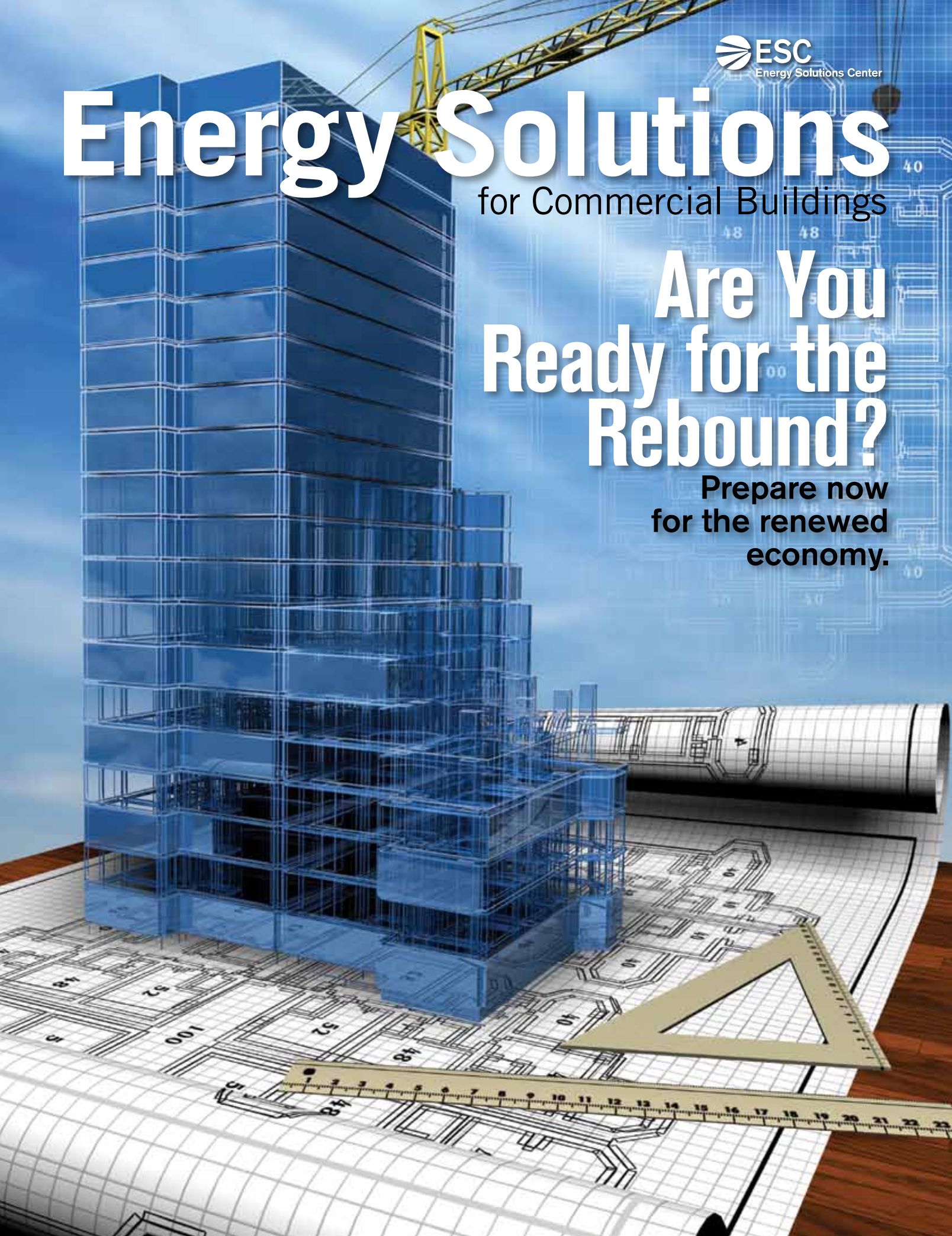

ESC
Energy Solutions Center
Energy Solutions
for Commercial Buildings
Are You Ready for the Rebound?
Prepare now for the renewed economy.

ESC Energy Solutions Center

TABLE OF CONTENTS

Energy Solutions for Commercial Buildings is a trademark of Energy Solutions Center, and is published in cooperation with PRISM Media Group. We offer our special thanks to the utilities and other businesses that sponsor this issue.

Please recycle this magazine after you read it.

prism MEDIA GROUP

President Ray Larson
Group Publisher Lori Harvey
Managing Editor Paula Felps
Production Manager Pete Adauto
Graphic Designer Nancy Kekich
Contributing Writers Cindy Baldhoff, Jake Delwiche, Tonya McMurray, Molly Petrilla

ENERGY SOLUTIONS FOR COMMERCIAL BUILDINGS is published by PRISM Media Group, 1830 Lakeway Drive, Lewisville, Texas 75057. Visit www.prismmediagroup.com. No part of this publication may be reprinted without permission. © 2011 Energy Solutions Center.

A Rosy Future

The prospects are looking up for natural gas supply and price.

January 2006. The country was still reeling from hurricanes Katrina and Rita. Natural gas supply was the lowest it had been since the late 1970s. And natural gas prices had soared almost 40 percent in only a year.

Compare that to the far rosier natural gas landscape in January 2011, when prices were 50 percent lower than those in 2006—despite it being one of the coldest Januaries in more than 15 years.

So what changed in the last five years? It all boils down to one word: supply.

One of the biggest issues back in 2006 was the hurricane damage experienced by on- and off-shore natural gas production and processing sites in the U.S. As a result of that damage, about 14 percent of domestic natural gas production was incapacitated, according to a report from the American Gas Association (AGA). The U.S. also lacked needed natural gas reserves.

"Compared to five years ago, one big development we've seen is a decidedly more domestic resource base," says Chris McGill, managing director of policy analysis at the AGA. In addition to repairing the hurricane-ravaged facilities, the United States has begun to rely more heavily on domestic shale gas production, which has been rising steadily over the last few years, instead of depending upon imported gas. In fact, gas production from shale alone increased from about 2.5 billion cubic feet (bcf) per day in 2006 to more than 12 bcf per day in 2010. As the AGA report puts it: "Enhanced domestic production, coupled with pipeline imports from Canada, has created a decidedly North American solution to meet the needs of consumers."

As a result, predictions for supply levels in the future are equally optimistic and supply levels are expected to remain steady. According to the AGA's report, estimates of total gas resources

Potential Gas Committee Determination of Future Supply of Natural Gas in the United States

	DOE Reserves	+ Traditional Resources	+ Coal Gas =	Future Supply	+ Cumulative Production =	Ultimate Resource
1990	169	855	147	1,172	777	1,949
1992	165	854	147	1,166	815	1,981
1994	164	881	147	1,192	853	2,045
1996	166	921	146	1,234	893	2,127
1998	164	896	141	1,202	933	2,134
2000	177	936	155	1,268	973	2,241
2002	187	958	169	1,314	1,013	2,327
2004	193	950	169	1,312	1,053	2,364
2006	211	1,155	166	1,532	1,091	2,623
2008	238	1,673	163	2,074	1,132	3,206

Source: *Potential Supply of Natural Gas in the United States, December 31, 2008,* Potential Gas Committee

have grown 77 percent, which would be enough gas to meet current demand levels for at least 100 years. Another report from the AGA states that "for most of the past 30 years, messaging around natural gas supply…has often been negative with outlooks reflecting shortages and domestic production reductions. In fact, for many years promoting natural gas as a long-term solution within our national energy supply mix was simply considered to be irrational. Today, that view has changed. Natural gas is abundant in North America."

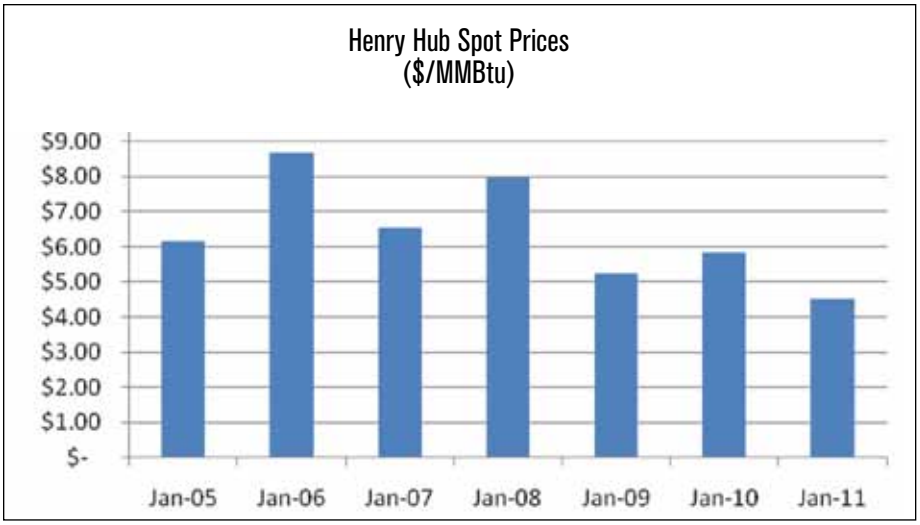
Dollars and Cents

That covers the supply half of the equation, but what about the equally important issue of pricing? There's good news there, too, both in the short- and long-term.

"The key word I would use around pricing for the [natural gas] market is 'stability,'" McGill says. According to McGill, all indicators point toward current prices and those in the next two years staying in the $4.25 to $5.50 (per million BTU) range. "In the history of natural gas pricing, that's not the lowest price," he adds, "but it is very stable compared to what we've seen in the past."

He also noted the price is much lower than it has been in recent years.

"If you compare 2011 projections to those of 2010 or 2009 or 2008," McGill says, "the price of natural gas is significantly less than those previous projections."



Source: Energy Information Administration

What's Ahead?

Looking farther forward, McGill says the current outlook to 2035 in 2009 dollars ranges from $5 to $7 per million BTU. "Compared to history," he adds, "that's a measure of relative stability, and it reflects a very strong gas resource position."

Of course, there's one more aspect to consider when thinking about the future of both price and supply in the future: demand. Currently, McGill says, "we're slightly supply-long compared to the demand for natural gas overall." Looking forward, "supply-demand balance is what will lead to continued price stability," he adds. "The two things that could change the price outlook would be [either] some sort of impediment to the supply curve or some extraordinary increase in demand."

All things considered, McGill says, "our view of the current market is one in which we see a strong supply position, a growing demand position, and relative acquisition-price stability. There have been tangible benefits to consumers because of this, and we see it as something that will continue."

In other words, the news is good all around.

FOR MORE INFORMATION

AMERICAN GAS ASSOCIATION www.aga.org
AMERICAS NATURAL GAS ALLIANCE www.ANGA.us

Reconsidering Cogeneration

It's time to take a second look at co-generation as a lasting solution.

Natural gas-fired cogeneration is an idea that many building operators considered back in the 1980s, but oftentimes chose another energy solution for their commercial buildings. Whether it was due to concerns about system cost, reliability, or simply that, back then, cogeneration was too new an idea, it was often overlooked. Today, things have changed, and it's time to give cogeneration a second look.

Cogeneration – often called combined heat and power (CHP) – is a widely accepted energy solution. Systems today are packaged to simplify startup and operation. Maintenance intervals have been extended and equipment reliability has been enhanced.

The concept is this: Typically electricity is generated on site using either reciprocating engines or microturbines. Even with today's highly efficient engines and turbines, a major amount of the energy used is converted to waste heat. But it's only waste heat if you waste it!

The heat can actually be a valuable byproduct. Unlike most central-station generating plants, cogeneration sites can use this byproduct heat for a variety of uses, including space heating, water heating, laundry, food service steam and hot water, pavement ice melting, or even to supply an absorption cooling unit. With full utilization of the heat, cogeneration plants are showing energy efficiencies of 80 percent and more.

The key to a successful cogeneration installation is using the heat effectively through most of the operating hours of the generating unit. Usually, the best approach is to size the cogeneration system to the thermal requirements of the facility, and to purchase additional electric energy to meet the full electric requirement. The U.S. Department of Energy offers a CHP tool to help owners select and operate the right sized system. The tool can be used to size or select design parameters for a new system or to modify a system in use.

Examine Energy Usage Patterns

Results from an analysis by a qualifed consulting engineer should include the estimated payback period for the application based on the fuel and electricity rates, costs of the turbine, including engineering and installation and annual maintenance costs of the system. DOE recommends that owners look carefully at the ways and hours during which they are currently buying energy for thermal purposes, and then calculate the appropriate sized unit. An experienced engineering consultant can help with this process.

The Oregon Health Science Center is equipped with five Capstone microturbines, supplying both electric power and hot water.

Manufacturers of gas turbines and engines are completely aware of the heat utilization process and have equipment designed for this specific application. The byproduct heat from microturbines and from reciprocating engines is extracted, then heat exchangers collect this waste heat and transfer it to the building's circulating water heating system and hot water system.

High Potential for Turbine Heat Recovery

Microturbines use the combustion exhaust to generate hot water or even steam for building use. Microturbine exhaust temperatures can be as high as 600 degrees Fahrenheit (316 degrees Celsius) and have significant potential for high-grade heat recovery. According to Jim Crouse, vice president, sales and marketing for Capstone Microturbines, the interest in microturbines is growing in the commercial sector.

"Natural gas prices are relatively low and it appears they will stay there for the foreseeable future," he says. "Energy efficiency is a growing priority for many

businesses and institutions. A lot of CHP systems are being installed for swimming pools, hospitals and other applications where there is a sizable thermal load."

Multiple Microturbines the Norm

Crouse notes that many of the new installations feature multiple units being installed on a site. "Microturbines are easy to connect together, and the turbine exhausts can be manifolded into a single heat exchanger. This simplifies the installation." He adds that with multiple units, it is easy to temporarily take individual units out of service for inspection or maintenance without losing the thermal source.

Microturbines are available in sizes from 30 kWe, to 200 kWe. Crouse notes that installations of multiple units is common, and can supply up to 100 percent of a facility's thermal and electrical needs. In addition, owners benefit from having an on-site source of standby energy in the event of an area utility power outage.

Hotel Pleased with Energy Savings

The Four Seasons Hotel in Philadelphia is a five-star luxury facility in the central part of the city. In October 2009, the hotel installed three 65 kWe Capstone microturbines on the rooftop of the eight-story building. Before this installation, the hotel relied heavily on purchasing steam from a central steam loop and the local electric grid to meet its energy needs. Today, the hotel uses natural gas to meet much of its own electrical and thermal energy needs.

According to Marvin Dixon, the hotel's director of engineering, the electricity supplied costs 20 percent less than utility power. "Instead of dumping rejected heat into the atmosphere, we can reuse it. The first two months of operation we saw a cost avoidance of over $80,000," Dixon says.

The system supplies 100 percent of the hotel's domestic hot water needs, 30 percent of its electric needs, and 15 percent of its needs for building heat.

At only 65db at 10 meters, the system is very quiet, and the units fit within a 37 square meter footprint. "Four Seasons is a leader in the community and accustomed to setting the standard for future generations," Dixon says. "The microturbine installation is a step in the right direction in helping Philadelphia become a more sustainable city."

Engine Sets a Popular Solution

Another widely used approach is the use of natural gas-fired engine generator sets. Today's engine generator sets are designed for continuous duty with longer service intervals and higher generation efficiencies than earlier equipment. At the small end of the scale, generator sets by Marathon Engine Systems rated at 2.5 and 5.0 kWe can also produce limited

This 620 Jenbacher engine-generator set is installed in a Coca-Cola plant in Romania.

quantities of hot water for washrooms, small-scale laundry operations, etc. Examples of mid-sized engine generator sets that are well adapted to cogeneration operations include GE-Jenbacher's family of engines that begin at 250 kWe and range upward to 4.4 MWe. Units are designed for continuous operation and can be equipped to extract heat for water heating from engine cooling water, oil coolers, and the engine exhaust stream.

Another important provider of mid-sized engine cogeneration equipment is Tecogen, which offers continuous-duty cogeneration units ranging in size from 30kWe to 650 kWe and currently services over 250 cogeneration units in the U.S. and Canada. According to Tecogen, the units have typical combined electric and thermal efficiencies of about 83 percent and offer site power security as well as operating cost savings.

Two Marathon Engines cogeneration units are installed in a multi-family residential building in the City of New York.

At the other end of the size scale of cogeneration sets are units such as those manufactured by Dresser Waukesha, a division of General Electric. Units range from 350 kWe to 4.0 MWe in a variety of engine types, and Waukesha has placed special attention on extending the service intervals, so many current engines do not require a top end overhaul for 16,000 hours or a major overhaul for 32,000 hours. Other manufacturers of engine-generator sets include Caterpillar at the large end of the scale, with systems from 2 MWe to 100 MWE.

Selecting and sizing a natural gas-fired cogeneration system requires good information on present and future thermal and electric loads, and decisions on whether you want to use microturbines or engine generator sets. A wide range of system types are available.

FOR MORE INFORMATION

CAPSTONE MICROTURBINES	www.capstoneturbine.com
CATERPILLAR	www.cat.com/engines
DRESSER WAUKESHA	www.dresserwaukesha.com
MARATHON ENGINE SYSTEMS	www.marathonengine.com
TECOGEN	www.tecogen.com

Keeping it Cool

Efficiency and cost savings fuel resurgence of natural gas air conditioning.

When people think about air conditioning today, they typically assume it is powered by electricity. But that hasn't always been the case, and the benefits of natural gas air conditioning are driving a renewed interest in it.

Over the last decade, gas-powered air conditioning has become more efficient and less expensive, leading consumers to rediscover gas cooling and humidity control. Initial up-front costs of gas air conditioning are still higher than electric systems, but when the life cycle costs are factored into the equation, natural gas emerges as the clear winner.

A gas cooling system results in lower operating costs, reduced electric demand charges and better air quality. Users typically see a 25 to 50 percent reduction in operating costs, and those lower costs translate into a quick payback (often within three to five years) on equipment purchases.

Significant advances in gas cooling equipment make for more reliable systems that require less maintenance. For example, a recently installed gas heat pump in a Plano, Texas, fire station is expected to run a minimum of 30,000 hours before needing an overhaul, said Greg Anderson, commercial marketing manager for Atmos Energy.

The 15-ton heat pump installed at Plano (TX) Fire Station No. 13 offers the opportunity to test the operating costs of gas vs. electric cooling. Energy use and cost at the station will be compared with that of another "twin" station using electric cooling technology.

Earth-Friendly Technology

Not only is gas air conditioning easier on the pocketbook, but it is also easier on the environment. Based on Environmental Protection Agency comparisons, natural gas is the cleanest fossil fuel available, emitting fewer harmful pollutants.

Gas cooling also helps stabilize the overtaxed electric grid by reducing electric demand at peak hours. This reduced demand means more grid reliability and millions of dollars in savings on transmission and distribution infrastructure upgrades. Because commercial and industrial customers typically pay electric penalty charges during peak summer

Gas cooling also helps stabilize the overtaxed electric grid by reducing electric demand at peak hours. This reduced demand means more grid reliability and millions of dollars in savings on transmission and distribution infrastructure upgrades.

months, a gas-powered system also saves money.

Gas-Powered Cooling Technologies

Consumers have several options for gas-powered cooling. In absorption cooling, a thermal compressor replaces the traditional electric compressor, providing more efficiency and lower operating costs. Absorption technologies can use natural gas, oil, hot water, waste heat from another process, or some combination of fuels for flexibility. Some absorbers provide simultaneous heating and cooling, and they range in size from residential to industrial units.

Absorption units are often integrated into cogeneration or Combined Heat and Power (CHP) systems. Conventional power generation converts an average of one-third of a fuel's potential energy into electricity, giving off substantial heat. A CHP system captures this heat, achieving efficiencies of up to 75 to 85 percent.

Heat pumps can both heat and cool, and are available in absorption or engine driven based systems. Heating and cooling input temperature is managed better, allowing more precise adjustments to comfort and increasing efficiency.

The Big Chill

Natural gas engine-driven chillers, in which a natural gas engine replaces the electric motor, provide even greater efficiency. The engine-driven chiller sends a stream of chilled water to individual air coils to cool and dehumidify the air.

Ranging in size from 50 to 400 tons, engine-driven chillers have excellent part-load performance and can usually run at 20 percent of their rated capacity without losing efficiency. Customers can recover waste heat off the engine for use elsewhere in the building.

The efficiency and lifetime cost of the gas chiller led contractor BT Lindsay & Co. to recommend it for a Meridan, Connecticut, Response Insurance facility. The projected energy savings and lower operating cost sold the customer on gas technology, said Brian Cullinane of The Clover Corp., the East Hartford, CT HVAC wholesale distributor that supplied the 200-ton TECOCHILL chiller.

With an incentive to help offset equipment costs, Response Insurance was able to see savings quickly and is pleased with the operating cost of the unit, Cullinane said.

Gas-fired heat pumps also offer greater efficiency to the cooling market. Heat pumps can both heat and cool, and are available in absorption or engine driven based systems. Heating and cooling input temperature is managed better, allowing more precise adjustments to comfort and increasing efficiency.

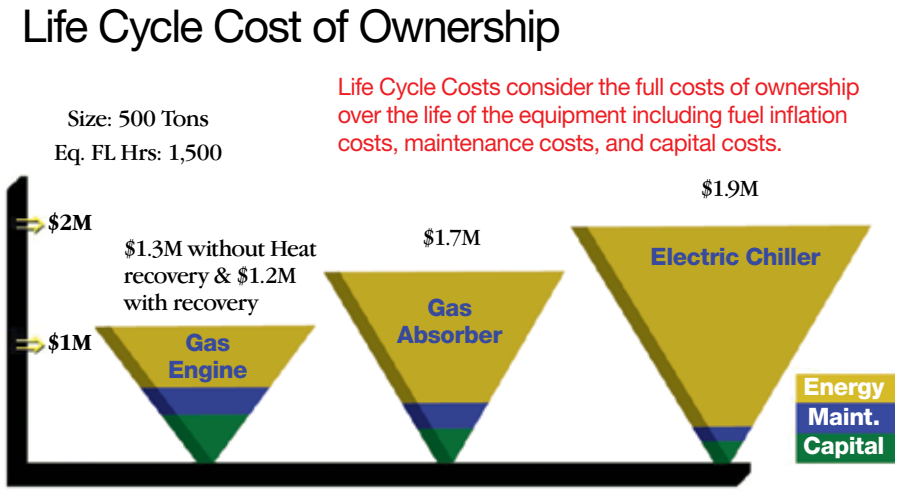
That efficiency was a large determining factor when the Plano Fire Department decided to put gas heat pump technology to the test with its new fire station. The city's lead engineer recommended installing a gas heat pump to conduct a head-to-head test with an electric heat pump installed in an almost identical fire station built last year.

The 15-ton gas heat pump installed in May is one of the first gas heat pumps in Texas and provides a unique opportunity to test the advantages of gas-powered cooling, said Atmos Energy's Anderson.

Once Plano Fire Station No. 13 is commissioned for service in September, the city will monitor energy at the two fire stations for the coming year to gather data about operating costs for each system. Anderson said the city expects a 90 percent reduction in electricity demand and hopes to see a reduction in overall energy use. However, he said, even if energy use remains the same, there will still be a significant cost reduction because of the lower cost of gas.

A Promising Future

As the public learns more about the lower carbon footprint of natural gas and as building owners, operators and engineers more carefully evaluate the life cycle cost, gas-powered cooling may once again rival their electric counterparts.



Reduced energy costs, increased efficiency, and greater reliability result in lower lifetime costs for gas cooling equipment.

FOR MORE INFORMATION

To learn more about the benefits of gas air conditioning, go to www.gasairconditioning.org

Degrees of Difference

Humidity control can cut operation costs and absenteeism while improving occupant comfort.

Humidity control does more than make an environment more comfortable for its occupants. It can also reduce absenteeism, increase productivity and slash overall healthcare costs. As more and more building owners become aware of the need for better indoor environmental control, and recognize the true value of indoor air quality, humidity control is becoming crucial from both an economic and health standpoint.

"Humidity indoors is a comfort issue; if there's too little, the air is dry and we are more vulnerable to nosebleeds and viral infections," explains Dr. Charlene Bayer, principal research scientist at Georgia Tech Research Institute in Atlanta. Dr. Bayer co-authored a study, "Report Card on Humidity Control" for ASHRAE.

"If it's too humid you feel much warmer. You can have the same temperature at a high humidity and feel much worse than you would with that same temperature with controlled humidity," she says. "But the biggest problem humidity causes indoors is it increases the potential of mold growth."

Mold growth can, in turn, create other problems, including respiratory ailments. Dr. Bayer's landmark study, conducted with John C. Fischer, a technology consultant at SEMCO in Columbia, Mo., outlined the effects of poor humidity control on America's schools. Their study found that the majority of schools – and particularly those in hot and humid climates – use packaged cooling equipment which is incapable of effectively managing humidity. The result, it found, was occupant discomfort and mold growth leading to, among other problems, respiratory illness. Together, all of these negative factors affected the students' ability to learn and were identified as a major contributing factor to the increase in childhood asthma.

"That's why I'm a proponent of maintaining proper humidity, and we have the technology to do it," Dr. Bayer says. "What we found in the schools was that when the humidity wasn't controlled, the facilities tended to run the buildings about two degrees colder to reach the same comfort level."

Those two degrees can translate into several thousands of dollars annually spent on electricity to cool the building.

"People don't realize how much a couple of degrees can make a difference," Dr. Bayer says. "If you can maintain humidity very close to 50 percent – where people are most comfortable – you can actually move the temperature up a little in the summer and down in the winter and still keep people comfortable – while saving money."

That's because cold air does not hold as much moisture as warm air, explains Gary L. Berlin, vice president of sales at Nortec – Walter Meier.

"In the winter when the cold outdoor air infiltrates a building, the indoor humidity becomes lower," he explains. "A humidifier is designed to add moisture to the indoor air and maintain the warmer air at a more comfortable indoor relative humidity."

Dangerous Side Effects

In addition to the potential for saving thousands of dollars in operational costs, properly monitoring and controlling humidity will inhibit mold growth, eliminating asthmatic and allergic reactions – not to mention eliminating the lawsuits that have become prevalent with mold-plagued buildings. A lesser known but very common side effect of high building humidity is the release of formaldehyde from pressed wood products.

"Pressed wood products, such as less expensive furniture, are made out of a formaldehyde-based resin, and the polymer always has a small amount of free formaldehyde in it," says Dr. Bayer.

Studies indicate that a high humidity environment can cause an increase in the release of formaldehyde. According to the Environmental Protection Agency, the presence of formaldehyde can cause watery eyes, burning sensations in the eyes and throat, nausea and difficulty breathing. It has been linked to cancer, fatigue, skin rash, severe allergic reactions and asthma. When coupled with the dangers of mold, it can create an environment that is uncomfortable at best and could be extremely hazardous to the long-term health of its occupants.

If that's not enough, Dr. Bayer also notes that insects are attracted to humidity, which means a building with a high level of humidity is a natural invitation to termites and ants.

While too much humidity is a big issue, too little humidity brings its own set of problems. Studies indicate that viruses such as H1N1 and influenza can live as long as 16 hours outside of the body in low humidity environments, while they rarely live more than four hours when a building is kept at proper humidity levels of 40 to 50 percent.

In a recent school study, research found that increasing the indoor relative humidity to 35 to 40 percent reduced absenteeism by 20 percent, according to Nortec's Berlin. "Basically, maintaining a proper relative humidity indoors reduces our chances of contracting colds, flu and pneumonia as well as reduces dry, itchy eyes and skin."

That directly relates to savings in healthcare costs, productivity loss and absenteeism, he says. "I think more and more building owners have become aware of the need for good environmental control and indoor air quality," Berlin notes.

A Simple Solution

The case for proper humidity control is clear-cut. Not only does it make the building more comfortable – which creates a positive and more productive environment – but it also has a direct effect on both the short-term and long-term health of its occupants. In addition, it can save facility operators the headache and expense of replacing furnishings, wall coverings and flooring as often, and it will further save money by saving the amount of energy used by the building.

With the recent emphasis on humidification several manufacturers are now producing natural gas fired humidifiers for commercial buildings. These new state-of-the-art products help maintain proper humidity levels. Research released in the ASHRAE school study found that schools using a natural gas fired humidifier system had, on average, 9 percent less absenteeism than those using a conventional system.

FOR MORE INFORMATION

NORTEC	www.humidity.com
ASHRAE	www.ashrae.org
SEMCO	www.semcohvac.com
GAS-FIRED AIR CONDITIONING EQUIPMENT	www.gasairconditioning.org

Boiler Basics

Adapting to new boiler technologies has many benefits for commercial buildings.

If there's one place where the "we've always done it that way" mindset won't work, it's with new boiler technologies for commercial buildings. Today's high-efficiency boilers are different, and require a change in thinking and often a change in boiler plant operations. Because of some of those changes, it just might mean doing things in a different way.

Timing is Everything

If your facility has an older boiler plant, it may be time to consider an upgrade. Older boilers often require increasing maintenance or have reliability problems. Your system may use oil or even coal as a fuel source and now has issues with emissions or fuel availability.

Engineering studies have shown that an upgraded boiler plant would operate at much lower cost. In any case, installing the right kind of high-efficiency natural gas boiler is an important decision. It's also important to understand that your operating practices may have to be upgraded as well.

This Circulatic® steam generator by Vapor Power International offers rapid response to changing loads and a turndown ration of up to 10:1 to minimize unit cycling.

Previous high energy costs may have been partly the result of shortcomings in the building's steam or hot water system. Boiler replacement is also an ideal time to improve the condensate return system, adjust or replace steam traps, insulate steam and hot water lines, and consider installing or improving heat recovery in the boiler blowdown system. All of these steps make sense for any steam or hot water system, and are especially important when commissioning a new main boiler plant.

Benefit from New Boiler Technologies

James Stein, an industrial gas engineer with Southwest Gas, suggests that owners consider choosing a natural gas boiler with a U.S. EPA ENERGY STAR rating. These units have an annual fuel utilization efficiency (AFUE) of 85 percent or greater. Stein points out that ENERGY STAR boilers typically have features such as electronic ignition, which eliminates the need for a pilot light, and new combustion technologies that offer greater heat extraction from the same amount of fuel. He adds that many are also designed for sealed combustion, allowing outside air to supply the burner, thereby increasing efficiency, reducing drafts and improving safety.

Stein also says that it is important for users not to just "assume" a boiler is sized correctly when replacing an older boiler. Because of building and process improvements, many times a smaller replacement boiler is better because it will cycle less frequently, thus operating more efficiently. Stein also points out that many earlier boilers were operated in a basic on-off pattern, but many newer boilers offer modulated firing to reduce cycling. The boiler should also be tuned to reduce excess air in firing. This both increases efficiency and reduces NOx emissions.

Today's packaged boilers, such as this Clayton unit, are very compact, allowing expansion of mechanical plant capacity in the same floor space.

Condensing Boilers Offer Highest Efficiency

Commercial buildings are increasingly choosing smaller condensing-type boilers, both for building heat and other hot water applications. The goal with a condensing boiler is to keep the temperature of the feedwater below the condensing point of water vapor in the boiler exhaust. In this way, the latent heat of vaporization in the combustion process is recovered, resulting in enhanced boiler efficiency. Condensing boilers offer efficiencies as high as 95 percent, a figure unimaginable in previous decades. Because of their extremely clean combustion process, natural-gas fired boilers are ideal for this condensing operation.

Stay in the Sweet Spot

To achieve the highest level of efficiency, the condensing boiler must be operated at a part-load efficiency "sweet spot" which can be considerably lower than with older boilers. In the past, many units were at their peak efficiency at 85 to 90 percent of full load. According to Alan Wedal, product manager-commercial boiler for Cleaver Brooks, "Many of today's modular units have better part load efficiency than at full load. Two units running at 40 percent could be better than one at 80 percent."

Value of Lower Feedwater Temperatures

If you've operated your system with a feedwater return of 165 degrees Fahrenheit (74 degrees Celsius) with a condensing boiler, you'll have to get that down to 140 degrees F (60 degrees C) or less to stay in the condensing range. In heating applications, that may require adding more radiation surface or simply making adjustments in heating unit controls. Some manufacturers offer boilers with a split return, allowing a separate stream of colder feedwater at the condensing end of the heat exchanger to achieve higher unit efficiency. This might be the portion of the feedwater stream where makeup water is being added.

Mix Boiler Types to Minimize Investment

Because of the additional expense involved in building boiler heat exchangers that can stand up to condensing boiler duty, it is sometimes most cost effective to choose a high-efficiency non-condensing boiler, or perhaps to have multiple units of which only one is a condensing type. Wedal explains, "The use of hybrid systems (a mixture of condensing alongside existing non-condensing boilers) can be very cost-effective. The condensing unit can also be sized to handle the lower heating needs in off-peak seasons."

Modern non-condensing boilers are far more efficient than older units because of better heat exchange design and better controls. Today's digital burner controls and direct-drive actuators eliminate the "control drift" that was common with older mechanical linkage controls, and allow boilers to achieve lower emissions of all types.

With increasing frequency, owners are replacing one or two large boilers with multiple smaller high-efficiency units. Because of their compact size, eight or 10 modular units will usually take up less floor space than two older boilers. Having multiple units makes it easier to operate the system at its peak efficiency. Redundant units add system reliability and allow units to come offline for maintenance without affecting building comfort or efficiency.

Controls are Critical

A key to multiple unit installation efficiency is having the right controls programmed by a technician who understands the system and your building's specific needs. Boiler manufacturers will give guidance on the appropriate operating cycles and control systems that are appropriate. The boiler control system can be tied to an overall building control system.

Another key to building efficiency is selecting the right sizes of boilers, not only for peak loads but for minimal loads as well. In the past, many commercial buildings needed to keep a large boiler hot and operating far below its optimal range to supply necessary steam or hot water loads in the non-heating season. A solution to this is a design with a small "summer boiler" or "pony boiler" for these non-heating periods. According to Richard Biljetina from the Energy Solutions Center, "Boiler manufacturers (see end of article) can help you select the optimum combination of equipment and controls for the highest in-service efficiencies, thus maximizing year-round energy savings. But it is important that you provide them with good historical data or estimates of your seasonal hot water or steam consumption needs."

By installing multiple condensing boilers such as these Cleaver Brooks ClearFire units, plant efficiency can be maintained in the "sweet spot" through the year, while also allowing redundant capacity for simplified unit maintenance.

Smaller Footprints Save Space

Replacing an aging boiler or adding a new high-efficiency boiler to an existing plant may be easier than you think because many of the newer designs are very space efficient. Many of the new boilers are completely packaged and ready to slide into place. They will simply need connection to water, steam, natural gas and electrical lines. Many require only a few square feet of floor space and, if they are replacing an older unit, will probably make the boiler room less crowded.

Whether you are operating an office building, a hotel, a shopping center or another commercial facility that requires a boiler for heating and other applications, now is a good time to review your present equipment. Plan for a more efficient future using the new generation of high efficiency gas-fired boilers.

FOR MORE INFORMATION

CLAYTON INDUSTRIES	www.claytonindustries.com
CLEAVER BROOKS	www.cleaver-brooks.com
ENERGY SOLUTIONS CENTER CLEANBOILER SITE	www.CleanBoiler.org
FULTON HEATING PRODUCTS	www.hurstboiler.com
SUPERIOR BOILER WORKS	www.superiorboiler.com
U.S. EPA ENERGY STAR PROGRAM	www.energystar.gov
VAPOR POWER INTERNATIONAL	www.vaporpower.com

Counting the Cost

Look inside the economics of energy audits.

Regardless of its size or style, odds are your building isn't as energy efficient as it could be. To find the best solutions for your individual property, consider calling in the professionals for an energy audit. The audit will consist of an inspection, survey and complete analysis of your building's energy use, which then will lead to suggestions on where and how you can cut costs.

"Your [energy] efficiency levels start to drop as the building ages," says James Stein, an industrial gas engineer and key account manager at Southwest Gas. "It's good to reassess your building or your equipment to see where you can conserve energy."

But how effective are audits in dollars and cents? Will the money you save on your energy bills even outweigh the cost of the changes you make and the audit itself?

Richard L. Johnson, director of building commissioning services for Commissioning Agents, Inc., offers an encouraging example. He recently audited a 670,000-square-foot hotel that, at 30 years old, was showing signs of extreme inefficiency.

"We concentrated on getting [the building] back to a functional schedule for running equipment and tying that into temperature, both indoor and outdoor," he says.

For $4,500, Johnson performed an energy audit and offered several solutions. His proposed changes cost less than $40,000 to implement and it took just 12 days to recoup the cost of the survey and changes.

Johnson says the optimal ROI window for audits are "anything within a year."

That timeline can vary greatly depending on the facility. In Las Vegas, City Project Manager Patrick Batte is implementing changes suggested by an outside energy auditing firm. The audit cost $100,000 and the changes will provide an annual savings of about $280,000. Although payback could take several years, the much-needed improvements will continue providing savings even after they have paid for themselves.

FOR MORE INFORMATION

GREEN BUILDING INITIATIVE	www.thegbi.org
COMMISSIONING AGENTS, INC.	www.commissioningagents.com

Power Players

Back-up power generation is becoming increasingly important.

Today more than ever before, the value of back-up power is apparent across all industries. From medical care centers to convenience stores, having consistent power is key to keeping customers – and perhaps even keeping a business afloat.

"The cost of just a single hour without power can run into the millions for some businesses," says Steve Landrum, marketing and communications manager for CenterPoint Energy in Houston, Texas. "People will look at the price [of a generator] without understanding the true value of that purchase. What they need to look at is what it will cost not to have a generator if your power goes out."

Three primary factors are driving the growing need for emergency power generators: increased weather-related activity, sophisticated equipment that is more sensitive to power interruptions, and aged electric systems prone to outages.

Landrum said that natural gas back-up generators can withstand events ranging from winter storms to turbulent spring weather to more severe natural disasters like floods, hurricanes and tornados. For both reliability and accessibility, natural gas is the winner, he says.

"To a large degree, weather that impacts electricity doesn't have the same impact on natural gas," he says. "Natural gas back-up generators are a great way to assure that you will always have power when you need it."