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BRINGING YOUR STEAM PLANT TO PEAK EFFICIENCY

ESC
Energy Solutions Center

on the cover

With improved maintenance practices, modernization of the boiler and installation of exhaust heat recovery equipment, major improvements in plant efficiency are possible.

ESC Energy Solutions Center

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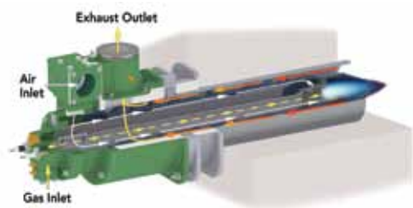


Improving Steam System Efficiency

Systematic Plant Improvements

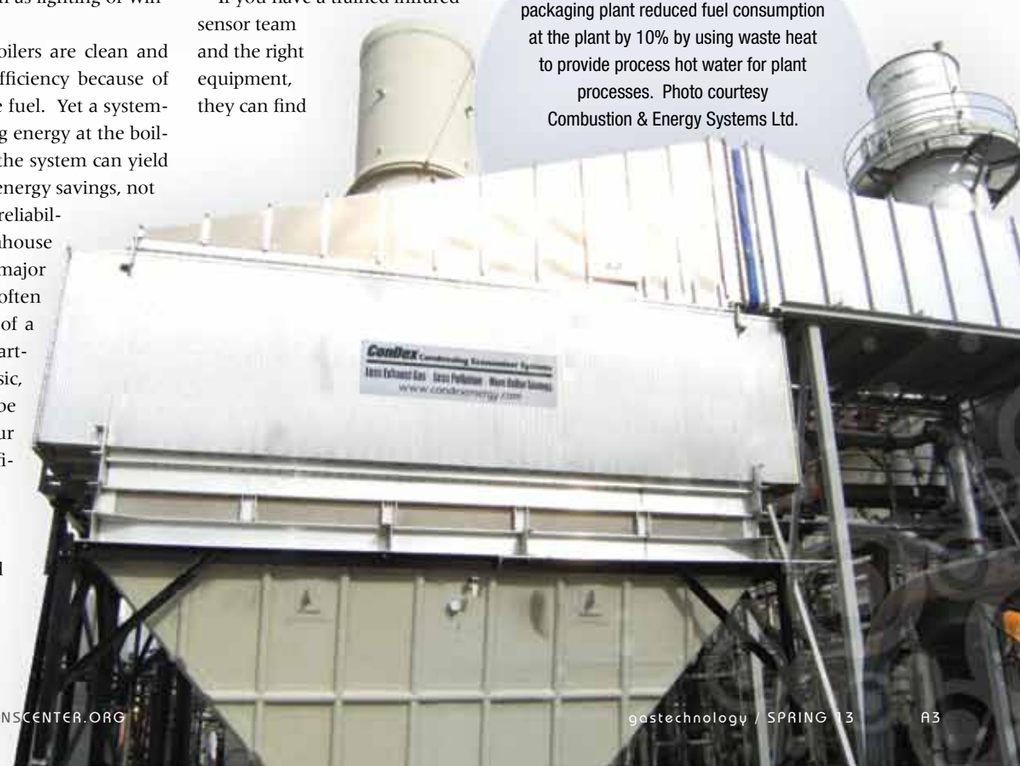
STEAM SYSTEM EFFICIENCY sometimes doesn't get the attention it deserves. Perhaps it's because the boiler plant is hidden in a lower level mechanical room. Perhaps it's because today's gas-fired steam systems run unobtrusively, without the need for constant attendance. But these systems are often the largest energy user in industrial facilities and deserve at least as much attention as lighting or window leaks.

Natural gas-fired boilers are clean and have high inherent efficiency because of the ideal nature of the fuel. Yet a systematic approach to saving energy at the boiler plant and through the system can yield significant additional energy savings, not to mention improved reliability and lowered greenhouse gas emissions. A major improvement can often be made by addition of a boiler economizer. Starting with the most basic, what steps should be taken to make your steam plant more efficient?

Find the Leaks

A first step is to find steam and condensate leaks. Puddles on the mechanical room floor or elsewhere in the plant are often signs of leaky steam traps or valve packing, or problems in the condensate return system. You don't need special equipment to find these problem areas. Trace them to the source and fix them. Hot spots along steam and condensate lines are also obvious indications of either steam leaks or inadequate insulation.

If you have a trained infrared sensor team and the right equipment, they can find these hot spots. Alternatively, help is available from infrared specialists. A single large uninsulated valve could be costing your company hundreds or even thousands of energy budget dollars each year. Custom insulation companies make removable



Installation of a ConDex condensing economizer at California packaging plant reduced fuel consumption at the plant by 10% by using waste heat to provide process hot water for plant processes. Photo courtesy Combustion & Energy Systems Ltd.

covers for pipes and fittings that are efficient and easy to replace after service work.

Condensate Return Systems

In older plants, condensate return lines were often incomplete and these are seldom adequately inspected or kept in repair. With today's tight energy budgets, this is unacceptable. You need to study the entire condensate system and extend return lines throughout the plant. Just as importantly, plan to inspect the entire system with regularity. Failure rates of steam traps and valve packings make such systematic inspection essential. By taking advantage of improved condensate return you not only salvage the heat from the condensate, but also reduce your costs for makeup water treatment and feedwater pre-heating.

Boiler Blowdown Heat Recovery

If you are not currently salvaging waste heat from your boiler blowdown system, this should be considered. Blowdown heat recovery is particularly effective for higher-pressure industrial boilers. Recovered heat is often used for preheating makeup water, feedwater, or for building potable water systems. Package heat recovery systems are available for a wide range of blowdown systems sizes. This chart illustrates potential heat recovery values.

Boiler Burner Review

Even if your boiler is in excellent condition, it can't perform efficiently without a high-efficiency burner in peak operating trim. Some owners are improving the efficiency of their boiler by replacing older burners that have slack mechanical controls with newer models that feature precise digital controls and fuel-air mixture feedback devices. Not only does this reduce the need for constant combustion recalibration, but it also permits the boiler to operate with an optimum mixture at all firing levels.

You'll probably want an industrial boiler specialist to evaluate the burner-boiler operation. Provide this consultant with a complete profile of your varying steam and hot water requirements throughout the week and throughout the year. The payback on a burner replacement can be remarkably short – sometimes just a few months. Don't postpone this decision.

The Heart of the Boiler

If you aren't doing a complete and systematic boiler internal inspection at least once a year, you are missing another opportunity to keep the boiler in trim. Inspection by qualified personnel will reveal cracked or broken tubes, broken refractory material or corrosion on boiler tubes. If you are partially or completely firing with oil, wood waste or other fuels, then regular sootblowing and periodic combustion-side cleaning will be necessary.

Most gas-fired boilers need little periodic cleaning on the combustion side, but the water-steam side needs close watching. Tube inspection will note scale buildup from feedwater. Just an eighth-inch of scale can drop heat exchange efficiency by several percent. Inspection may reveal the need for changes in feedwater treatment.

Economizers, the Grand Opportunity

Possibly the greatest opportunity for significant plant energy saving is in boiler exhaust heat recovery with the right economizer system. An economizer is an exhaust gas-to-liquid heat exchanger downstream from the boiler that takes the last shot at capturing heat that would otherwise be discharged to the atmosphere. The liquid collecting the waste heat – usually water – can be boiler feedwater or makeup water, building potable hot water, process hot water, space heating water, or any process fluid that requires heating.

Combustion & Energy Systems, Ltd. Of Markham, Ontario is a major provider of combustion and heat recovery systems for industrial plants. Cameron Veitch from this firm was a recent presenter at a Technology & Market Assessment Forum sponsored by the Energy Solutions Center. He noted that economizers are a major opportunity for many industrial and institutional steam plants. His company designs and manages the installation of ConDex condensing economizers. These capture both the sensible and latent heat from a boiler exhaust and use it to heat water or other process fluids.

By passing the exhaust gas over water-cooled tubing, sensible heat as well as significant latent energy from combustion is captured. According to Veitch, the most common uses for the recovered energy is to heat boiler makeup water, district heating water or plant process water for various uses. He notes, "By using recovered energy to heat the water instead of using 'live' fuel, savings are found."

Boiler Blowdown Heat Recovery Potential

Blowdown Rate, % Boiler Feedwater	Heat Recovered, Million Btu per hour (MMBtu/hr)				
	Steam Pressure, psig				
	50	100	150	250	300
2	0.45	0.5	0.55	0.65	0.65
4	0.9	1.0	1.1	1.3	1.3
6	1.3	1.5	1.7	1.9	2.0
8	1.7	2.0	2.2	2.6	2.7
10	2.2	2.5	2.8	3.2	3.3
20	4.4	5.0	5.6	6.4	6.6

Based on a steam production rate of 100,000 pounds per hour, 60°F makeup water, and 90% heat recovery. Illustration from DOE/EERE Energy Tips, Steam

This HeatSponge economizer requires minimal space in the mechanical room and significantly increases the efficiency of the boiler plant. Photo courtesy Boilerroom Equipment Company.

Cool Water Needed

To capture energy from exhaust condensation, water temperatures of approximately 130° F or less are required. At higher temperatures, much of the sensible heat is captured but not the latent heat. Veitch emphasizes "The colder the water the better! This will maximize the fuel utilization efficiency of the heat input to the boiler."

Where the operating efficiency of a modern non-condensing boiler without an economizer may be 80%, additional savings of more than 10% can be achieved with a condensing economizer. Veitch indicates, "Typical ConDex units result in a boiler efficiency of 90-97%. We seldom see anything below a 10% efficiency improvement in a condensing economizer application." He adds that the most common payback for the systems is 1.5 years, sometimes less. He points out that most plant operators have a pretty good idea of where they are currently using the most live energy to heat water, and can target those uses for the recovered heat.

A Modular Approach

Another interesting approach to the economizer solution is the development of modular economizing units, such as the HeatSponge™ family of units, manufactured by Boilerroom Equipment, Inc. of Export, Pennsylvania. According to Vince Sands from that company, the modular approach to economizer units allows standardization of design and manufacturing efficiencies, along with the quality control that comes with shipping complete units rather than requiring site assembly. Multiple units can be installed to match the exhaust and cold water flow of the project. "The modular approach offers flexibility in system design, and quality in the manufacturing cycle because of repetition and our quality assurance program."

Sands points out that there are places for both condensing and non-condensing economizers. "If you don't have the cold water source, there's no advantage to going with the condensing design." He explains that because of the acidic character of the condensate, stainless steel is the best heat-exchange medium for condensing units. "But carbon steel is a better and more economical choice for non-condensing. We stress the importance of accurate information on the exhaust and cold water conditions so we can optimize the units for the site."

Alternative to a Condensing Boiler

He notes that the payback with HeatSponge™ units can range from a few months to three years, rarely more. He also points out that the added efficiency from a condensing economizer can make conversion to a condensing boiler unnecessary. "We are accomplishing the same thing at a lower cost.

Boilerrom Equipment offers assistance with "Bruce", a robotic on-line sales engineer, to help owners select a HeatSponge economizer and generate predicted performance, pricing, and even a proposal online within a matter of minutes. According to Sands, this feature provides access to many years of experience designing and optimizing heat recovery systems suitable for most industrial applications.

Time to Get Started

The key to boiler efficiency is optimizing combustion and letting the least possible amount of heat go out the exhaust stack. Beyond the boiler, paybacks on leaks, faulty insulation and condensate return improvements are remarkably short. Today's natural gas being used as an industrial fuel is attractive economically, but not so inexpensive that you can afford to waste the energy you are buying. Beyond this, improvements in steam system and boiler efficiency will certainly reduce your carbon emissions. Don't delay in putting your system at peak efficiency. **GT**

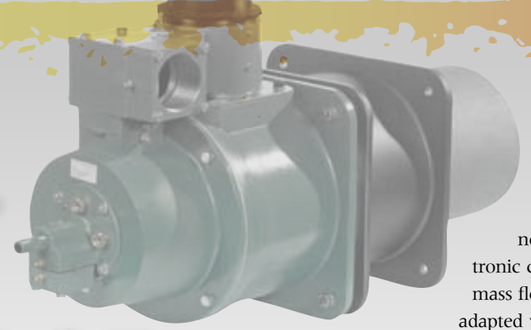
MORE info

BOILERROOM EQUIPMENT, INC.
http://www.boilerroom-equipment.com

COMBUSTION & ENERGY SYSTEMS, LTD.
http://www.combustionandenergy.com

DOE ACCESS TO INFORMATION ON STEAM PLANT EFFICIENCY
http://www1.eere.energy.gov/manufacturing/tech_deployment/steam.html

ENERGY SOLUTIONS CENTER INFORMATION ON BOILERS
http://cleanboiler.org



CAPTURING HEAT FROM THE FURNACE

Heat Recovery Options

NATURAL GAS-FIRED PROCESS FURNACES are widely used in industry, particularly in applications involving metallurgy, heat-treating, glass and ceramics. Even at today's attractive rates for natural gas as an industrial fuel, it makes complete sense to recover as much of the waste heat from the furnace as possible and use it for beneficial purposes.

Sources of Heat Loss

In any furnace operation, heat is lost from the furnace skin, from heated product leaving the treatment area, from conveyer or pusher equipment, from excessive draft and from open doors or other access points. But easily the largest and most concentrated type of heat loss is from the furnace exhaust, some with temperatures of 1000° F or higher. Fortunately, this is usually also the most practical heat to recover and reuse.

Two types of heat recovery systems that are commonly used with industrial furnaces are recuperators and regenerators. According to the U.S. Department of Energy, the recuperator is the most widely used heat recovery device. A recuperator is a gas-to-gas heat exchanger that is installed on the furnace exhaust that preheats incoming combustion air.

Recuperator Upgrades

With relatively clean natural gas combustion exhaust, these heat exchange surfaces may even be finned or dimpled to capture the maximum amount of heat. Although the combustion exhaust itself is clean, the heating process may be producing corrosive or particulate byproducts that could damage or clog a high efficiency heat exchanger such as one with fins. Be sure your recuperator design takes into account the specific characteristics of your furnace operation.

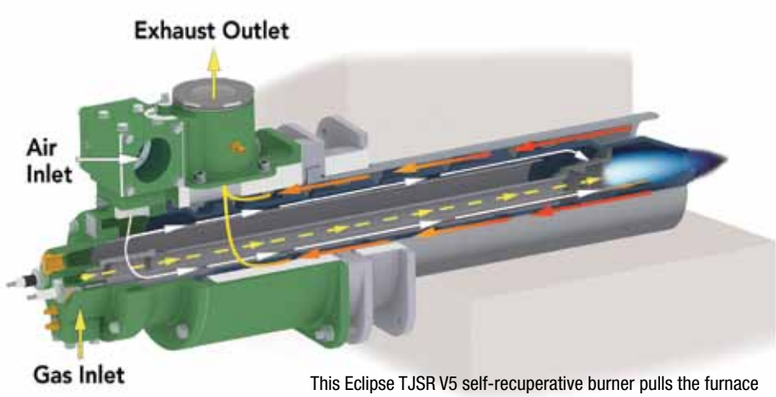
Technology is Available

John Sultzbaugh is the Director of Engineering for Hauck Manufacturing Company of Lebanon, Pennsylvania. Hauck both manufactures furnace combustion equipment, including recuperative burners, and offers custom engineering services to industrial furnace users. Sultzbaugh points out that the current attractive pricing of natural gas from domestic sources encourages the use of gas-fired furnaces, but in some cases may give recuperation retrofits a longer payback. However, he also points out that for operators with site emission permits written on a lb/MMBtu basis, recuperation allows the use of more furnace capacity, hence increased productivity.

Hauck offers a range of burner types for industrial furnaces, including its Ecomax™ direct-fired self-recuperative burner for high temperature furnaces in the North American market. The company also provides assistance to customers looking to add recuperation to an existing burner system.

He notes that items to consider include existing burner construction to determine exposed metal parts and insulation that may have to be upgraded to accommodate higher temperature combustion air and flame temperatures. Air supply piping may need to be increased in size or redesigned to allow higher air pressure. Sultzbaugh adds, "We also need to look at the air-fuel ratio, which will require adjustment."

Asked whether existing burner controls can be adapted to the addition of recuperation, Sultzbaugh explains, "It depends on the type of control method being used. Older type technology using relay logic is not readily adaptable. If an electronic control is used, such as one using mass flow control, it can more readily be adapted via programmable logic controller (PLC) programming changes."



This Eclipse TJSR V5 self-recuperative burner pulls the furnace exhaust through an internal ceramic recuperator. Heating the incoming combustion air improves furnace operating efficiency to reduce fuel usage by as much as 50% over typical ambient air burners. Illustration courtesy Eclipse Combustion Inc.

Firebridge, Inc is a combustion engineering firm headquartered in Burlington, Ontario with wide experience in industrial furnace engineering. Russ Chapman from that firm points out that flue gas recuperators are generally restricted to about 1800° F flue gas temperatures. His company is working on designs that might allow systems to operate at temperatures as high as 2200° F, but for the time being the limitation still stands.

Eclipse, Inc. is a long-time leader in industrial furnace burner technology. According to Jim Roberts from Eclipse, in recent years an important improvement in furnace heat recovery is development of self-recuperative burners, such as Eclipse's ThermaJet™ design. He says, "This is the culmination of 20 years of development in the marketplace to get burners that not only eject a hot stream of gases, but bring the exhaust gases back through the burner to recover heat normally lost to the flue."

Regenerators – Another Approach

Another potential tool for salvaging a significant amount of the heat energy from a furnace exhaust is the regenerator. Although less commonly used than recuperators, regenerators are still widely used in high temperature furnaces such as glass and steel reheat furnaces. A regenerator uses two or more vessels or vessel sections containing a high thermal conductivity matrix. The matrices may be ceramic or metallic. Exhaust passes through the matrix giving up a large portion of its heat before discharging.

After the matrix is heated, the stream is mechanically directed to another section or vessel and incoming combustion air is drawn through the hot section and heated. The regenerator alternates the hot and cold flows so heat recovery is continuous. The advantage of a regenerator over a recuperator is that it presents a much larger amount of heat exchange surface to the hot exhaust flow.

Self-recuperative burners can be retrofit on existing furnaces. Adjustments in combustion air and fuel flows and furnace temperature will be necessary. Photo courtesy Eclipse Combustion Inc.

A disadvantage is that the heat content of the incoming air has some variation, making precise combustion control more difficult. This can be reduced by faster cycle times or the use of multiple vessels at various stages of cooling. Another consideration is that some exhaust products inevitably remain in the vessel to combine with incoming combustion air.

In the Future

There are still a good many plants with major energy reduction potential, and the level of adoption is uneven. Russ Chapman from Firebridge notes that larger companies are starting to benchmark their large plants against each other, and against the competition, in terms of sustainability of the plants. However he feels that a single-minded focus on short term profitability sometimes means a lack of incentives for long-term energy saving projects.

As an example he cites a Tier 2 automotive manufacturer that has a plant with a monthly energy bill of $200,000 per month. He feels this company could reduce that bill by 25%. However the plant is on its third plant manager in three years, and no action is taking place in making improvements. Clearly, energy savings are not always enough.

Global Competition Driven

Chapman notes that smelting in the copper mining industry is an example of an industry starting to move in this direction. "It's because they are competing worldwide and are comparing key performance indicators, making efforts to get in line."

MORE info

BLOOM ENGINEERING
www.bloomeng.com

DOE INDUSTRIAL TECHNOLOGIES PROGRAM
www1.eere.energy.gov/manufacturing/tech_deployment/pdfs/install_waste_heat_process_htgts8.pdf

ECLIPSE, INC.
www.eclipsenet.com

ENERGY SOLUTIONS CENTER INFO ON FURNACE HEAT RECOVERY
www.energysolutionscenter.org/gas_solutions/regenerators_and_recuperators.aspx

FIREBRIDGE INC.
www.firebridgeinc.com

HAUCK MANUFACTURING
www.hauckburner.com

Asked if effective heat recovery can lower greenhouse gas emissions from industrial furnace applications, Chapman replies, "Absolutely! Energy reduction equals emission reduction. The only inhibitor is scale." He explains, "The cost of retrofitting little furnaces is disproportionately higher than one operating at, say, 45 MMBtu/hr or larger, so the economic case is more difficult to make."

Taking the Step

Unquestionably, heat recovery strategies have huge potential for reducing energy bills and plant emissions.

Jim Roberts from Eclipse notes, "Sometimes the cost looks staggering, but remember that most furnaces have a very active running schedule, so the paybacks, even at low gas costs, can be very fast. Even if paybacks are in the two-to-three year range, the long-term savings are worth it." **GT**

Loading docks are an area frequently protected by air curtains. Typically, the unit switches on when the overhead door is opened. Photo courtesy Enershield Industries.

Modern Air Curtains Conserve Energy, Maintain Comfort

Block Air Movement, Invisibly

FROM THE TIME WE WERE CHILDREN, we remember being told, "Close the door. We can't heat the whole outdoors!" That problem is acute in manufacturing, warehousing, and shipping operations. Outside doors on loading docks, or passages between manufacturing and warehouse areas are sources of huge potential energy losses. Yet safe and rapid passage of pedestrians, lift trucks and even conveyors through those openings is essential. Various approaches have been tried, but one of the most attractive is the use of modern air curtains, sometimes called air barriers.

Problems with Open Doors

Most manufacturing operations require frequent movement of pedestrians and vehicles between spaces with differing environmental conditions. It might be lift truck traffic between the manufacturing floor and warehouse or outdoor storage for parts, supplies or finished products. It might be loading docks for rail or truck access. It could even be wall openings for conveyor transfer of manufacturing inputs or outputs. In some industries, there is also a need for frequent traffic into and out of refrigerated or freezer areas.

The problem is that all of those openings allow the escape of conditioned air, and entry of undesired elements including dust, fumes or insects. Conventional doors are impractical because of traffic volume and because of the need for visual contact between areas for safety reasons. An approach that is sometimes used is suspended clear vinyl strips that push aside for vehicle or pedestrian passage. Although initially somewhat transparent, these strips quickly become scratched or clouded and visibility through the opening is lost, creating a safety hazard. Vinyl strips are also subject to damage by passing vehicles, so maintenance expense can be high.

Air Curtains -- A Better Way

An alternative approach increasingly being adopted is the use of air curtains. These create an invisible barrier across openings while not impairing safety or quick passage of pedestrians and vehicles. The air curtain uses a high-speed laminar flow of air across the opening to effectively block air flow from either direction.

Dan Hallihan is the National Sales Manager for Enershield Industries of Edmonton, Alberta. He explains that the barrier is mounted as close to the door opening as possible. "It takes facility air and disperses it across the doorway to create a 90% efficient barrier that prevents outside air from infiltrating in and inside air from escaping." He recommends that for facilities that are trying to stop cold outside air from infiltrating, the air barrier be installed horizontally across the door opening so that it can pull waste heat from the ceiling area and recirculate it back into the facility.

He notes that the Enershield system uses a nozzle that spans the full height or width of the doorway and can be angled as much as 25 degrees outward. Hallihan advises, "The angling of the nozzle is crucial in offering resistance to any outside air trying to penetrate the doorway." The air barrier uses the facility air to create a wind shear effect on the doorway, sealing the opening efficiently. For applications that do not have adequate head-room above the doorway for horizontal installations, the units can be installed vertically and be just as effective.

Steve Benes is the Sales Manager for Berner International Corp., another major manufacturer of these devices. He notes, "The demand for air curtains continues to grow as North American manufacturing companies look for cost effective solutions and products to save energy or create a more comfortable environment for their employees or clientele."

Benes explains that with the use of various types of mounting brackets and accessories, most existing openings can accommodate the addition of air curtains. He points out, "The most common obstruction to the installation of an air curtain is the placement of the hardware for a roll-up garage door. We provide several options for our customers to solve this. Our air curtain systems are compatible for new construction as well as retrofit applications."

A Clearer View

An important feature of the air curtain system is that it provides a clear view across the opening, helping to eliminate safety hazards from vehicle operators not seeing oncoming or crossing pedestrian or vehicle traffic. Where they are installed on multiple doors on loading docks, they typically turn on automatically when the overhead door is opened and shut off when it closes.

In many locations, preventing entry of outdoor insects is a high priority. This is a special concern for food processing or food service businesses. Benes notes that the U.S. EPA recommends the use of air curtains for integrated pest management (IPM) programs as a viable alternative to the use of pesticides. An application with which many are familiar is the use of air curtains across the windows in fast-food drive-up operations.

Built to Last

Air barrier equipment is built to provide long service with minimum maintenance. Most standard models have welded frame and powder-painted surface. Manufacturers offer models for harsh climate conditions and for areas that require frequent washdowns. According to Julie Konowitz from Mars Air Systems, their air curtains keep their effectiveness through their entire operating life.

She notes that Mars provides architects, engineers and food service consultants with a comprehensive line of air curtains and air door products. "This is achieved while giving building owners peace of mind of a reliable product and dedicated support. Our newest product line, the Series 2, includes slimmer units, updated colors, and a sleek new design for everything from a drive-thru window to a lobby entrance to warehouse loading dock doors."

Konowitz indicates that there is growing acceptance of efficiency and effectiveness of air curtains in the food processing and general manufacturing industries, focusing on energy savings and sanitation management. She says that many times the installations are aftermarket applications where a solution is urgently needed for temperature control or to inhibit airborne contaminants. If your facility is struggling with any of these challenges, it may be time to consider today's efficient air curtain solution. **GT**

MORE info

ENERSHIELD INDUSTRIES
www.enershield.ca

BERNER INTERNATIONAL
www.berner.com

MARS AIR SYSTEMS
www.marsair.com

For specialized applications where there is heavy pedestrian and vehicle traffic, air curtains maintain the environment while allowing convenient passage.
Photo courtesy Mars Air Systems.

Even relatively large and high doors can effectively be controlled with industrial air curtains.
Illustration courtesy Mars Air Systems.

A New York beverage packaging plant uses a CHP plant powered by six InVerde 100 sets from Tecogen to assure reliable on-site power and a continuous supply of hot water for process purposes.

Packaged CHP Systems

Profit Engines for Industry

The best CHP packaged systems are designed for ease of service access and ground-up design for efficient electric generation plus heat recovery. Skid mounting speeds and simplifies site installation. Photo courtesy 2-G Cenergy.

AT BUDGET TIME AT INDUSTRIAL COMPANIES, attention is drawn to energy expenses. Think how sweet it would be to foresee a major decline in those expenses. More dollars could be dedicated to research, development, manufacturing improvements and marketing programs. That energy solution may already be available, in the form of packaged engine-powered combined heat and power (CHP).

Power + Heat = Savings

Packaged engine CHP uses proven, factory-assembled systems for reliable onsite generation of electric power. Increasing numbers of packaged natural gas engine CHP systems are now available in sizes from 80 kWe to 3 MWe. Reliable natural gas-fired reciprocating engines designed for peak efficiency at steady generation speeds offer electric generation efficiencies from 25% to 40%.

But the systems don't stop there. They extract heat from the engine cooling process, and often from the engine exhaust as well, to heat water to levels useful for domestic hot water, process hot water, boiler feedwater preheating, or even to supply an absorption chiller for cooling. Major portions of the engine heat that would otherwise be wasted will replace water heating energy that previously was purchased.

Packaging Means Reliability and Economy

In the early years of these "cogeneration" applications, each installation was engineered individually. Components were ordered separately and then installed on site -- a slow, expensive and sometimes troublesome process. Owners had to supervise each step of the assembly. Those days are in the past.

Today's factory packages offer engines, generators, heat extraction and system auxiliaries pre-engineered and assembled at the factory for optimum operation. Systems arrive on a single skid that need only be placed and connected with the electric service, fuel lines and chosen hot water applications. Startup is straightforward and little on-site assembly labor or testing is needed. Those tasks were already completed at the factory.

Packaged 100 kW Units

Jeff Glick from Tecogen was a recent presenter at a Technology & Market Assessment Forum (TMAF) sponsored by the Energy Solutions Center. He explained the business benefit of packaged CHP units, used singly or in groups. He provided information on Tecogen's InVerde 100™ package that is widely used in multifamily, commercial and industrial applications. Single packaged units can simultaneously generate 100 KW of electricity and hot water at 700,000 Btu/hr.

According to Glick, these packages are commonly used in multiple applications of six or more units. This modular approach assures engine operation at levels of optimum efficiency, and provides redundant sources of electricity and hot water, even while a unit is being serviced. Modularity also simplifies fitting the equipment into existing spaces and allows future expansion.

MORE info

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www1.eere.energy.gov/manufacturing/distributedenergy

DRESSER-RAND
www.dresser-rand.com

MTU ONSITE ENERGY
www.mtuonsiteenergy.com/home

TECOGEN
www.tecogen.com/products-cogeneration.htm

High Total System Efficiency

Tecogen's InVerde 100 system efficiency is 27.0% on the electrical side and 55.4% on the heating side, for a total efficiency of 82.4%, based on Lower Heating Value (LHV). Glick indicates this solution can cut energy costs by 30-50%, and can reduce a facility's carbon footprint by 50%. Units offer high power quality and can be equipped for black-start capability, Using abundant, low-cost natural gas also reduces our dependence on imported fuels.

Tecogen spokesperson Melinda Furse observes that in the past CHP was usually prescribed for a site by an engineering or energy firm, but that practice is changing. "Today we see more solicitations from end users – building owners and building managers – than we ever have in the past. We have found that offering a single point of accountability for engineering, installation and maintenance has been an invaluable asset to furthering the adoption of CHP."

Changing Sizing Philosophy

Furse notes that in the past the practice was to size systems purely on the thermal requirements of the site, producing only as much electricity as the thermal load would allow. "The latest trend seems to be that facilities are choosing advanced CHP systems with additional capacity, giving greater power flexibility. During peak hours they can run the system harder to offset power from the grid. The additional capacity also allows many sites to produce 100% of their needs in case of a blackout."

She stresses, "Building owners want energy independence. They understand intrinsically the value of making your own electricity while capturing and repurposing the heat, and offsetting boilers. Offering turnkey solutions makes this technology more accessible and easier for a site to implement."

A recent graphic example of the value of onsite generation was at a co-op residential facility in Greenwich Village, the Brevoort. It was able to maintain power, hot water and electric service during the recent outages in Manhattan following Superstorm Sandy. The 20-story facility is equipped with four InVerde 100 kW units that had replaced an oil-heat system two years earlier. According to Diane Nardone, the president of the co-op, theirs was the only building on lower Fifth Avenue to continue to offer energy and full service to residents.

Tecogen indicates that the low and stable prices for natural gas in recent years have influenced decisions on CHP. Furse says, "Sites that have been calculated as having a four or five year payback might now be only two to three years. Obviously, the shorter the payback, the more compelling the project."

Larger Units for Larger Loads

Another recent presenter was Bill Pearson from Western Branch Diesel, representing MTU Onsite Energy, a wholly owned subsidiary of the Tognum group, a German company with a worldwide presence in onsite energy generation. This company offers systems manufactured and assembled in North America with full CHP potential. They have two product lines, the Series 400 ranging from 128 to 354 kW, and the Series 4000 ranging from 764 to 1930 kW.

The MTU Onsite Energy systems are designed to operate over a wide range of gas fuels, including natural gas, biogas, landfill gas and coalbed methane. This makes these units particularly attractive for applications where multiple fuels are used. Units are available with or without heat recovery options for various industrial uses.

Project Paybacks

The claimed efficiency of the MTU electrical generation ranges from 33% to 35%, and with full heat recovery, overall efficiency ranges from 90% to 92%, depending on the engine selected. Pearson explained that financial analysis indicates that a full heat recovery installation could have an investment payback of three years.

In another TMAF presentation, Stephen Zilonis from Dresser-Rand discussed his firm's offerings in packaged CHP. The company offers an array of packaged or engineered systems well suited to industrial and institutional applications, including systems powered by Guascor or Caterpillar.

Cooling Option

One intriguing possibility is the Dresser-Rand Caterpillar Trigen Package, which includes a 555 kW electrical output, hot water delivered at 180° F in quantities of 3,617,000 Btu/hr, and absorption cooling totaling 130 ton capacity. The entire unit is skid mounted and suitable for indoor or outdoor installation. The package includes all utility-required controls and customer monitoring capabilities.

Wide Range of Sizes

For any package CHP installation, it is important to accurately characterize the load to be served and to evaluate the physical space available for the CHP plant. 2G-Cenergy is a firm with long experience in gas-fueled CNG plants in Europe and now offering this technology in North America. The company offers units with capacities ranging from 80 kWe to 3 MWe, and designed for various fuels, including natural gas and many biofuels. In particular they emphasize that their units can be sited either indoors or outdoors, and they make special accommodation for use with absorption chiller packages.

Getting Started

As you consider the feasibility of CHP for your plant or institution, it is important to gather full-year energy usage information for electrical and boiler operations so that total energy requirements can be accurately forecast. Your natural gas utility can be of assistance in explaining service policies and can tell you about other CHP installations in your area. **GT**

Taking the Longer View

Practical Energy Sustainability for Industry

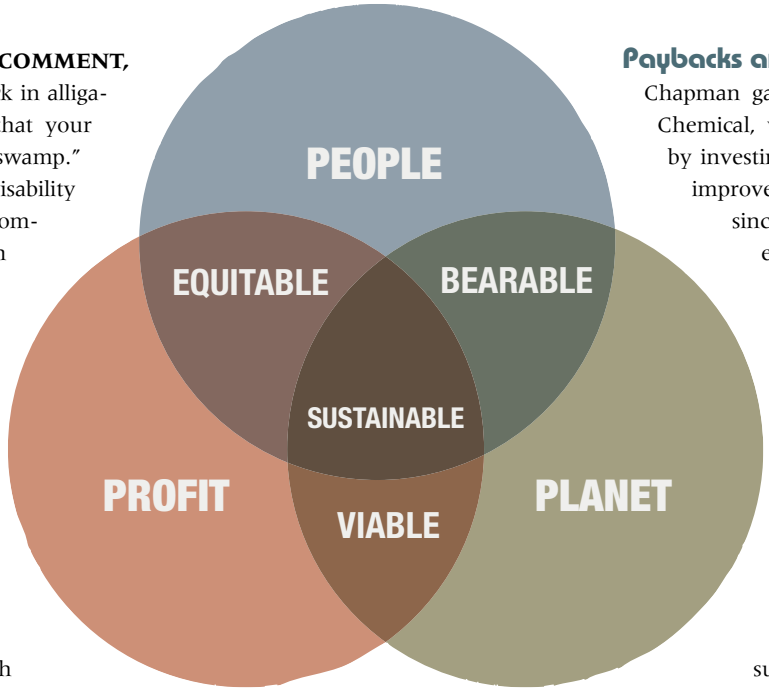
MORE info

ESPRC CENTRE SUSTAINABILITY INFORMATION
http://www.industrialsustainability.org/projects

ENERGY SOLUTIONS CENTER
INDUSTRIAL EFFICIENCY
http://www.naturalgasefficiency.org/index_industrial.htm

FIREBRIDGE
http://www.firebridgeinc.com

WE'VE HEARD THE WRY COMMENT, "When you're up to your neck in alligators, sometimes you forget that your mission was to drain the swamp." Aside from the general inadvisability of destroying wetlands, the comment reminds us that often short term needs can distract us from laudable long term goals such as working harmoniously, conserving natural resources, or offering lasting value to customers. Certainly this challenge is one faced by industrial process and energy managers. The effects of prudent long-term energy management sometimes create conflict with short term bottom-line targets.



Energy Improvements a Hard Sell?

In these pages from time to time we have discussed significant opportunities for major energy savings with simple paybacks of three, five or seven years. We know from experience that these steps are sometimes difficult to accept or sell if they will negatively affect immediate profitability. A recent presenter at a Technology & Market Assessment Forum sponsored by the Energy Solutions Center discussed this challenge, and provided perspectives on where the future may lie. Russ Chapman from Firebridge, Inc., an Ontario-based combustion engineering firm, gave some views on the topic.

Chapman noted the value proposition for the broad concept of sustainable industries – those that can thrive long-term by balancing the needs of people (both employees and customers), the environment and the business. This challenge is both acute and obvious in decisions involving energy. A decision not to adopt energy-conserving equipment and processes might lead to a better short-term bottom line, but likely will lead to a longer-term lack of competitiveness, thus adversely affecting customers and employees, while adding to the excessive depletion of resources, and environmental damages.

Paybacks are Possible

Chapman gave as an example Dow Chemical, which has reported that by investing less than $2 billion to improve its resource efficiency since 1994, it has accumulated savings of over $9.8 billion by reducing waste of bothwater and energy in its manufacturing processes. By this process and by integrating other environmental, safety and health-related goals into its processes, it has maintained global competitiveness and has surpassed Kyoto Protocol greenhouse gas emission targets.

The presentation stressed the influence of appropriate energy resource decisions on industrial corporation risk management, and on reducing exposure to any effects from emerging environmental regulation. As an example he cited mining giant BHP Billiton, which managed its exposure to future regulations by proactively reducing its emissions.

Chapman suggests that a strong case can be made for taking the longer view. Financing instruments are available that repay the cost of energy improvements with savings. Once the project is amortized – perhaps three to five years – the savings drop to the bottom line. He also stresses that greenhouse gas emission restrictions will likely make these improvements inevitable, so why not begin to capture the savings today?

Further, he feels that savings in site productivity, product quality and workplace safety often accompany these facility improvements. Correctly selected, and innovatively financed, needed energy improvements can even begin showing on the bottom line immediately. Taking the longer view can also mean taking the smarter view. **GT**