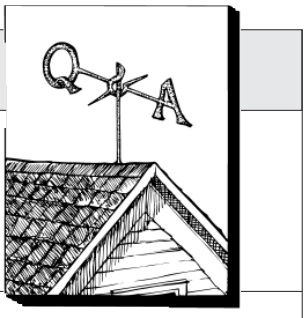
New Heat Pump Makes More Hot Water

by Jim Clark



Geothermal or ground-source heat pumps can provide heating and cooling in nearly any climate. But they can also supply hot water, and the technology for doing so has improved greatly over the past few years. In the past, the only way to get domestic hot water from a heat pump was with an add-on that provided only part-time, partial hot water. Newer models include a dedicated hot-water coil that supplies all of a home's year-round hot water needs.

To understand how this works, you have to know how a heat pump provides heat. Like a refrigerator, which uses a compressor and a refrigerant loop to remove heat from the box and blow it into the kitchen, a geothermal heat pump uses similar equipment to extract latent heat from groundwater in winter and transfer it to the house. In summer, the heat pump works in reverse, removing heat from the house and dumping it into the ground. Heat pumps can use open or closed loops. A closed loop draws its heat from a coil placed in trenches in the earth, while an open loop uses water pumped into the home from a conventional well.

Part-Time Hot Water

Getting hot water from a heat pump is a matter of transferring the heat in the refrigerant loop to a hot water storage tank. In the early 1980s, some manufacturers accomplished this with an add-on called a desuperheater. A desuperheater is a small heat exchanger coil that's placed in the refrigerant loop between the compressor and the air coil (see Figure 1). It siphons off some of the heat in the hot refrigerant and uses it to heat domestic water. But desuperheaters have major drawbacks. Because a desuperheater coil is relatively small, it will accept only a fraction of the compressor's output. It can supply 100% of a home's hot water while the heat pump is in the cooling mode (when it's looking for places to get rid of excess heat), but can meet only half of the demand while the heat pump is in the heating mode (when it needs most of the energy for space heating). Worse still, the desuperheater only works when the heat pump is working. If there's no call for heating or cooling, there's no hot water. On days when neither heating nor cooling is needed, the house must get its hot water from a conventional tank.

A Better Way

There's now an alternative to the desuperheater: A dual-coil heat pump that provides full-time domestic hot water regardless of the call for space heating. Dual-coil systems are available from Hydro Delta Corp. (1000 Rico Rd., Monroeville, PA 15146; 412/373-5800) and Hydro-Temp Corp. (P.O. Box 566, Pocahontas, AR 72455; 800/382-3113 or 501/892-8343).

The dual-coil system is designed from the ground up as a combination space/water heater (Figure 2). It includes two heat-exchanger coils —

Heat Pump Payback

Geothermal heat pumps are relatively expensive: As a rule of thumb, figure on an installed cost of $1,200 to $2,500 per ton with a typical home requiring a 2- to 3-ton unit. The time needed to recover the extra cost, called "payback time," varies depending on the price of the heat pump and the cost of conventional heating. Payback can range from 1.4 to 7 years for replacing a propane or electrical heating system, from 7 to 15 years for replacing natural gas, and from 1.5 to 15 years for replacing oil. Many utility companies offer cash rebates of several hundred dollars per ton. Dan Christy of Geotherm International in Tully, N.Y., for instance, recently installed a 5 1/2-ton unit in a 3,800-sq. ft. home. The utility's $750 ton rebate totalled $4,125, representing about 40% of the total installed cost.

— J.C.

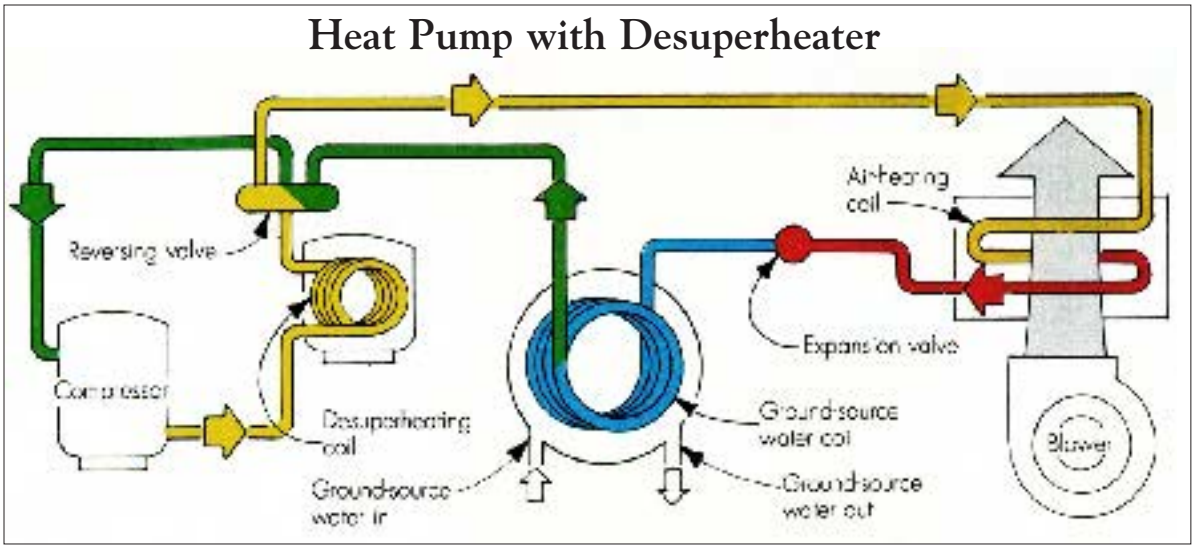


Figure 1. *A desuperheater coil is placed between the compressor and the air coil. It siphons off some of the heat in the hot refrigerant and uses it to heat domestic water. A desuperheater will supply only a portion of a home's domestic hot water needs and will work only when there's a call for space conditioning.*

an air-heating coil and a water-heating coil — placed in parallel refrigerant loops. When there's a call for hot water, a system of valves redirects the refrigerant from the air-heating coil to the water-heating coil. The heated water is then pumped to a storage tank.

The dual-coil system doesn't require a bigger compressor or a bigger groundwater loop than a standard geothermal heat pump. In fact, it's actually more efficient than a desuperheater system because the compressor's output is directed to one heat exchanger at a time, rather than being divided between the air coil and the desuperheater coil.

Microprocessor Control System

The system's storage tank is a conventional electric hot water heater with the thermostat set to 120°F. When the temperature in the tank falls below this, the heat pump goes into water-heating mode. A microprocessor then signals a three-way valve to divert the hot refrigerant to the water-heating coil. When the setpoint temperature is reached, the microprocessor either redirects the refrigerant to the air coil (when the house is calling for space conditioning) or shuts the system down. The microprocessor interrupts water heating if the house temperature drops or rises more than 2°F, then returns to water heating after satisfying the space-heating needs.

Savings

A dedicated dual-coil system can save up to 65% of the cost of electrically heated hot water, a desuperheater only 21%. Given an annual average cost of $500 for electrically heated hot water, this saves $225 more than a standard heat pump with a desuperheater. The dual-coil system will cost $750 to $1,200 more, giving it a 3- to 5-year payback. ■

Jim Clark is an energy educator from Syracuse, N.Y., and technical adviser to Energy Matters, a Public Radio program produced by WRVO-FM90 in Oswego, N.Y.

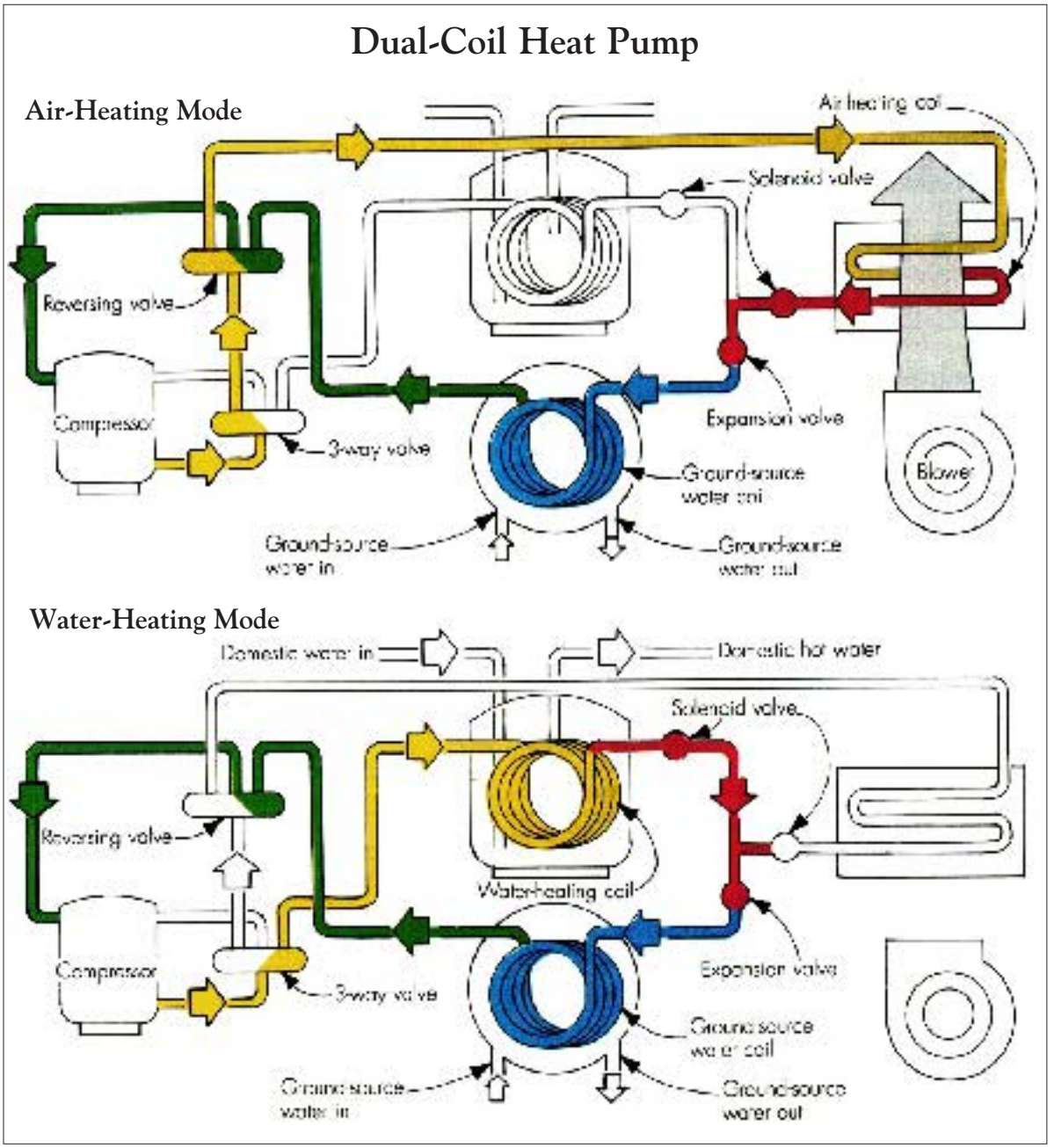


Figure 2. *Dual-coil systems place the air-heating and water-heating coils in parallel and use a three-way valve and a solenoid to direct the compressor's full output to one or the other. It can supply all of a home's hot water, because it works even when there is no call for heating or cooling.*