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Industrial Gas Turbines

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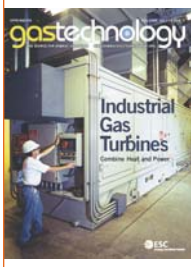

on the cover

This Taurus™ 60 unit by Solar Turbines equipped with a heat recovery steam generator (HRSG) serves an East Coast pharmaceutical manufacturing plant. The unit is rated at 5.5 MW.

Photo courtesy Solar Turbines.

ESC Energy Solutions Center

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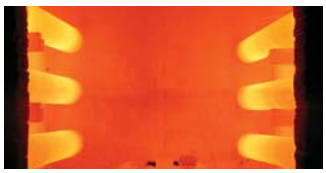


INDUSTRIAL-SCALE TURBINES

Gaining Respect

Heat Recovery Makes the Difference

WITH FLUCTUATING ENERGY PRICES and ever-increasing emphasis on operating economies, mid-sized industrial gas turbines feel right at home. Several configurations help industrial energy users take more complete advantage of the energy they purchase, and offer added energy supply security. The keys are newer turbine designs and cost-effective heat recovery.

Defining the Sweet Spot for Industry

Industrial machines are bracketed between the microturbines that generate from 30 to several hundred kW for residential and commercial markets, and utility-scale machines that put out 25 to 300 MW. This industrial size category – 1.0 to 20 MW – is ideal for industrial and institutional users that want a reliable source of self-generation and are able to use the substantial byproduct heat in a variety of applications.

Larger simple-cycle gas turbines are commonly used by central-station electric utilities for peaking generation. Annual operating hours are generally limited and usually no attempt is made to salvage waste heat. For longer run-hour applications, combined-cycle designs direct the gas turbine exhaust at temperatures up to 1000° F to a heat-recovery steam generator (HRSG) and the steam is then used to operate a steam turbine-generator.

Unit Efficiencies Are Better Than Ever

But it is the industrial and institutional users that are uniquely positioned to take the most complete advantage of the dual energy outputs. Today's mid-sized gas turbines have heat rates substantially better than those of a few decades ago, meaning the output of electric energy and the generation of byproduct steam is much more balanced. The HRSG produces steam that can be used for a variety of applications. These include smaller scale versions of the utility combined-cycle generation scheme as outlined above or, or for water heating, food processing, space heating, absorption cooling, and many other process uses.

Aeroderivative and Industrial Designs Merging

In the past, much attention was given to the distinctions between the aeroderivative family of gas turbines and the industrial or "frame-built" family of machines. Aeroderivative turbines are descendants of turbine designs originally used for aircraft engines.

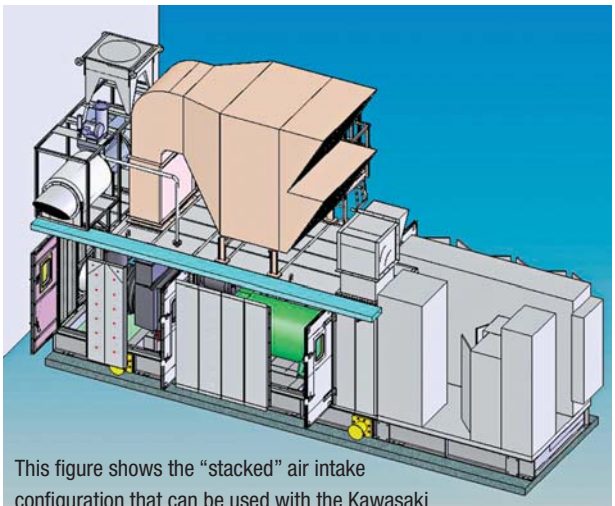
This 5.5 MW Taurus™ 60 SoLoNOx unit by Solar Turbines replaced a coal-fired generating unit at a Midwestern university campus. Photo courtesy Solar Turbines.

They are characterized by a smaller footprint, lighter weight, and a more complex gas path.

The industrial family uses heavier, larger machines and its more open designs simplify service work. In truth, much of the best of both of these technologies has merged in today's designs. For example, the use of super-alloys and "single-crystal" elements for turbine blades and new ceramics for gas path elements, as developed for the aeroderivatives, are now widely found in the "frame-built" designs.

Gas turbines are also available with a second reduced-speed shaft drive for pumping applications, air compression, or to operate refrigeration equipment. Whether used for electric generation or in a direct-drive application, the best application is when the turbine's considerable byproduct heat can be captured and used for a beneficial purpose.

Manufacturers of industrial-scale gas turbines include Solar Turbines Incorporated (a wholly-owned subsidiary of Caterpillar), General Electric, Kawasaki, and others. These manufacturers offer conventional gas turbine-generator sets in the range from 1.0 to 20 MW, as well as dual shaft machines for combined electric and mechanical drive applications. All are designed to accommodate heat-recovery boilers for steam generation.



This figure shows the "stacked" air intake configuration that can be used with the Kawasaki gas turbine generation unit. Illustration courtesy Kawasaki.

Center Stage for the Environment

David Schnaars, Manager, Environmental Strategies for Solar Turbines, was a presenter at a Technology and Market Assessment Forum sponsored by the Energy Solutions Center in Birmingham, Alabama in February, 2008. In his presentation, he emphasized the environmental benefits from combined heat and power (CHP) using natural gas-fired combustion turbines. He noted that natural gas has a significantly lower carbon footprint than coal or oil-fired electricity, and using natural gas for CHP offers fuel efficiencies greater than 80%, as compared to about 31% for central station electricity.

Chris Lyons, also from Solar Turbines, explains that the company offers six families of gas turbines suited for industrial applications, ranging from the Saturn® 20 model, rated at 1.21 MW to the Titan® 250, rated at 21.7 MW. He calls special attention to the Mercury® 50, rated at 4.6 MW. Lyons indicates that this product, which was first shipped to customers in 2005, has exceptional efficiency for electric generation through the use of a recuperative design that recycles exhaust heat to pre-heat combustion air. In this way, the unit is able to achieve a 38.5% electrical efficiency, making it ideal for applications where electric generation is a priority. In addition, this product has a lean low-NOx emissions system, which allows permitting of the turbine without add-on environmental control equipment, even in Los Angeles.

According to Lyons, the market acceptance for this product has been excellent. "We have sold Mercury 50 turbine-generators in the past couple of years to a variety of customers, including industrial and institutional users, and to those who burn renewable fuels such as landfill and digester gas."

Customers Watch Carbon Emissions

Lyons notes that carbon emissions concerns have influenced a number of customers. He explains, "Due to the efficiency of CHP versus grid-supplied power, and with the use of an on-site package boiler, companies can make reductions in their carbon footprint of 30 to 40%. In Europe, which has active carbon trading, we have sold a number of turbine-based CHP installations due to carbon trading economics or carbon credits that allow further plant expansions."

Another important manufacturer of gas turbines for the industrial and institutional market is Kawasaki. Steve Cernik from Kawasaki feels that the improved fuel efficiency, increased reliability, and clean operation of their industrial gas turbines make them an increasingly popular option. He indicates that the Kawasaki 1.5 MW unit with the KLean catalytic combustion system lowers NOx emissions to less than 2.5 ppm, making it "the greenest gas turbine on the planet." Kawasaki offers units in sizes of 1.5 to 18 MW.

Solution Meets Emission Restrictions

Cernik believes the growing acceptance of gas turbines by industry is because of their "green" potential, especially on the East and West coasts of the U.S. where sales are driven by demanding state emission requirements and because of the availability of state grants. He points out that the trend toward CHP is strong, with over 90% of new Kawasaki units being equipped for heat recovery. He says, "This allows them to attain high annual energy savings through reduced fuel costs, and resulting quick returns on the initial investment."

Cernik adds that concerns about carbon emissions are also driving increased interest in CHP with industrial gas turbines. "With today's pressures to move to greener technologies to reduce carbon footprints, our customers view our gas turbines as a step in the right direction. We also see that many of our international clients are now interested in replacing old equipment with green GT alternatives."

Also Chosen for Standby Power

Cernik says that in addition to widespread CHP installations, companies are also using

natural gas-fired simple-cycle gas turbines for standby generation. Dual fuel designs allow these systems to start on liquid fuel but for longer runs – days or weeks – to switch to pipeline-supplied gas, which in most situations is highly reliable. "This allows these customers to pay for their backup fuel when they use it, as opposed to buying it up front and storing large quantities on site awaiting an emergency."

Rooftop Installation an Option

He adds, "These units are also light in weight compared to the diesel engine alternatives and can be roof-mounted to save space. Our GPS gas turbine units can go from start to full load in 40 seconds, making them quite competitive for standby power."

Cernik gives as an example of a successful CHP installation one at the Bridgewater Correctional Complex, operated by the Massachusetts Department of Correction. According to Todd Gundlach, Deputy Director of the Department's Division of Resource Management, this site has a central power plant with three boilers for facility steam supply, as well as an electric distribution center. The complex had a long-standing problem with service interruptions, requiring frequent startups of their standby generation equipment.

In 2006 the facility negotiated an energy saving performance contract which involved a wide range of improvements, including water saving devices, variable frequency motor drives, window replacements and improvements to the steam distribution system. They also decided to install a 1.5 MW Kawasaki gas turbine together with a HRSG to supply most of their required site electric power as well as to augment the existing steam supply. Gundlach says, "Heat utilization is what makes this project practical. The HRSG supplies 125 psi steam to match the existing boiler output. The steam is used for heating, laundry, cooking and water heating. Gundlach notes, "The State Division of Capital Asset Management was impressed with the potential energy savings, and has asked us to handle referrals from other state agencies."

Since startup in 2006, the turbine-generator has logged over 17,000 operating hours and supplies over 90% of the required site electric energy. The site still has an operating connection with the electric utility, but the turbine normally operates over 660 hours per month. Gundlach indicates he would recommend this type installation to any similar institution. "To make this work, you have to take advantage of the byproduct steam. That's why it's important that the turbine isn't oversized."

Today's gas turbines are available in a wide range of sizes for the industrial and institutional markets. Emissions are extremely low and efficiency, especially with byproduct heat recovery, is exceptionally high. For all or part of your on-site electric and heat requirements, the gas turbine may be the perfect solution. If you haven't studied this option, now is the time. **GT**

MORE info

DOE INFO ON CHP APPLICATIONS
http://www.eere.energy.gov

ENERGY SOLUTIONS CENTER INFO ON CHP
http://www.energysolutionscenter.org/tech/tech_cogen.asp

GENERAL ELECTRIC
www.gepower.com

KAWASAKI
www.kawasakigasturbines.com

SOLAR TURBINES
www.solarturbines.com

This 4.6 MW Mercury™ recuperative gas turbine by Solar Turbines provides hot water for a university hospital in France, and provides surplus electric energy to the regional grid. Photo courtesy Solar Turbines.

DIRECT-CONTACT WATER HEATING

Providing Efficient Hot Water

BECAUSE OF ITS EFFICIENCY and its instant output, direct-contact water heating is an interesting option for large volume users of hot water. The basic principle is to apply the hot natural gas burner exhaust directly to a spray or cascade of cold water. Heat and combustion products move upward as the water descends, resulting in a virtually complete utilization of the heat and a more load-responsive, immediate supply of hot water.

Direct-contact water heaters are ideal for laundries, large commercial kitchens, food processing plants, concrete plants, fertilizer plants, greenhouses and other medium to large volume users of hot water. Direct-contact can also be used to supply hydronic heating systems, and to preheat boiler-makeup water.

No Pressure Vessel Needed

Direct-contact systems operate at atmospheric pressure, eliminating the need for a pressure vessel and related code requirements. Manufacturers in this growing market include Armstrong International, Kemco, Ludell, QuikWater, and Sofame Technologies

Tammy Collins from QuikWater was a presenter at a Technology Marketing and Assessment Forum sponsored by the Energy Solutions Center in Kansas City in October, 2008. QuikWater offers 16 standard models producing from 12 to 700 gpm at a 100°F temperature rise. The design pushes heated products of combustion through a heat exchange vessel packed with specially designed stainless steel rings. Heat from combustion is transferred directly to downward-moving water.

Collins notes that the direct-contact method has numerous advantages. “These units are 99% energy efficient and can provide energy savings of up to 40%, depending on what type of unit they are replacing. This means they can provide a very quick return on investment.”

Limitations with a Boiler

Collins claims that steam-to-hot water systems using an indirect source such as a steam/water heat exchanger, even with a well-maintained boiler and full heat recovery, are at best 69% efficient. She says, "With direct-contact water heating you should see at least a 30% saving on fuel use for generating the same amount of hot water."

Because they operate at atmospheric pressure, no permits or inspections are required, nor does a licensed boiler operator need to be on the premises. "Also," she says, "they provide hot water on demand, so there are virtually no standby losses. This is important in operations where the demand for hot water is intermittent." The QuikWater burner can be modulated to adjust to varying hot water demands. A low-NOx burner is available for air compliance regions.

Lowest-Cost Solution

Asked about an equipment cost comparison between the QuikWater system and a traditional fire-tube boiler, Collins indicates, "The QuikWater system comes in lower — hands down." She says, for example, a dedicated boiler system with an output of 6.0 MMBtu/hr will cost roughly 45% more than the comparable QuikWater system. Regarding service life of such a system, Collins suggests that a well-maintained system can last a lifetime. "We have units with 20+ years on them, still operating."

The comparatively small footprint and high efficiency of direct-contact water heaters make them ideal for many institutional and industrial installations. Photo courtesy Ludell Manufacturing.

A Quikwater system is used to supply hot water to maintain the temperature of rearing tanks for commercially raised alligators at Donald Farms in West Monroe, Louisiana. Proprietor Jeff Donald says the farm uses up to 300,000 gallons of heated water per day to supply the insulated tanks in barns. Donald remembers, "We previously used a swimming pool heater that we modified for this application. We went to the direct-contact system for its improved efficiency and its ability to handle a large volume of water."

> "If you need hot water, do the math."
>
> Mark Schwenneker, Tyson Foods

Tyson Foods operates numerous facilities throughout North America, as well as other regions. Mark Schwenneker, Director Engineering Renewable Fuels Operations with the firm, notes that Tyson has traditionally used steam-boiler generated hot water at its facilities, but has begun replacing older steam systems with direct-contact water heating in many situations. He has used the QuikWater systems in several plants.

He points out, "I don't believe there is any argument on this subject. The direct-contact heater is much more efficient." Schwenneker sees opportunities for this technology for various applications. He suggests that many facilities need hot water at varying temperatures for different operations, and direct-contact units have the flexibility to meet these multiple needs, but always at a high efficiency. "Or a heater could provide preheated makeup water either to a deaerator or boiler feedwater tank, eliminating much of the steam required for these applications.

"I would only say, if you need hot water, do the math. Evaluate the savings vs. cost between steam and a direct-contact system. If it's a new installation and you don't need the temperatures that steam can provide, it's a no-brainer—direct contact is the way to go."

Using Boiler Exhaust

Although it uses a different approach, a similar result is achieved with the Percotherm direct-contact condensing stack economizer by Sofame Technologies of Quebec. Boiler exhaust gases are blown upward through a vessel filled with stainless steel elements. A cold water spray courses downward through the packing section vessel, en route picking up the heat from the exhaust gases. Because it more fully extracts the heat from the boiler, this unit can actually improve the efficiency of the boiler system, and can help take fuller advantage of low-firing boiler capacity during summer months.

In addition to the Percotherm condensing stack economizer, Sofame also offers its Percomax direct-contact water heater, which uses a dedicated burner that exhausts through the heat exchange vessel. The Percotherm and Percomax systems can be combined at locations where there is a hot boiler exhaust and the need for large quantities of hot water.

An example of a successful combination of the two systems is at Sacré Coeur Hospital in Montreal. Here older boilers were recently replaced with two new 6 MW boilers, a Percotherm condensing stack economizer, and a Percomax direct-contact water heater. As a result of the installation, the hospital now generates hot water at efficiencies exceeding 95%.

John Rivers from Armstrong International's Hot Water Group emphasizes the efficiency of the direct contact approach. He notes

Multiple units can be combined to increase capacity or to provide diverse hot water temperatures. Photo courtesy Kemco Systems.

that the direct-contact water heating concept dates back to 1908.

He explains that the reason for his company's claimed 99.7% unit efficiency is that there are no stack losses, no storage radiant heat losses, no scale buildup, no condensate losses and no idle run time. He compares this with boiler systems that offer 80% at best, and often it is closer to 60%. Armstrong offers units with outputs ranging from 15 gpm to 10,000+ gpm.

> "Today's systems are so efficient that they are practical to use for applications such as boiler makeup water, hydronic heating, and food processing water sterilization."

One of the veterans in the field of direct-contact water heaters is Ludell Manufacturing, a division of Ellis Corporation. According to Greg Thorn from Ludell, his firm has patents for direct-contact water heating equipment going back to 1986. The equipment features very high efficiency, delivering 180° F water at efficiency greater that 99%.

The Ludell heater features corrosion resistant stainless vessel construction, giving it longer life than carbon steel vessels. The vessel is welded to ASME standards, but doesn't require a certified ASME stamp in order to perform repairs in the field if ever necessary. Thorn also notes that, unlike boiler systems, the Ludell unit can use water that has not been chemically treated or deaerated.

Wide Range of Applications

Kemco Systems Inc. also offers a wide range of industrial water heating and treatment systems. According to Kemco's John O'Hehir, the company has sold direct-contact systems since 1985, and these units make sense for a wide range of applications. "Compared to boiler systems, it's not just lower first cost, but lower system maintenance as well. You don't have that daily list of tasks that you have for a boiler system. And you don't have to have an operator in attendance."

O'Hehir indicates that the 99.8% efficiency design of the Kemco product continues to attract new converts. "Ready-mix concrete companies are a good application. They need large volumes of hot water on an irregular schedule. A direct-contact system is perfect for them." Other major markets for Kemco are commercial and institutional laundries and the food industry. O'Hehir says, "The food industry uses huge volumes of hot water not just for processing but for plant cleanup and sanitation. There are typically one or two big demand periods for cleanup water on each shift. The direct-contact heater can answer this need easily."

Interface with Process Controls

O'Hehir says that recent developments in the product line largely involve more sophisticated and flexible controls. "Today we are often asked to design water heater controls that can interface with process control systems. Today's controls can be customized to meet that requirement."

The manufacturers all emphasize that they can provide systems customized to meet the needs of a wide range of customers. O'Hehir says, "We suggest that an interested customer get in contact with us. We will study their application; even send a rep to their site at no charge to completely understand their hot water needs. Then we can design a system that will completely meet their needs, now and for the future." **GT**

MORE info

ARMSTRONG INTERNATIONAL
http://www.armstronginternational.com/fbflodirect

KEMCO SYSTEMS
www.kemcosystems.com

LUDELL MANUFACTURING COMPANY
www.elliscorp.com

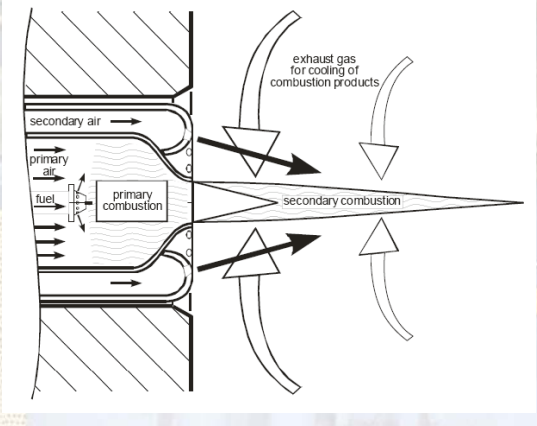
QUIKWATER
www.quikwater.com

SOFAME TECHNOLOGIES
http://www.sofame.com

This furnace at Rock River Heat Treat was upgraded with the installation of six Eclipse AutoRecupe SER burners, reducing process time sufficient to allow three additional treatment loads per day. Photo courtesy Eclipse.

BETTER Heat Treatment

WITH LESS WASTED ENERGY



Staged air combustion has become a widespread technique for improved burner efficiency and reduced NOx emissions. Illustration courtesy WS Thermal.

HEAT TREATMENT IS AN ESSENTIAL ELEMENT in modern metallurgical practice. The goal may be hardening, tempering, annealing, stress relief, or other modifications of the metal. The right heat treatment, followed by the right cooling process, changes the characteristics of metal, making it harder, softer, tougher, more malleable or more ductile. Most frequently, the heat originates from a natural gas-fired burner and the treatment takes place in an oven or furnace. Both ferrous and non-ferrous metals commonly receive heat treatment.

Pay Attention to Burner Efficiency

Thinking about Efficiency

Today, savvy process managers are becoming concerned about the efficiency of these systems. Certain basic steps can be taken. Ovens and furnaces can be modified to shut off burners when doors are open. In some cases, ovens and furnaces can receive additional insulation to reduce heat losses. Process changes such as staged heating in an oven can reduce energy costs.

But another key step is to evaluate, adjust, and, if necessary, replace the burners. Often this needs to be done within the context of achieving air quality compliance. According to Jeff Rafter from Maxon, a major manufacturer of burners, the opportunities for improvement are great. He notes, "The bulk of installed burners are often ignored and their operation is not well understood. Preventive maintenance is seldom practiced and knowledge of combustion devices has been dwindling with baby boomer retirements, outsourcing and downsizing trends."

Choosing the Right Burner

Rafter explains that burners in heat treating applications are broadly divided into those for direct-fired processes (annealing, aging and normalizing) and those for indirect processes (carburizing, nitriding, vacuum treatment, etc.). In indirect-firing, combustion takes place in a radiative U-tube or similar device. Rafter indicates that the efficiency of new burner models of both types has been increasing over the last two decades due to the increased use of heat recuperation in the designs, and, in some cases, due to the use of pulse firing systems. Pulse firing increases thermal turndown capability and increases temperature uniformity.

Digital Control Now Possible

Rafter points out that technology now exists that provides intelligent, automated control of the fuel-air ratio through the use of digital, high-resolution actuators, flow meters, and burner "brains." He emphasizes, "The result is a self-compensating burner that fully optimizes fuel-air ratio control and related burner efficiency."

Rafter indicates that Maxon's SMARTFIRE™ and SMARTLINK™ control systems use these techniques to dramatically advance the accuracy, reliability and efficiency of any burner application.

New Generation of Burners

Burners from WS Thermal are also widely used for heat-treating oven furnaces, both in direct-fired and indirect-fired applications. Steven Mickey from WS Thermal presented an update on burner technology at a Technology Marketing Assessment Forum sponsored by the Energy Solutions Center in Birmingham, Alabama in February, 2008. He pointed out how a new generation of burners using recuperative, regenerative and pulsed combustion burner designs both increases combustion efficiency and reduce burner NOx emissions.

More than 50,000 of the WS Thermal Rekumat® recuperative burners are in use, and the product is available in a variety of sizes and materials, with the choice of either staged air combustion or FLOX® (flameless oxidation) designs. The FLOX concept has considerable value for reducing NOx emissions even below those achieved with staged combustion. Mickey pointed out that both increased burner efficiencies and reduced emissions rely on controlling ideal fuel-air mixtures and combustion temperatures.

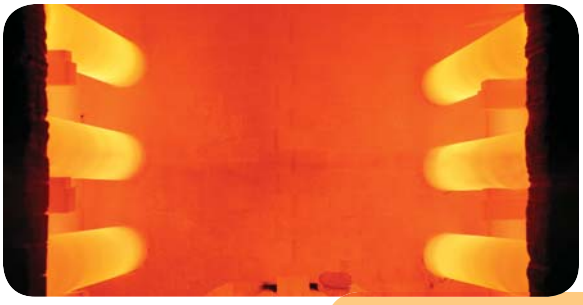
Strive for Perfect Fuel-Air Balance

The correct balance of fuel and air is also emphasized in an article published in *Heat Treating Progress (January/February 2008)* by Hauck Manufacturing Co. Hauck, located in Lebanon, Pennsylvania, is another major manufacturer of burners for heat-treating applications. The article notes, "The air to fuel ratio should be established as close to [the] stoichiometric ratio as possible throughout the entire burner operating range (high to low fire). Excess air or fuel reduces combustion efficiency. Burners should be sized and fired as close to their maximum output as possible, especially with high velocity burners."

Hauck indicates that their Kromschroder IC 40 burner control actuators, along with their Super Versa Tile high velocity burners, offer a good solution to optimizing the air-fuel ratio and maximizing combustion system efficiency.

Recuperative Designs Now Mainstream

As mentioned above, one of the keys to improved burner and process efficiency is the incorporation of recuperative designs. Most of the burner suppliers now offer recuperative units for both direct and indirect burner application. The recuperative principle is to reuse the heat from each burner exhaust to preheat combustion air or the fuel-air mixture. The SER AutoRecupe indirect-fired burner by Eclipse efficiently transfers heat from the exhaust to the combustion air supply, providing high preheat temperatures. Metallic or silicon carbide tubes are available for furnace temperatures ranging from 1000° to 1260°C (1830° to 2300°F) and are suitable wherever high efficiency, low emissions, and superior temperature uniformity are necessary.



These six indirect-fired burners by Eclipse use recuperative firing for increased efficiency and reduced emissions. Photo courtesy Eclipse.

An example of energy savings and improved production achievable with a burner retrofit is at Rock River Heat Treat in Rockford, Illinois. The company had installed a furnace and quench operation in 1981 that used four indirect-fired tube burners to process a 1,700 lb. load in one hour and 40 minutes. Tube failures were becoming increasingly problematic, and downtime was excessive.

Working with Eclipse, they performed a furnace rebuild and installed six AutoRecupe SER version 3 burners with ceramic inner and metallic outer tubes. Much of the original furnace equipment was still usable. With the new arrangement, the same size load could now be processed in one hour and 10 minutes, saving 30 minutes per load. This meant two to three extra loads per day using the same amount of fuel as previously. Plant maintenance manager Walter Wear says, "It's like getting the extra capacity free. After 20 months, we have had no maintenance problems or tube failures."

Inspection and Adjustment - a Minimum Requirement

All of the experts feel that if you are not able to justify installing the newer, high-efficiency burners, at a minimum you should perform an inspection and test of your existing burner arrangements. Verify that all of the burners are properly adjusted and that mechanical adjustments are made to ensure the correct fuel-air mixture. Repair or replace any failed burners or burner heads. Evaluate your heat-treating process to assure that you are operating in the most efficient manner possible.

Just as an accurate heat-treating process is necessary for optimum product quality, so also accurate burner operation is necessary for the process to be economical and emission-compliant. It's easy to forget about those burners. Don't let that happen. **GT**

MORE info

ECLIPSE
www.eclipsenet.com

HAUCK
www.hauckburner.com

MAXON
www.maxoncorp.com

WS THERMAL
www.flox.com

The industrial boiler room is often a rich opportunity for significant energy savings. Photo courtesy Cleaver-Brooks.

TAKING THE PATH TOWARD Energy Efficiency

Industry Looks for Ideas, Asks for Help

IN THESE DIFFICULT ECONOMIC times, industry engineers look for ways to increase operating efficiency. One obvious target is to reduce energy costs. Recent years have seen dramatic spikes in all energy costs, punctuated by short-term declines. But regardless of where we are on the price curve, a reduction in energy consumption will reduce the cost of production.

Lots of Help Available

Help is available from a variety of public and private sources to simplify the job of identifying, prioritizing and funding energy efficiency improvements. In some cases, the solution is new technology; in other situations what is needed is a rigorous review of existing systems and necessary repairs or adjustments. Most essential is a corporate commitment to finding and implementing energy efficiency solutions.

One company that has made such a commitment is Terra Industries, a U.S. manufacturer of nitrogen products, including fertilizer, chemical feedstocks, and reagents for air emission reduction. In a presentation at the Energy Solutions Center's Technology Marketing and Assessment Forum in Kansas City in October, 2008, the company's Senior Vice President of Commercial Operations, Joe Giesler, described his firm's commitment to reducing energy use and air emissions with process improvements at their six plants in the U.S. and Canada.

Beginning with a Detailed Study

As a result of a rigorous energy usage evaluation, in the period 2005-2007 the company implemented five compressor efficiency improvement projects and four process improvement projects at its plants, resulting in reduction of natural gas usage totaling $50 million per year. In the 2008-2009 period, Giesler said they will complete three additional compressor improvements and two steam turbine improvements resulting in an additional energy savings of $30 million per year. These four years of process improvements resulted in an overall reduction in natural gas usage of between 10 to 15%.

Help from ARRA

U.S. industry is also now looking at the recent "Stimulus Bill," the American Recovery and Reinvestment Act of 2009 (ARRA), for additional opportunities to initiate energy efficiency improvements. The U.S. Federal Government has committed to programs totaling approximately $787 billion.

Approximately $11 billion is going to subsidize energy-efficient and alternative fuel vehicles and related research. If you are operating a fleet of vehicles and can convert to new energy-efficient technologies, you may benefit. David Weiss, Executive Director of the Energy Solutions Center, states that some industries may get assistance here. He says, "Expanded interest in natural gas-fueled fleets for distribution and warehousing sectors

results from their awareness that abundant supplies of natural gas are available here in North America, and that natural gas vehicles are so much cleaner than those powered by gasoline or diesel."

ARRA also spells out a wide range of tax credits or favorable tax treatments for geothermal, microturbine, combined heat and power (CHP), fuel cell and other alternate energy installations.

Funds Beginning to Flow

According to a recent presentation by Kateri Callahan, President of the Alliance to Save Energy, the new law has the potential to expend $75 billion on energy efficiency programs. This includes both federally administered programs and federal funding for state programs. According to Callahan, the goal is for program funding to be expended in 18 to 24 months. "This means that federal and state agencies are scrambling to create programs as quickly as possible.

Two Department of Energy websites can help you stay informed on the provisions of ARRA. They are http://www.energy.gov/recovery and http://erendev.nrel.gov/recovery.

DOE Programs

DOE's Industrial Technology Program (ITP) also offers a wide range of tools to assist large-scale industrial energy users. DOE's Save Energy Now Program features three-day detailed energy assessments by qualified teams of energy experts, working with company staff. DOE claims that industries that have had full efficiency assessments under Save Energy Now have on average reduced their overall energy usage by 10%, including a reduction a 17% reduction in annual natural gas energy use.

For smaller industrial installations, ITP sponsors 26 regional Industrial Assessment Centers (IAC) located at various engineering university campuses. If you run a small- to medium-sized manufacturing facility with gross annual sales below $100 million and fewer than 500 employees at the plant site, you may be especially interested in an IAC energy and waste assessment. Additionally, the IAC serves as a training ground for the next generation of energy-savvy engineers.

MORE info

ALLIANCE TO SAVE ENERGY
http://ase.org

DOE SAVE ENERGY NOW PROGRAM
http://www1.eere.energy.gov/industry/saveenergynow

DOE ARRA INFORMATION WEBSITES
http://www.energy.gov/recovery/
http://erendev.nrel.gov/recovery

ENERGY SOLUTIONS CENTER EFFICIENCY CONSORTIUM
www.naturalgasefficiency.org

Where the Savings are Being Found

DOE, ESC, and other studies have identified certain industries and processes as having especially rich opportunities for energy saving. Many of the assessment recommendations to date have focused on boilers and steam systems, thermal processing equipment, thermal exhausts, and process controls and automation as being especially good opportunities for savings.

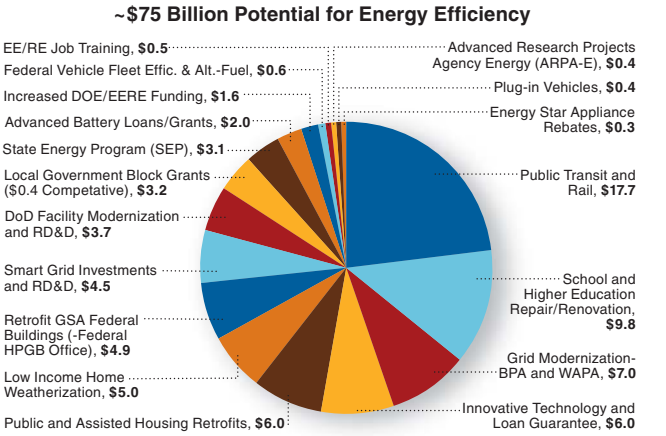


Chart shows planned distribution of ARRA funds for energy efficiency programs. Chart courtesy Alliance to Save Energy.

Recommendations for steam applications often include boiler or burner replacement, steam trap adjustment or replacement, condensate return improvements, blowdown heat recovery, and use of economizers for feedwater heating.

Improving process energy efficiency can sometimes be achieved with simple adjustments or repairs, but sometimes it is necessary to make major process changes, stretching over several years. Such was the case with a program undertaken by the Lighting Division of Philips Global. To help meet the corporation's energy reduction target of 10%, the Division initiated a program to evaluate energy efficiency of glass furnaces at its facilities.

Oxy-Gas Furnace Boosts Fuel Efficiency

As a result of this evaluation, the company replaced an existing electric glass furnace with an oxy-gas furnace. According to Philips' David Goldammer, glass furnaces have an operating life of about ten years before replacement. For this reason, it is important to make the right energy decisions at the replacement point. Company studies demonstrated that the oxy-fuel approach is more energy efficient, and had the potential for significant savings. It also resulted in lower air emissions when compared with coal-fired electric generation.

The new furnace also takes advantage of advanced burner technology, using eight Maxon LEFF Oxy-Therm® flat flame burners, which provide improved heat transfer across the furnace face and offer lower NOx emissions than earlier burner designs.

Utilities Also Can Help

In addition to federal and state energy assessment programs and tax credits or grants for emerging energy-efficient technology, many natural gas utilities offer assistance in performing energy evaluations or taking advantage of newer energy technologies. A consortium of ESC utilities recently launched a new website www.naturalgasefficiency.org to help customers tackle the job of energy conservation and improvements. What all of the programs have in common is that it is necessary to ask for help. If you are an industrial energy user and are concerned about the impact of energy costs, now is the time to study the current opportunities and ask for help. GT