

by James E. Houck and Paul Tiegs

Both fuels have an impact on the environment, and on the nation. Which one has the least negative impact is a complex question with a very elusive answer.

# WOOD or GAS Fireplaces?



*There has been considerable debate regarding the future of woodburning fireplaces. Pivotal in the debate are the facts that woodburning fireplaces are generally not used for serious home heating but for pleasure or supplemental heating; they have air quality issues associated with them and gas-fueled fireplaces can serve nearly the same role in a household.*

**W**oodburning fireplaces are in the crosshairs of many air quality regulators. They emit significant quantities of particles and toxic pollutants into the air and, unlike wood stoves, they cannot be defended as a realistic home heating option. With rare exceptions, even when woodburning fireplaces are used for heat rather than for aesthetics, they are unquestionably inefficient compared to wood stoves.

The U.S. EPA air quality “cookbook” lists their air emissions per pound of

wood burned higher than for wood stoves (which is absolutely untrue). Some believe gas-fired fireplaces are the way to go due to their cleaner burning characteristics. The difference in cost between the installations of a woodburning fireplace compared to a gas fireplace at the time of home construction is negligible when the cost of a new home is considered.

For the hearth industry, the revenue stream is still there regardless of whether a woodburning or gas fireplace is installed. The conversion of an exist-

ing woodburning fireplace to gas with a gas log set represents a relatively small cost for the homeowner, and for the hearth industry it provides revenue not associated with new home construction. The addition of a gas insert to a fireplace changes it into a serious heating appliance. Finally, a gas appliance is arguably easier to use than its woodburning counterpart.

There are, however, staunch defenders of the smell, sound and feel of a real woodburning fireplace. For many, the aesthetic appeal of a woodburn-

ing fire is strong, and there is certainly nothing wrong with the enjoyment of life. Some affluent households in urban areas have gone to great expense to have a “real” woodburning fireplace with custom designs and control systems.

It has been shown that manufactured wax/sawdust firelogs burned in woodburning fireplaces produce lower air emissions than natural wood, and they are a very popular consumer item due to their convenience. The manufacture of less polluting woodburning fireplaces appears possible, and the Hearth, Patio & Barbecue Association is investigating the development of a testing protocol for woodburning fireplaces to be able to certify cleaner models.

While gas-fired fireplaces may be, on the whole, environmentally more sound, there is no free lunch: Gas is a non-renewable fossil fuel with concomitant emissions of greenhouse gases; it contributes to the acid precipitation problem, and to the formation of secondary particles in the atmosphere.

To the consumer, wood is an attractive fuel in that the gathering of firewood is a recreational activity for many households, and the source of wood is not volatile or interruptible, nor subject to commensurate price increases such as is the case for gas.

For the nation, the use of wood for fireplaces is desirable because gas is a strategic fuel used widely for power generation and by industry. The wood fuel option for fireplaces provides an opportunity to conserve natural gas and divert the petroleum resources used for LPG production consumed in fireplaces for other purposes. Furthermore, in some cases, gas is not realistic or economical.

It has been estimated that around 40 percent of households in the U.S. are not connected to natural gas. In some areas, notably in parts of New England, natural gas is not available. LPG can be used when natural gas is not available, but it is more expensive than natural gas and less environmentally sound when all the steps necessary to produce and deliver it are taken into consideration.

So, what’s the answer – woodburning fireplaces or gas fireplaces? Certainly strong arguments can be made

for both positions. Here are some facts to consider.

**The Numbers**

There are currently 46.2 million fireplaces in households nationwide, including both vacant and occupied homes. (See Figure 1.) According to U.S. Census Bureau data, over the last

burning fireplaces report using manufactured wax/sawdust firelogs rather than cordwood some of the time, and 12 percent report using them exclusively. Many woodburning fireplaces without inserts are never used in a given 12-month period. Most that are used are used for aesthetics, some are used for supplemental heating sources, and a small percentage are used as a main heating source. It should be remembered that there is a gray area between aesthetic use and supplemental heating use – after all, no one uses a fireplace to cool their home. (See Figure 2.)

**The Demographics**

The South has the largest number of fireplaces – 12 million (2001, occupied units). The West, while it has fewer fireplaces (10 million), has the highest per capita fireplace percentage (44% compared to 32% for the South). The Northeast has both the smallest number of total fireplaces and the lowest per capita percentage (5 million total with a per capita value of 26%). The Midwest falls in

between with seven million total fireplaces representing 29 percent of the households.

The number of new homes built annually with fireplaces shows the same trend by region as the total number that are already in homes, with the highest number being installed in the South and the fewest in the Northeast. (See Figure 3.) While only a relatively small fraction of woodburning fireplaces without inserts are used as a main heating source, many that are, are located in the Southeast.

The percentage of homes that use fireplaces for supplemental heating is higher in suburban and rural areas than in cities or towns. This is important in both an environmental and energy sense because the amount of wood burned in fireplaces being used for supplemental heating is far larger than any other category. Wood burned for supplemental heat in fireplaces is about six times greater than the amount of wood burned for aesthetic reasons and many times greater than for the few fireplaces reported to be used as a main heating source. U.S. EPA-sponsored research conducted by OMNI has shown that, on average, 0.66 cords of wood per year are burned in fireplaces used for heating purposes,

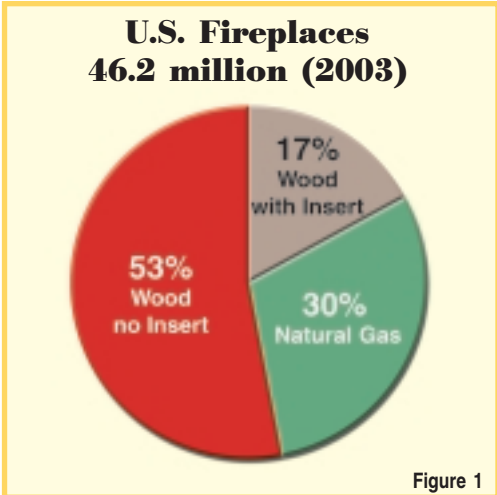


Figure 1

10 years an average of 710,000 fireplaces were installed annually in new construction. It has been estimated that somewhere around 30 percent of existing fireplaces are gas-fired units. (Some argue the number is actually closer to

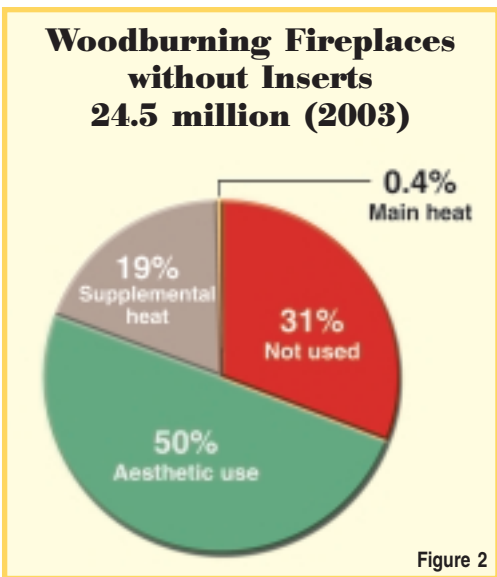


Figure 2

20%.) About 17 percent of the fireplaces have woodburning inserts installed in them so that they can be used as a real heat source. Thirty percent of home occupants with wood-

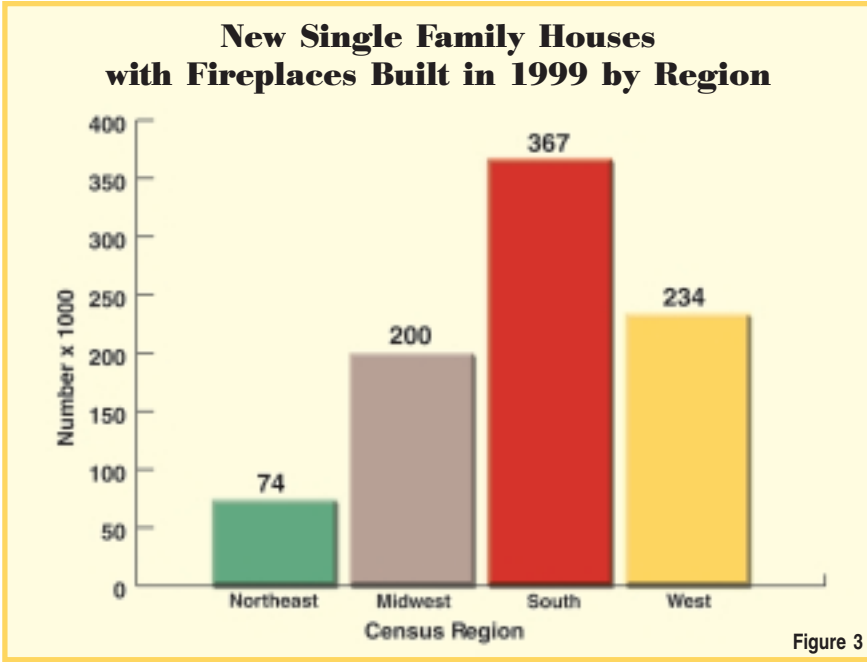


Figure 3

whereas only about 0.07 cords of wood are burned in fireplaces used for aesthetic purposes. (See Figure 4.)

It should be no surprise that the installation of new fireplaces is more prevalent in higher cost homes. In 1999, the average sales price of a new one-family home in the

U.S. was \$195,800. The average sales price of a one-family home with a fireplace was \$208,200 compared to the average sales price of \$147,500 for a one-family home without a fireplace. The average sales price of a new one-family home with two or more fireplaces was \$370,000. Interestingly, 22 percent of new one-family homes that cost more than \$300,000 have two or more fireplaces compared to about two percent for new one-family homes that cost less than \$300,000. (See Figure 5.)

**The Future**

It is clear that the installation of gas fireplaces in new homes has become far more common in the last decade. The trend can be seen by using as an indicator of fireplace installation the number of households that report using gas or woodburning fireplaces as supplemental heating sources in Energy Information Administration surveys. (See Figure 6.)

For homes built between 1980 and 1989, only 3.3 percent reported using gas fireplaces for supplemental heating and 11.4 percent reported using woodburning fireplaces for supplemental heating. For homes built between 1990 and 2001, the number that reported using gas fireplaces for supplemental heating increased to 7.8 percent,

and the number that reported using woodburning fireplaces declined slightly to 11.1 percent.

While the use of fireplaces for supplemental heating is an inexact indicator of new installation numbers, primarily because home occupants are more likely to use a gas fireplace for supplemental heat rather than a woodburning fireplace because of its convenience, the data do show an interesting fact. If the same trend seen in the last decade continues through the next decade, by the year 2010 the number of households using gas fireplaces for supplemental heating will surpass the number using woodburning fireplaces for secondary heating.

This is significant because, as previously noted, most cordwood burned (with associated air emissions) is consumed in fireplaces used for secondary heating. The character of future energy demands for fireplace usage will change, as will air quality impacts.

### The Environment

The differences between the perceived air impacts from woodburning fireplaces and gas fireplaces is, to a large extent, the difference between local versus regional/global concerns. Fireplace emissions, unlike emissions from most industrial smokestacks, enter the atmosphere at near ground level (15 ft. to 35 ft.) in residential areas. Woodburning fireplaces have high fine particulate and carbon monoxide emissions and emit a number of organic compounds that are reported to be injurious to health. These compounds are often referred to as “air toxics” and include formaldehyde, phenol, benzene, polycyclic organic material (POM) and dioxins.

### Supplemental Heating with Fireplaces by Location (2001)

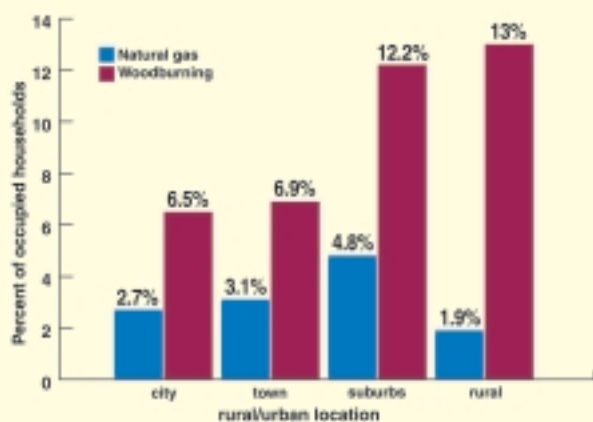
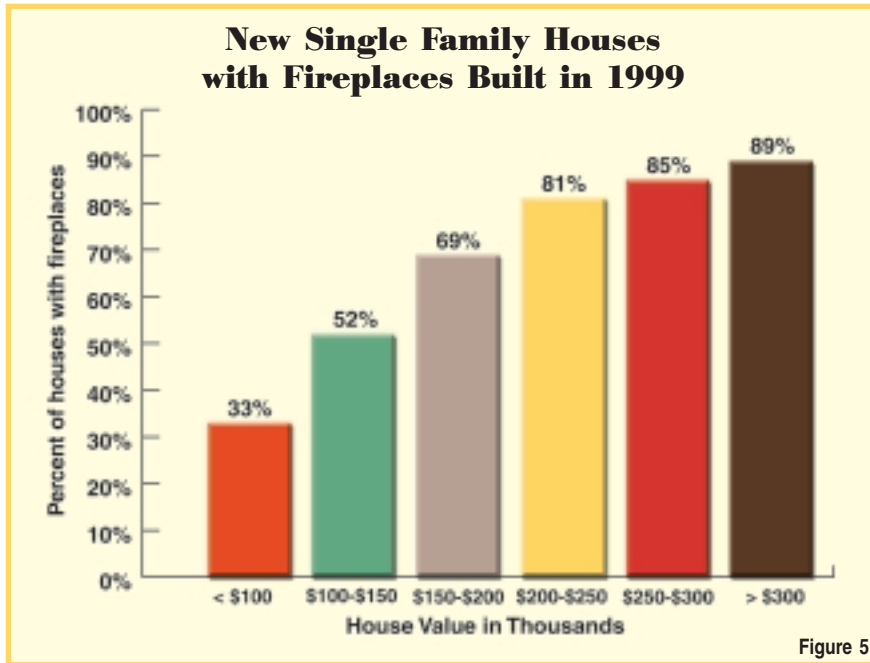


Figure 4

The need to meet federal requirements for localized atmospheric concentrations of particles has driven most regulations regarding the use of woodburning fireplaces. More specifically, compliance with the federal  $PM_{10}$  particulate standard has been the biggest “driver” so far. In the future, it most likely will be compliance with the newer federal  $PM_{2.5}$  particulate standard.

Gas fireplaces have much lower particulate, carbon monoxide and air toxics emissions than woodburning fireplaces. However, because there are numerous steps needed



to deliver a unit of gas to a home fireplace, the bigger picture needs to be taken into consideration when evaluating their total air emissions.

For natural gas, this includes extraction, processing, compressor stations and leakage. For LPG, it includes extrac-

tion, a number of petroleum refining and processing steps and transportation. The bottom line is that when all steps are taken into consideration, gas fireplaces have a larger impact on acid precipitation and greenhouse gases than woodburning fireplaces.

Not only are the various sources of air emissions for gas fireplaces dispersed geographically, i.e., spread out, making concerns less localized, but also acid precipitation and greenhouse gases are not local, but regional and global issues, respectively.

Several other air quality points need to be considered when comparing gas and woodburning fireplaces.

1. Extensive work done by OMNI and others has shown that significant reduction in air emissions can be achieved with standard woodburning fireplaces by using manufactured wax/sawdust firelogs in lieu of cordwood.

2. Gas fireplaces do produce particles, but the majority of these particles are produced by the reaction of fireplace exhaust

gases with pollutant gases from other sources in the atmosphere. These are called "secondary" particles in contrast to the "primary" particles emitted directly from chimneys.

3. The replacement of mature trees that have been harvested for fuel with new trees provides a greenhouse gas

### Percent of Homes with Fireplaces That Are Used for Supplemental Heat

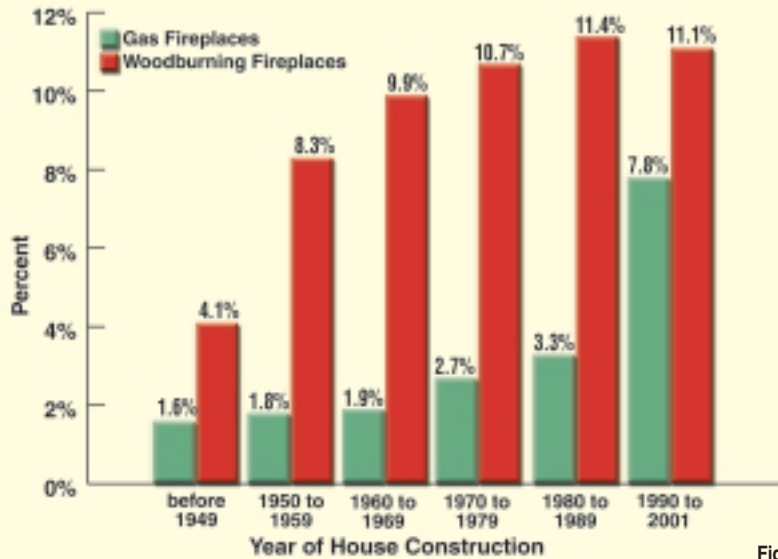


Figure 6

“credit” for woodburning fireplaces because younger trees photosynthesize more rapidly than more mature trees, thus removing more carbon dioxide (greenhouse gases) from the atmosphere.

4. Vent-free gas fireplaces have been the subject of indoor air quality concern as they vent combustion gases and prod-

ucts of incomplete combustion directly into the living space.

#### The Appliances

There is a potpourri of fireplace appliances and accessories. The major categories of woodburning fireplaces are factory-manufactured zero-clearance fireplaces, factory-manufactured freestanding fireplaces and site-built masonry fireplaces. Most fireplaces are factory-manufactured zero-clearance fireplaces. Factory-manufactured freestanding fireplaces represent at most a few percent of the total woodburning fireplaces.

It has been estimated that about 20 percent of existing woodburning fireplaces and 10 percent of fireplaces installed with new construction are masonry. Some of the masonry fireplaces have specially shaped fireboxes to focus infrared radiation and to reduce emissions. Some masonry fireplaces have hollow metal tubes in them or hollow metal jackets around them to allow for

air to be heated and convected for room heating.

There are a number of specialized grates for use in woodburning fireplaces. There are grate systems that force air into the fire to enhance combustion and reduce emissions. There are grate systems available which facilitate the

ignition of the fuel with gas. There are grates with bar spacing less than three inches to optimize manufactured wax/sawdust firelog performance, and there are grates that are hollow, allowing for the heated gases to be blown into the room or to enter the room passively through convection.

The major categories of gas appliances are B-vent, direct-vent and vent-free. Most are direct-vent units. Free-standing gas fireplaces are available, but they are essentially gas stoves. Most gas appliances can be manufactured to burn either natural gas or LPG with minor component changes.

An existing woodburning fireplace can be converted to natural gas with a gas firelog set, or a B-vent, direct-vent or vent-free insert can be placed into the fireplace. Again, these can be made to burn either natural gas or LPG. A woodburning fireplace can also have a pellet or woodburning insert placed in it, turning it into a wood heater. The cordwood insert can be either catalytic or non-catalytic. Those sold after July 1990 have to be certified by the U.S. EPA for low emissions because they are essentially a

wood stove fit into a fireplace cavity.

Two other allied appliance types with low air emissions are EPA fireplaces and masonry heaters. The term EPA fireplace is used for an EPA-certified wood stove made to look like a fireplace. EPA fireplaces are sometimes called "high-tech" fireplaces. They are much more expensive than a typical factory-manufactured fireplace and few, compared to true wood-burning fireplaces, are sold.

Masonry heaters, while superficially resembling a masonry fireplace, are quite different. They are designed to burn a large amount of wood over a short time period, which heats a large thermal mass facilitated by a folded chimney path. They are more expensive than a typical masonry fireplace and, according to the Masonry Heater Association of North America, only about 12,000 have been installed in North America, with about 900 new units being installed annually.

### The Affected Parties

A complete socioeconomic analysis of the wood versus gas fireplace option would be staggering and, quite frankly,

boring to most readers. Most products have manufacturers, distributors and dealers involved. Masonry fireplaces, of course, require masons and masonry supplies. Besides fireplaces themselves, and their associated chimneys and accessories, chimney sweeps and various fuel suppliers are affected.

According to the National Chimney Sweep Guild, there are an estimated 6,000 chimney sweeps in the U.S. Based on interviews with certified chimney sweeps, it is estimated that about one-third of a chimney sweep's business is typically for wood-burning fireplaces, the remaining portion for wood stoves.

In 1999, there were about 3.4 million cords of wood consumed in fireplaces in the U.S. and about 260,000 tons of wax/sawdust firelogs sold. It should also be remembered that, for an insert or gas log set to be sold, a woodburning fireplace must have been installed in a home.

Affected Parties are involved in the following primary products and services. Secondary products and services, such as the chain saw required to harvest cordwood or the additional

compressor needed for natural gas supply for increased gas fireplace use, are not included.

**Primary Products & Services**

Gas fireplaces	Woodburning fireplaces
Pellet inserts	Gas inserts
Woodburning inserts	Gas log sets
Masons	Masonry supplies
Chimney supplies	Fireplace accessories
Bulk cordwood	Bundled cordwood
Manufactured firelogs	Chimney sweeps
Natural gas utilities	LPG suppliers

**The Answer**

So what's the answer to the question – Woodburning or Gas Fireplaces? We don't have an answer. In fact, most likely there will never be an either/or answer. Many members of the public and of the hearth community will be affected in the most fundamental of ways. While, on the one hand, so much attention to fireplaces seems trivial in the scheme of things, on the other hand, one must remember more than one-third of all households have a fireplace and more than one-half of new single family homes will have a fireplace.

Whether we like it or not, most of us are impacted in our homes, in our neighborhoods, or at our business. There are national energy ramifications. Business and personal finances are affected. There are livelihoods at risk, and there are serious health and environmental issues to be balanced.

---

*The authors: Dr. James E. Houck is the president of OMNI Consulting Services, which conducts design, environmental and marketing research with fireplaces, combustion equipment and fuels. Paul Tiegs is a professional engineer and president of OMNI-Test Laboratories, which is accredited to conduct emissions and safety testing on home heating appliances. Both authors have had over 25 years experience in the hearth field.*

