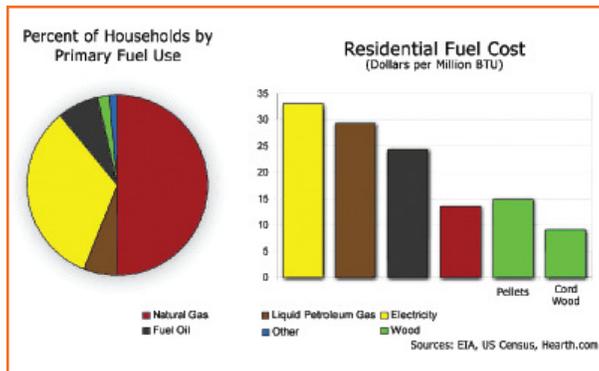


Residential Heating

There are numerous benefits to using biomass instead of fossil fuels like oil, coal and gas for providing heat for homes, commercial users and industrial processes.

Space heating represents about 40% of the total energy requirement of the average American home (cite). In colder regions such as New England, this number can climb as high as 60% or more. This means that the choices that homeowners make which could have the greatest impact—on the environment and their energy bills alike—are the ones that they make about their heating practices. One often overlooked option that has the capacity to address both of these issues is heating with biomass.



greatest priority. From this standpoint biomass is particularly well suited to displace heating oil. Heating oil is a non-renewable fuel which is significantly derived

from foreign markets. As a consequence, not only does the long term price tend to increase, but it can also fluctuate dramatically in the short term—a phenomenon which is becoming more pronounced today than ever before. Using a wood or pellet stove as a secondary source of heat can mitigate the costs associated with these fluctuations. Heating a home solely with biomass can rid a homeowner of these problems altogether.

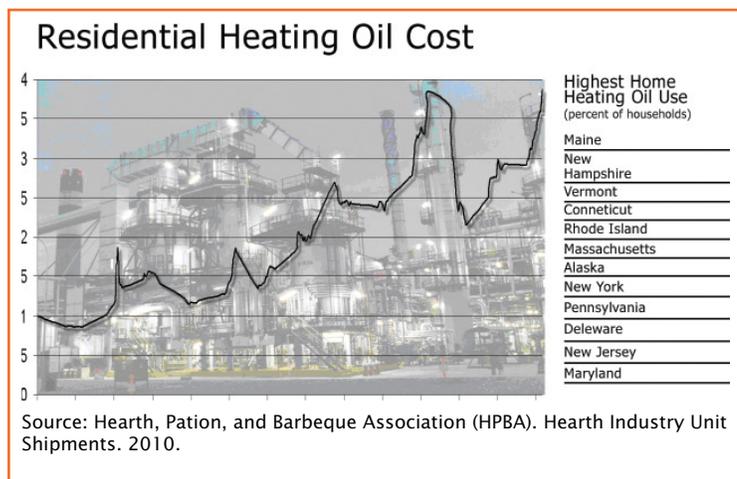
There are many other reasons that people choose to heat their homes with biomass as well: becoming energy independent, supporting local economies, or reducing their carbon footprint. Many homeowners, however, are simply enamored with the ambiance that wood and pellet stoves provide. Whatever the reason, there are a range of heating appliances on the market which are available to suit the desires of any particular homeowner.

Heating Fuels

As with most energy consumptive sectors, the majority of residential heating is currently being met with non-renewable sources such as natural gas and fuel oil. These fuels are typically combusted in a furnace or boiler, and are the primary source of heat for the whole house. Depending on the appliance, biomass can provide heat to an entire home in much the same way as a conventional furnace, or it can be used as a secondary heating source. Wood burning stoves can provide primary heating for small homes and are an excellent back-up heat source. Regardless of the size of a biomass appliance, the bottom line is that when it is in use, it can replace or supplement the consumption of fossil fuels. Currently, there are about 12 million wood stoves being used in American homes for either primary or secondary heating purposes ².

Heating Oil

Homeowners use biomass to heat their homes for a variety of reasons, but often cost savings is of the



Appliances^{3,4}

Many people associate wood heating with billowing chimneys and smoky emissions, when in fact visible smoke is merely symptomatic of an inefficient combustion process. Not only have technological advances led to cleaner burning conventional wood stoves, but they have also spawned a new generation of extremely efficient, automated biomass heating appliances.

Fireplaces

Conventional fireplaces represent the lowest efficiency wood burning technology, and are not generally considered a heating appliance at all. Often, fireplaces feel warm right in front of it, but it is sucking more hot air up the chimney from the house than it is producing. There are, however, a number of models in production which meet EPA's voluntary standard for fireplaces that are 70% cleaner than older models. A much better option that lends itself well to older fireplaces is a fireplace insert, which is essentially a woodstove that fits into the existing space and greatly increases the efficiency of its use by offering more complete combustion and redirecting more heat into the living space.

Wood Stoves

Fireplaces and woodstoves typically burn cordwood, or small logs, an attribute that offers a high degree of fuel cost flexibility, since cordwood can often be purchased locally or self harvested. Modern woodstoves-- freestanding units usually made from cast iron or steel-- however, are much more efficient than fireplaces. This is due in part to EPA regulations that went into effect in the early 1990's aimed at significantly reducing emissions from new wood stoves. Stoves belonging to this new generation are intrinsically more efficient because in reducing their emissions, they combust more of the materials that would otherwise escape the flue as particulate pollution. Currently, the EPA maintains a list of over 900 models of certified wood stoves from scores of manufacturers. These models are offered in a range of sizes, styles and applications, and can provide either primary or secondary heating within the home.



Example of a free-standing wood stove. Source: harmanstoves.com

¹ Energy Information Administration. 2009. Residential Energy Consumption Survey: Home Energy Uses and Costs.

² US Census. 2011. American Housing Survey for the United States: 2009.

³ The Alliance for Green Heat. 2009. Available at <http://www.forgreenheat.org/technology>

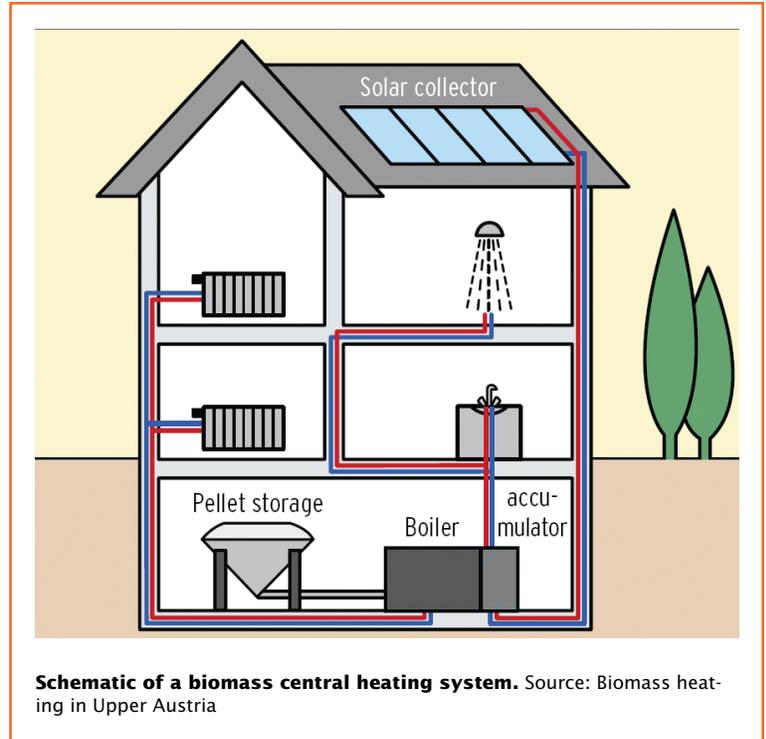
⁴ Environmental Protection Agency Burnwise Program. 2011. Available at <http://www.epa.gov/burnwise/appliances.html>

⁵ Environmental Protection Agency. 2011. List of EPA Certified Wood Stoves.

Pellet Stoves

Pellet stoves represent the nexus of convenience, automation, and efficiency. As the name implies, these stoves typically burn wood pellets—uniformly sized condensed biomass—but they can also burn corn kernels, with some units able to handle either type of fuel. The high degree of automation, coupled with the uniform, low-moisture fuel allows for an unprecedented emission profile, high efficiency, and user friendliness. Demand from the user is typically limited to reloading the pellet hopper and intermittently removing ash from the collection bin. Wood and corn pellets can be ordered by the ton and delivered to

take advantage of existing ductwork and radiators. Much like pellet stoves, they also can enjoy a high degree of automation which allows for extremely high conversion efficiencies and low emissions. However, many low efficiency and high emission boilers are also available, particularly traditional outdoor wood boilers, and should be avoided. Since pellets have a high energy density and uniformity, their utilization in a central heater is very similar to an oil furnace—the fuel being stored in a bin which is automatically fed into the combustor at the rate required to maintain the temperature dictated by the thermostat. The only extra user input that these systems typically require is ash removal and refilling the fuel bin as necessary.



Schematic of a biomass central heating system. Source: Biomass heating in Upper Austria

United States can also realize the energy independence, environmental mitigation, and financial saving that biomass offers.

Zone Heating

Wood and pellet stoves are often categorized as zone heaters, meaning that heat is sourced directly from the appliance into the room and adjacent areas. Installing a stove in the highest used ‘zone’ of the house allows for the thermostat to be turned down for the entire home without compromising comfort. This strategy can significantly shrink heating bills and fossil fuel usage alike.

The Future of Biomass Heating

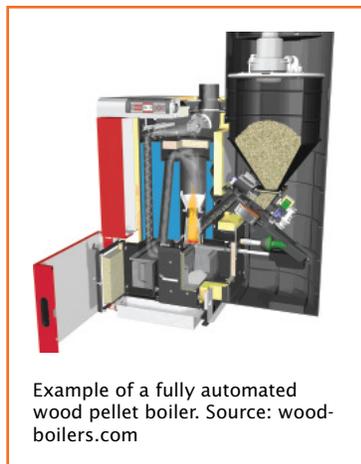
Many European countries might arguably represent the future potential of residential biomass heating in the United States. Upper Austria, for example, was highly dependent upon heating oil until the emergence of state policies, technological innovation, and forward-thinking forest owners initiated the growth of the its biomass heating market.

Today, upper Austria enjoys a strong pellet distribution network, which fuels tens of thousands of fully automated residential pellet heating systems. Furthermore, biomass now accounts for 1/3 of the thermal energy use in that region. Meanwhile, pellet production capacity is rapidly expanding in the United States, but so is exportation to European markets (cite). With greater domestic residential heating adoption, the

the home, or they can be purchased by the bag—typically 40 lbs—from a variety of vendors including stove dealers, hardware, home and garden, and feed supply stores.

Wood Furnaces and Boilers

Wood furnaces and boilers are centralized heating systems and can provide for both space and water heating. They are used to heat the entire home in much the same fashion as conventional oil and gas systems, and can even



Example of a fully automated wood pellet boiler. Source: wood-boilers.com

Conclusion

Using biomass for residential heating is a simple way to reduce fossil fuel consumption while securing a more energy independent home. The variety of choices concerning both appliances and fuel allows for nearly any homeowner to take advantage of the benefits that heating with biomass can provide.



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