

# RESIDENTIAL PROPANE APPLICATIONS: HYBRID HEATING SYSTEMS

## FACT SHEET

*A hybrid heating “dual fuel” system can protect homeowners from rising utility costs. They’re more energy efficient, provide greater comfort, and have a smaller carbon footprint.*

A hybrid heating system is the combination of an air-source heat pump (ASHP) or ground source heat pump (GSHP) with a gas/propane furnace. Hybrid heating systems, which may also be called “dual fuel” systems, improve ASHP and GSHP performance by using a propane furnace — typically a high efficiency unit — during colder, outdoor temperatures instead of the heat pump’s inefficient electric resistance secondary heat. By relying on the high efficiency propane furnace during colder periods, the overall heating system is more energy efficient, provides greater comfort, and has a smaller carbon footprint.

Hybrid heating systems are a good alternative to ASHP-only or GSHP-only systems, especially in mixed and colder climates where winter temperatures frequently fall below approximately 40 degrees Fahrenheit. At these lower outdoor temperatures, ASHPs will rely more on electric resistance back-up heat. By using the high efficiency propane furnace to heat the home during colder outdoor temperatures, the hybrid system maintains efficiency, delivers warm air, and reduces electricity costs, which rise sharply with the use of electric resistance back-up.

Similarly, in colder climates the ground loop of a GSHP system — which is typically the most costly system component — can be significantly downsized if a propane furnace is used to handle the more extreme heating

loads. Instead of the GSHP loop being sized to handle 100 percent of the heating load, it is smaller and may only address 50-75 percent of the heating load with the furnace handling the remainder. In one design example, the net first cost saving of a hybrid design compared to a GSHP-only design was \$5,200 (including the added cost of the furnace). This major reduction in the first cost can dramatically improve the cost-effectiveness of GSHP technology, while the propane furnace also provides high efficiency and maintains comfort in the home.

### PERFORMANCE

Hybrid heating systems offer the ability to use both a high efficiency heat pump (which offers heating and cooling benefits) along with a high efficiency furnace to efficiently and comfortably address colder winter conditions. In the case of ASHP-furnace hybrids, when the propane furnace cycles on for heating — typically at a transition point near 40 degrees Fahrenheit — it greatly boosts the heating system’s output capacity and also assures that warm air delivery temperatures of around 120 degrees Fahrenheit leave the furnace.

Hybrid heating systems also provide a homeowner with an energy choice. As energy prices fluctuate, or the homeowner grows to prefer the warmer air delivery of the furnace, the transition point can be adjusted upward or downward.



### APPLICATIONS FOR USE

- New Construction: suitable for all climate zones and especially effective in mixed climates.
- Replacement/Retrofits: especially suitable for replacements of older ASHP systems.

### AT A GLANCE

- Maintains efficiency, delivers warm air, and reduces electricity costs.
- Utilizes both a high efficiency heat pump and furnace to address winter conditions.
- The redundant heating system ensures the home will always be heated.
- Combines various efficiency levels of both the heat pump and the furnace.
- Saves over \$300/year compared with a standard ASHP-only system.
- Offers a payback of less than two years, based on its annual energy savings.
- Qualifies for rebates and credits to further reduce up front costs.



Hybrid systems also provide a redundant heating system. If the ASHP compressor experiences a problem, the home can still be heated with the high efficiency propane furnace. Surprisingly, adding a propane furnace to an ASHP in a hybrid configuration also improves *cooling* performance. An oversized cooling system cools the air off too quickly, lowering its temperature but not removing enough of the humidity. This “short cycling” leaves the indoor air cool but still humid, leading to comfort, moisture, and mold problems. ASHPs must be sized to handle both cooling and heating loads in a home. By precisely sizing the ASHP based on the cooling load and then allowing any shortfall in the system’s heating capacity to be covered by the propane furnace, a hybrid system is optimized for cooling and humidity control as well as heating.

### ENERGY EFFICIENCY

Hybrid heating systems can combine various efficiency levels of both the heat pump [air-source or ground-source] and the furnace. The propane furnace back-up is typically a high efficiency system  $\geq 90$  AFUE (up to 98 AFUE). High efficiency furnaces are direct-vented, meaning they take all air needed for combustion directly from outdoors, which improves efficiency and helps assure the home’s indoor air quality. Also, credits and rebates worth hundreds or thousands of dollars are available for both of the heating components. Visit [dsireusa.org](http://dsireusa.org) and [buildwithpropane.com](http://buildwithpropane.com) [look under Research and Incentive] for details.

### ENERGY CONSUMPTION & COSTS

Hybrids comprised of an ASHP and a high efficiency propane furnace save nearly \$300/year or more compared with a standard efficiency ASHP-only system [see table].<sup>1</sup> In existing cold climate homes with an older ASHP, at the time of system replacement [~10-15 years] the marginal first cost for upgrading to a hybrid system instead of another ASHP-only system is about 12 percent. The hybrid system offers a payback of less than two years, based on its annual energy savings.

CHART 1 COLD CLIMATE ANNUAL HEATING & COOLING COSTS FOR A 2,400 -SQUARE-FOOT HOME

HVAC SYSTEM	ANNUAL ENERGY COST
Hybrid HP: Standard efficiency ASHP & High efficiency propane furnace	\$1,805
Standard efficiency ASHP with electric resistance back-up	\$2,114

In fact, in a region like the Midwest, the annual difference in CO<sub>2</sub> emissions between an ASHP-only and an ASHP-furnace hybrid system is roughly equal to the greenhouse gas emissions of a passenger vehicle for an entire year. In other words, a homeowner in the Midwest could offset the CO<sub>2</sub> emissions from his/her passenger car every year by opting to use a hybrid system with a high efficiency propane furnace instead of an air-source heat pump.

### ENVIRONMENTAL

Most heating systems besides renewable-based options will have CO<sub>2</sub> emissions linked to their operations. In the case of ASHPs, many of these systems are powered by upstream, coal-fired power generation plants. In areas with significant coal-fired power generation, the inefficient electric resistance back-up heat in ASHPs creates much higher CO<sub>2</sub> emissions compared to ASHP-furnace hybrid systems, which avoid the electric resistance back-up.

1. Performance Comparison of Residential Heating Systems: Energy, Economics, and Emissions, PERC, 2013. [buildwithpropane.com/Research-and-Training/Compare-Space-Heating-Systems](http://buildwithpropane.com/Research-and-Training/Compare-Space-Heating-Systems).

### FOR MORE INFORMATION

To learn more about hybrid heating systems and the Propane Education & Research Council, visit [buildwithpropane.com](http://buildwithpropane.com).

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