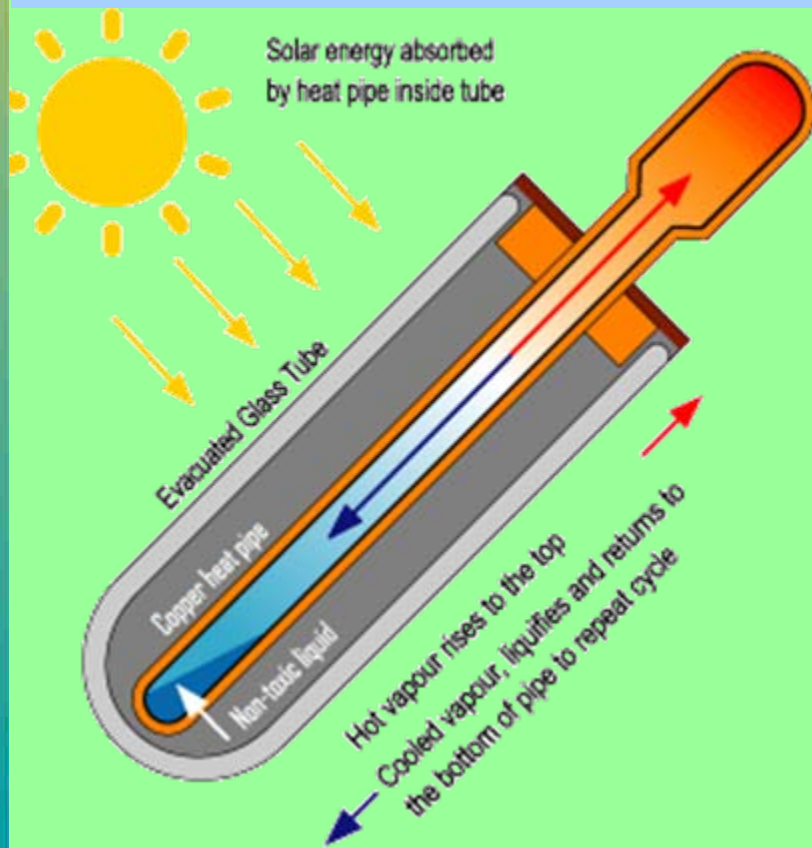
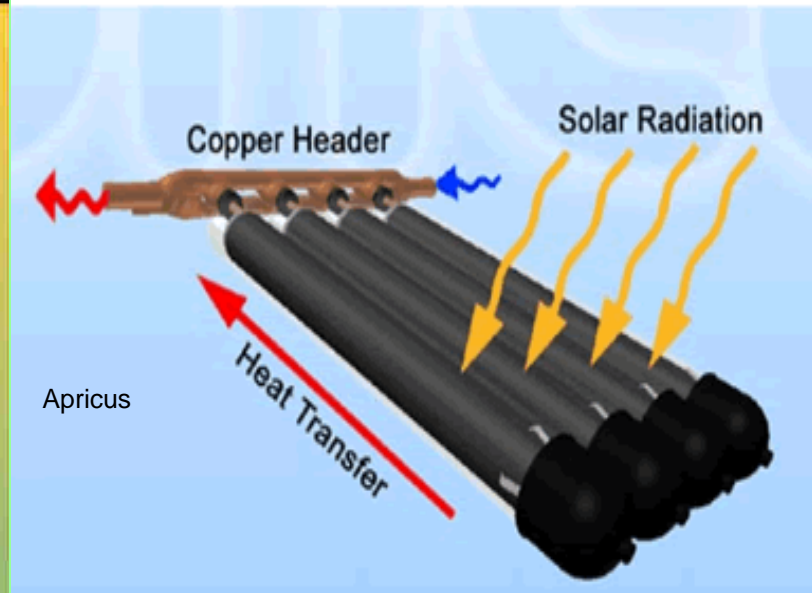
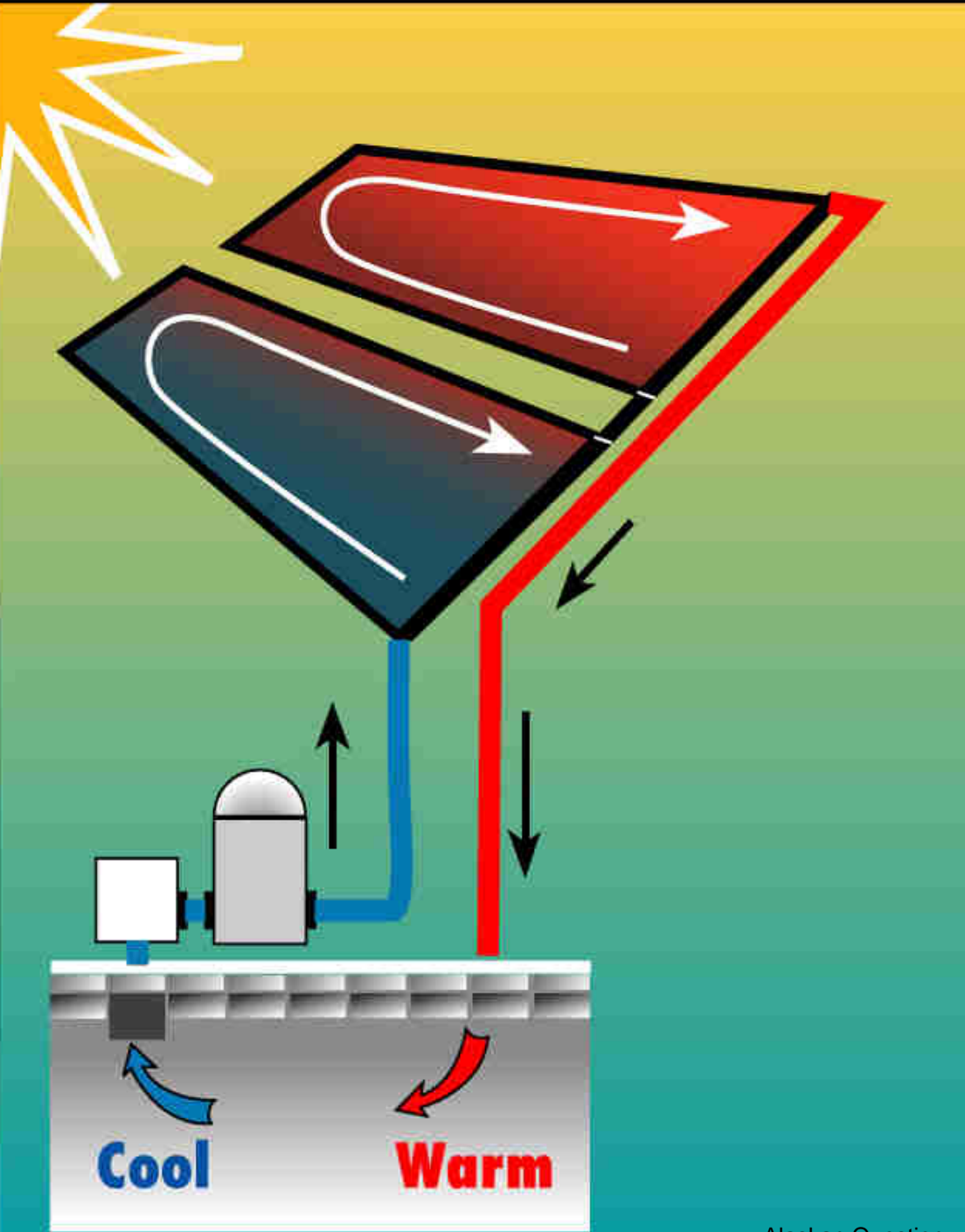
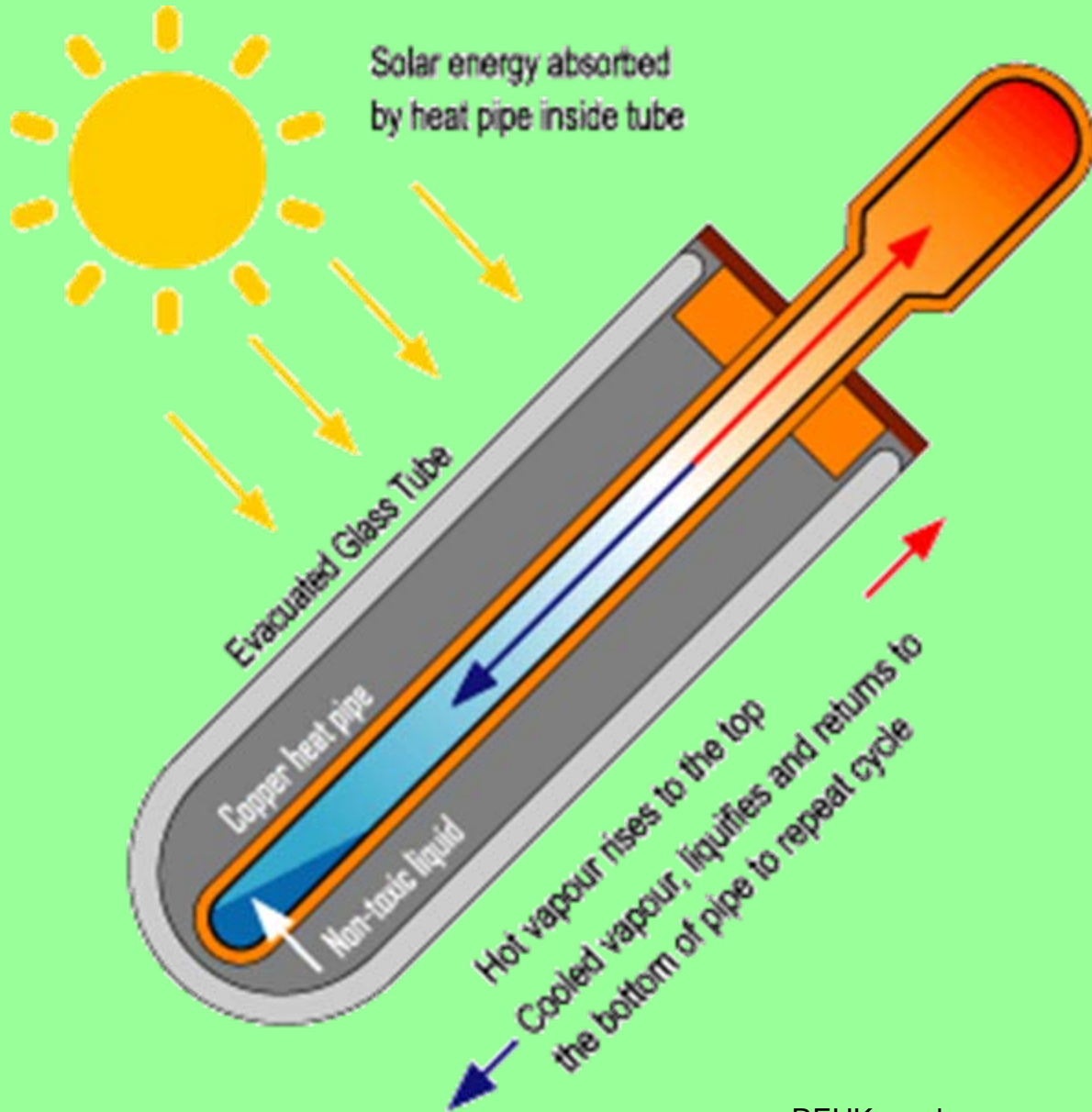


Integrated (Solar Assisted) DHW





Evacuated Tubes



Solar Hot Water Collector

- Supplies heat to a storage tank which in turn supplies tempered (pre-warmed) water to the domestic hot water tank where temperature is boosted (then tempered again before it exits the tap to prevent scalding)
- May or may not be powered by a pump
- May or may not require anti-freeze (propylene glycol) or drain down to protect from freezing

Domestic Hot Water Heaters

High efficiency water heater type	Energy savings vs minimum standards	Best Climates	Expected energy savings over equipment lifetime	Expected lifetime	Major advantages
High efficiency storage (tank) (oil, gas, electric)	10% – 20%	Any	Up to \$500.	8-10 years	Lowest first cost
Demand (tankless) (gas or electric)	45% to 60%	Any	Up to \$1800.	20 years	Unlimited supply of hot water
Heat Pump	65% compared to electric resistance	Mild / Hot	Up to \$900.	10 years	Most efficient electric fuel option
Solar with electric back up	70% to 90%	Mild / Hot	Up to \$2,200.	20 years	Largest energy savings using a renewable energy source

Solar Collectors

- Photovoltaic (PV)
- Thermal Hot Water
- Thermal Air
- Combination (combo)
- Flat plate
- Slinky (spiral tube)
- Evacuated Tube
- Aspirated (air holes)



Thermal (Hot Water) Collectors



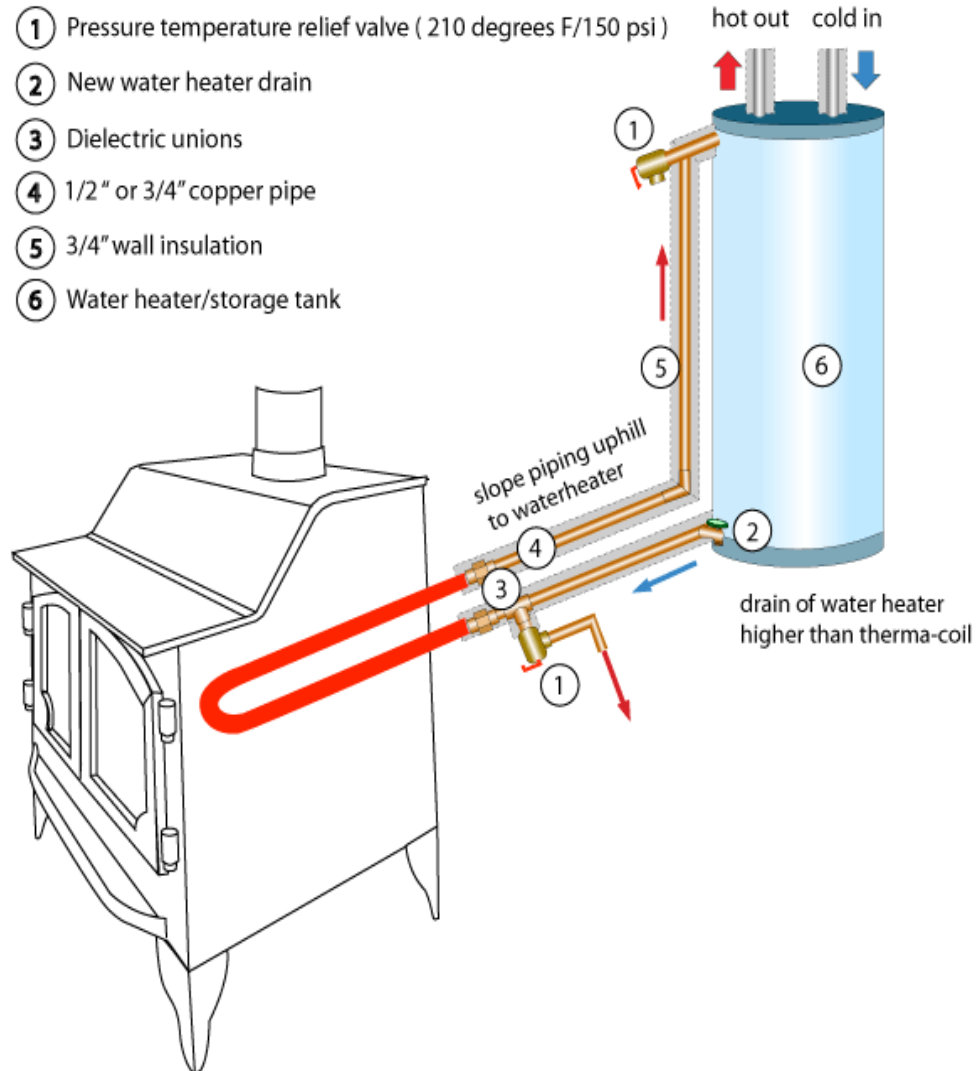
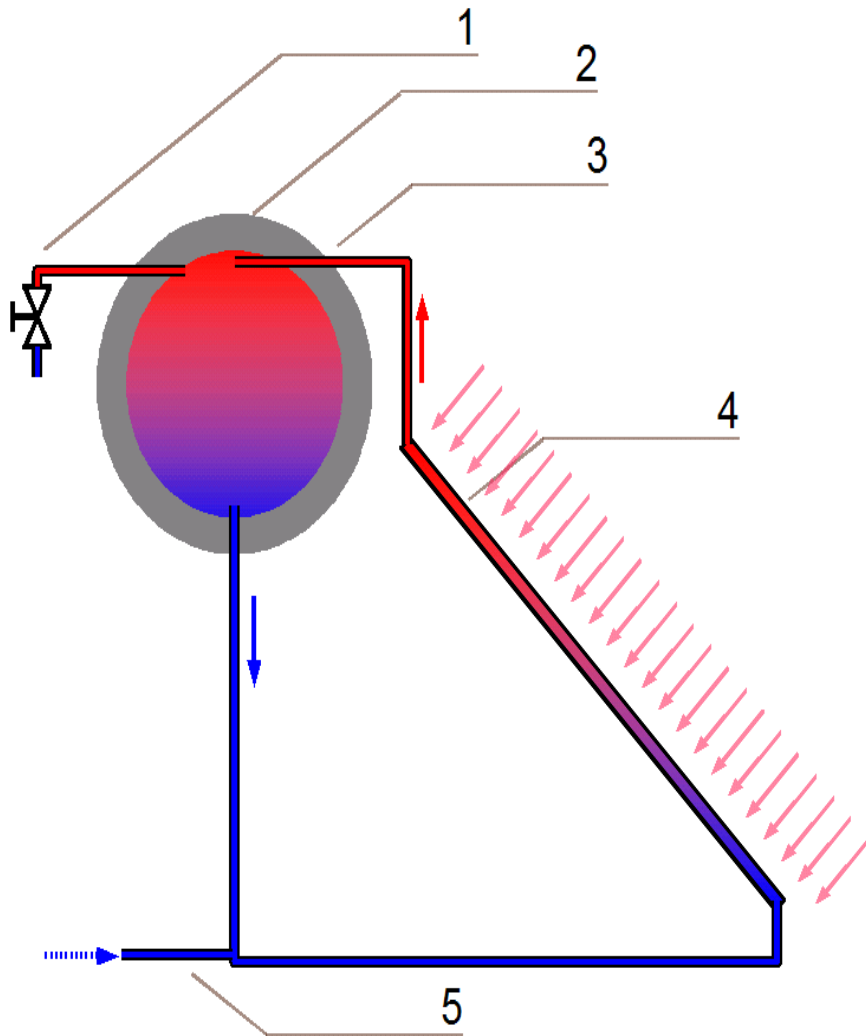
- Domestic hot water**
 - May need a glycol loop from the collector to an insulated storage tank (indirect)
 - Storage tank feeds domestic hot water tank with pre-warmed water

Swimming pools

- Water circulates from the pool through the collector and back (direct)
- Thermosiphon or pump



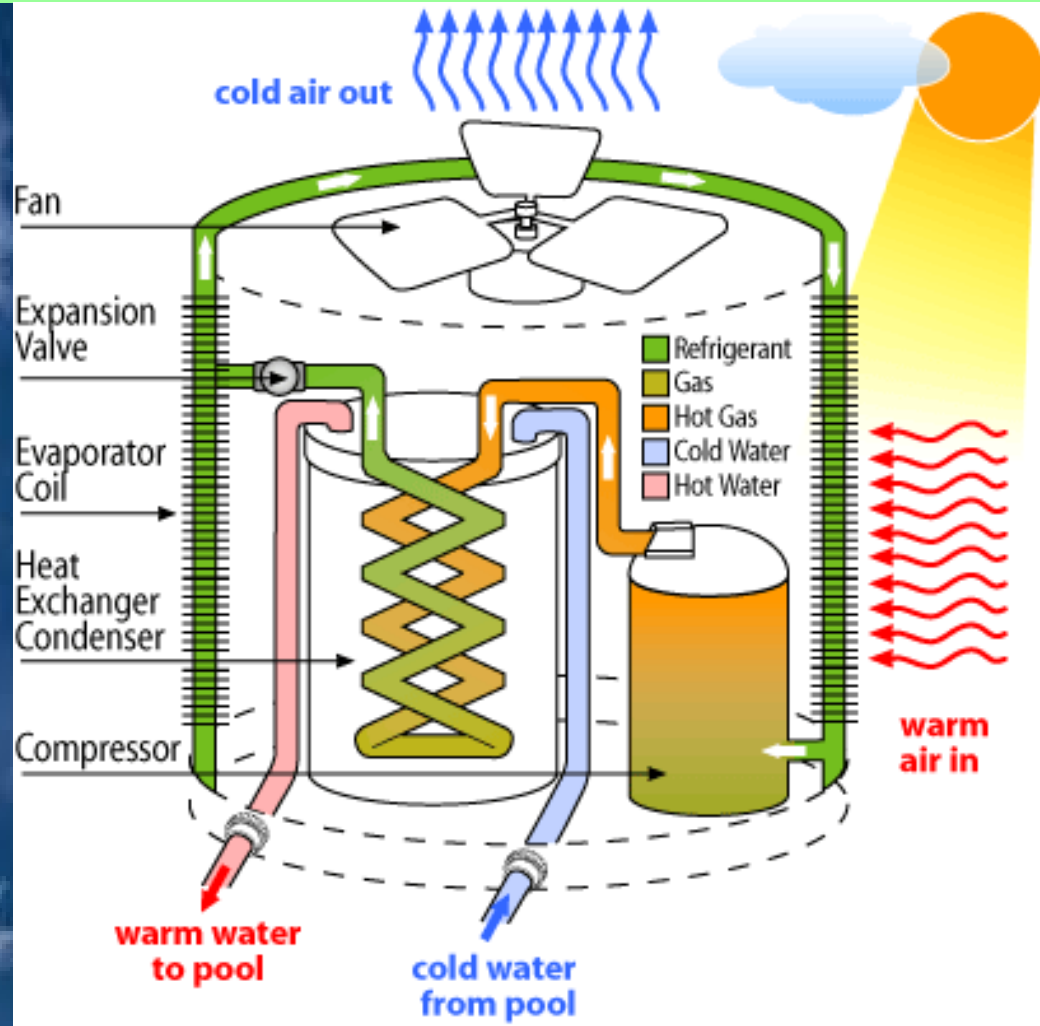
Thermosiphon (no pump)



Earth Energy

Geothermal (hot spot)

Heat Pump (ambient)



Ground / Water Source Heat Pump

Waterfurnace



ENERGY STAR qualified ground source heat pumps use about 30% less energy than a standard heat pump and are quieter than conventional systems.

Several Options

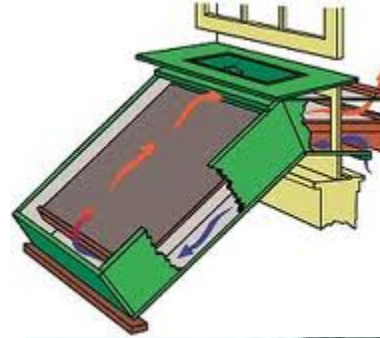
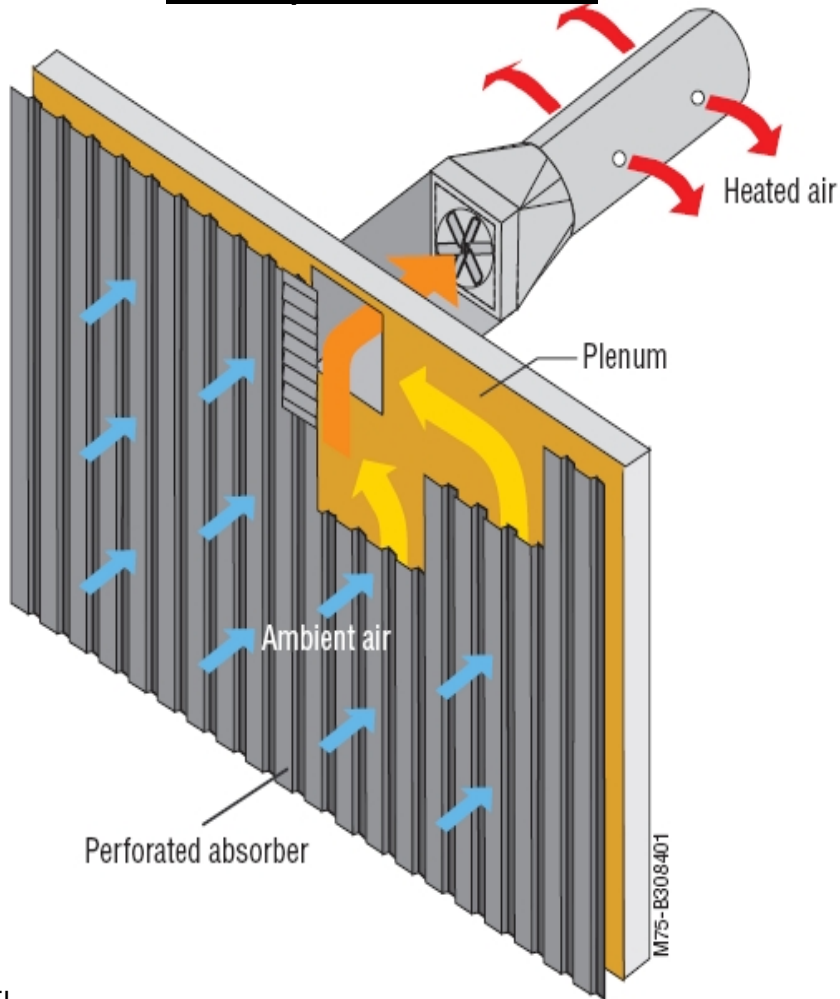
- **Closed Loop with plastic tubing and antifreeze (vertical boreholes or horizontal field)**
- **Closed loop with copper tubing and refrigerant (DX = Direct Exchange)**
- **Well to Well**
- **Boreholes may go down 1500 ft.**
- **ASTM standard (less than 1500 ft.)**



Aliant Energy

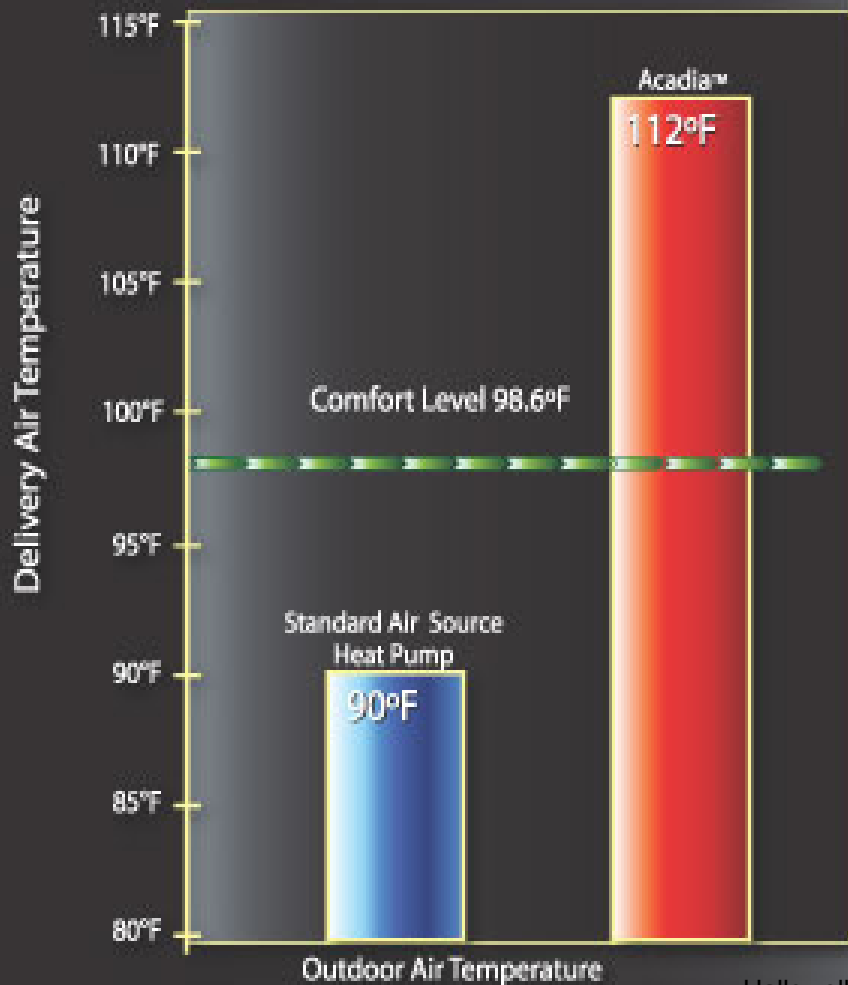
Solar Air Collectors

Transpired Collector



Air Source Heat Pumps

Heat Pump Delivery Air Temperatures at 15°F Outdoor Temperature



Hallowell Acadia

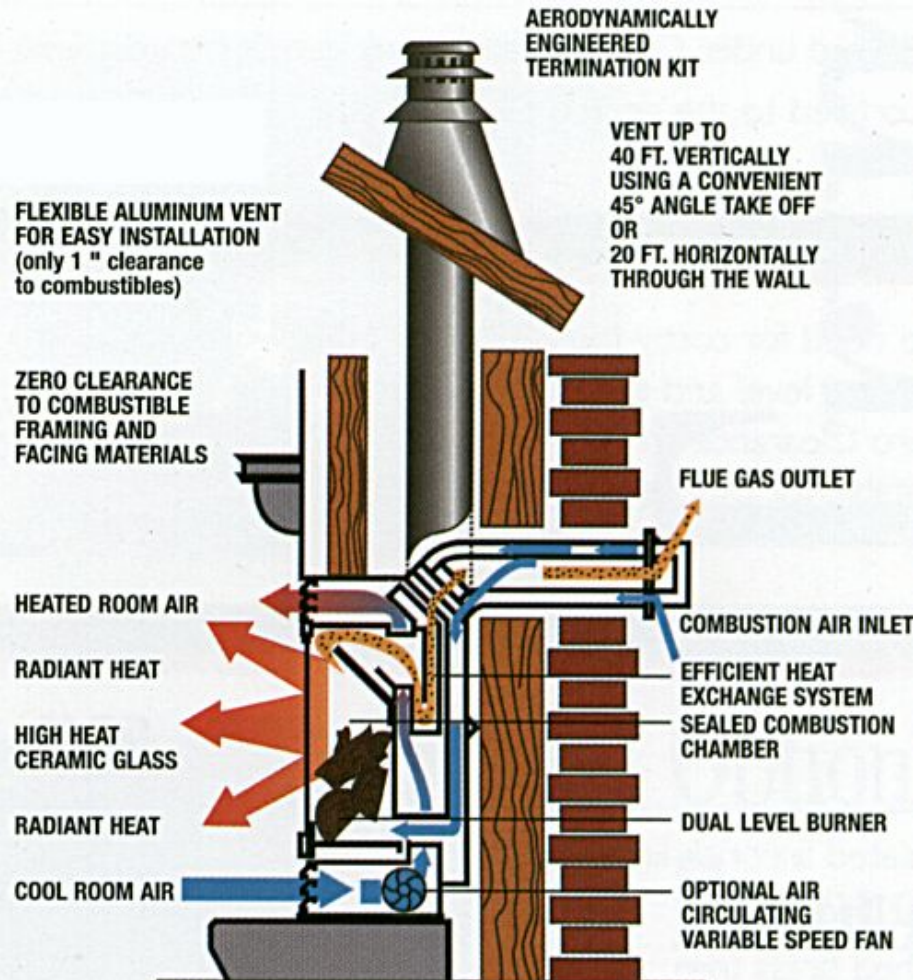
- With or without collectors
- Air Conditioning
- Air Source Heat Pump
 - Southern Climate (one compressor)
 - Northern Climate (two compressors)

Masonry Heater



Hot Water From Masonry Fireplace





Napoleon

- Gas Fireplace - Mid Efficiency (78-82%)
- High [sealed combustion] (92 +) AFU
- Chimney or direct vent (hole in the wall - cold drafts)
- Some can operate when electricity is off



Wood Fireplace

- Little heat contribution
- May smoke
- Chimney = air leakage
- May need a chimney top damper
- WETT certified installation, maintenance and inspection
- Rumford or Heatilator better



- Woodstove or Insert Stove
- WETT Certified installation
- Chimney = cold air
- High efficiency /Low Emission (EPA, Oregon)

Waste to Energy



Waste to Toxicity

EPA – 2 to 40 barrels = 200 ton/day incinerator

Wind Atlas

