PROPANE
CLEAN AMERICAN ENERGY

EXECUTIVE SUMMARY FACT SHEET:

A COMPARATIVE ANALYSIS OF RESIDENTIAL HEATING SYSTEMS

THERE ARE more options than ever for home heating. To understand which system is best for a project, it's important to look at a variety of factors. This fact sheet summarizes the findings from an extensive technical analysis of heating system performance at locations throughout the U.S.

METHODOLOGY

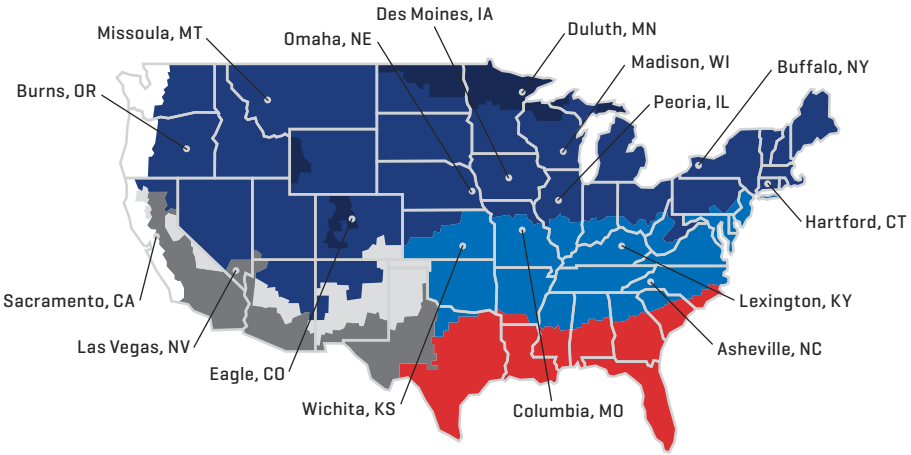
Newport Partners, LLC examined the performance of seven heating systems in 16 different locations, for new and existing homes. Each system was analyzed and compared in terms of its first cost, energy cost, emissions, and simple payback. Two systems were analyzed for their impact on comfort. Both heating and air conditioning are included in the energy costs, to create an equal comparison between heating-only systems and systems which provide both.

SYSTEM TYPE	HEATING SYSTEM DESCRIPTION*	SYSTEM EFFICIENCY RATINGS
Furnaces (with A/C)	· Standard-Efficiency Propane · High-Efficiency Propane · Standard-Efficiency Heating Oil	· 80 AFUE & 14 SEER A/C · 95 AFUE & 14 SEER A/C · 83 AFUE & 14 SEER A/C
Air Source Heat Pumps (ASHP)	· Standard-Efficiency ASHP with Electric Resistance Backup	· 8.2 HSPF & 14 SEER
Ground Source Heat Pumps (GSHP)	· GSHP Closed Loop with Electric Resistance Backup	· 3.6 COP & 17.1 EER · GSHP meets 100% of cooling load and ≥ 80% of heating load
Hybrid Heat Pump + Furnace	· ASHP (standard-efficiency) with High-Efficiency Propane Furnace Backup · GSHP Closed Loop with High-Efficiency Propane Furnace Backup	· ASHP 14 SEER; 8.2 HSPF; 95 AFUE propane furnace · GSHP 3.6 COP, 17.1 EER; 95 AFUE propane furnace (GSHP loop sized for ≥ 40% of heating load)

*Standard equipment based on federally regulated minimum levels. High-efficiency equipment based on thresholds set by the Energy Star program.

RESEARCH LOCATIONS

The locations chosen for analysis represent the main U.S. climate zones and the variations in heating loads that go along with them. The majority are concentrated in the Cold Climate zone, where heating energy use and costs are greater. The two Northeast locations were added because heating oil systems have significant market share in that region.



KEY FINDINGS

FIRST COSTS

For equipment and installation costs – known as "first costs" – the air source heat pump (ASHP), standard-efficiency propane furnace with standard A/C, and high-efficiency propane furnace with standard A/C were among the lowest of the seven systems analyzed. The high first costs of a ground source heat pump (GSHP) can be offset by adding a high-efficiency propane furnace as backup. This reduces the number of ground coils needed, which add to the system's cost.

ENERGY COSTS

For new homes in the cold climate zone, the GSHP and the GSHP-propane furnace hybrid system had the lowest annual energy costs, at about $1,000. The standard-efficiency hybrid ASHP featuring a high-efficiency propane furnace backup had annual heating and cooling costs of roughly $1,400. The high-efficiency propane furnace had annual energy costs of about $1,650, nearly 10 percent lower than the standard-efficiency ASHP, and about 14 percent lower than the heating oil furnace.

PAYBACK PERIOD

Simple payback evaluates how long it will take to "pay back" the first costs of a heating system through reduced energy costs. One scenario evaluated system paybacks for alternatives to a 95 AFUE furnace in a cold climate, new home. The analysis found that the furnace was a cost-effective option: the GSHP system had a payback of over 20 years due to its higher first cost; the ASHP showed no payback because it actually has higher energy costs; and the hybrid heat pump-furnace system had a payback of about eight years.

COMFORT ANALYSIS

Comfort is often a deciding factor for homeowners. Heating supply temperatures at or below body temperature (approximated as ≤ 100 degrees Fahrenheit) are assumed to feel cool and uncomfortable. The ASHP supplies air varying in temperature from 90-115 degrees Fahrenheit. The propane furnace, by contrast, consistently delivers air at 115 degrees Fahrenheit or higher for greater comfort in cold climates.

EMISSIONS

For environmentally conscious consumers, the emissions of heating systems are a factor in decision-making. Even electricity-based heating systems result in carbon emissions, unless they're powered entirely by non-fossil-based sources such as solar. The two GSHP systems had the lowest emissions for new homes in the Midwest, while the ASHP system had the highest, due partly to electric resistance back-up heat. The hybrid heat pump-furnace system significantly reduces emissions compared to the ASHP.

CONCLUSION

Selecting the best heating system for a project depends on the project's priorities with first cost, energy cost, emissions, comfort, and payback all being possible factors. Builders and designers can use the information from this study to help identify the best solutions for their projects.

LOW ANNUAL ENERGY COSTS

The research showed that a high-efficiency propane furnace offered low annual energy costs compared to several other options.

$1,650 HIGH-EFFICIENCY PROPANE FURNACE ANNUAL ENERGY COSTS

10% LOWER THAN STANDARD-EFFICIENCY AIR SOURCE HEAT PUMPS

14% LOWER THAN HEATING OIL FURNACES

ABOUT NEWPORT PARTNERS, LLC

Newport Partners, LLC, based in Davidsonville, MD, conducted the study mentioned in this fact sheet. They specialize in analyzing building systems' energy performance. Download the full study at **BuildWithPropane.com**.

LEARN MORE, AND TAKE THE COURSE

Discover more about the differences between propane heating and other heating systems at **BuildWithPropane.com**. You can also take the course based on this study at **PropaneTrainingAcademy.com**.

THE PROPANE EDUCATION & RESEARCH COUNCIL was authorized by the U.S. Congress with the passage of Public Law 104-284, the Propane Education and Research Act (PERA), signed into law on October 11, 1996. The mission of the Propane Education & Research Council is to promote the safe, efficient use of odorized propane gas as a preferred energy source.

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