



## Comparative Analysis of Residential Heating Systems Study

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### Overview

Evaluating 14 different heating systems in 16 locations across the United States in both new and existing homes, this study measured each system's comparative equipment and installation cost, annual operating cost, carbon dioxide (CO<sub>2</sub>) emissions, and return on investment (ROI). The study did not consider equipment maintenance costs, or cash or tax rebates available to homeowners or construction professionals.

### Overall findings

The study revealed the superior performance of propane-fueled heating systems when comparing several factors, including faster ROI, lower CO<sub>2</sub> emissions, and efficacy as a backup system to air-source heat pumps (ASHPs) in moderate to warm climate zones.

### Midwest Region overview

The Midwest Region sees the nation's widest temperature swings, from hot and steamy summer days to bitterly cold winter nights. As a result, construction professionals and homeowners in this part of the United States place a premium on high-performing home HVAC systems that can deliver both efficient heating and cooling.

The high utility bills that Midwestern homeowners face may make a geothermal system, otherwise known as a ground-source heat pump (GSHP), sound like an attractive alternative. But the comparative heating analysis study reveals that the extraordinarily steep upfront cost to purchase and install a GSHP — not to mention the potential cost of repair and maintenance of underground components — don't generate monthly energy savings fast enough to justify the investment. Additionally, because GSHP systems rely on electricity, they generate more CO<sub>2</sub> emissions than propane-fueled systems, considering that most electricity in the Midwest is generated by coal-fired power plants.

### Midwest Region findings: cost

Highlights from the study's findings on the environmental performance of propane versus competitive fuels include:

- The average closed-loop geothermal heating and cooling system (also called a ground-source heat pump, or GSHP) with an electric-resistance backup for heating, costs about \$22,000 to install, and \$938 a year to operate.
- In a retrofit scenario involving the replacement of an existing forced-air system, a GSHP requires more than six years to recover installation costs through energy savings. A 95% Annual Fuel Utilization Efficiency (AFUE) propane furnace, by comparison, has a payback time of less than a year.

At the time of the study, builders and homeowners in this region were continuing to benefit from some of the lowest prices-per-gallon for propane in the nation. Of the 16 different markets evaluated in the study, the four markets with the lowest price-per-gallon for residential propane were all in the Midwest: Des Moines, Iowa; Duluth, Minn.; Columbia, Mo.; and Madison, Wis.

Additionally, in October of 2009, the U.S. Energy Information Administration forecasted household heating expenditures for propane-heated homes would decrease 14% in 2009–2010, compared to a decrease of just 2% for electric-heated homes.

### 4 markets

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## Midwest Region findings: environment

Highlights from the study's findings on the environmental performance of propane versus competitive fuels include:

- Although an on-site geothermal unit itself may not emit CO<sub>2</sub>, the electricity used by pumps, fans, compressors, and backup heating elements draw power from an upstream plant. In the Midwest, that's most likely a coal-powered plant that produces considerable CO<sub>2</sub> emissions.
- Systems like GSHPs can be responsible for more greenhouse gas emissions than a propane-fueled system such as a high-efficiency propane furnace. For existing homes in this region, GSHP systems' CO<sub>2</sub> emissions were 40% higher than high-efficiency propane furnace systems.

## Conclusion

With consumer awareness of renewable-energy systems on the rise, building professionals need to be ready to explain what kind of payback homeowners are likely to expect from their heating systems, as well as what unintended consequences they may have on the environment.

Energy-conscious homeowners shopping for a home heating system almost always ask a construction professional: "Which system costs the least to operate and is the cheapest to install?" This study shows how that question warrants a careful answer, one that covers first costs as well as fuel costs.

For eco-conscious homeowners asking "Which system has the lowest carbon emissions footprint?" the surprising conclusion is that propane systems frequently have much lower CO<sub>2</sub> emissions compared to alternative-fuel systems like GSHPs, which require electricity from the grid to operate.

Because residential heating systems are generally replaced every 12 to 18 years, construction professionals have ongoing opportunities to improve the energy and environmental performance of residential heating systems across the United States.

## About the author of the study

Newport Partners LLC, a market research firm based in Davidsonville, Md., conducted this study in 2008. Newport Partners specializes in the analysis of building systems' energy performance.

## For more information

Download the full heating analysis study at [buildwithpropane.com](http://buildwithpropane.com).

Access information on tax incentives and credits at [buildwithpropane.com/stimulus](http://buildwithpropane.com/stimulus).

For more information on the reliability, efficiency, and performance of propane furnaces and boilers, contact Tracy Burlison, PERC director of residential programs, at 202-452-8975 or [tracy.burlison@propanecouncil.org](mailto:tracy.burlison@propanecouncil.org).

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