

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 furnaces 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.

Southwest Region overview

The Southwest Region is among the most geographically diverse in the United States, resulting in a full range of climate extremes. The region's mountainous northern states are dry and frequently cold, while the region's southern states are dominated by dry desert heat. In areas of the Southwest such as Nevada, temperatures can range from blistering hot to cold enough for snow, requiring HVAC systems that can pivot efficiently between home heating and home cooling.

Southwest Region findings: cost

A comparative analysis based on typical housing in Nevada found that:

- 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. Compared with ASHPs with electric resistance backup heating, dual-fuel systems averaged about 10% lower heating and cooling costs annually.
- The lowest-first-cost heating/cooling system in this region was the standard-efficiency propane furnace with central A/C, followed by the high-efficiency propane furnace with central A/C. Each of these systems had less than half the first cost of the ground-source heat pump (GSHP) system, resulting in payback periods for the GSHP system over 10 years.

Compared with air-source heat pumps

that use electric resistance backup heating, dual-fuel systems averaged about 10% lower heating and cooling costs annually.

Southwest Region findings: environment

Highlights from the study's findings on environmental performance, based on typical Nevada housing, include:

- Propane systems' CO₂ emissions profile is either comparable to, or surpasses, other energy and heating systems options.
- ASHP systems had CO₂ emissions from heating operation that were at least 50% higher than comparable dual-fuel heating systems. In dual-fuel heating systems, the propane furnace operates during colder periods. This displaces the use of electric resistance backup heating, which is very inefficient and results in heavy electrical energy use and CO₂ emissions.
- The high-efficiency propane furnace dual-fuel heating system in this market had CO₂ emissions from heating that were within 4% of the emissions from the GSHP.

For both the cost and environmental findings, the results are based on typical Nevada housing and may vary in other states depending on energy rates and climate variations.

Conclusion

Energy-conscious homeowners shopping for a home heating and cooling 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 for the system with the lowest carbon emissions footprint, it's clear that propane systems are a compelling option.

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 Burlison, PERC director of residential programs, at 202-452-8975 or tracy.burlison@propanecouncil.org.

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eco-conscious
homeowners
looking to reduce their
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