Gas-Fired Air Conditioning

by Martin Holladay

Most new homes use natural gas or propane for space heating and domestic hot water. But few residential builders realize that gas can also be used as a fuel for air conditioning. Although residential gas-fired air conditioners make up only a tiny percentage of the market, interest in them is increasing, especially in California, where power shortages are spurring attempts to reduce electrical demand.

Gas-fired air conditioning is not a new technology. The heyday of gas-fired chillers was in the 1960s, when appliance manufacturers, including Whirlpool and Bryant, sold 75,000 units a year. But in the late 1960s, natural gas shortages led to a moratorium on residential gas hookups, and the industry all but died. Now there is only one U.S. manufacturer of residential-sized gas-fired air conditioners: the Robur Corporation of Evansville, Ind. (888/785-2665; www.robur.com). Robur manufactures two models (a three-ton and a five-ton unit) under the Servel brand name. Another company, Cooling Technologies of Toledo, Ohio (419/536-9006; www.coolingtechnologies.com), hopes to begin production of a five-ton gas-fired absorption chiller later this year.

Robur Corp.

The Servel five-ton air conditioner, which burns either natural gas or propane, has only one moving part, a diaphragm pump.

How Do They Work?

Robur's gas-fired air conditioners use the ammonia-water absorption process, a refrigeration cycle that has been known for over 140 years. Unlike electric air conditioners, absorption units have no compressor, so they operate quietly, require little maintenance, and are very durable.

There are four basic parts to an absorption chiller: a generator, a condenser, an evaporator, and an absorber. In the generator, an ammonia-water solution is heated with a gas flame, causing the ammonia to be driven off as vapor. The ammonia gas passes into a condenser, where it cools to a liquid. The liquid ammonia, which is still hot and under high pressure, then shoots through an orifice into a low-pressure vessel called the evaporator. In the low-pressure environment, the ammonia expands, boils at a temperature of 40°F, and absorbs heat from tubes of circulating water, chilling the water. (The chilled water circulates to a fan-coil unit to provide cooling.) The ammonia gas travels to the absorber, where the weak ammonia solution reabsorbs the ammonia gas. The strong ammonia solution then returns to the generator, where the cycle begins again.

Advantages. According to proponents of the technology, a gas-fired absorption unit has several advantages over an electric air conditioner. It's quieter, for one thing, and can be located farther away from the house. "Since you're moving chilled water into the home, the air conditioner doesn't have to be under your bedroom window," says Gordon Broberg, West Coast regional sales manager for Robur. "You can move it to the back corner of your lot."

These units are also more durable. "You've only got one significant moving part, a small diaphragm pump," says Bill Ryan, a senior engineer at the University of Illinois in Chicago. "We still see units from the 1960s behind people's houses."

A gas-fired unit is more environmentally friendly. "Ammonia has always been an ozone-friendly refrigerant," says Ryan. "Any ammonia released into the atmosphere is swept down by rain as fertilizer."

Finally, zoning is simpler with gas-fired air conditioning than with conventional electric.

Electrical Shortages Spur Interest

In California, inquiries about gas-fired air conditioners are increasing. "My phone is ringing a lot, and interest is up significantly," says Broberg. Even with the recent increases in natural gas prices, it still costs less to operate a gas-fired air conditioner than an electric one. Most gas utilities offer reduced rates during the summer, when electric rates are often highest. "Right now, for a large residence in Southern California, it costs about 50 percent more to run an electric air-conditioning unit than a gas-fired unit," says Broberg.

What's the catch? Although gas-fired air conditioners save on operating costs, they're expensive to install. "You're probably looking at double what an elec-

tric unit would cost," says Rick Halbig, Robur's national sales manager. Robur sells more five-ton units than three-ton units. "Most of our residential applications are in large custom homes," says Halbig. "Generally, a three-ton unit is used in a smaller 1,500- to 1,800-square-foot house. That end of the market is usually very price sensitive."

Multi-Zone Systems

With electric air conditioning, providing effective zoning in a large home often requires the installation of two or three AC units. But since an absorption air conditioner delivers chilled (44° to 45°F) water, the systems are easy to zone. Insulated pipes (generally 1/2-inch to 1-inch pipes) can deliver chilled water to individually controlled fan-coil units, which can be wall-mounted or installed between floor joists. "It's cheaper to run insulated chilled piping than to run ductwork," says Broberg.

Mike Collins, owner of Collins Construction in Hemet, Calif., is an experienced installer of gas-fired chillers. "I helped install some units at a YMCA day-care center in Redlands, Calif.," says Collins. "For each zone, we installed a separate fan-coil unit, the kind you mount up on a ceiling with no ductwork. We piped the chilled water with copper. Each fan-coil unit got a 1/2-inch line." Collins is impressed with the versatility of gas-fired systems. "A regular electric five-ton unit will always blast five tons of air conditioning. But with a gas-fired chiller, you can provide cooling only when and where you need it."

Reality Check

Other installers are less enthusiastic. Village Green, a 186-unit residential project in Sylmar, Calif., is cooled with Robur gas-fired chillers. "The chillers are working," says Jay Stark, director of development at Lee Homes, one of the builders of Village Green. "But the technology is very sensitive — it needs to become a little more robust. We had trouble getting the units up and running, and they needed to be tinkered with a lot. We're not using them at any other projects at the moment."

Future developments. Several manufacturers are currently working to improve gas-powered chillers. "You have to realize that the current units were designed in the 1950s, when they were the state-of-the-art technology," says Donald Erickson, president of Energy Concepts, a research company in Annapolis, Md., that is developing new absorption chillers. "The two primary things we're working on are making the cycle more efficient and making the units less expensive."

Researchers anticipate that the next generation of gas-fired air conditioners will include a heat-pump cycle for winter heating. "Absorption units hold great promise as heat pumps," says Ron Soka, president of Cooling Technologies. "Because of the heat of absorption, which occurs when the ammonia and water go back together, you can get heat-pump efficiencies of 1.5. You get more heat out than the raw energy you put in."