Heating oil, also known as fuel oil or Number 2 oil, has been a popular choice for homeowners since the early 1900s. As an alternative to coal or wood as a fuel source for boilers and domestic hot water production, heating oil proved to be a reliable, clean, and economical choice for millions of consumers, especially in the Northeast where other fuel types were often more difficult to acquire or were more expensive. However, in the past few decades heating oil has started to lose market share. Electricity, natural gas, and propane have all increased in popularity while heating oil has consistently declined. Environmental concerns over leaking oil tanks and the significant environmental impact associated with burning oil have also encouraged homeowners to explore other fuel types as their primary energy source for heating and domestic hot water.

Natural gas, where available, is one choice for homeowners; electric resistance heat and electric heat pumps can also be alternatives to heating oil. However, these are often expensive choices, plus most of the electricity available to consumers is from coal-fired generation plants, which have a negative environmental impact. Propane is also an attractive alternative to heating oil, especially in areas where natural gas is not available. Propane can be used in many of the same ways as heating oil and it is also stored on site. However, propane is a much more versatile energy source than oil. Propane is used for central, space, or domestic water heating, cooking, lawn and garden use, and in many industrial applications. The Propane Education & Research Council (PERC) Presents Heating Oil Conversion: Exploring Propane as a Viable Alternative Energy Source.

LEARNING OBJECTIVES
After reading this article, you should be able to:
• Describe the history and current use of heating oil in the United States.
• List which alternative fuel sources are available to current heating oil consumers.
• Complete a heating analysis of alternative energy choices.
• Describe why propane is a superior alternative to heating oil.
• Explain considerations when converting from heating oil to another fuel source.

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CONTINUING EDUCATION
Use the learning objectives to the right to focus your study as you read Heating Oil Conversion: Exploring Propane as a Viable Alternative Energy Source.
To earn one AIA/CES Learning Unit please take our online test located at hanleywooduniversity.com.
heating, cooking appliances, clothes dryers, fireplaces, and patio and pool heating. Propane also reduces the United States’ dependence on foreign oil because 95% of propane used in this country is produced in North America. From an environmental standpoint, propane is a superior energy source because of its relatively low carbon footprint when compared with the footprint of heating oil and electricity.

When converting from heating oil to an alternative energy source, environmental impact, equipment sizing, efficiency, and initial costs are all important things to consider. Understanding the energy output of fuel and the advantages of high-efficiency appliances will help guide the decision-making process to enable the homeowner to choose a system that provides comfortable, reliable, and economical energy. When evaluating the heating oil conversion process, tax incentives and return on investment (ROI) considerations should also be noted.

Removing old heating oil equipment and preparing the home for new equipment is the final step in converting a home to an alternative energy source. Understanding the necessary requirements of installing an electric, natural gas, or propane heating and cooling system will help complete the transition from heating oil to an alternative energy source.

HEATING OIL HISTORY AND ITS CURRENT USES

In 1840 Abraham Gesner invented a process to distill kerosene from crude oil. Kerosene then became the primary fuel for lamps and domestic lighting. This discovery and the subsequent success of oil sales quickly led to widespread oil exploration. By the 1880s, wells and distribution systems for refined oils were established across the United States. These developments allowed for petroleum products and especially heating oil to be readily available to an ever-expanding market. The 1920s brought the first wave of oil boilers to the domestic market.

Today, of the 111 million households in America about eight million homes use oil as their main heating fuel. Within that group of heating oil users, 78% (about 6.3 million) live in the Northeast where older homes are plentiful and natural gas is not (less than 10% of the producing domestic gas wells are located here). Nationally, heating oil accounts for around 7% of the residential market for heating. The leading fuel source is natural gas (56%) followed by electricity (26%). Propane currently accounts for about 6% of the domestic market serving more than 60 million consumers.

The heating oil industry continues to lose market share at a rate of about 2% per year. The reasons for this are many and include environmental concerns related to the potential of fuel tank leakage, maintaining aging equipment, and the increasing availability of alternative energy sources.

The environmental consequences of a heating oil spill can be devastating to the local ecosystem and ground-water supply. Heating oil, once spilled, does not vaporize (evaporate) like other petroleum fuels and can easily flow in concentrated form to storm water drains, streams, wells, and lakes. When heating oil leaks or spills inside a home—or out—the cost to clean up the spill can range from $20,000 to over $50,000.

The relative high maintenance of a heating oil system can often lead homeowners to convert to a different energy source for their
heating needs. The heating oil tank can be the most vulnerable part of a heating oil system and must be diligently maintained in order to reduce the risk of leaks and groundwater contamination.

A recent U.S. Department of Energy (DOE) estimate of energy performance in older homes revealed that existing heating-oil boilers used for hydronic (radiator) heating can lose up to 30 percent efficiency in as few as 14 years. This decrease in efficiency is significant, especially when compared to similar propane models installed in comparable homes. The propane models in the comparable homes retained 81% of their efficiency over the same period of time.

The useful life of a heating appliance should be an important consideration for occupants because older and worn out heating oil equipment not only results in an uncomfortable living space, but it can also significantly increase energy costs and contribute to excessive carbon emissions. According to the Department of Energy, when converting from an old and worn out heating oil system with an annual fuel efficiency (AFUE) rating of 56 to a modern high-efficiency propane system with a rating of 97, consumers can save over $40 for every $100 spent on energy and decrease carbon emissions by more than 2.5 tons annually.

ALTERNATIVE ENERGY SOURCES AVAILABLE TO HEATING OIL CONSUMERS

When it comes time to upgrade or replace heating oil equipment, the first inclination of a heating and cooling contractor or home-owner may be to simply purchase new heating oil equipment. While new heating oil equipment may help reduce energy costs slightly, simply replacing the heating appliances will do little to reduce the amount of carbon emissions. Standard heating oil systems, whether new or old, produce high levels of carbon emissions when compared to other cleaner energy sources such as propane. If the homeowner is hoping to significantly reduce energy bills by replacing heating oil equipment, other energy sources offer much higher AFUE ratings for less cost. Propane heating appliances, for instance, are widely available with efficiency ratings of 95% to 98% and may be eligible for tax credits and incentives that can help offset the cost of upgrading to a high-efficiency unit.

Propane offers many of the same benefits that heating oil customers have grown fond of, as well as a host of other advantages. Like heating oil, propane is stored on site, which provides
security and independence for the occupant during times of power interruptions, natural disasters, emergencies, or prolonged weather events. Another advantage is that propane appliances, whether a boiler unit or furnace unit, can easily be integrated into an existing heating oil system. Fast and easy set-ups will significantly reduce the initial cost of conversions, leave existing systems intact, and reduce the risk of damaging radiant heaters and hydronic systems.

Heat pumps have become more popular lately with homeowners converting from heating oil. According to the DOE, an air source heat pump (ASHP) can reduce electrical use by over 30% for homes using electricity as the primary form of energy for heating and cooling. While offsetting high energy costs may make heat pumps seem like an economical solution, initial costs and increased energy use can result in hidden costs and additional carbon emissions.

If electricity is the only energy choice available, a heat pump system can cut electricity use by over a third when compared to electric resistance heating. However, when compared to other energy sources, such as propane, an ASHP or ground source heat pump (GSHP) system may not be the best choice for the heating oil consumer.

HEATING ANALYSIS OF FUEL CHOICES

Heating oil is thought of as a more economical choice for residential space heating because of its relatively high British thermal unit (Btu) rating compared to other fuel types. However, the Btu rating is only part of the information needed to evaluate the best energy choice for a home. To fully evaluate which energy source is most appropriate for a home, you must first understand the potential energy contained in the fuel type, the AFUE rating of the heating appliance to be installed, and evaluate the specific needs of the home. This evaluation will help you determine what kind of energy source, heating appliance, and distribution system is best suited to ensure that the home is comfortable, energy efficient, and has a low carbon footprint.

British thermal units or Btu are the standard unit of measurement used in the United States to determine how much heat energy different fuel sources contain. One Btu is the amount of energy needed to raise the temperature of one pound of water by 1 degree Fahrenheit. The Btu rating of an appliance is the total amount of Btu the unit expels during an hour. It is important to note that the Btu of an appliance does not correlate to how efficiently it generates heat from a fuel source, nor does it determine how much heat energy is actually being delivered by the distribution system. The Btu simply measures the heat potential of a fuel source.
Propane is a versatile energy source that can do everything from heating your home to making outdoor living more enjoyable.

In order to conserve natural resources, reduce carbon emissions, and save consumers money on energy bills, the DOE has set the minimum AFUE rating for fossil-fueled boilers at 80%. The minimum AFUE rating for a fossil-fuel furnace is 78%. These baseline numbers are considered the standard for new heating equipment today.

High-efficiency heating appliances are units that achieve an AFUE of 90 or greater. With the exception of condensing units, this efficiency rating is impossible to obtain for a heating oil furnace or boiler. Even though heating oil contains more Btu per gallon than propane, heat energy is lost up the chimney or elsewhere in the conversion of heating oil to usable energy. By contrast, a propane furnace or boiler can achieve an AFUE rating of 95 with only a modest (less than $250) increase in cost for the upgrade.

An electric furnace or boiler will typically have an AFUE rating between 95 and 100 because the units do not require a flue and thus have no loss of heat energy through the exhaust. However, the high cost of electricity makes these resistance-style heaters expensive to operate.

When the AFUE of an appliance is combined with the average cost of the fuel, a more accurate comparison can be made between fuel types. Again, the EIA heating fuel analysis calculation tool can assist with this process. For instance, when electricity is compared to propane, electricity will cost almost twice as much per million Btu to heat a home.

**THE BENEFITS OF PROPANE IN HEATING OIL CONVERSION**

Propane is often the best alternative fuel available for homeowners who want to convert from a heating oil system. Propane offers many of the...
key benefits of heating oil without the significant drawbacks associated with fossil fuel. All heating systems, regardless of the energy source, produce carbon emissions. Fossil-fuel systems, like those that use propane, fuel oil, or other fossil fuel sources for combustion release greenhouse gasses such as carbon dioxide as a result of the combustion of the fuel. Propane, however, is a much more environmentally sensitive fuel type compared to heating oil or electricity.

A new high-efficiency propane furnace will emit 10,000 fewer pounds of carbon annually than a standard heating oil furnace.

Based on a comparative review of heating systems in both new and existing homes in the Northeast, a high-efficiency propane furnace with an AFUE of 95 is less expensive to install as a replacement system compared to a standard efficiency (78% AFUE) fuel-oil furnace. Additionally, a propane furnace has lower operating costs. And unlike heating oil, propane can be safely stored underground as it is not toxic to ground water or soil.

**CONSIDERATIONS WHEN CONVERTING FROM HEATING OIL TO ANOTHER FUEL SOURCE**

Converting from heating oil to an alternative energy source does not have to be a major investment for a home's occupants if the same style of heat delivery system (hydronic or forced air) is retained. The major expenses will be the safe removal of old equipment, the purchase of new appliances, and installation. Tax incentives and tax credits offered through the state, local utility companies, and the Federal government will often make the investment in a high performance propane heating appliance very attractive. For the most current tax credits and financial incentives for choosing a propane appliance visit www.dsireusa.org.

Often the ROI for high-efficiency heating systems can render the initial costs moot within a few years. Because propane systems integrate so easily with heating oil systems, the ROI of installing a high-efficiency propane furnace or boiler is relatively short.

Because of the high cost of installation, a GSHP can have an ROI of more than 10 years, making it unattractive for homeowners looking to immediately reduce energy costs. Because ASHPs operate poorly in colder climates, their ROI is also long.

**SUMMARY & RESOURCES**

Additional information on propane and its economic and environmental benefits can be found at buildwithpropane.com.

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**About the Propane Education & Research Council (PERC)**

The Propane Education & Research Council (PERC) provides architects with free AIA- and NAHB-approved continuing education coursework on the application, installation, and material profile of propane and propane products.

PERC continuing education courses cover a broad range of topics including tankless water heaters, community propane tank systems, underground propane tanks, hydronic radiant heating, propane in outdoor applications, residential heating analysis, and enhanced energy systems.

Visit www.buildwithpropane.com/training to learn more about the economic, environmental, and efficiency benefits of building with propane while fulfilling your CEU requirements.