technology**
- **There is one system for heating and cooling**

Geothermal Concepts

- Earth's surface temperature @ 8 feet remains constant at about 50°
- Geothermal **moves** heat naturally
- Fossil fuel systems create heat

Your Solar Collector



Geothermal Concepts

Purpose of the Heat Pump:

- To provide a temperature difference
- The temperature difference moves Btu's



Geothermal Concept

Winter - Heating:

Geothermal moves heat out of the Earth



Summer - Cooling

Geothermal moves heat into the Earth

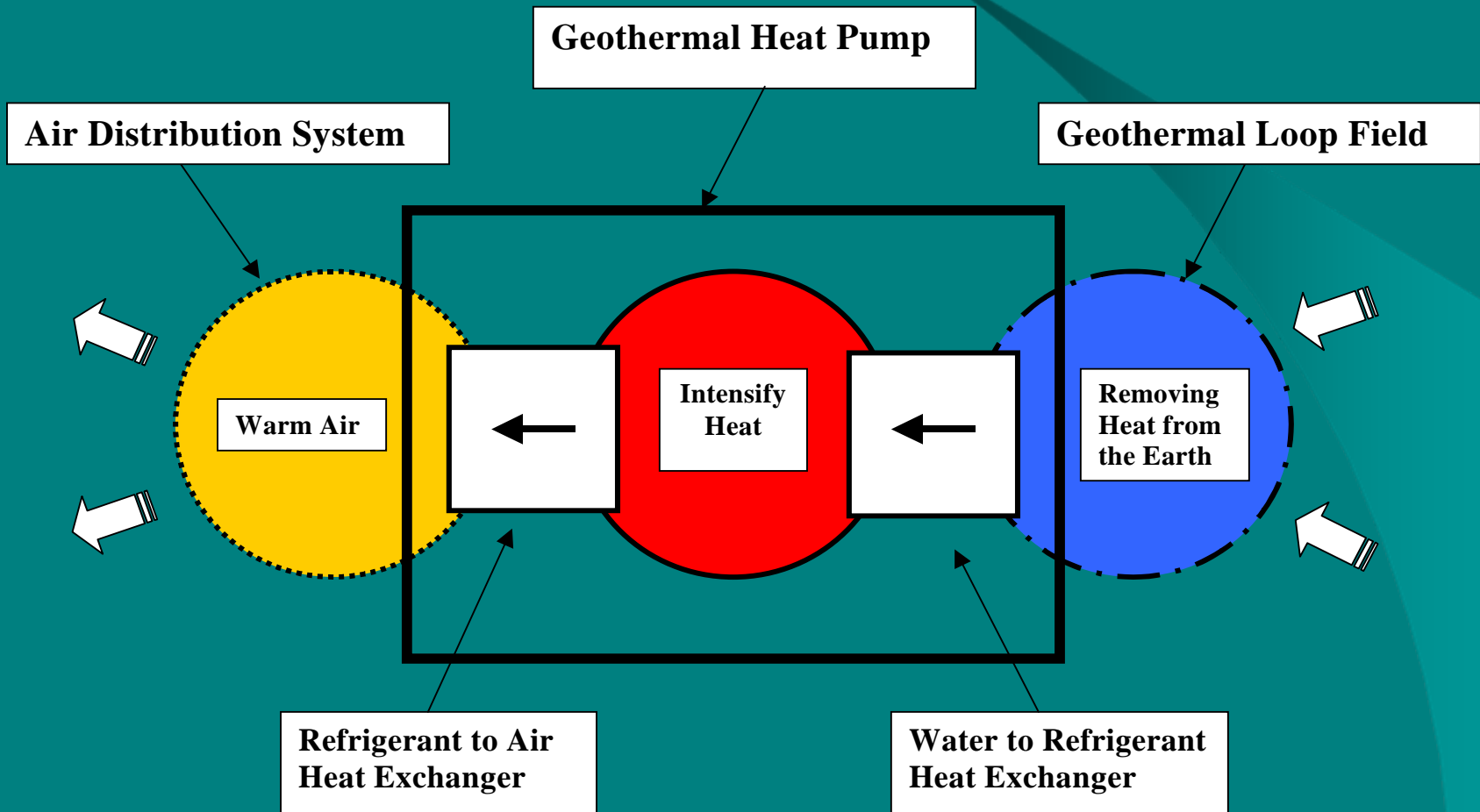


Three Basic Components

- **1) The Earth**
- **2) Geothermal Heat Pump**
- **3) HVAC Distribution Systems**

Moving Heat - The Geothermal Concept

Key Components



The Earth

The 1st Component

Your Solar Collector



The Earth

- **Excellent solar collector**
- **Natural renewal heat source**
- **Easy to use as heat exchanger**

Earth Heat Exchangers

Two types:

- **Earth Loop / Pond Loop (closed)**
- **Open Loop (well water)**

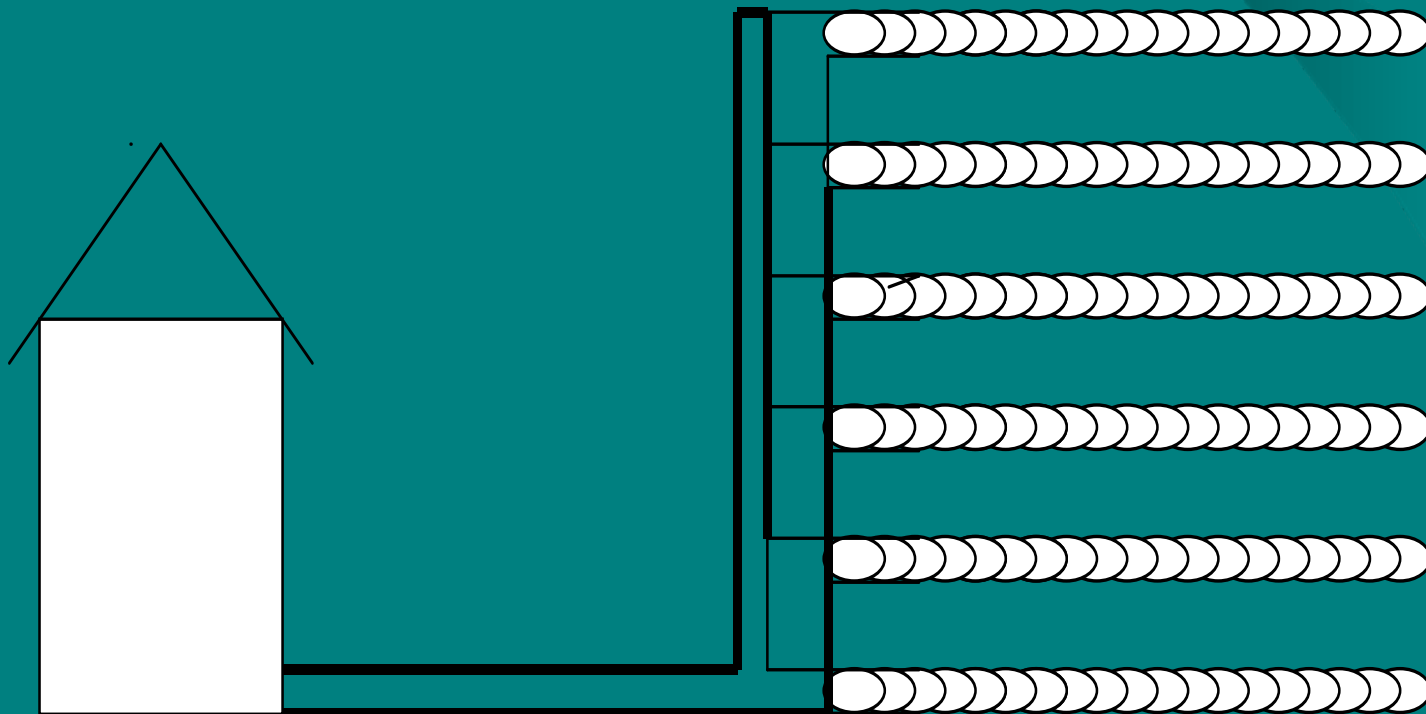




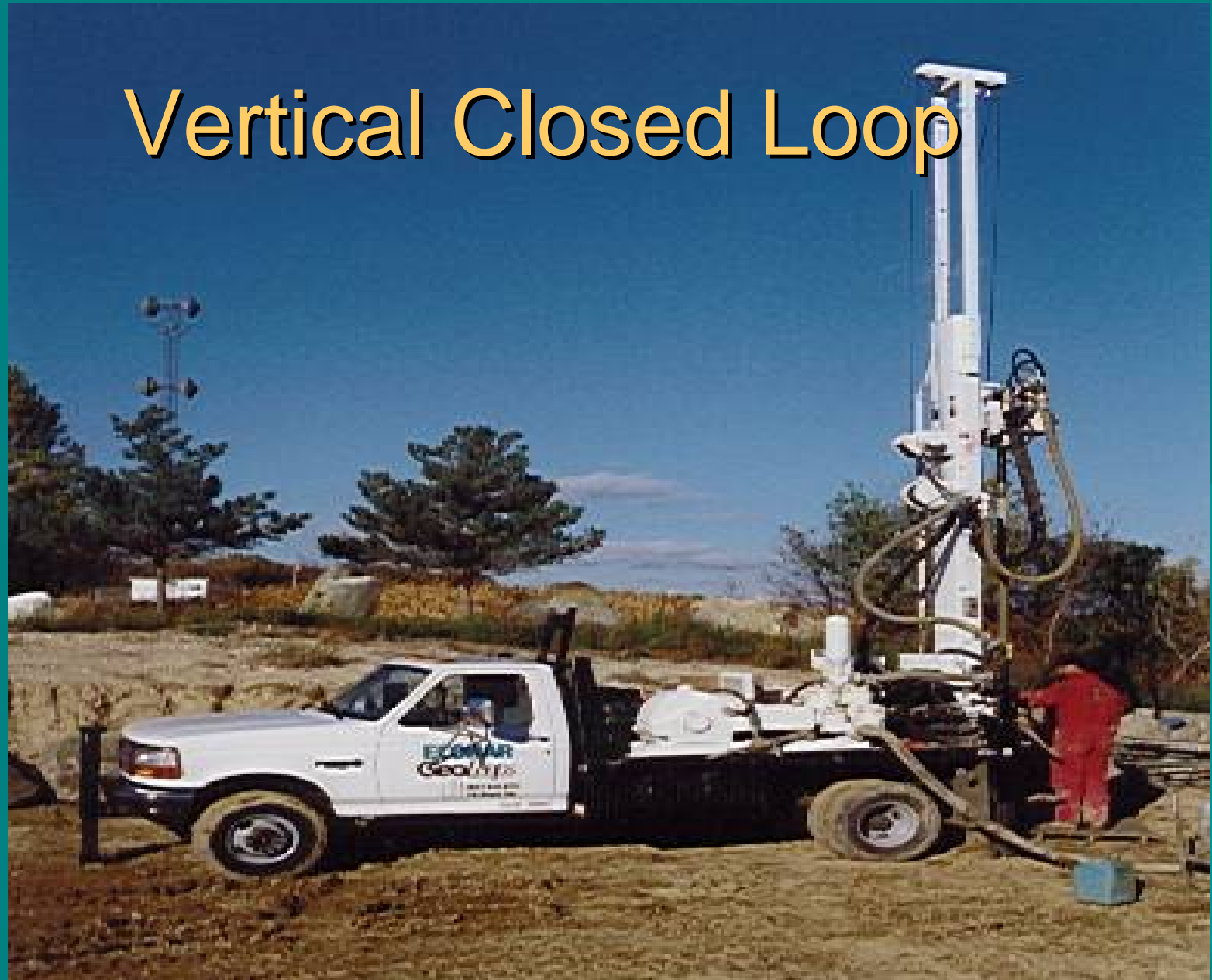


Earth Heat Exchanger: Horizontal Closed Loop Field

Typical 6-Ton Horizontal System



Vertical Closed Loop





Types of Heat Pumps

- **Forced Air Heating & Cooling**
- **Hydronic**
- **Combination Forced Air & Hydronic**



Inside the Heat Pump

- **Compressor**
- **Refrigerant**
- **Water Coil**
- **Expansion Valve**
- **Air Coil**
- **Electronic Sensors & Controls**

Moving Heat Naturally

50° Ground

warms 32° Water

warms 25° Refrigerant

Compressor

Refrigerant enters @ 25°

Refrigerant leaves @ 160°

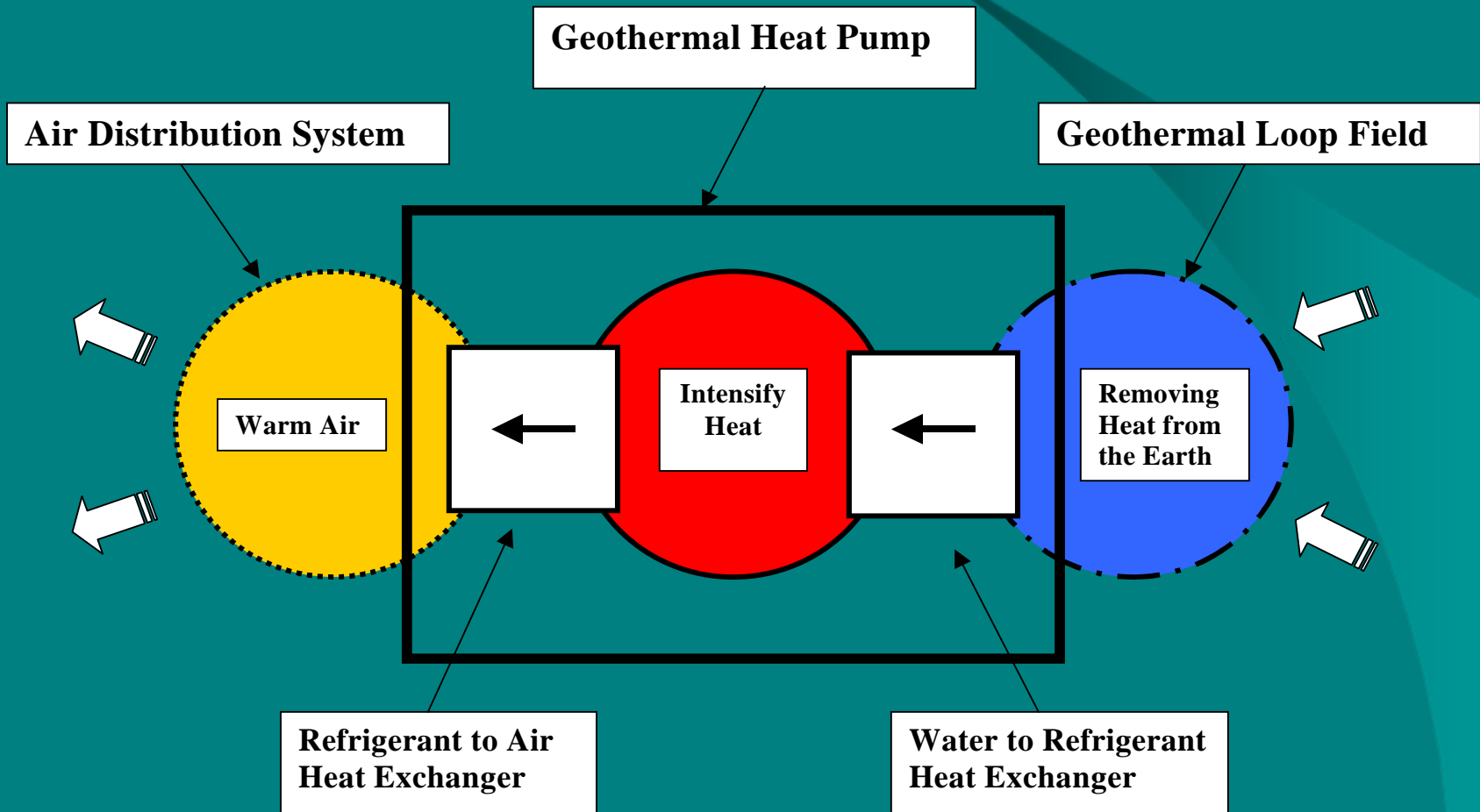
160° Refrigerant

warms 70° Return Air

to 100° Supply Air

Moving Heat - The Geothermal Concept

Key Components



A Review: The 3 Geothermal Components

- **Earth Heat Exchanger**
- **Geothermal Heat Pump**
- **HVAC Distribution System**

Geothermal Advantages

- **Economical:** 50 % savings vs. Natural Gas
75 % savings vs. Propane
- **Renewable** Earth's Surface – Solar Heated
- **Comfortable:** Not a Drying Heat & Better A/C
- **Single Unit:** Heat & Cooling
- **No Fossil Fuel:** No Combustion, Safe
- **Low Maint.** Located Inside, uses Ref. System

Geo 101 Summary

- Moving the Earth's renewable heat
- Heat will always move from Warm to Cool
- Geothermal Heat Pumps:
 - create the needed temperature difference to **move** Btu's
- Single system for heating & cooling



Your Solar Collector



Case Study - Residential

- **Typical Minnesota Home**
- **3,000 SF**
- **Annual Heating @ 100 MBTU**

Residential Heating Costs

<u>Type of System</u>	<u>Cost</u>	
Geothermal	\$ 651	(using \$.080 per Kwh)
85% Nat. Gas	\$ 1,588	(using \$1.35 / therm)
85% Propane	\$ 3,343	(using \$ 2.60 / gal.)
Electric	\$ 2,345	(using \$.080 per Kwh)

Annual Heating Usage @ 100 Mbtu

Case Study – Residential Clg.

Annual Cooling Cost:

Traditional A/C \$ 200

Geothermal Cooling \$ 140

Geo Savings \$ 60

Case Study – Residential Annual Savings Summary

Annual Geothermal Savings

<u>Compared to:</u>	<u>Htg</u>	+	<u>Clg</u>	=	<u>Total</u>
Natural Gas	\$ 937	+	\$ 60	=	\$ 997
Propane	\$ 2,694	+	\$ 60	=	\$ 2,754
Electric	\$ 1,694	+	\$ 60	=	\$ 1,754

Your Solar Collector

