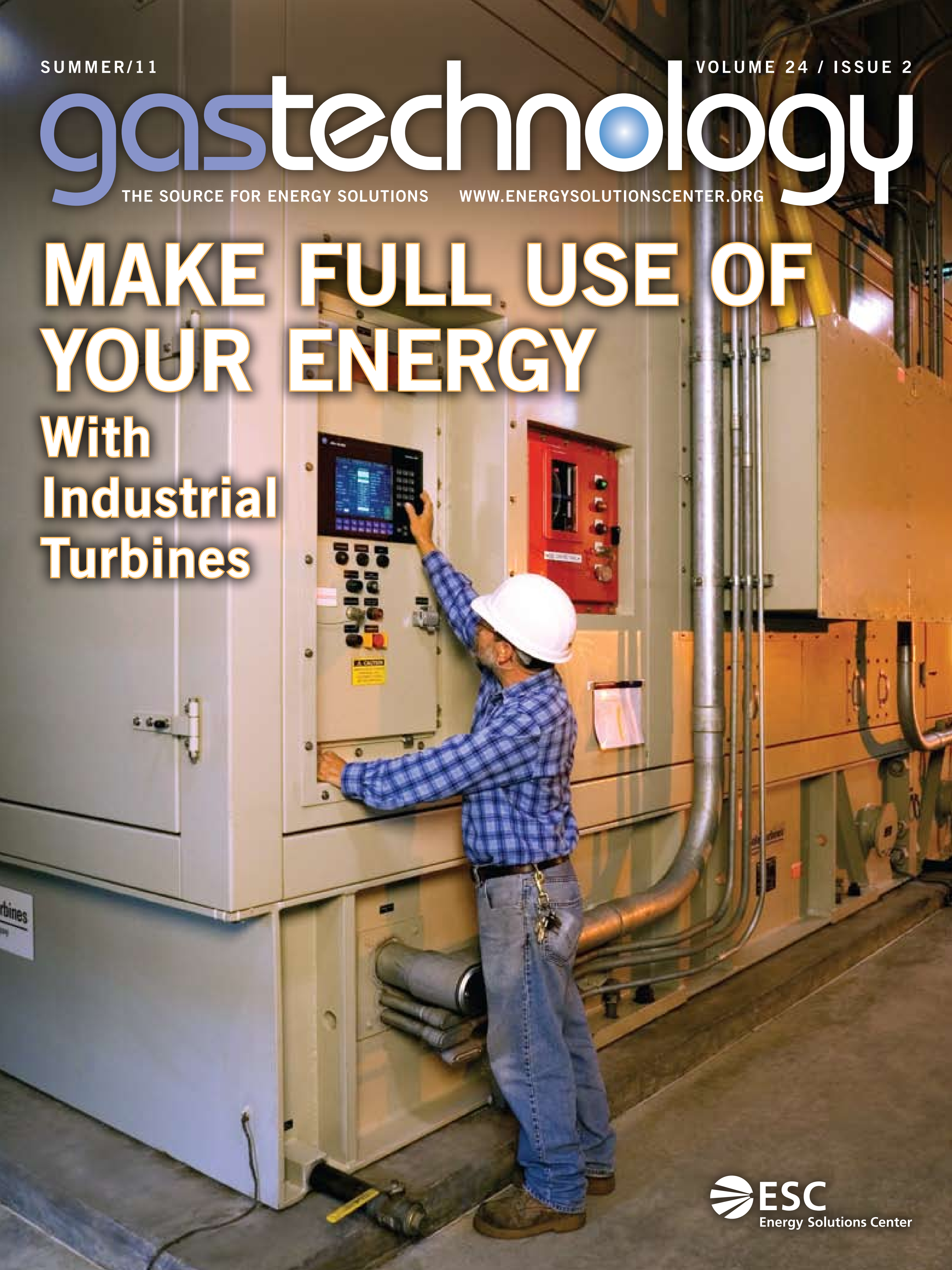
SUMMER/11

VOLUME 24 / ISSUE 2

gastechnology

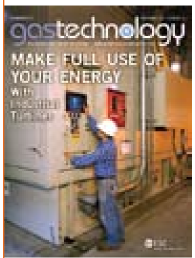
THE SOURCE FOR ENERGY SOLUTIONS WWW.ENERGYSOLUTIONSCENTER.ORG



MAKE FULL USE OF YOUR ENERGY

With Industrial Turbines

ESC
Energy Solutions Center



on the cover

An industrial turbine in combined heat and power service at a plastics manufacturing plant in Rhode Island. Photo courtesy Solar Turbines.

ESC Energy Solutions Center

Gas Technology is a trademark of Energy Solutions Center Inc. and is published in cooperation with CFE Media, LLC.

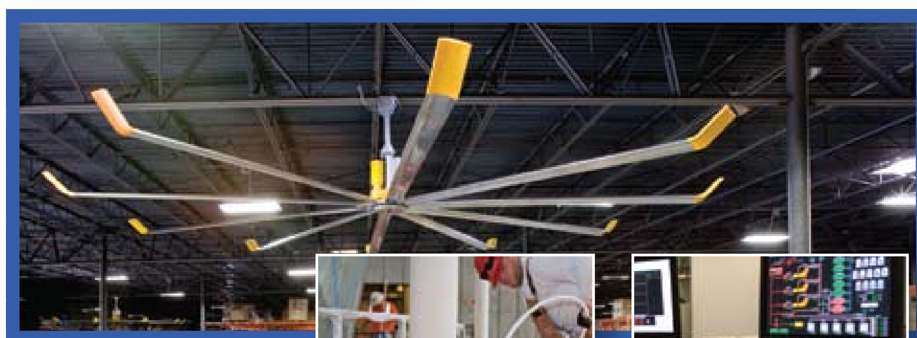
Gas Technology is an educational supplement from:
Energy Solutions Center Inc.
400 N. Capitol St., N.W.
Washington, DC 20001
(202) 824-7150
www.energysolutionscenter.org

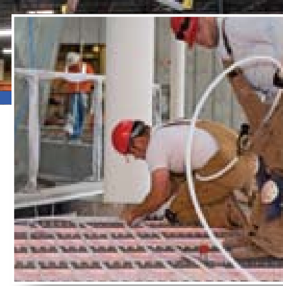
David Weiss, Executive Director
Jake Delwiche
Contributing Editor
Comments may be directed to:
Gas Technology Editor
Plant Engineering Magazine
1111 W. 22nd Street, Ste. 250
Oak Brook, IL 60523
(630) 571-4070
Printed in the USA

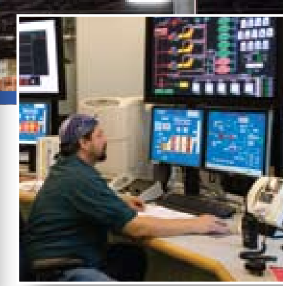
energy solutions center websites

www.aircompressor.org
www.cleanboiler.org
www.energysolutionscenter.org
www.naturalgasefficiency.org
www.gasairconditioning.org
www.poweronsite.org
www.foodtechinfo.com

inside







A3
Industrial Turbines Spell Opportunity.
Owners find industrial turbines an ideal way to improve energy utilization efficiency, plus gain energy supply reliability.

A6 Natural Gas-Powered Trucking.
More engine and vehicle options and a growing CNG distribution network support sustainable growth in natural gas fueled trucks.

A8 Big Fans Make a Big Difference.
HVLS fans have the ability to keep the workplace cool by creating continuous high-volume air movement. What's more, they can reduce heating costs by de-stratifying air.

A10 Floor Heating Finds New Friends.
Radiant floor heating systems are ideal for manufacturing and warehouse areas by supplying heat at the working level.

A12 Vertical Tubeless Boilers.
An innovative design for package boilers offers high efficiency, rapid response to demand, and a small footprint to add capacity to a crowded boiler room.

Two Solar Titan 130 gas turbine generator sets in cogeneration application at a paper processing plant in Connecticut. Photo courtesy Solar Turbines.

Gas Turbines Spell Opportunity for Industry

Getting Much More for Your Energy Dollar

TODAY MANY INDUSTRIAL ENERGY USERS understand the opportunity implicit in cogeneration. The idea is that all thermal methods of electric generation also produce waste heat – a lot of it. Combined heat and power (CHP) installations capture that heat and use it as a valuable byproduct rather than rejecting it as waste. Gas turbine CHP plants are an increasingly popular way of meeting the electrical needs of industrial and institutional facilities, as well as their requirements for steam or hot water.

Not a New Technology

Gas turbines in various sizes have been available for more than 50 years. Fuels can include oil or industrial byproduct gases, however most installations use natural gas. Units can be used for direct-drive applications, such as for pipeline gas compression, but the most common usage is for electric generation. Within these systems, a portion of the mechanical energy generated by combustion is used in the combustion air compressor section of the turbine, and the remainder of the rotational energy spins a generator for electric generation.

With all gas turbines, a significant amount of energy is produced in the form of combustion waste heat. In typical electric utility gas turbine generation installations, this waste heat is sometimes simply exhausted. These are called single cycle installations. In other utility installations the heat is used to fire a heat recovery steam generator (HRSG) to generate steam for additional electric generation. These heat recovery combination systems are called combined-cycle plants.

Utilities Use as Peaking Generation

Utilities often use gas turbines for peaking generation or even for longer duty operation when they are combined-cycle plants. They are attractive to utilities because they are largely factory assembled and can be erected in a matter of weeks or months rather than requiring years as with more traditional forms of generation. Further, they can be started quickly and brought on line, often in less than one minute.

Increasingly, owners of industrial and institutional facilities are also looking at owning gas turbine equipment for on-site electric generation, and they are more likely to take full advantage of

A recuperated gas turbine providing heating, cooling, and power at hospital in Texas. Photo courtesy Solar Turbines.

the byproduct heat output. These are called combined heat and power (CHP) installations.

Wide Range of Potential Uses

Examples of facilities that might be able to effectively use both the electrical and thermal outputs of a gas turbine are large hotels, resorts, prisons, universities, laundries, food processing plants, pulp and paper mills, and other industries that use either steam or hot water in significant quantities.

Control area for three gas turbine generator sets in a combined heat and power application at a university in Connecticut.
Photo courtesy Solar Turbines.

Another potential application is using the heat to supply absorption chillers to provide chilled water for comfort cooling or process applications. In addition to the energy-saving potential of cogeneration gas turbines, they also provide energy system security by having an onsite source of electric power in the event of a utility service outage.

Higher-Grade Byproduct Heat

Typically, gas turbines generate higher-temperature waste heat than engine-powered CHP systems, making high quality steam generation possible and broadening the range of potential applications. Although the electric generation efficiency of gas turbines has been steadily improving, the proportion of byproduct heat is still very significant. An example might be a natural gas-fired turbine rated at 5 MWe. The turbine exhaust can be diverted through a steam generator and can produce 23,000 lbs. of 150 psig steam per hour, enough to meet the heating and hot water needs of a good-sized industrial or university campus.

Several manufacturers, including Solar, Kawasaki, Opra, and Dresser-Rand, offer gas turbine electrical generation packages that range from 500 kWe to 10 MWe and even larger — sizes ideal for many institutional and industrial applications. Units much larger than this and microturbines rated below 500 kWe are also available.

Solar Offers Range of Units

Chris Lyons from Solar Turbines was recently a presenter at a Technology & Market Assessment Forum, sponsored by the Energy Solutions Center. Solar is a major manufacturer of gas turbine-generators for the industrial market and offers 11 models ranging in size from 1.2 to 21.7 MWe in capacity. He explains that the generation efficiency of gas turbines is generally expressed as their "heat rate", the required number of Btus needed to generate one kWh. In the Solar family of gas turbines for electric generation in the industrial range, heat rates range from 8,774 to 14,025. Generally speaking, the larger turbine packages have lower heat rates, meaning they are more efficient.

Lyons points out that Solar has a worldwide presence in both the oil and gas industry and the power generation markets. "We have 43 service centers, including 13 overhaul centers and 19 parts centers. We have over 13,800 turbines installed in 98 countries." Solar is a division of Caterpillar.

Potential Benefits to Economy

Lyons stresses the potential benefits of CHP. "DOE has set the goal of doubling the use of CHP in the U.S. In this way, an additional 25 million tons of CO_2 could be avoided, grid reliability could be increased, line losses could be reduced by 5-20% and the utility investment to meet power production costs could be reduced by $136 billion. The advantages are enormous."

Obviously, the more hours an industrial owner plans to operate a CHP plant, the more priority should placed on a low heat rate. However, most gas turbines are most efficient near their rated capacity. For this reason, your system efficiency may be highest if you have multiple smaller units, allowing you to operate several units closer to their optimum heat rate.

Sizing to Thermal Demand

In order to maximize CHP energy efficiency, owners generally size the system to match their need for process or comfort heat and cooling, and purchase the necessary additional electric energy. In some situations where there is high heat energy utilization, operators may be able to generate more electric power that can be used on site. In many such situations, the remaining electric energy can be sold back to the electric utility.

The advantages of CHP are becoming understood. In another recent presentation at a Technology & Market Assessment Forum, Kawasaki spokesman Mario DeRobertis noted that the largest market share is in gas turbine units 10 MW and below — the industrial market. He pointed out that Kawasaki has sold over 8,000 units — mostly into CHP projects. He indicated that owners typically experience thermodynamic efficiencies from 75% to 82%. Kawasaki offers base-load units sized at 600 kW, and 1.5, 1.7, 3.0, 5.5, 8.0 and 17.9 MW.

Documented Installation Shows Benefits

A well-documented installation of CHP in an industrial facility was a DOE project at a Frito-Lay food processing plant in Killingly, Connecticut. DOE notes that food processing is a high-growth industry with tremendous potential for CHP because of its need for significant amounts of both electrical and thermal energy. In this project, a 4.6 MW Solar Centaur 50 combustion turbine was installed, combined with a Rentech heat recovery steam generator. The system was commissioned in April 2009 and one year of data collection was completed in May 2010 with funding from DOE and a consortium of Energy Solution Center utility members.

A recent DOE report states, "Operating data show the CHP system providing over 90% of the electrical demand and about 80% of the steam load for the facility. The performance of the CHP system has been excellent, with virtually no interruptions in operation and an overall CHP efficiency of 70%." On two occasions during the one year data collection period, the CHP system helped the plant maintain operations during extended periods of grid power outages. DOE indicates "This information will be valuable for understanding the role of CHP in providing economic and reliable energy services for small- and medium-sized industrial facilities."

Time to Take a Hard Look

Industrial and institutional energy users that have both high electrical and thermal energy requirements need to take a hard look at gas turbine packages complete with heat recovery — CHP. The technology is mature and reliable. Natural gas prices are low and promise to remain attractive into the future. The door of opportunity is open. **GT**

MORE info

DRESSER-RAND GAS TURBINES
www.dresser-rand.com/products/turbo/gasturbine

ENERGY SOLUTIONS CENTER DISTRIBUTED GENERATION
www.poweronsite.org

KAWASAKI GAS TURBINES – AMERICAS
www.kawasakigasturbines.com

OPRA TURBINES
www.opra.no/en

SOLAR TURBINES
mysolar.cat.com

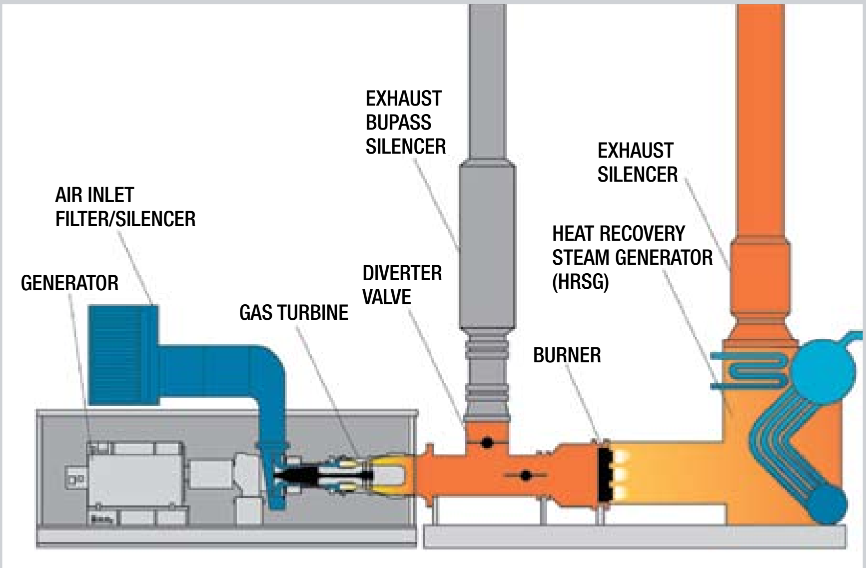


Diagram illustrates energy flows through a CHP application with a gas turbine. Illustration courtesy Solar Turbines.

Natural Gas-Powered Trucking

POWERED BY PERSISTENTLY HIGH diesel and gasoline fuel prices, and encouraged by state and federal incentive programs for alternate fuel vehicles, the use of natural gas as a trucking fuel continues to find converts in the U.S. and Canada. Many of the applications are on vehicles that are used during the day and returned to a base station at night, making refueling easier. Both public and private refueling stations are becoming more abundant.

Fueling Stations Critical Components

One of the leading industry organizations supporting natural gas fueling is the Natural Gas Vehicle Institute (NGVi). This organization offers guidance and training for fleet operators who are contemplating converting to or expanding natural gas-powered fleet vehicles. NGVi CEO Leo Thomason was a recent presenter on a panel discussion on natural gas vehicles at a Technology Market Assessment Forum sponsored by the Energy Solutions Center. In his presentation, Thomason stressed the key role played by fueling stations for commercial and industrial natural gas users.

He explained that there are four basic types of natural gas fuelling stations. The simplest is time-fill fueling, where a fleet of vehicles at a central garage can be filled during nighttime or other inactive hours. This is ideal for fleets of vehicles that are at a central location for 6-8 hours and can operate all day on a single fill. Examples are school buses, transit buses, delivery vans, refuse trucks and ready-mix cement vehicles.

Fast-Fill Stations for Random Fueling

The opposite is fast-fill, which is used for vehicles that need to be quickly refueled at random hours through the day. A third type is combination time-fill and fast-fill, which is suitable for a mix of vehicle types and for those that require refueling at random times. The fourth type is buffer fast-fill, used where large numbers of vehicles need to be refueled consecutively - for example, fleets of transit buses. A buffer tank allows quick consecutive refilling.

Thomason explains that the cost of the refueling station varies with the type of capability, and can range from several thousand dollars for a small timed-fill system for a single vehicle to several million dollars for a fleet refueling station for 200 transit buses. He notes that a public-access fast-fill station could run from $400,000 to $500,000. Owners need to consider this expense in evaluating the feasibility of going to a natural gas fleet. He indicates that there continues to be an active "buildout" of natural gas fueling infrastructure in North America.

Infrastructure Continues to Expand

The natural gas fueling infrastructure has been steadily expanding beyond California in recent years. According to Thomason, a good part of the expansion has come from the activities of Clean Energy of Seal Beach, California. This company is the largest retailer of natural gas as a transportation fuel in the U.S. Clean Energy has built and operates public-access CNG fueling stations in Arizona, Colorado, Nevada, New Mexico, New York, Texas, Wyoming, Oklahoma and Georgia.

Thomason adds that many natural gas utilities have and continue to operate public-access fueling stations within their areas. These include DTE Energy, Avista Utilities, Alabama Gas, Atlanta Gas Light, National Grid, Questar Utilities, Piedmont Natural Gas and others.

Manufacturer Credits Offset Engine Expense

According to Andy Douglas, National Sales Manager, Specialty Markets for Kenworth Truck Company, there continue to be price credits for owners who choose to operate CNG trucks. A CNG-powered refuse truck or cement truck would receive a $10,000 credit for not having the SCR after-exhaust treatment system required for a diesel-powered version of the same truck. This would offset the $10,000 premium for the Cummins-Westport CNG engine for the truck. According to Thomason, there continue to be new natural gas engine conversion companies entering the market. Currently there are five companies that manufacture EPA/CARB certified conversion systems for gasoline-powered vehicles in the U.S.

Rich Kolodziej is the President of NGVAmerica, an organization dedicated to the promotion of the use of natural gas vehicles in the U.S. He points out that earlier arguments that the U.S. lacked a sufficient long-term supply of natural gas have been demolished. He states, "Technological advances such as deep drilling, horizontal drilling and fracturing have made previous uneconomic gas play (like shale gas) quite economic. This has in turn resulted in estimates of economically recoverable gas at (or over) 100 years."

Current NGV Legislation Important

Kolodziej stresses the importance of legislation such as the currently pending NAT GAS Act (HR 1380) currently under consideration in the House of Representatives. A companion Senate bill will be introduced this summer. The bill would provide a number of financial incentives to fleets and consumers who buy natural gas vehicles, and to fueling station operators who install natural gas fueling equipment. He is hopeful the legislation will be signed into law in 2011 and will continue and enhance previous federal incentive programs.

Kolodziej also points out that there is incredible activity at the state level promoting NGVs. Currently 255 bills are under consideration in state legislatures that would provide a variety of incentives or supports for NGV activity. Kolodziej notes, "Because of its special environmental problems and concerns, Utah has been in the vanguard of providing incentives for and otherwise promoting NGVs. But the rest of the country is catching up fast. Utah has been a strong NGV promoter for a number of years and Oklahoma, Louisiana and Texas have recently enacted or expanded incentives for NGVs."

Fuel Price Advantage Continues

Since 2005 the energy market has shown significant price spreads between the delivered fuel cost of diesel fuel and natural gas. Natural gas at $6/mmBtu is approximately equivalent to crude oil at $45/barrel, a price we haven't enjoyed for a long time.

According to recent studies, the next three to five years may show increasing price spreads as a result of strong domestic production of natural gas from conventional and shale gas sources, and continuing upward pressure on petroleum prices because of global oil demand and geopolitical uncertainty. At the current time, up to 98% of the natural gas used in the U.S. and Canada is from U.S. and Canadian sources. This gives additional security for fleet fuel supplies.

Things Lining Up Favorably

The future looks bright for the NGV industry. Rich Kolodziej says, "NGVs have always had public policy benefits. Now that we have the natural gas supply, we have the vehicles, we have public policy support and we have the economics." He notes that the number of NGVs worldwide has grown from 3.8 million in 2003 to 13.2 million today. While many of those are light-duty vehicles in Pakistan, India and Iran, the growth in North America has been largely heavy-duty trucks and buses. This truly is a growth industry, and one that promises rewards for early adaptors. Now may be your time to take advantage of this trend. **GT**

Fast CNG refueling station in St. George, Utah.
Photo courtesy NGVAmerica.

MORE info

DOE NATURAL GAS VEHICLE INFORMATION
www.afdc.energy.gov/afdc/vehicles/natural_gas.html

ENERGY SOLUTIONS CENTER NGV WORKGROUP
www.energysolutionscenter.org/consortia/ngv_workgroup.aspx

NATURAL GAS VEHICLES FOR AMERICA (NGVAMERICA)
www.ngvc.org

NATURAL GAS VEHICLE INSTITUTE (NGVI)
www.ngvi.com

Big Fans MAKE A Big Difference

HVLS Fans Cool in Summer, Distribute Heat in Winter

WITHOUT TAKING ANYTHING away from air conditioning, it is not the only option for comfort cooling. What's more, it doesn't do anything for your building during the heating season. An option that is receiving increasing attention is high-volume low-speed (HVLS) ceiling fans. These not only provide energy-efficient comfort cooling in the summer, but they can also improve the efficiency of your heating system in winter.

Comfort Level Up Dramatically

Don't confuse these with the small ceiling paddle fans in your living room, kitchen or bedroom. These are BIG fans, with diameters up to 24 feet. They rotate slowly, but because of their size can move a lot of air. And air movement is the key to summer comfort for many spaces. By moving air over building occupants, evaporative cooling increases, improving comfort levels. According to some experts, the right HVLS system can reduce the perception of heat by 8 to 16 degrees.

Many commercial and industrial building have high ceilings and require higher overhead clearances. You need a big fan to move the necessary volume of air to give effective cooling. That's why HVLS fans have large diameters and because of their blade length, can operate efficiently at relatively low rotational speeds.

Units Designed for Large Spaces

One of the industry leaders in HVLS fans is the humorously-named Big Ass Fan Co. of Lexington, Kentucky. The company offers its Powerfoil line of fans for the industrial building market in sizes ranging from 8 to 24 feet. These fans feature a sealed and nitrogen-bathed gear reduction drive, with prewired on-board electronic controls. The design of the ten airfoil blades maximizes efficient air movement and minimizes acoustic levels to nearly undetectable levels. A winglet at the tip of each blade eliminates efficiency-robbing vortex formation. Big Ass Fan Co. also offer its Isis line of smaller, lighter fans in diameters of eight or ten feet for ceilings as low as 12 feet as in smaller commercial and industrial areas.

According to company spokesperson Katie Hunt, increasing number of owners are discovering the benefits of HVLS fans. "Given the vast space within manufacuring and warehouse facilities, these fans help eliminate cold and hot spots often prevalent with small, high velocity fans. During the winter, the fans run at a much slower speed to turn the air over at least once per hour to destratify the space and keep the temperature even, which can significantly reduce heating bills. The slow speed also prevents occupants from feeling a chilly draft."

Added Benefits in Heating Season

As Hunter notes, HVLS fans also bring comfort benefits during the heating season. In many cases the heat in these high spaces stratifies and it can be as much as 20 degrees F warmer at the ceiling than at

Left: Large space with high ceilings are the ideal location for HVLS fans.

Right: HVLS fans not only improve comfort by generating air movement during hot weather, but can help reduce heating costs by de-stratifying air during the heating season.
Photos courtesy Big Ass Fan Company

Shipping and receiving areas benefit from air movement generated by overhead large-diameter fans.

the floor or working level. Worker comfort can be maintained by fans gently pressing the heat layer down. This results in much less heating energy needed and with less unnecessary thermostat cycling.

Big Ass Fans are available with a remote control wall panel. Hunter notes, "This allows users to turn the fans on and off, set parameters, program speeds and troubleshoot operations. An unlimited number of fans can operate off a singe keypad, simplifying operations." Fans can be supported by SmartSense365, an intuitive interface engineered to maximize energy savings and assure comfort through year-round automated control of each fan.

Benefits Beyond Comfort

HVLS fans are most often installed to improve summer and winter comfort in industrial and commercial spaces, but they can provide other benefits as well. According to Big Ass Fan Co., a recent Garland, Texas installation was designed to help eliminate damage to rolled steel products which resulted from condensate that forms on concrete floors and on the products during periods of high humidity and temperature changes. To the delight of the customer, the four 24-foot fans were completely effective in eliminating the condensation problem, saving the company $250,000 in product damage expense.

Maintenance expense for an HVLS fan system is minimal. According to Hunter, they do recommend an annual servicing of fans, including inspection of all safety cables, mounting bolts, fan controller connections, blade retainers and hub safety clips, along with a dusting of the motors, motor housings and airfoils.

Blade Mimics Whale Fin

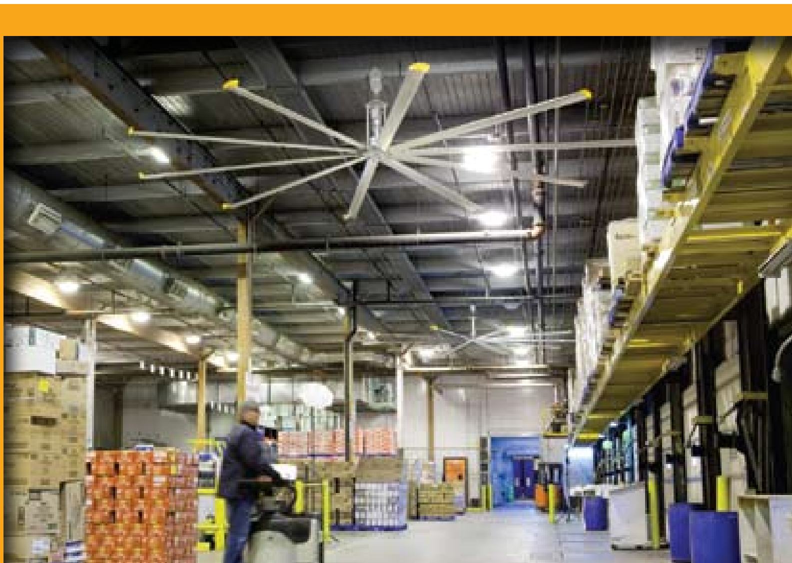
Another manufacturer, Envira-North of Seaforth, Ontario, offers an industrial HVLS fan model called Altra-Air that features a blade design developed in collaboration with WhalePower Corp. The blade uses Tubercle Technology or "ripples" along the leading edge of the blades that mimic the fins of humpback whales. Research has shown that this approach allows the blade to have stall angles as high as 31 degrees. This improves blade efficiency and further reduces the acoustic signature.

Envira-North's five-bladed Altra-Air fan is available in sizes from 2.4 to 7.3 m (8 to 24 ft.). The company suggests these fans are suitable for malls, atriums, auditoriums, barns, hockey rinks, gymnasiums, manufacturing facilities, warehouses, distribution centres, hangars, indoor paint ball arenas, pools, garages and lobbies. That represents a lot of air that needs to move.

Quiet Operation

Because of the low speed at which they operate and their sealed gearbox drives, HVLS fans are essentially very quiet, usually not being noticeable above other background noise. By placing the gearbox and motor near each other, electromagnetic interference (EMI) and radio frequency interference (RFI) are greatly reduced.

If your facility has large spaces with high ceilings, and if you would like to increase floor-level comfort and possibly even reduce heating expense in the winter, a HVLS fan system may be your best choice. You'll need to determine ceiling height, potential mounting structures, type and amount of obstructions and the floor dimensions of the working area. By sharing this information with a manufacturer, they can determine the size and number of fans required for your facility to optimize comfort. You might be on the way to a changed indoor atmosphere. **GT**

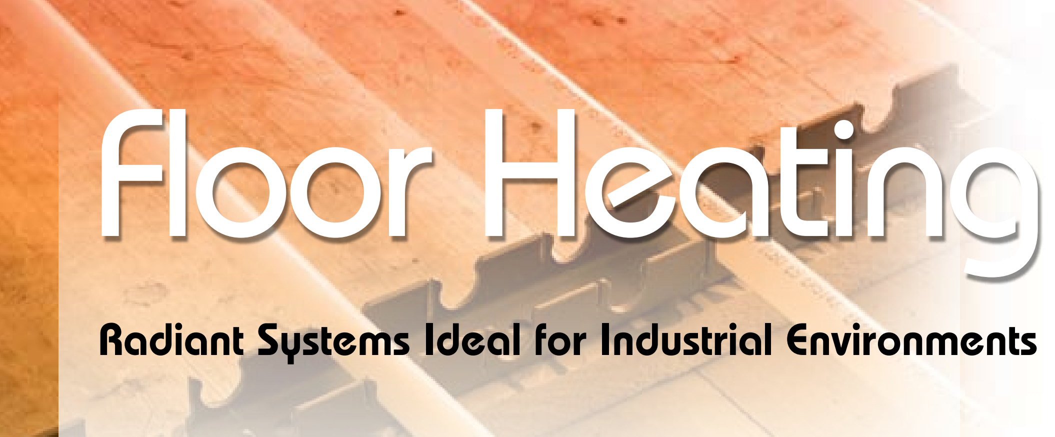


MORE **info**

BIG ASS FAN COMPANY
www.bigassfans.com/industrial

ENVIRA-NORTH SYSTEMS LTD.
www.enviranorth.com

MACROAIR TECHNOLOGIES
www.macro-air.com



Floor Heating Finds

Radiant Systems Ideal for Industrial Environments

For most of the U.S. and all of Canada, it is necessary to provide heat for indoor manufacturing areas and much of the warehouse space. Winter temperature control is needed not only for worker comfort and efficiency, but also to protect products and maintain calibration on process machinery. Numerous types of heating systems have been used in the past. Today, many owners are discovering the benefits of in-floor radiant heat.

Warm Liquid Circulates Beneath Floor

An ideal way to achieve warm floors is to circulate a heated liquid through tubing beneath the concrete floor. Today, high-strength plastic tubing makes installation much easier and more reliable than earlier metal pipe heat distribution schemes. The tubing material is cross-linked polyethylene, sometimes called PEX or XLPE. This tough, durable material has been used for decades for in-floor radiant systems in Europe, and is quickly gaining in popularity in North America.

Today's highly efficient natural gas-fired boilers and modern heat transfer products make these systems more efficient than ever. Most in-floor systems use a water-glycol circulating fluid designed to protect the system in the event of a freeze-up. An expansion tank adjusts for volume variations with heating.

The working fluid is pumped through a heat exchanger where it can also be heated by a variety of other sources. These might include process waste heat water, process steam, heat from onsite engines or gas turbine electric generation, along with a dedicated high efficiency boiler. Often, a combination of these sources is used, with the dedicated boiler being used when other heat sources cannot meet heating needs.

Heat Where It's Needed

Part of the reason for this newfound popularity is the growing recognition that these systems provide even heat where it is needed most – at the working level. Most workers and machinery are near floor level, even in high-bay manufacturing and warehouse facilities. Yet forced air systems tend to make the space near the ceiling the warmest. Energy is wasted in heating areas that are not occupied.

One of the major suppliers of PEX-based radiant floor systems is Uponor. This firm supplies the full range of tubing, connectors and supplies. Mark Huboda from Uponor is the Senior Product Manager, Radiant Heating and Cooling. He was recently a speaker at a Technology & Market Assessment Forum, sponsored by the Energy Solutions Center. Huboda states, "Awareness of the comfort and energy efficiency provided by radiant heating continues to grow. This is being fueled by recent increases in energy costs. Specifications of radiant systems for commercial sites have nearly doubled since 2005."

Suitable for a Variety of Floors

With floor systems, the heated floor is only a few degrees above ambient air temperatures, but the heat radiates upward and keeps workers and machinery in their most efficient working range. According to Huboda, even carpeting or floor mats can be used with radiant floor systems. "Radiant floor heating systems can almost always be designed to accommodate the characteristic of different flooring materials."

The durability of PEX tubing is proven, and manufacturers offer long-term warranties. Huboda emphasizes, "Standard concrete cracks and floor movements will not harm Uponor PEX tubing. Over four decades, more than 12 billion feet of Uponor PEX tubing has been installed worldwide, with in-slab installations being commonplace. Uponor PEX tubing is backed with a 30-year warranty and independent testing shows it will last far longer than that."

Manufacturer Support Available

It is important that system designers and installers receive factory training in the use of this material. Companies such as Uponor provide design and technical services to assist engineers, contractors and customers. Special tools and fittings are needed for installation.

One of the beauties of in-floor heat is that it can be zoned to allow for different heating levels. Examples might be lower heating levels in warehouse areas, and higher heat density near outside doors or in high-occupancy manufacturing or administrative areas. Huboda also points out, "Zoning provides improved energy efficiency and comfort by controlling the temperatures in different areas or zones. "

For example, if only a couple of rooms are being used in a building, the heating energy directed at other zones can be reduced or eliminated. Radiant zoning provides the ability to control the different amounts of heat required by each room to maintain the optimal comfort within each zone.

New Friends

In installing a radiant floor system, spacers are used to assure the correct heat density in each area. This can be varied for varying climate conditions and differing uses of spaces.

Zoning Provides Operating Flexibility

Heat output can be controlled both by the spacing of heating tubes and thermostatic control of heat outputs by zone. Zone-by-zone thermostat control is especially useful in manufacturing areas that are frequently re-arranged, or where there are seasonal variations in floor usage. Manufacturers such as Uponor offer a variety of thermostats with different features to accommodate a wide variety of applications and user preferences.

An example of a successful installation of radiant flooring is in a 50,000 square foot distribution center operated by Henri Studio, a designer and manufacturer of case stone fountains and statuary in Wauconda, Illinois. One of the owners of the company, Dennis Prosperi, says, "The facility serves as the hub of our business, so it must run as efficiently as possible. When designing it, one of our main concerns was finding the right heating system. Research led me to hydronic heating systems."

Rapid Heat Recovery Attractive

Prosperi points out, "A forced air system makes no sense in a warehouse with 30-foot ceilings and numerous windows. You can't beat the rapid heat recovery in the shipping area where doors are opened and closed constantly." Preliminary data revealed that the company could save about $11,000 with the radiant floor system. Actual savings were nearly $19,000, paying for the system in as little as two years.

These are the kinds of experiences customers are discovering with radiant floor heating systems. If your company is considering building or remodeling a manufacturing or distribution center, this option should be carefully considered. **GT**

In most radiant floor applications, each floor has multiple zones, allowing flexible control of heat levels as building use changes. Photos courtesy Uponor.

MORE info

HYDRONICS INDUSTRY ALLIANCE
www.myhomeheating.com

RADIANT DESIGN INSTITUTE
www.radiantdesigninstitute.com

UPONOR
www.uponor.ca

Vertical Tubeless Boilers

Can Be a Solution

MODERN VERTICAL TUBELESS BOILERS offer rapid startup, high efficiency and a small footprint to save space in the crowded boiler room. They can be used for either steam or hot water. The earliest designs were simply a cylindrical furnace surrounded by an outer tank of water. Combustion gases made a quick trip through the furnace, gave up what heat they could through the walls of the vessel, and were exhausted. These boilers were necessarily inefficient and slow to heat up. Today's tubeless designs are a great departure from this primitive system.

Nearly Complete Heat Extraction

Designers of today's vertical tubeless designs have taken this basic concept and reworked it to vastly increase efficiency and shorten startup cycles. The key has been to take the exhaust from the internal vessel and pass it through multiple heat exchange surfaces also surrounded by water. This results in nearly complete extraction of the heat of combustion.

An example is the Cyclone 4VT tubeless boiler by Hurst, which features a long exhaust path through four passes in the water vessel. An additional pass of the exhaust gas is used to dry the steam product, thereby reducing scaling. This boiler is available in 12 sizes ranging from 6 bhp to 100 bhp, producing steam quantities ranging from 207 to 3450 lbs/hr at 15 to 250 psig.

Small Footprint a Popular Feature

According to Chad Fletcher from Hurst, there are several significant advantages to this boiler over other compact boiler types. "They have a smaller footprint due to the vertical design and a much larger capacity boiler can be put into the same space as a scotch boiler. They are faster to come from cold to full steam. Finally, they are completely packaged at the factory with the feed tank and blowdown tank prepped and prewired there. Installation on the jobsite becomes as simple as electricity, feedwater, blowdown and steam connections."

He notes that they can be installed either as standalones or in combination with existing boiler equipment. "You often see these units as standalone pony boilers or backups for summer. You will find large systems like hospitals with multiple large boilers using these package units for steam for laundry, kitchens, etc. when the demand for steam is small and there is no reason to fire up a large unit during non-peak hours in these places."

Outstanding Efficiency

Efficiency of the modern vertical tubeless boiler is outstanding. Fletcher indicates that efficiencies from 79% to 83% are typical. "It will depend on fuel and firing conditions." Fletcher points out that rapid startup and quick response to changing loads is an important feature. "Their ability to handle large swing loads in start-and-stop situations is critical."

In addition to the steam boiler, Hurst also offers a 4VT Cyclone hot water boiler for situations where hot water only is needed. It delivers hot water at a standard pressure of 30 psi, with optional delivery up to 160 psi, 250° F. Like the steam boiler it offers rapid response from a cold start and the ability to meet fluctuating hot water demands.

MORE info

FULTON BOILER WORKS, INC.
www.fulton.com

HURST BOILER CO.
www.hurstboiler.com

LATTNER BOILER CO.
www.lattnerboiler.com

Time to Take a Look

Whether your interest is in replacing an old, inefficient boiler or adding steam or hot water capacity to your plant without expanding the boiler room, the tubeless vertical approach is worth considering. You may find its efficiency pays for the upgrade quickly, without requiring difficult plant modifications or boiler room expansions. **GT**

This skid mounted 100 bhp boiler by Hurst exemplifies the complete factory assembly and compact size of modern vertical tubeless boilers. Photo courtesy Hurst Boiler Co.