

Geothermal vs. Air-Source Heat-pump Systems prepared by David L. Faulkner, July 2012

Consideration	Air-Source	Geothermal
Initial cost (purchase price and installation):	\$3,000 - \$20,000 depending on model (different models have different efficiency ratings with the most efficient having the highest initial cost, but lower operating costs) and depending on size (2-5 tons most common for residential models);	\$10,000 - \$32,000 depending on model (the most efficient have the highest initial cost, but lower operating costs), depending on size (2-5 tons most common for residential models), depending upon type of thermal exchange loop installed (vertical loops are the most efficient, but require a drilling rig and are more expensive; horizontal loops are less expensive, but a little less efficient) and depending upon the geology (soft sedimentary rock is easier and less expensive to drill into as compared to granite for example – Woodlake sits on top of sedimentary marine deposits that are easy/less costly to drill through);
Federal tax credit:	None currently available	30% of installed cost (no maximum);
Annual maintenance cost:	\$60-\$150 depending upon service provider and if you get just an inspection or full service;	\$60-\$150 depending upon service provider and if you get just an inspection or full service;
Use of air filters:	At in-house ductwork returns and/or at the air-handler;	At in-house ductwork returns and/or at the compressor/air-handler unit;
Cost of air filters:	From approx. \$1-\$65 each depending upon thickness and quality;	From approx. \$1-\$65 each depending upon thickness and quality (we use cheap ones at the returns and high quality filters at the unit);
Key components:	Compressor and heat-exchange fan; air-handler;	Combined compressor and air-handler in a single unit;
Location of key components:	Compressor and fan: outdoors; Air-handler: crawl-space or indoor somewhere (typically in a closet, garage, basement or attic);	The entire unit is typically either located in the crawl-space, garage, a utility room or basement;
Ease of installation	Usual installation is easy;	Installation of the heat-exchange loop can be very disruptive and messy in the short-term;
Exposure to outdoor elements:	The compressor and fan are completely exposed;	Entire unit is completely protected from the sun, wind, rain, temperature fluctuations that cause shrinking, swelling and frost heaves, acidic droppings from birds/other animals, etc.
Performance sensitive to air temperature?	Yes, don't perform best in extreme heat and cold, operating best between 50-85 degrees Fahrenheit;	No, only sensitive to the temperature of the earth which is relatively constant below 10ft. (horizontal loop systems are typically installed 5-8ft. deep);
Site limitations?	None	Vertical loops: sites with hard rock geology cost more to drill through, but have superior thermal-conductivity/heat exchange capacity; Horizontal loops: sites with deep sandy soils are inappropriate as they lack adequate thermal-conductivity;
Accessories:	Humidifiers, dehumidifiers	Humidifiers, dehumidifiers and desuperheaters
Expected useful life:	10-15 years (12 on average?)	20-30 years (25 on average?)

System Features Comparison						
Type System	Installation Cost	Annual Operating Cost	Maintenance Cost	Eventual Replacement Cost	Expected Useful Life	Life-cycle Cost
Geo-thermal heat-pump	High	Lowest	Low	Moderate	Very Long	Lowest Life-Cycle Cost
Air-source heat-pump	Moderate	Moderate	Low in early years – Moderate in later years	Moderate	Medium	Moderate
Combination Systems: Air-source unit for cooling and Combustion system for heating	High-Very High depending on whether or not you have to install a storage tank underground, e.g., for heating fuel or propane, or if you have to pay for a supply pipeline installed for natural gas and how long it has to be	Moderate depending upon heating fuel source markets	Moderate-High	Moderate for each system = High together	Medium for Air-source, Long for Combustion	Moderate for Air-source and Moderate to High/Very High for Combustion systems depending upon installation requirements and heating fuel source markets