2012 DFW Solar Home Tour
October 6, 2012
Reference – Geothermal Heating & Cooling

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2012 DFW Solar Home Tour
Geothermal HVAC

How Does It Work?

[Diagram of Geothermal HVAC system showing cooling and heating modes with labeled components such as supply air, return air, water heater, heat dispersion, and heat absorption.]
Geothermal heat pumps exchange heat into the limited temp range of the earth, vs. Air Source heat pumps that exchange heat into the much hotter/colder air, thus providing significant efficiency advantage.
Overview

Seasons: Year-round heating & cooling

Energy Type Required: Electricity only

Size of Residence: 3400 sq feet, single story

2012 Avg Monthly Heating/Cooling Cost: $47 (521 kWh)

Thermostats: WaterFurance Programmable (daytime: 77° living / 81° bedrooms; night time: 81° living / 74–76° bedrooms)


System Summary

Commissioned: July, 2007

Technology: 2 WaterFurnace Envision (3 and 5 ton) geothermal-source heat pumps, with dual-speed compressors and variable speed fan blowers.

Refrigerant to Water Loop: Shared single loop, vertical wells, no antifreeze

Heat Pump Packaging: Self-contained (blower, compressor, heat exchanger, coil in single package); equipment is indoors - no refrigerant lines

Location of Heat Pump Unit(s) and Air Ducts: Attic

Other: R410A refrigerant; no aux heating capability; DeSuperHeater available but not connected

Number of Independent Air Distribution Zones: 4

Technical Details

Design Temperatures: +1° F / 112° (records)

Cooling Capacity: 2.1 - 8 tons max; 27 - 78 KBTU/hr (2.2 - 6.5 tons) typical; 750 KBTU/day heat rejection on 100°+ days.

Structure Performance: 516 sf / ton of cooling capacity

Heat Pump Performance (including blower & pumps): 21 EER (24 – 28 SEER) cooling, 5.0 COP heating

Inside Humidity Control Performance: 40 – 50% RH during cooling season

Water Loop: 8 wells, 300 ft each, 20 ft spacing

Water Pipe: 1” high-density polyethylene (HDPE), approximately 1 mile, 60 psi static pressure

Loop Water Temperatures: Extremes: 61° F (Winter) / 85° (Summer); Averages: 67° (Winter) / 80° (Summer)

Earth Heat Absorption/Supply: 80,000 KBTU annual heat absorption (cooling), 18,000 KBTU annual heat supply (heating)

Pumps: 3 Grundfos 1/6 hp, 385 Watts each; 14 – 30 gpm
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Needs good design, availability of land, comfortableness with water pipes in attic
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Performance

Aug. 2011 Actual Cooling Performance:
21 EER ~ 24 – 28 SEER
(matches WaterFurnace specs)

Jan. 2011 Actual Heating Performance:
~ 5 COP (matches WF specs)
Heating & Cooling Monthly Cost (starting 2008)
(3400 sf single-story residence, at stated grid rate (no solar PV included), Plano, TX 75074)

HVAC 12 mo. avg = $47/mo

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Operating Cost

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