

COMPARATIVE STUDY AND ANALYSIS:

RESIDENTIAL SPACE HEATING SYSTEMS

FACT SHEET

Space heating and cooling accounts for about half of the energy use in most American homes. Energy costs associated with heating and cooling systems can vary widely, as can equipment efficiency and energy costs.

This fact sheet summarizes key findings from a 2013 study by Newport Partners that used building energy modeling to compare 15 different heating systems using propane, electricity, or heating oil¹ in new and existing homes in 20 locations across the United States. By comparing such a large number of systems, the study established that in most cases, **systems incorporating high-efficiency propane furnaces cost less to purchase and install than comparable heating systems** running on heating oil or electricity. Further, the propane furnaces operated at energy costs that were competitive to other systems, making them a **better overall value** in many cases than systems known for their energy savings, such as ground source heat pumps [GSHPs]. Last, propane furnaces possessed the measurable environmental benefit of lower carbon emissions from system operation than many other alternatives.

Construction professionals can differentiate themselves by providing homeowners with the information needed to select a heating system with clarity and confidence.

ECONOMICS

A high efficiency propane furnace paired with a standard central air-conditioning system yields upfront savings and competitive energy costs.

Across the 15 heating systems evaluated, the four heating oil systems had the highest energy costs for new homes in cold climates.

In new installations, **high efficiency propane furnaces were the most affordable to purchase and install of all the systems**. In fact, because high efficiency units can vent through plastic pipes, the furnaces had lower total upfront costs than even standard efficiency propane furnaces, which require metal venting. **The lower first costs and lower energy costs associated with high efficiency propane furnaces are good news for builders and homeowners.**

In all cases, GSHPs produced lower monthly utility bills than propane systems, but the study also showed that those energy savings could not compensate for the high upfront cost of GSHPs until after 16 to 36 years of operation.

Installing a GSHP with a backup propane furnace² (40/60 load split) in cold-climate regions significantly reduced initial costs by decreasing the size of the GSHP's loop field. As one might expect, adding the propane backup increased the system's energy cost; but the propane backup reduced the rate of payback from energy savings by up to 13 years, compared with a standard GSHP setup.



KEY HIGHLIGHTS

- Propane furnaces can have both lower installation costs and lower monthly energy costs than other furnace options.
- In any climate, propane furnaces deliver a more comfortable heat.
- Propane furnaces create a smaller carbon footprint than electric furnaces.

FOR MORE INFORMATION

buildwithpropane.com/heatingstudy
Download "Comparative Analysis of Residential Heating Systems."

buildwithpropane.com/energycalc
Calculate the estimated annual energy costs and carbon emissions for space-heating systems installed in your project area with the Heating Energy Cost and Carbon Calculator.

For more information on propane systems, call PERC at 202-452-8975.

Also in cold-climate regions, replacing an air source heat pump (ASHP) with a high efficiency propane furnace had an immediate payback compared with a standard efficiency ASHP because the high efficiency propane furnace was less expensive to purchase, install and operate.

In a mixed or cold climate, **replacing an old propane furnace with a high efficiency propane furnace, instead of a standard efficiency one, produced a faster payback than any other option considered.** This included standard- and high-efficiency ASHPs, GSHPs, high efficiency oil furnaces,³ and ASHPs with propane backups. On average, the payback period of a high efficiency propane furnace was merely 1.2 years in both climate regions.

COMFORT

Based on simulations performed with the U.S. Department of Energy's EnergyPlus software, **an analysis of supply temperatures from propane forced-air furnaces versus electric ASHPs revealed superior performance for the propane system in hot-dry, mixed-humid, and cold climate zones.** ASHPs operating in heating mode are expected to supply air that feels cold [i.e., ≤ 100 degrees Fahrenheit] approximately 20 percent of the time in hot-dry climates like Las Vegas, and from 60-65 percent of the time in mixed-humid and cold climates, with supply temperatures decreasing as outdoor temperature decreases. On the other hand, the very warm supply temperatures of propane forced-air furnaces [e.g. supply

temperature between 115-125 degrees Fahrenheit] are relatively steady and are unaffected by cold outdoor temperatures.

ENVIRONMENTAL FACTORS

Comfort, low upfront costs, and long-term energy savings are the top reasons homeowners choose one system over another. Some homeowners, however, also consider the effect their homes have on the environment. **Construction professionals can remind buyers that propane systems are able to operate at a lower carbon dioxide (CO₂) emissions rate than systems running on electricity or heating oil.**

For example, the study showed that a high efficiency heating oil furnace caused 15 percent higher CO₂ emissions than a high-efficiency propane furnace. That propane furnace operating for 20 years would avert as much CO₂ as 514 tree seedlings could sequester in 10 years.⁴



By contrast, heating systems with “greener” reputations sometimes produce higher CO₂ emissions. According to the study, ASHPs operating in the Midwest emitted large quantities of CO₂. A hybrid system that pairs the ASHP with a propane furnace reduced that amount by about half. In general, **propane systems show to be better options than electric counterparts, especially in areas of the Midwest where electricity is produced by coal-fired power plants.**

Equipment change-outs present ongoing opportunities for construction professionals to improve the energy and environmental performance of our nation's homes.

CONCLUSION

Because residential heating systems are replaced every 15 to 25 years, construction professionals have ongoing opportunities to improve the energy and environmental performance of our nation's homes. When those opportunities arise, construction professionals can differentiate themselves by providing homeowners with the information needed to select a heating system with clarity and confidence. And in many cases, the facts support choosing high-efficiency propane systems.

Notes:

1. The goal of the study was to compare propane systems against competing options. Because propane systems are not used where natural gas is available, the study did not include natural gas systems.
2. Typically, an electric-resistance heating element backs up GSHPs.
3. The study evaluated heating oil furnaces only in the Northeast.
4. This comparison comes from the Environmental Protection Agency's Greenhouse Gas Equivalencies Calculator: epa.gov/cleanenergy/energy-resources/calculator.html.

FOR MORE INFORMATION

To learn more about high efficiency propane space heating systems and the Propane Education & Research Council, visit buildwithpropane.com.

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