WINTER/14
VOLUME 27 / ISSUE 3

gastechnology

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INNOVATIONS IN INDUSTRIAL OVENS

Solutions to Save Money

on the cover

Much of what we eat, tools that we use, and thousands of other household items are manufactured using industrial ovens, many of them fired with natural gas. Photo courtesy Infratrol Inc.

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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:
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Washington, DC 20001
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Printed in the USA

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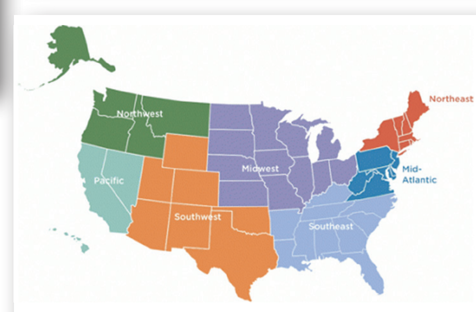


SOMETHING NEW IN THE OVEN

Technologies for Saving Energy

NATURAL GAS-FIRED OVENS serve a wide range of industries, coming in sizes from tiny laboratory ovens to enormous conveyor oven systems. Applications range from baking delicate pastries to high-temperature treatment of metal products. One of the most widespread applications is for drying and curing non-metallic industrial products, particularly powder paint surfaces, plastics and rubber. What all applications have in common is a need for optimum efficiency, minimal emissions, and tight temperature control. Newer oven and burner designs are reaching the market with an improved ability to meet these goals.

Natural Gas Often Chosen

The distinction between ovens and furnaces is a bit blurred, but generally speaking, industrial ovens are enclosed and insulated devices that operate at temperatures no greater than 1,000° F. Higher temperature units are usually classified as furnaces. Natural gas is often the heat source chosen for industrial ovens because of its favorable cost and low emission characteristics.

For many applications, for example powder paint curing or commercial pastry baking, precise temperature control is essential, and controlled product cooling is often as important a function as product heating. Ovens can be either directly fired with natural gas, in which case the combustion takes place in the oven itself, or indirectly fired, where the oven is heated radiantly, and combustion is outside the oven atmosphere.

Energy Saving Tips for Existing Ovens

In many cases, significant energy improvements are possible with existing ovens. Examine the seals around oven doors to assure their integrity. These areas can be a major source of heat loss and seals or gaskets can usually be adjusted or replaced quite economically. Evaluate your processing steps to assure that the oven is switched into idle mode when not actually in use. Conveyor ovens typically can be set to different temperatures at various cycle points.

Ovens and oven burners today are equipped with digital controls for precise temperature control and zone heating. Courtesy: Wisconsin Oven Corp.

Often the entire oven does not need to be heated, or lower temperature "soak times" can be utilized.

If a part of your process is product cooling and drying, check the exhaust humidity levels to assure that heat is reduced or shut off completely when the product has been brought down to the needed humidity level. If this drying function can be automated by the oven control system, so much the better.

Insulation a Key to Efficiency

Finally, you should regularly inspect oven insulation to be sure it has not shifted or settled to leave "hot spots" on oven wall or door panels. Insulation is an important key to oven efficiency. Generally speaking, newer industrial oven models place a higher priority on oven wall and roof insulation. Generally it is not practical to add insulation to an existing oven.

Infratrol Manufacturing Corp. of New Berlin, Wisconsin, manufactures a wide range of industrial ovens, including conveyor ovens, and standard and specialty batch ovens.

Functions include drying, curing plastic and adhesive products, powder paint processing, and metals annealing processes.

Use of Industrial Ovens Expanding

According to Mike Grande from Infratrol, the use of ovens in industrial processes continues to expand. He notes that 60% to 80% of his company's oven installations today are for expansion of process capacity. The remaining percentage is replacement of older existing units. He also notes that newer oven designs place a higher priority on energy conservation.

Batch-type ovens are used in a variety of applications, typically when required residence times are long. These units are often equipped with track systems for moving product in and out. Courtesy: Wisconsin Oven Corp.

Grande says, "Efficiency advances include thicker insulation and more efficient electric motors on both electric and gas-fired ovens." Oven controls are also an important improvement. Grande notes, "Newer controls include such features as door limit switches to put the burner on low-fire when the oven doors are open, and lower flammable limit (LFL) monitoring to reduce exhaust losses."

LFL monitoring assures that levels of volatile gases in the exhaust do not reach dangerous levels. In the past, high exhaust rates were used to assure that dilution was adequate, but often resulted in excessive heat loss. By monitoring LFL levels, excessive exhausting is avoided.

Burner Selection Important

Oven burners often last for the 20+ year life of the oven, so it is important to select the most efficient burner available, and to perform regular maintenance to assure it continues at specified performance levels. According to Grande, larger ovens, especially conveyors, are available today with additional energy efficiency features. "Our ovens include closed loop temperature control that maintains the temperature using only the amount of gas necessary. When more product is put in the oven, a burner valve opens proportionally to add more gas and it heats as necessary to meet the setpoint temperature."

Another major manufacturer is Wisconsin Oven Corp. of East Troy, Wisconsin. According to Gary Hanson, senior application engineer from this firm, the industrial oven market is evolving. One change is the need for reduced emissions from existing ovens. He notes, "Low NO_x burners are being requested more frequently as many areas of the U.S. establish more stringent controls." Hanson adds, "Often customers are looking for options to reduce operating cost of the equipment. We offer an E-Pack option that increases the oven insulation thickness and includes door limit switches, where applicable."

Heat Recovery from Higher Temperature Ovens

According to Hanson, the company sometimes has requests for recuperative heat recovery systems for the ovens. The company also offers an ECO-System option that captures exhaust heat from the equipment to preheat incoming air. "Its practicality is valid for application at higher temperatures and/or higher exhaust rates." He adds, "Caution should be used for Class A applications where solvents, combustibles, or powder constituents are being exhausted. These can collect in the heat exchanger and create a hazardous (explosive) situation."

Hanson points out that it is sometimes practical and cost-effective to replace an existing burner in an oven. "Depending on the emission level needed, it may require additional changes besides the burner and it might have changed mounting requirements. Also, since this would be a major change to the equipment, the customer could have to upgrade the equipment to meet current NFPA 86 standards if certain equipment changes were made. Even so, this is usually less costly than purchasing a new oven."

Conveyors ovens may use various methods for continuously moving product through various temperature heating and cooling zones. System include racks, trays, and suspension systems often used with powder paint. Courtesy: Infratrol, Inc.

Conveyor Oven Opportunities

Conveyor ovens often present significant opportunities for energy improvements. Both Grande from Infratrol and Hanson from Wisconsin Oven note that most conveyor ovens operate with multiple heating zones. Operators should assure that product is not being excessively heated. They indicate that if a conveyor oven has a heat recovery feature, operators should use this to full advantage for product preheating or drying stages. In some cases, product cooling at the end of the oven cycle can also recover heat for combustion air or product pre-heating.

Help with Oven Selection

Selecting an oven is a complex process. Owners need to consider current needs, but potential changes in process volume and possible changes in oven performance for the future. Grande suggests using an experienced consulting manufacturing engineer, and taking advantage of the technical abilities of the oven manufacturer's technical staff. Hanson from Wisconsin Oven adds, "A reputable oven manufacturer will ask many questions and listen to your needs before offering a solution. The supplier should act more like a consultant than a salesperson." Companies like Infratrol and Wisconsin Oven have qualified staff to assist with design requirements. GT

MORE info

DOE INFORMATION ON LFL MONITORING
www1.eere.energy.gov/manufacturing/tech_assistance/pdfs/use_lfl_monitor_process_htg11.pdf

GRIEVE CORPORATION
www.grievecorp.com

INFRATROL, INC.
www.infratrol.com

JENSEN INDUSTRIES
www.jensenind.com

WISCONSIN OVEN CORP.
www.wisoven.com

New Direction for Modular Boilers

Improved Efficiency, Precise Control

IN MANY SITUATIONS, it makes sense to replace one or two older steam or hot water boilers with an array of new smaller packaged boilers that have a sophisticated master boiler controller and other features. This approach can improve system efficiency, reduce emissions, and add to plant reliability. Other advantages of the modular approach include great seasonal turndown capabilities, rapid system start-up, and reduction in boiler room space requirements.

Vertical boilers are well-suited to modular boiler arrangements. Here are three 500 bhp units that serve a pharmaceutical plant. Compact size allows space for future boiler additions as needed. Courtesy: Clayton Boilers.

Compact and Efficient Solution

The modular approach is growing in popularity because newer compact boiler designs are far more efficient than small boilers from the past. Today's sophisticated controls assure optimum efficiency at all load levels. The traditional approach to sizing a boiler plant was to calculate the total peak steam requirement, select a boiler that met that need, then specify a second boiler the same size as a backup.

Thus if the peak steam need was for 480 bhp, then to allow a reasonable margin for growth, the owner might specify one 600 bhp boiler, with a second 600 bhp boiler for reserve. In most instances, the two boilers would be rotated in service, but there would always be boiler capacity in excess of 200% of peak load. Further, the single large operating boiler would need to remain in service even during minimal steam or hot water load requirements. Because most boilers are designed for their most efficient operation above 80% of peak load, it would often be operating at a less efficient level.

Large Boilers Must Be Kept Hot

Because the large boiler might take hours to heat up to steam generation temperatures, it would normally be kept hot overnight, even when no steam service was required. This system design is widely used even today, and represents a major target for future system upgrades.

Doug MacMaster is Senior Director of Eastern U.S. Operations for Miura North America. Miura is a prominent manufacturer of boilers of various types, and promotes the benefits of smaller, modular boiler systems. MacMaster points out that in the situation above, a better approach may be to have three or four smaller boilers, perhaps in the 200 to 300 bhp range. "All of these boilers would be used together and controlled by one master controller that would cycle the boilers evenly and fire them precisely."

Better Efficiency from Smaller Boilers

Using this modular boiler approach, the "N+1 system" - with two boilers -can be replaced by smaller package boilers that have similar or better base efficiency, and offer even better system efficiency because they can be fired individually near their peak efficiency range. Overall boiler system expense can be lowered because only 600 to 700 total bhp is needed to assure availability of a redundant unit.

The footprint for a series of boilers like this would be approximately 50-60% of that for the two current boilers that totaled 1,200 bhp. This frees up significant space for other needs of the company. Further, if expanded operations require more steam, a single smaller boiler can be added to the plant rather than another large 600 bhp unit.

Much Lower Water Volume

MacMaster further explains that these boilers contain just 80-100 gallons of water and require only five minutes to generate steam from a cold start. "This small water volume results in little concern for thermo-shock, as is the case with larger firetube boilers that can contain thousands of gallons of water and require hours to come on-line."

This quick startup time also enables the company to reduce labor costs since the boiler operators do not need to arrive early to turn on the boilers in preparation for the day's operations." He points out that because the water volume is small, and the system can use a unique chemical anti-corrosion system, the volume of blowdown water is significantly reduced. "This means less environmental impact and energy savings."

Sophisticated Master Controls

Control systems for modular boiler systems are designed for efficiency optimization, high quality steam and emissions management. MacMaster notes that in the situation above with four 200 bhp boilers, each Miura boiler has three burner settings – standby, medium-fire and high-fire. Thus the master control system would provide a 12:1 turndown ratio (4 boilers X 3 settings), allowing for steam pressure setpoints that track very close to the required steam demand.

McMaster indicates that currently Miura LX-300 boilers have efficiencies as high as 87%, with plans for nearly 90% efficiency in the future. With modular installations, most of the installed boiler capacity can be held to operate near that rate for outstanding system efficiency numbers.

Rapid Response to Steam Needs

Ron Polidori from Clayton Boilers emphasizes the ability of smaller boilers to come on line quickly and respond to varying load requirements. He says, "A Clayton steam generator has the advantage of having a small water content and unique design allowing for fast startup and fast response to load fluctuations while maintaining peak efficiencies across the entire turndown range of the boilers and system."

He also notes that skid-mounting the equipment is growing in popularity. "Skid-mounting is beneficial for numerous reasons such as being already piped and assembled to minimize installation costs or potential installation issues." He indicates that Clayton offers a variety of skid-mounted options for boilers and feedwater treatment equipment.

Systems Growing in Popularity

Chad Fletcher from Hurst Boiler also emphasizes the growing popularity of modular boiler solutions. "Using multiple boilers equals less energy cost and a more efficient system. It also provides the ability to adjust more quickly to a larger load." He indicates

An example of a large number of compact boilers giving great flexibility and system redundancy. A digital control system manages boiler duty hours and optimizes units for peak efficiency. Courtesy: Miura Boilers.

that all Hurst boilers can be used in modular installations. "The most standard is a series of vertical boilers, due to their small footprint, their efficiency, and the ability to react to loads much quicker than larger boilers."

Fletcher adds another advantage: "Some states require an operator at all times for a larger boiler, while multiple boilers each rated under the governed horsepower do not." This is another potential savings in personnel costs.

Meeting Widely Varying Loads

An example of the benefit of a modern modular boiler system is the campus steam system for the University of Arkansas in Fayetteville. The University replaced a pair of aging firetube boilers with six Miura LX-300 boilers to provide steam for many buildings on its 350 acre campus. The University's Director of Utility Operations and Maintenance, Scott Turley, notes that the site has widely varying weather and temperature conditions.

Further, the daily patterns of steam needs for dormitories and classroom buildings has wide and rapidly-changing swings. Turley says, "To accommodate that with old, large central-station boilers is not the most efficient approach. Replacing them with Miura's modular, rapid-start step-fired boilers that can match our load profile much more closely is more appealing to us." Preliminary data indicates that the University has been able to achieve annual savings of $280,000 through its new modular six boiler system.

Laundry Application

In another example, the Up To Date Laundry Company on the U.S. Eastern Seaboard is committed to energy conservation and sustainability, and has taken various steps to achieve that goal. One was to replace two older 300 bhp boilers with three Miura LX-200 boilers, rated at 200 bhp each. According to the laundry's Chief Engineer, the new units "heat up quicker, provide steam more steadily, and deliver more versatility." He notes that the system comes on line quickly, allowing the entire plant to be in operation in less than ten minutes at 125 psi. The combination of microprocessor control and on-demand steam has allowed annual energy savings of 20%. Further, it has significantly reduced emissions of NO_x and CO_2.

Consider Replacing Your System

Is it time for your facility to have an upgrade to a modular boiler system with central processor control? Perhaps so, if you are depending on one or two older boilers, particularly if your steam requirement is variable through the day or through the season. Today's modular boiler installations offer low emissions, a smaller footprint, and great operating flexibility. **GT**

MORE info

CLAYTON INDUSTRIES
www.claytonindustries.com

CLEAVER-BROOKS
www.cleaver-brooks.com

ENERGY SOLUTIONS CENTER BOILER CONSORTIUM SITE
www.cleanboiler.org

HURST BOILERS, INC.
www.hurstboiler.com

MIURA BOILERS
www.miuraboiler.com

Fuel Cells Today

Intriguing Technology Scales Up

The Bloom Energy fuel cell installation at an eBay facility in Utah totals 6 MWe in capacity. Photo courtesy Bloom Energy.

FOR DECADES WE'VE HEARD OF THE PROMISE OF FUEL CELLS for clean, reliable electric energy at the point of use. This technology, which was first suggested in the 1830s, is a method of converting chemical energy into direct current electricity without the need for combustion.

Energy is generated by the combination of hydrogen and an oxidizing agent with the use of a cathode, an anode and one of many possible intermediate electrolyte materials. Pure hydrogen alone is rare on our planet, so the most common source of the hydrogen molecules is natural gas. Other fuels can be used as hydrogen sources, including biogas, diesel fuel or propane.

Started with Space Program

We started hearing about fuel cell applications in the space program in the 1960s, and optimistic predictions were made that the fuel cell would be a primary energy source for our society in the near future. These predictions were of course wildly optimistic. What was practical – even essential – for small energy inputs on a space voyager could not then be economically scaled up for household, commercial or industrial use.

Recent years have seen developments in fuel cells that finally make them an attractive option for mainstream applications. They have become especially useful for remote communication sites, as backup power supplies, and even as primary power supplies in certain applications. One key to their successful development is the widespread availability of economical natural gas. Increasing production of biogas from landfills and digesters make fuel cells an interesting application as an alternative fuel in electricity production.

A second key has been improvements in the hydrogen reformers that extract hydrogen from the source fuel at increased efficiency. Reformers can be external devices that feed hydrogen to the fuel cell, or internal to the cell design itself.

Thirdly, new fuel cell types have been developed that are simpler and have longer electrolyte lives than older approaches. Fuel cells have been developed with electrolytes that include molten carbonate, proton exchange membrane (PEM), phosphoric acid, and increasingly, solid oxide designs.

Multiple Cells Combined

Systems have individual cells that generate relatively low voltages and amperages of direct current energy. By stacking individual cells and operating multiple parallel stacks, much higher outputs are achieved. Often the direct current output is converted into alternating current, with systems having outputs in the hundreds or even thousands of kilowatts.

Fuel cell generation often also has a significant thermal output, which can be utilized for household or even industrial purposes. By fully utilizing the byproduct heat, system efficiencies as high as 90% are achievable. However for these efficiencies to be fully realized, there must be an application for the byproduct heat which matches the fuel cell operation pattern. This is often not possible when the fuel cell is used for remote power applications, or in many industrial, commercial or institutional applications. In these situations especially, electric generation efficiency is most highly prized.

Solid Oxide Electrolyte Approach

As indicated, one of the interesting newer fuel cell electrolyte approaches is the solid oxide fuel cell. These promise higher electrical efficiency and longer operating life than many other system types, and require less elaborate containment mechanisms for the electrolyte.

Individual manufacturers have proprietary electrolyte designs and most involve a ceramic substrate for the anode and an electrolyte that is doped or treated with compounds containing rare metals such as yttrium, lanthanum, and gadolinium in various forms and combinations. The goal is maximum efficiency at temperatures that do not excessively shorten the life of the cell. Most solid oxide fuel cells have internal operating temperatures between 500° C to 1,000° C (932° F to 1832° F).

Ceramic Electrolyte

One of the prominent manufacturers of fuel cells today is Bloom Energy from Sunnyvale, California, with a manufacturing center in Newark, New Jersey. The Bloom fuel cell features a ceramic electrolyte with a specially treated surface to support the chemical reaction that generates electricity. Each individual cell generates about 25 watts of energy, and thousands of cells are "stacked" and stacks are combined to make generating units of 100 kW/AC and 200 kW/AC each.

According to Alanna Gino, spokesperson for Bloom, their system generates electricity at relatively high efficiency, thus does not rely on byproduct heat recovery to make the system economically attractive. Gino indicates, "The Bloom Energy fuel cell provides a clean, reliable, cost-effective onsite power generation solution that mitigates operational, environmental and economic risks associated with reliance on conventional grid power. Customers benefits from the predictability and long-term cost savings of their projects, in addition to greenhouse gas emission reductions and water savings."

Modular Approach

The Bloom Energy product is designated as an "Energy Server", and is offered in unit sizes of 100 and 200 kWe. The Energy Servers are commonly combined in multiple unit packages. Gino says, "Bloom Energy Servers are modular, scalable and easily sited for a variety of geographies and facility types. They serve a diverse range of sectors including retail, logistics, technology, manufacturing, financial services, food and beverage, data centers, biotech and healthcare as well as government agencies and nonprofits."

Fuel cells can be combined in large numbers to provide significant blocks of AC power with very low environmental or esthetic impact, as shown in this Nokia project. Photo courtesy Bloom Energy.

Growing Number of Installations

Gino points out that access to affordable and reliable natural gas and biogas provides a stable supply and an attractive economic proposition for expanded deployment of fuel cells. Currently there is more than 140 MWe of capacity installed across the U.S. and Japan. Large single installations include 6 MWe at eBay in Utah, 10 MWe at Apple in North Carolina and 30 MWe at Delmarva in Delaware.

An Option Worth Considering

Experts are necessarily cautious about over-promising the role of fuel cells in our future energy plans. We've made that mistake in the past. But the combination of increasing unit efficiencies, extended electrolyte life, and affordable natural gas supplies make the modular fuel cell an option worth considering. In this age when emission controls are tight and energy options have become limited, the fuel cell has a role to play. **GT**

MORE **info**

BLOOM ENERGY
http://www.bloomenergy.com

DOE INFORMATION ON FUEL CELLS
http://energy.gov/eere/fuelcells/fuel-cells

APPROACHING IDEAL COMBUSTION

New Tools Now Available

COMBUSTION IS THE CENTRAL PROCESS IN MANY INDUSTRIAL NATURAL GAS APPLICATIONS. This encompasses boilers, heat-treating equipment, furnaces, kilns, ovens, dryers and many other equipment types. Natural gas is an excellent fuel because of its clean-burning characteristics, its availability, and its simplicity of use. One challenge for process owners is to get closer to ideal combustion with a perfect air-fuel mixture. Ideal combustion implies complete and uniform mixing of fuel and air, and while this may not be entirely possible, new systems allow us to come much closer to the ideal.

The Old Excess-Air Approach

Historically, the approach was to calculate roughly the correct fuel-oxygen mixture, then make a generous allowance of excess air to assure complete combustion. Sometimes this has meant 50% excess air or even more. The problem has been that under most conditions, this excess air allowance was far too generous, taking much usable heat out with the exhaust.

Occasionally, the excess-air allowance was inadequate, with a potential for creating soot in the exhaust system and even the risk of fire or explosion downstream of the intended combustion area, or emitting potentially hazardous carbon monoxide in the exhaust.

The imperfection of this standard combustion mixture is caused by numerous potential variations in the combustion air, and even variations in the fuel itself. Until recently, seeing these variations and making appropriate adjustments has not been entirely possible.

Environment Affects Combustion Mix

On the air side, the density of combustion air varies with ambient temperature, and with barometric pressure. Today's combustion air may be more or less dense than the "ideal" used for burner settings. Seasonal or daily variations in humidity also affect combustion values. Settings established with humid, warm summer air will result in higher levels of excess air in the winter, when the air is denser and dryer. The inefficiencies of the standard excess air approach have long been recognized, and some solutions have been developed.

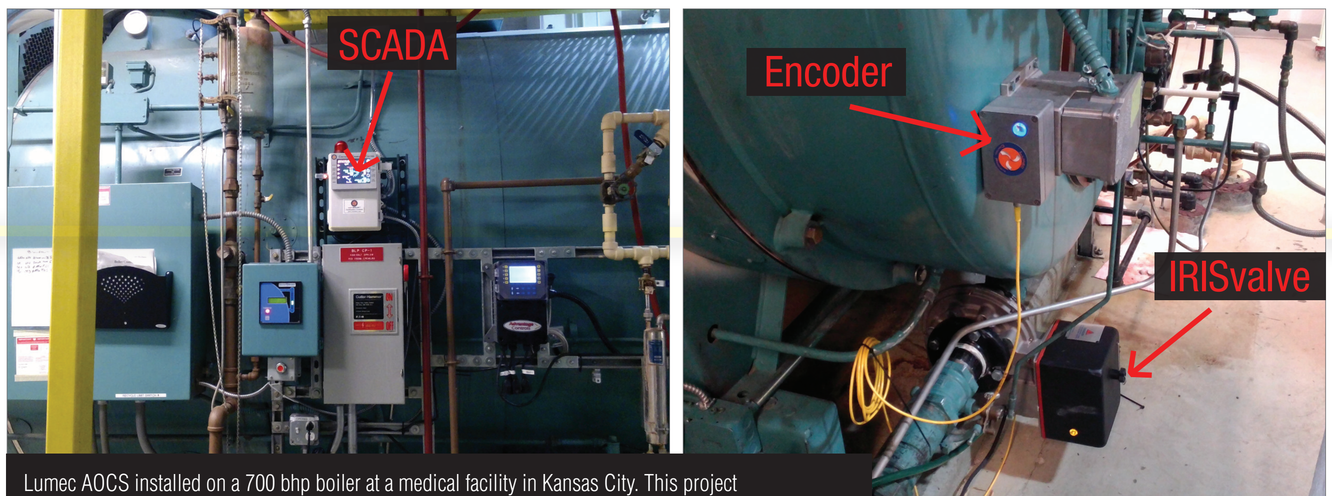
On the fuel delivery side, conventional butterfly-type fuel valves are designed for maximum flow and are inaccurate at lower fuel flow rates. These control mechanisms can be sloppy and will drift from calibration with wear of components. Another potential source of inaccuracy is variations in the content of the natural gas fuel as delivered.

While natural gas is primarily methane, it also contains some varying amounts of more complex combustible gases such as propane, ethane and others. Further, variations in fuel delivery pressures affect the combustion mixtures. These must also be taken into account.

Problems with Mechanical Linkages

Until the mid-1980s, most industrial combustion systems – boilers and other devices – used complex mechanical linkages to control air and fuel flows at various firing rates. These relied on jackshafts, cams, springs, set screws and other devices and were notorious for drifting out of alignment, again causing technicians to err on the side of excess air in the interest of safety. Many boiler codes required minimum 15% excess air to allow for the known inaccuracy of these systems, particularly at low-fire rates.

An important development was replacement of these mechanical linkages with valves operated directly by servomotors using digital inputs for positioning. This is the so-called parallel positioning burner control system. These systems make giant steps in eliminating sloppiness in control resulting from lash in mechanical controls and their tendency to drift out of calibration. If your combustion system uses mechanical linkages only, it's time to consider parallel positioning.



Lumec AOCS installed on a 700 bhp boiler at a medical facility in Kansas City. This project demonstrates the minimal modification typically needed to improve the efficiency of the boiler.

Measure Exhaust Oxygen

While parallel positioning is an improvement, these systems are still limited in accuracy without feedback on air and fuel conditions. A second important advance is the use of exhaust gas oxygen monitoring – so-called "O_2 trim" to provide feedback on exhaust gas excess-air levels. Without O_2 trim, most boiler codes required operators to maintain a 15% excess air (3% oxygen) level. With O_2 trim and parallel-positioning controls, combustion can be held much closer to ideal levels. By adding O_2 trim to your burner controls, you can take another step closer to ideal combustion.

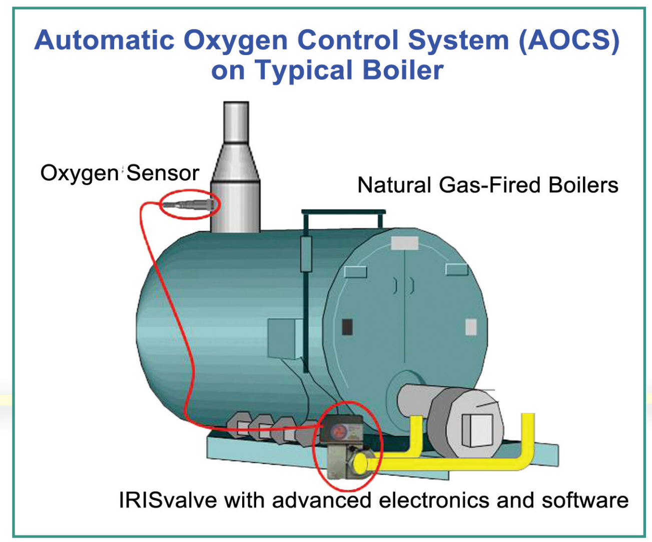
A DOE/EERE report titled "Improve your Boiler's Combustion Efficiency" notes, "When fuel composition is highly variable (such as refinery gas, hog fuel, or multi-fuel boilers), or where steam flows are highly variable, an on-line oxygen analyzer should be considered. The O_2 trim system provides feedback to the burner controls to automatically minimize excess combustion air and optimize the air-to-fuel ratio."

The chief obstacle to this approach is that it usually requires extensive re-piping and often new valves and sometimes entire burners. Some feel O_2 trim and parallel positioning are not practical as upgrades on smaller combustion applications – in the case of boilers, perhaps those below 1,000 bhp. But there's still hope!

Control Breakthrough

Systems have been developed that are also practical for smaller-scale applications. For example, Lumec Control Products, Inc. has put forward such an approach, which was introduced commercially in 2013, after extensive development and testing. This is Lumec's Automated Oxygen Control System (AOCS). This approach uses the company's proprietary IRISValve™ Continuous Combustion Control System. The heart of the system is the valve, with a variable-aperture opening similar to an iris lens on a camera. It provides very precise control of air and fuel flows. The valve is coupled to a rugged oxygen sensor in the stack and proprietary electronics to give precise control of combustion, coming very close to ideal proportions.

According to Lumec's Chief Technology Officer Paul Luebbers, no other control device can match the valve's linear response, adjustment speed and unlimited turndown. Luebbers says, "The rugged sensor 'closes the loop' by using the output flue gases to manage the input ratio simultaneously. The SCADA system is designed to make operation and oversight easy, while providing diagnostic information that is otherwise rarely available."



Major Efficiency Improvements Likely

According to Luebbers, the amount of combustion efficiency improvement is variable, but an 8% improvement for institutional applications using tempered air is a typical result. "The number is higher for industrial settings with wide fluctuations in humidity, temperature and fuel quality. The highest reported savings to date was a 40% reduction in energy per unit of product."

The AOCS normally does not require replacement of burners, and minimal changes in fuel and air piping. Luebbers suggests interested customers work with their consulting engineers and with Lumec to develop accurate baseline information and savings potential. He feels that the system makes the benefits of O_2 trim available to operators of boilers as small as 100 bhp, and other similar-sized combustion equipment.

Regardless of the size of your industrial combustion system, if it still relies on floppy, pure-mechanical combustion controls, it's due for an upgrade. In the interest of energy efficiency, reduced emissions, and reduced maintenance, today consider flow control upgrade options. Ask your engineering consultant for help in coming much closer to the ideal combustion. **GT**

MORE info

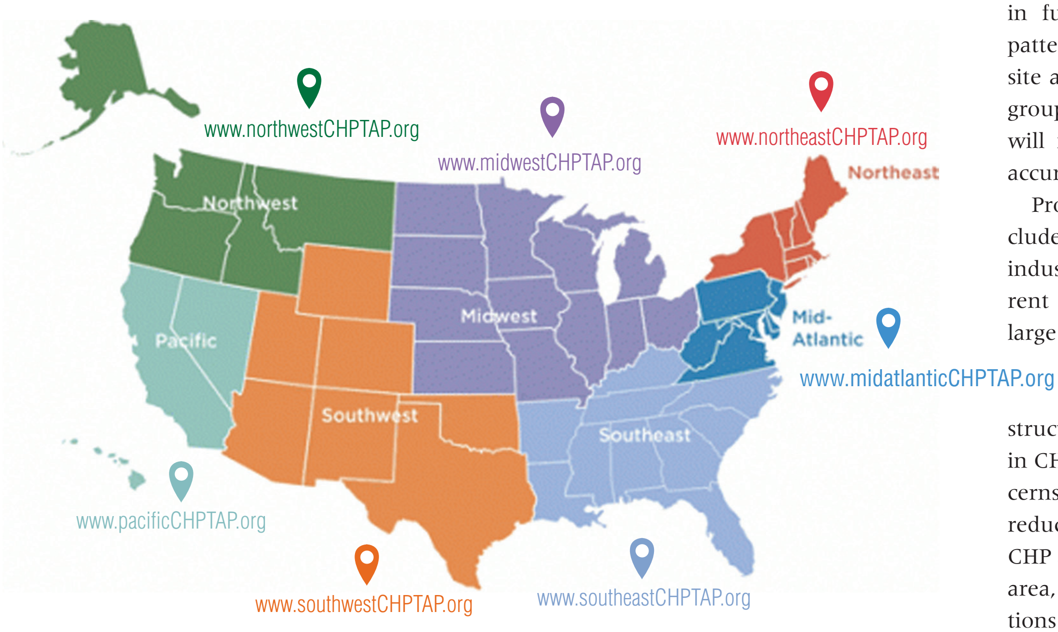
DOE-EERE INFORMATION ON IMPROVING BOILER EFFICIENCY
https://www1.eere.energy.gov/manufacturing/tech_assistance/pdfs/steam4_boiler_efficiency.pdf

ENERGY SOLUTIONS CENTER BOILER BURNER CONSORTIUM WEBSITE
http://www.cleanboiler.org

LUMEC CONTROL PRODUCTS
http://www.irisvalve.com

• • DOE Program Supports CHP • •

PROGRAMS FROM THE DEPARTMENT OF ENERGY'S OFFICE OF ENERGY EFFICIENCY AND RENEWABLE ENERGY (EERE) have potential to help industrial and institutional energy users reduce energy expense, curtail emissions, and improve site efficiency. These programs recognize potential benefits from shared knowledge and experience and are generally offered through regional knowledge centers using staff with industry and institutional experience and contacts.



TAP Programs for CHP Assessment

One important area is Technical Assistance Programs (TAPs) which focus on improved energy efficiency through mobilization of combined heat and power (CHP) strategies. According to Claudia Tighe from EERE, TAP programs can potentially benefit both the energy user and the nation. She notes that program details are available at the website http://www.energy.gov/eere/amo/chp-deployment.

Tighe says that after reviewing the program features, "The next step is to contact the CHP TAP Director in the region. If the end-user has more than one facility, please contact me via email so that I can provide appropriate resources based on the end-user's need and interest." Tighe's email is claudia.tighe@doe.ee.gov. The locations of the regional CHP TAP offices are shown in the illustration.

Expert Advice for Stakeholders

According to Tighe, the key services provided by the TAPs include market opportunity analyses, education and outreach, and technical assistance. She notes, "TAPs provide expert technical advice to stakeholders seeking CHP options. This includes engineering and project development screenings and feasibility assessments, as well as identification of incentives and financing options available to the facility."

The CHP TAP program, in effect since 2009, has a history of participation in a large number of successful CHP projects. TAPs have provided direct technical assistance to over 590 projects since program inception. Of these, 190 are currently under development or online, with a combined capacity of 1.5 GW.

Analysis of Energy Needs

A major consideration in assessment is evaluation of both electrical and thermal requirements of the site on a daily, seasonal and annual basis. Also included will be an evaluation of trends in future energy costs and usage patterns, both for the individual site and for the region and industry group. TAPs have access to data that will make these assessments more accurate.

Projects undertaken by TAPs include commercial, institutional, and industrial sites. Tighe points out current trends: "We are seeing more large commercial and institutional projects – hospitals, universities/colleges, critical infrastructure sites – becoming interested in CHP in part due to resiliency concerns and in part for operational cost reductions. Also, microgrids with CHP are becoming a significant topic area, and district energy configurations are continuing to be strong."

Opportunities Are Strengthening

Tighe notes that natural gas supplies and prices have contributed to CHP interest. "Economic development opportunities afforded by CHP in rural areas as well as industrial park settings are strengthening." In some cases, several industrial or institutional users can jointly participate in a project, sharing in the electrical and thermal energy benefits.

If your facility is considering doing a CHP feasibility analysis, or has even started one, it is to your benefit to include in the process the resources of your regional TAP. The key to a successful assessment is the best and most complete information. EERE's TAPs can be a very useful support for this process. **GT**

MORE info

DOE/EERE INFORMATION ON CHP TAP SERVICES
www.energy.gov/eere/amo/chp-technical-assistance-partnerships-chp-taps

ENERGY SOLUTIONS CENTER CONSORTIUM ON CHP
www.energysolutionscenter.org/consortia/distributed_generation_consortium.aspx