

## Comparative Analysis of Residential Heating Systems Study 2010

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### Overview

Evaluating 14 different heating systems in 16 locations across the United States in both new and existing homes, this 2010 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 used regionalized 2009 energy price data from the U.S. Energy Information Administration and did not consider equipment maintenance costs. Systems were evaluated for new homes and as efficiency upgrades for existing homes.

### Overall findings

The study revealed that selecting the optimal home-heating system is a balance of several factors, including upfront costs, efficiency and monthly operating costs, ROI, and long-term carbon emissions. Propane systems performed very strongly both as a primary option, and as a backup heating source when paired with air-source heat pumps (ASHPs) in "dual fuel" systems.

### Midwest/West Region overview

The Midwest and West Regions were the study's largest regions to be analyzed, and the ones that see 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 these sections of the United States place a premium on high-performing home HVAC systems that can deliver both heating and cooling efficiently.

The high utility bills that Upper Midwestern homeowners face in particular 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 — despite the tax credits available — 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 most propane-fueled systems, considering that most electricity in the Midwest is generated by coal-fired power plants.

### Midwest/West Region findings: cost

Based on an analysis of numerous locations in the Midwest and West for typical housing, the study arrived at these conclusions on heating system costs:

- A high efficiency propane furnace with a standard central A/C system blends energy performance and affordability. In contrast, a GSHP system — despite lower monthly bills — would take roughly 13 years to pay back in a new home installation compared to the high efficiency propane furnace. Even with potential tax credits, the GSHP payback is still about 6 years.
- In an efficiency upgrade scenario examining alternatives to using a standard efficiency furnace, a high efficiency propane furnace has a payback period of less than 6 months — 18 times faster than a GSHP.
- The best option for replacing an existing ASHP system is a high efficiency furnace with standard efficiency central A/C. This system has an immediate payback, compared to replacing the old ASHP system with a new one. Paybacks for dual-fuel systems are also very competitive (1-2 years).

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## Midwest/West Region findings: environment

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

- Propane systems' CO<sub>2</sub> emissions profile is either comparative to, or surpasses, other energy and heating systems options in the Midwest/West Regions, including GSHPs.
- Despite the high energy-efficiency ratings of most GSHPs, they showed significantly higher carbon emissions than most propane-based and dual-fuel heating systems.
- By selecting a standard 78% AFUE propane furnace instead of a standard ASHP, a homeowner can reduce annual CO<sub>2</sub> emissions by an amount equal to the annual emissions of a typical car. Similar emissions reductions are found for high efficiency propane furnaces when compared to high efficiency ASHPs.

## Conclusion

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 energy costs.

For eco-conscious homeowners asking "Which system has the lowest carbon emissions footprint?" it's clear that propane systems are an outstanding performer in the Midwest and West. And when it comes to simple payback rates, GSHP technology as it's currently priced simply can't compete with propane.

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 building industry research firm based in Davidsonville, Md., conducted this study in 2010. 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).

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

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eco-conscious  
homeowners  
looking to reduce their  
home's carbon emissions,  
propane systems offer a  
compelling choice.