

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 (CO₂) 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.

Key findings: cost

Based on an analysis of typical housing and energy pricing for different cities around the country, the study arrived at these conclusions on system costs:

- A high efficiency propane furnace with a standard central A/C system blends energy performance and affordability. A ground-source heat pump (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. Overall, the lengthy payback rate of a GSHP in different scenarios and regions is longer than most homeowners stay in their home.
- In the Northeast: In an efficiency upgrade scenario examining alternatives to installing a standard efficiency fuel oil furnace in an existing home, a high efficiency propane furnace has an immediate payback. This means that it costs less to purchase and to operate than the standard fuel oil furnace. In this same scenario, a GSHP system has a payback greater than 15 years.
- In cold climates: 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).
- In the Southeast: Compared to a high-efficiency electric ASHP — a common HVAC setup in the region — a dual-fuel system using propane offers more fuel flexibility when energy prices fluctuate, as well as the ability to avoid electric backup heating, which is the least efficient, most expensive, and most carbon-emitting mode of operation. A dual fuel system will cost roughly 8% more than an ASHP system while reducing annual heating costs by about 14%.
- In the Southwest: dual-fuel systems pairing an ASHP with a high efficiency propane furnace had two of the three lowest annual operating costs for heating and cooling.

Key findings: environment

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

- In the Northeast: A standard-efficiency 78% AFUE propane furnace emits about 32% less CO₂ than a comparative 78% AFUE fuel oil furnace, because fuel oil combustion is more carbon-intensive than propane combustion.
- In the Midwest: Despite the high energy-efficiency ratings of most GSHPs, they showed significantly higher carbon emissions than most propane-based and dual fuel heating systems.

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 ongoing energy costs.

For eco-conscious homeowners asking "Which system has the lowest carbon emissions footprint?" it's clear that propane systems are a compelling option. 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.

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.

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