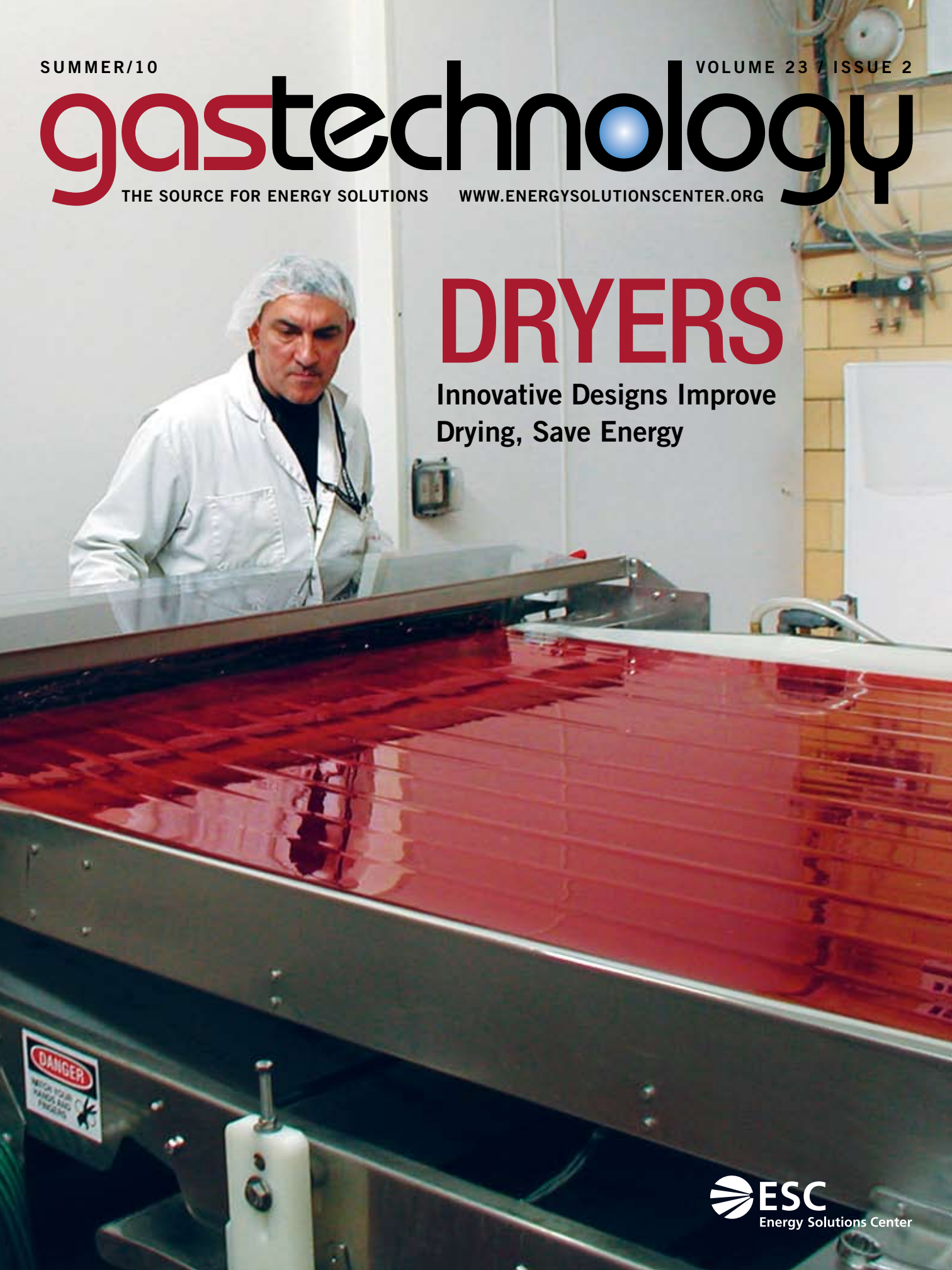
SUMMER/10

VOLUME 23 / ISSUE 2

gastechnology

THE SOURCE FOR ENERGY SOLUTIONS WWW.ENERGYSOLUTIONSCENTER.ORG



DRYERS

Innovative Designs Improve Drying, Save Energy

ESC
Energy Solutions Center

on the cover

Newer dryer technologies, like this MCD Technologies Refractance Window® application drying berry extract, promise increased efficiency and a better dried product.

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

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

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

energy solutions center websites

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

inside

Dryer Technology on the Move

Food and Feed Drying Equipment is Evolving

FEW PIECES OF INDUSTRIAL EQUIPMENT serve as many purposes and are available in as many configurations as dryers. They are widely used for drying wood, paper, painted surfaces, plastics, livestock feed, pharmaceuticals, food products and many more materials. They range from large conveyor dryers to small batch units and are most commonly fueled by natural gas. According to Shelly Ryder of Aeroglide Corporation, a major manufacturer of food drying equipment, "The majority of our dryers are gas-fired, and have been for many years. We consider the gas-fired dryer to be the norm rather than the exception."

This conveyor dryer by Aeroglide takes advantage of staged drying and easy cleanability features.

Food Drying a Special Challenge

Food and feed dryers are often the most complex in the dryer family, and today these are the beneficiaries of major innovations. Ryder explains that food dryer technology is continuously changing. She notes, "Although most dryers have not fundamentally changed over the past ten years, today's food dryers are significantly improved in terms of energy efficiency, process control and drying uniformity." Many of the advances in energy efficiency are a result of the advancements in controls, allowing more precise control of temperatures through the process.

Ryder points out, "Ten years ago, many dryers were operated improperly, resulting in high energy consumption. Today's advanced digital controls allow us to ensure that the dryer is always operating at optimum efficiency." Food dryers have not only progressed in efficiency, but also in terms of sanitary design. Ryder emphasizes, "This, for the food producer, is number one on the list of priorities."

Cleanability a Key Feature

Sanitary design involves minimizing ledges, ensuring good access, and using materials that can be cleaned, but Ryder stresses, "Many food producers are looking for dryer manufacturers to offer innovative solutions that take sanitation to the next level." Some newer designs offer improved access for both video and physical inspection, and to simplify cleaning. Materials widely used in construction include new specialty plastics and stainless steel for better cleanability and longer life.

Another aspect of food dryers that is receiving increasing attention is improving operating efficiency through heat recovery. Most frequently, heat exchangers are installed on dryer exhaust air. The heat recovered is used to pre-heat dryer makeup air. This type of heat recovery typically reduces energy usage by 10-15%, but savings can be much higher in certain applications. Newer dryers are also designed to stage heat at different levels through the machine, eliminating waste heat and over-drying.

This airless dryer by the Dupps Company uses superheated steam rather than hot air as a drying medium, and is well-adapted for animal feed and protein byproduct applications.

Assure Dryer Can Handle Product

When purchasing a dryer for any application, industrial operators will want to assure that the machine can handle its specific product. Most dryer manufacturers encourage owners to submit samples of the product, which can then be tested in the specific dryer that the owner is considering.

Aeroglide, for example, operates a Technical Center that houses a wide range of dryers. The facility is used both for product development and for customer test drying. Ryder adds, "All of our lab equipment is also transportable, so when product or process dictates, test units can be shipped to the customer site. In addition, we have portable lab units permanently located in both the European and Asia Pacific regions."

Importance of Handling Product Gently

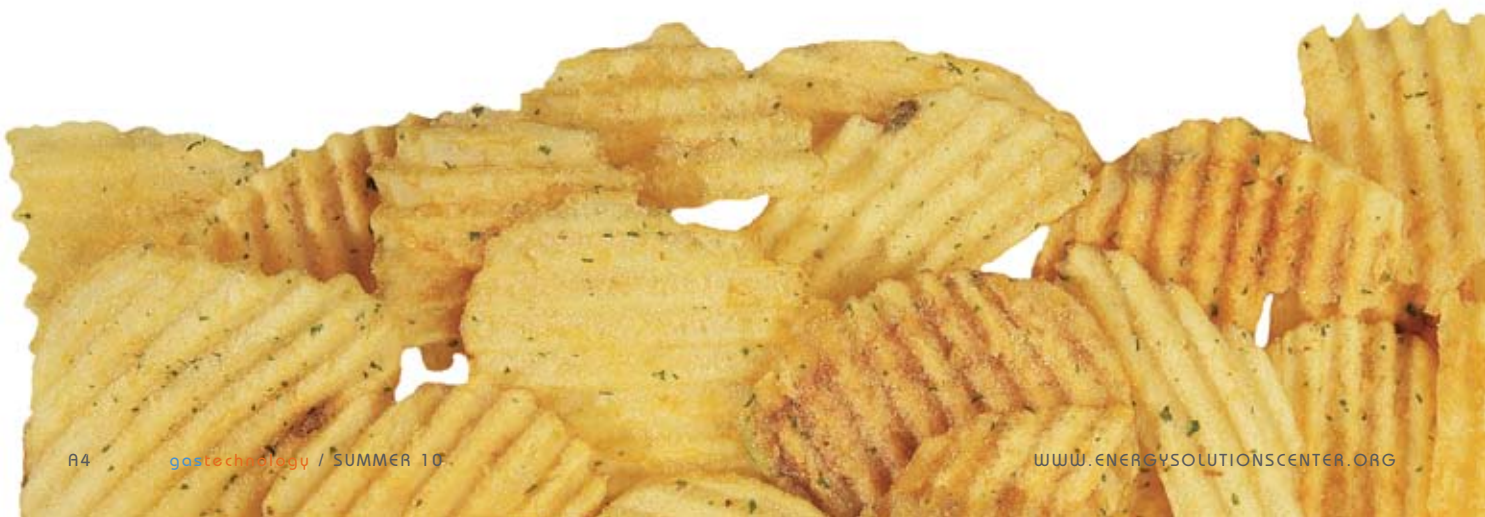
Food dryers can take many different forms, including batch cabinets, tray and belt conveyors, single and multiple drum or barrel dryers, and very specialized equipment such as spray dryers for milk, whey and other food products. In general, the goal is to produce food product with as little effect on color, aroma and chemical makeup as possible.

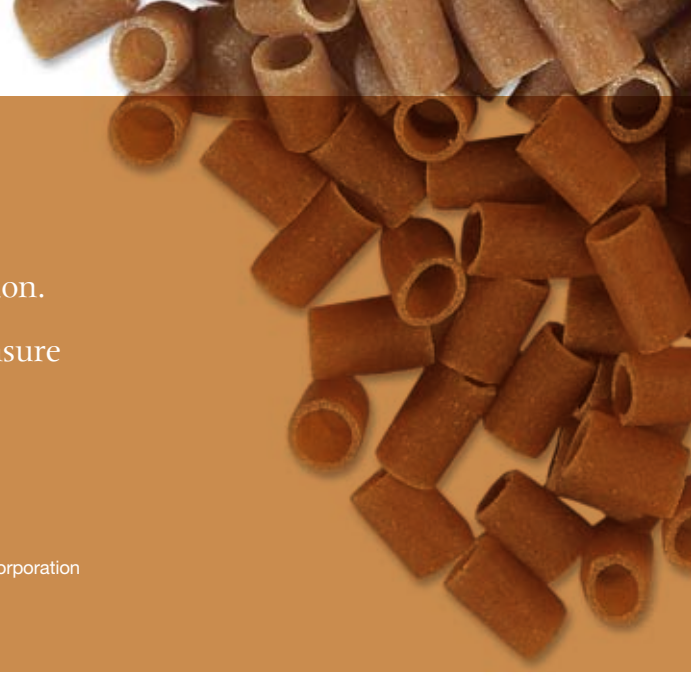
An interesting innovation in food drying is the Refractance Window® concept introduced by MCD Technologies, a dryer manufacturer headquartered in Tacoma, Washington. This product was featured at a recent Technology and Market Assessment Forum sponsored by the Energy Solutions Center. In this dryer design, a slurry of liquid product is evenly applied to the top surface of a continuous sheet of transparent plastic. This impervious conveyor belt floats on a surface of hot water at temperatures of 210°F or less.

"Window" Solution Uses Infrared Characteristic

The "window" aspect of the transparent sheet allows infrared energy from the hot water to pass rapidly and directly into the slurry. Heat is also conducted through the belt, which helps to evaporate moisture in the product. Evaporate is carried away by mechanically boosted airflow. The transfer of infrared energy through the transparent sheet slows as the product loses moisture, creating a controlled drying process that retains nutrition, flavor, color and aroma.

The Refractance Window dryer is also suitable for pharmaceuticals, nutraceuticals, cosmetics, pigments and byproducts such as whey and fish oil. According to MCD, besides its gentle drying characteristic, Washington State University research has cal-





> “Ten years ago, many dryers were operated improperly, resulting in high energy consumption. Today’s advanced digital controls allow us to ensure that the dryer is always operating at optimum efficiency.”
>
> Shelly Ryder — Aeroglide Corporation

culated that the Refractance Window dryer is 99% efficient in its heat transfer. Its automated operation reduces labor costs and the transparent belt design allows quick cleanup and minimizes maintenance.

Airless Drying with Steam

Another innovation in food and feed drying technology is an “airless” dryer that uses superheated steam at atmospheric pressure rather than heated air as the drying medium. This product was developed by the Dupps Company, another major dryer manufacturer. According to Robert Horton, process engineer from Dupps, this dryer has about the same energy consumption as conventional direct-fired dryers. “However,” adds Horton, “The exhaust contains latent heat, which can be recovered.” He adds that the exhaust can be condensed and the water potentially reused in the process.

The airless dryer minimizes risks of fires and dust explosions because it is an oxygen-starved drying environment. Horton points out that the effluent gas emission rate is significantly lower than that of conventional dryers. “This yields better odor control and reduces the need for scrubbing.” No plume of condensed vapor is visible with this design, and because it operates at atmospheric pressure, a pressure vessel is not required.

This is a large-volume drum type dryer, and is suitable for drying a wide range of feed products and animal protein materials. These products are less prone to bacteriological contamination because they are dried with superheated steam instead of air. Dupps offers trial drying on customer materials.

Priority on Maintenance

Preventive maintenance is an important aspect of dryer operation. Most of today’s dryers are built to a high reliability standard, but this can breed complacency in performing recommended inspections or activities such as lubrication and belt replacement. Because drying is often a key step in a longer process, a dryer outage can stop an entire line, cause loss of product and require considerable labor to get the process moving again.

After initial dryer startup, a regular PM program should be established to eliminate unscheduled downtime. Regular inspections should be scheduled by a qualified engineering expert with a goal of anticipating mechanical or structural failure.

A Long-Term Relationship

Because dryers have proprietary design and operation features, the process of selecting a dryer manufacturer should be carefully done, with a look toward the long term. Once the dryer is selected, owners will likely maintain a relationship with its manufacturer for years. For that reason, industrial buyers should look not only at the equipment, but at the manufacturer’s ability to support the product, promptly provide parts and service, and train plant operators and maintenance staff.

Look for a provider within the industry that has a history of customer support. Take advantage of the energy-conserving features of the newest dryer designs, as these will become increasingly important. Because you will be living with it for a long time, make sure your new dryer is a good match for your product. **GT**

MORE info

AEROGLIDE
www.aeroglide.com

DUPPS COMPANY
www.dupps.com

ENERGY SOLUTION CENTER DRYING INFORMATION
www.energysolutionscenter.org/tech/tech_drying.asp

MCD TECHNOLOGIES INC.
www.mcdtechnologiesinc.com

Boiler NO_x Emissions
- A Look at New Options

IN MANY AREAS, industrial boiler operators face stricter regulation of NO_x emissions, even with the use of clean natural gas. In some areas, operators are required to meet what are called "Ultra-Low NO_x" (ULN) requirements, typically less than 10-12 ppm. It is widely believed that the ULN requirements will be broadened to more areas. In recent years, boiler and burner designers have focused on achieving ULN compliance without significant performance penalties.

Reduced Atmospheric NO_x the Goal

Early on, it was discovered that the largest contributors to NO_x in most regions are motor vehicles and non-stationary engines, followed by industrial, residential, agricultural and natural sources. Passage of the Clean Air Act in 1963, followed by major amendments in 1970, 1977 and 1990, established a framework for the ever-tightening regulation of NO_x. The first NO_x emission target was highway vehicles.

A Nebraska boiler by Cleaver-Brooks with NATCOM burner technology meets ULN standards while retaining high boiler efficiency.

In the 1970s major strides were made in reducing automotive NO_x as well as other pollutants through the use of exhaust gas recirculation valves and catalytic exhaust gas treatment.

Regulators next turned to industrial emissions and to boilers in particular. Federal air quality laws and rules were applied to industrial boilers, and allowed states to set local standards more stringent than the federal standard to achieve acceptable ambient air quality. This was first done in California.

Changing to Natural Gas

For many operators of industrial boilers, an important first step was to change from coal or oil boiler fuels to natural gas, which is cleaner burning in many respects. However, NO_x continues to be a target. With natural gas, fuel based nitrogen is not the concern, but the use of air for combustion does provide the primary source for NO_x. An efficient, clean-burning traditional gas burner in high temperature applications may still produce significant levels of NO_x.

Commonly used strategies for natural gas-fired boiler burners include staged combustion, flue gas recirculation (FGR), flame temperature adjustment, and combinations of these approaches. These reduce NO_x emissions from previous levels of 80-150 ppm of NO_x to less than 30 ppm. But in many parts of the country, such strategies alone may fall short of what is necessary for ULN compliance.

Tougher Standards for Some Areas

In some areas, air quality compliance re-

quires boiler emissions to be further reduced to below 30 ppm and in some cases to less than 10-12 ppm of NO_x. According to Steve Connor from Cleaver Brooks, the current major markets for these ULN boilers are in California, Texas, Louisiana and New Jersey. In addition, Clark County, Nevada (Las Vegas) has a similar requirement. However, Chad Fletcher from Hurst Boiler & Welding Co. indicates that customers across the country are asking about boilers with ULN performance levels. He says, "Mainly, I think this is in fear of regulations changing in the future."

In some cases existing boilers can be brought to ULN compliance with a burner replacement. Jon Backlund is Vice President of Sales & Marketing for ALZETA Corporation, a major manufacturer of ULN compliance burners. Backlund indicates that Alzeta burners use gas premix surface combustion designs. He says, "The burner surface can be built in many geometries and the flame supply conforms to the surface. This approach works very well in both firetube and watertube boilers, and also in small atmospheric boilers." Backlund notes that his firm has supplied ULN burners for hundreds of boilers as well as other applications.

Burner Replacement is Practical

Chad Fletcher from Hurst indicates that retrofit ULN burners can be installed on all his company's scotch (firetube) boilers over 125 hp. "What we run into with smaller sizes are furnace dimensions that are too small, so we make custom boilers of 125 hp and smaller for these specific applications." Fletcher believes that burner technology is the most important determinant of NO_x emissions. "There are areas like furnace dimensions that we must adjust but it is mainly burner technology that gets it done."

Some providers focus on a complete ULN boiler design. Miura North America offers its LX Series boiler that provides ULN levels of 9 ppm and has plans to release a near-zero NO_x boiler into the North American market. This unit uses a proprietary catalyzer to virtually eliminate NO_x altogether. According to Jason Smith from Miura North America, it features a sophisticated pre-mix burner that produces a very low-temperature, "self-quenching" flame, thereby minimizing the endothermic reaction that causes oxygen and nitrogen to form NO_x in the first place.

Smith adds, "Miura utilizes its own flue gas recirculation system to reduce NO_x levels to 9 ppm, meeting California's stringent air quality regulations for stationary equipment." Smith points out that he sees a general trend of natural gas boilers replacing other fossil fuels. "It is the cleanest fuel when considering CO_2, NO_x and other greenhouse gas emissions per Btu of energy produced."

The FIR Solution from GTI

More recently, some advanced burner designs have included a concept called forced internal recirculation (FIR), which was developed by the Gas Technology Institute. The FIR burner can achieve ULN emissions of less than 10 ppm without the use of flue gas recirculation. The unique burner design provides excellent flame retention for stable combustion at sub-9 ppm NO_x levels.

These low levels of NO_x and CO will meet the stringent emission requirements found in California, Houston and other non-attainment zones. Two boilers using FIR burners are installed and running at Fullerton College, California. The boilers are used to supply steam heat to the campus buildings and utilities. These boilers operate at less than 9 ppm NO_x while maintaining thermal efficiencies of over 85%.

According to Jon Backlund from ALZETA, even lower NO_x emission standards of 7 ppm are already being promulgated in parts of California and these levels can be achieved with ALZETA technology. As mentioned above, Miura is also introducing boilers that can achieve very low NO_x emissions. Whether these "extra-ultra-low" NO_x rules will be more widely encountered is not yet known.

Another promising development is the C-RMB Burner developed by Todd Combustion, a division of John Zink Company. Information on this new solution was provided at a recent Energy Solutions Center Technology and Market Assessment Forum. According to the company, this offering uses a burner-only stable flame solution than can achieve emissions of less than 5 ppm. The key to this approach is the use of multiple smaller burners rather than a single larger unit.

The company believes that the need for this level of ULN performance is growing. They note that <9 ppm performance was once considered to be exclusive to California. Today, fewer than half of the company's ULN jobs are in that state and interest in lower levels seems to be growing.

Owners Still Look for Performance

In any case, boiler operators ask for equipment that meets increasingly rigorous emission performance levels with little or no penalty in performance. Newer solutions are meeting the ULN challenge with minimal impact on operating efficiency. Continuing progress in boiler and burner design will undoubtedly follow to meet that need. If you have an expectation of tightening NO_x standards in your area, remember to consider ULN boilers and burners before making a selection. **GT**

MORE info

ALZETA CORPORATION
www.alzeta.com

CLEAVER-BROOKS
www.cleaver-brooks.com

ENERGY SOLUTIONS CENTER BOILER BURNER CONSORTIUM
www.energysolutionscenter.org/boilerburner

HURST BOILER & WELDING
www.hurstboiler.com

MIURA NORTH AMERICA
www.miuraboiler.com

TODD COMBUSTION/COEN COMPANY
www.coen.com

CNG FUELING FOR *HEAVY-DUTY* TRUCKS

A Spreading Fuel Infrastructure

GROWING NUMBERS OF COMPANIES have figured it out: Trucks, even heavy trucks, are excellent candidates for compressed natural gas (CNG) fueling, and the technology for these vehicles is available. Until recently, it was argued that although CNG trucks make good sense, in North America, there isn't the infrastructure to support the change. Rich Kolodziej says that's no longer true.

Kolodziej is the President of Natural Gas Vehicles for America (NGVA). He explains that the future looks bright for natural gas-powered truck transportation. "First of all, we now have the engines and vehicles available," Kolodziej says. "Secondly, fleet operators increasingly understand that natural gas prices are stable, and diesel prices will continue to rise. They are moving toward a natural gas future."

Kolodziej explains that fuel costs are a major expense for trucking companies and other truck operators. Current EPA restrictions on diesel truck emissions are going to continue to tighten, making diesel fuel increasingly expensive. Kolodziej expects the major fuel cost advantage currently enjoyed by CNG to continue to broaden.

An Expanding Fueling Network

According to Leo Thomason, Executive Director of the Natural Gas Vehicle Institute, an improved CNG fueling situation is also part of the change. "The CNG fueling infrastructure has been steadily expanding beyond California over the past several years." Thomason gives credit for much of this expansion to Clean Energy of Seal Beach, California. This organization is the largest retailer of natural gas as a transportation fuel in the United States. It has built and operates public access CNG fueling stations in Arizona, Colorado, Nevada, New Mexico, New York, Texas, Wyoming, Oklahoma and Georgia.

California has been a pioneer in the use of CNG for heavy trucks. The State and the South Coast Air Quality Management District (SCAQMD) use vehicle emission restrictions, tax incentives, and fleet fuel restrictions to encourage use of alternative fuels. Operators of fleets of more than 15 transit buses, school buses, public and private refuse trucks, street sweepers and other heavy vehicles are required to specify alternative fuels when replacing vehicles. In most cases, these operators have chosen CNG as the alternative fuel of choice.

CNG Trucks as Cash Generators

The financial picture of CNG heavy-duty truck is encouraging. According to Andy Douglas, National Sales Manager, Specialty Markets for Kenworth Truck Company, the CNG-powered refuse or cement truck receives a $10,000 credit for not requiring the SCR after-exhaust treatment system needed in diesel models. The natural gas heavy-duty engine (Cummins Westport 8.9 L model) costs an additional $10,000. Thus, the base natural gas-powered truck costs no more than a diesel model.

According to Jeffery Swertfeger, Director of Marketing and Communications for McNeilus Truck and Manufacturing, a company that puts refuse and cement bodies on Kenworth trucks, the CNG fuel system costs an additional $25,000. But, Leo Thomason points out, there is a $32,000 federal tax credit available for CNG-powered heavy-duty trucks, thus providing a $7,000 excess credit beyond the cost of the vehicle.

Tax Credit Makes Payback Quick

Thomason explains that prices per diesel gallon-equivalent (DGE) vary among locations, but fuel savings generally range from $.40 to $2.00. In addition to receiving the $7,000 excess federal tax credit, a CNG-powered refuse truck using 50 DGE for 250 days per year at $.93 per DGE would save $20,000 to $25,000 per year on truck fuel. Even where the fuel cost is $2.59 per DGE, there would still be a savings of over $1,000 per year, plus the tax credit.

Kolodziej from NGVA expects that with increasing production volume of heavy-duty CNG trucks, and with possible increasing competition, the price differential between diesel and CNG will diminish. "Will it ever be the same? Probably not, because of the cost for the CNG tank. But the costs of a CNG truck will become closer to the equivalent diesel model."

Friendly Regulation and Legislation

The U.S. EPA has issued rule modifications to make the conversion of gasoline and diesel engines to natural gas less restrictive and easier to achieve from engine family to engine family, and from year to year. Several federal bills are pending to add tax credits for bi-fuel (gasoline/CNG) and dual-fuel (diesel-natural gas) and to

Factory-built refuse pickup vehicles and concrete delivery trucks are among the types of heavy-duty vehicles using CNG fuel.

double the tax credits for CNG and LNG fueling structures.

For CNG vehicles that are not garaged at a central location daily, it is important to have access to high-speed refueling stations. Growing networks of public-access CNG fueling stations are already in place in California, Arizona, Nevada, New Mexico, New York, Texas, Wyoming, Oklahoma and Georgia. A network of stations is developing in Utah, with strong support from gas utility Questar Gas.

CNG for the Future

According to Darren Shepherd from Questar, the utility believes that natural gas is well positioned to meet U.S. energy needs and still reduce emissions. He says, "Many people have called natural gas a bridge fuel. Now it is clear that natural gas is more than a bridge fuel; it is a superhighway to a lower carbon future." Part of the key is discoveries of new natural gas fields and the development of shale gas extraction technologies. Shepherd explains, "The new, abundant natural gas supplies may be the catalyst for America's commercial transportation market to make the jump to CNG and do it without drawing upon traditional supplies used for residential and manufacturing markets."

Barriers Coming Down

Shepherd notes that several reasons had been given by fleet operators for not adopting CNG-powered vehicles. "They cited limited refueling infrastructure, few engine-size options, high incremental vehicle costs and lack of governmental incentives and the previous relatively low cost of petroleum fuels. These barriers are fading, and furthermore, owners are becoming educated about the ease and independence that comes with onsite CNG refueling and the growing availability of CNG-powered engines and vehicles.

Questar has already built 19 public CNG stations along major highways in Utah where consumers can buy natural gas for less than half the cost of gasoline or diesel fuels. The State of Utah also opened six of its CNG stations to the public. where the same low price prevails. Added to this are the 50 companies that have onsite private CNG refueling stations.

CNG Excitement in Utah

Utah is seeing an increase in the number of refuse trucks and home-based delivery vehicles switching to natural gas. Shepherd indicates that one company in particular is a global food marketing and distribution company. Two of the world's largest beverage companies are running delivery vehicles on CNG and many Utah school districts are adding CNG-powered buses. One Utah shuttle service provider runs eight CNG vans that average between 120,000 and 140,000 miles per year. Shepherd says, "Some of the vans now have more than a million miles on them. The owner will be the first to tell you CNG is profitable and his customers see the business as eco-friendly."

Educational Tools are Available

For truck fleet operators, additional information is available from several sources. The Natural Gas Vehicle Institute offers a wide array of courses on natural gas vehicles and fueling station operation. Other sources include DOE/Clean Cities, NGV America, and the National Alternative Fuels Training Consortium located at West Virginia University.

In a growing number of places, CNG networks are growing and with them the numbers of fleets and individual vehicle operators. Important roles are being played by the federal government, by promotional and educational organizations, and by local and regional natural gas utilities. Darren Shepherd summarizes well the potential for natural gas transportation. "We have an abundant supply of domestic natural gas that can be used to move our products, protect our environment, and provide jobs." **GT**

MORE info

U.S DOE NATURAL GAS VEHICLE INFORMATION
www.nrel.gov/vehiclesandfuels/pdfs/34650.pdf

NATIONAL ALTERNATIVE FUELS TRAINING CONSORTIUM
www.naftc.wvu.edu

NATURAL GAS VEHICLE INSTITUTE
www.ngvi.com

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

QUESTAR GAS NGV INFORMATION
www.questargas.com/FuelingSystems/NGV/ngv.php

NEW THERMAL OXIDIZER DESIGNS

Enhance Heat Recovery

Remove the Pollutant, Conserve the Energy

IN THE INTEREST OF workplace health and safety as well as compliance with emissions limitations, it is essential to efficiently collect vapors and mists from industrial processes and treat them using thermal oxidation. The goal is to reduce emissions of volatile organic compounds (VOCs) and hazardous air pollutants (HAPs). Examples of such exhaust stream sources are paint or solvent vapors, printing exhausts, petrochemicals, pharmaceuticals, and plastics manufacturing.

Multiple large Anguil regenerative oxidizers at a manufacturing facility.

Simple Flares Can Still Work

The earliest and simplest systems were simply flares or burners, where the exhaust stream was directed through a combustion zone for a time sufficient to break down most complex hydrocarbon molecules. Where the exhaust stream itself is sufficient to support stable combustion, this may still be a practical approach.

But, if it is necessary to add natural gas or another fuel to support combustion, such a system may have unacceptably high operating costs. Increasingly, industry is choosing to use regenerative or recuperative thermal oxidizers, sometimes with catalytic process elements, which conserve energy and allow for more complete destruction of undesired emissions.

Recuperative Units Use Heat Exchangers

Recuperative thermal oxidizers use a stable flame from a natural gas burner to support combustion of the plant exhaust stream, then recover as much heat as possible from the process exhaust using a plate or tube heat exchanger. These systems are most practical for exhaust streams with a high proportion of VOCs, typically 20% or more. According to Keith Herbert, Vice President of Sales for Catalytic Combustion Corporation, a manufacturer of thermal oxidizers, the typical recuperative oxidizer allows 50-60% heat recovery. He adds, "If there is a need for very high destruction efficiency (say more than 99%), then a cost evaluation may show that a recuperative heat exchange is the most effective."

Regenerative Systems in Spotlight

A large proportion of the systems being installed today are regenerative thermal oxidizers (RTOs). These pass the process exhaust through a ceramic heat sink where pollutants are destroyed by high-temperature oxidation, supported by a natural gas burner. The oxidation process heats the ceramic and the stream is alternated between two heat sink areas, which captures the exhaust heat and uses it to support the process.

Herbert indicates that RTOs typically provide 95% heat recovery. He adds, "The proportion of the combustion heat that needs to be provided by the supporting natural gas ranges from 65% to 95%, with outside ranges being from 10% to 100%." Obviously much depends on the combustion characteristics and richness of the exhaust stream.

Interest in Increasing Efficiency

Another provider of a wide range of thermal oxidizer technologies is Anguil Environmental Systems. Anguil was a presenter at a recent Technology and Market Assessment Forum, sponsored by the Energy Solutions Center. According to Kevin Summ, Marketing Manager for Anguil, there is a growing interest in heat recovery, including secondary heat recovery from the exhaust stacks of all types of thermal oxidizers.

Summ points out, "Secondary heat recovery is even applied on the RTO, but because these are so efficient, the low stack temperatures don't offer as much potential." He explains that the RTO uses 95% of the heat generated during combustion to pre-heat incoming flow. "For example, at 95% thermal efficiency, the outlet temperature of an RTO may be only 70 degrees F higher than the inlet process temperature."

Potential for Electric Generation

Summ indicates that secondary heat exchangers capture heat that can be used to generate hot air, water, steam and even electricity. He says, "On the horizon, heat-to-power systems are in development for reclaiming oxidizer stack heat and creating electricity." Obviously this option is only practical where there is a significant volume of reclaimed heat.

He notes that one option that has been used sparingly involves taking hot oxidizer stack air directly back for use in production processes. This is sometimes referred to as Direct Heat Recovery. He cautions that direct heat recovery is generally avoided due to the risks of introducing products of incomplete combustion back into a plant environment or of oxidizer "oven dirt" contaminating the product. "But there are limited cases where this form of oxidizer stack heat recovery has been used effectively."

Choosing the Right Solution

On the question of choosing between regenerative and recuperative thermal oxidizers, Summ stresses that every application for VOC/HAP abatement is unique. "Here are some of the criteria we use to determine the proper technology: Emission composition and concentration, required destruction rate efficiency, and operating costs versus capital cost restrictions."

John Zink Co. offers an array of thermal oxidation and heat recovery systems that can safely handle a wide range of hazardous industrial waste gases and liquids. According to Charles Baukal, Director of the John Zink Institute, the company specializes in custom-engineered solutions for the hydrocarbon processing, chemical processing and ethanol industries. Baukal explains, "These systems remove odorous VOCs and CO and regulate emissions in ethanol dryer exhaust and other plant streams resulting in increased uptime, and fuel economy through total energy integration."

John Zink Co. LLC's TANGENT™ system is a breakthrough thermal oxidation technology that drastically reduces thermal NO_x levels to near zero ppm while maintaining non-detectible CO levels. TANGENT technology can eliminate post-combustion NO_x reduction systems and greatly reduces the plot space typically required for comparable NO_x performance. Applications include ethanol plant dryer off-gases, sulfur plant tail gases, natural gas processing off-gases, direct fired air heaters and endothermic liquid and gaseous waste thermal oxidizers.

Get Help in Making the Choice

In selecting a thermal oxidizer, it is crucial to work with a consultant as well as a manufacturer for equipment selection and for performance guarantees. This process requires detailed characterization of the waste stream and consideration of possible future additions or process changes. The consultant also plays an important role in the permitting process, using information provided by both the operator and the provider of the thermal oxidizer. All manufacturers agree that choosing the right oxidizer is a critical step in achieving air emission compliance. **GT**

A typical indoor installation of John Zink regenerative thermal oxidixers.

Small regenerative oxidizer installation by Catalytic Combustion Corporation.

MORE info

ANGUIL ENVIRONMENTAL SYSTEMS
www.anguil.com

CATALYTIC COMBUSTION CORPORATION
www.catalyticcombustion.com

ENERGY SOLUTIONS CENTER INFO ON THERMAL OXIDIZERS
www.energysolutionscenter.org/tech/tech_oxidizers.asp

JOHN ZINK COMPANY
www.johnzink.com

Linkageless Boiler Controls Take Over

Linkages are Way Old-Fashioned

LINKAGELESS CONTROL SYSTEMS on boilers or other industrial burners can reduce energy consumption and harmful emissions, and assure better combustion. These systems control the combustion process using microprocessor technology, and are often combined with an exhaust emission analyzer to assure continuous ideal combustion.

Aqeel Zaidi, Energy Solutions Manager from Enbridge Gas Distribution in Ontario, has wide experience working with customers in improving burner efficiency. He indicates, "By eliminating the slop in mechanical linkages, linkageless controls will run a boiler at repeatable air-fuel ratios at all firing rates, resulting in optimum fuel combustion and safer boiler operation."

What We Used to Use

Until the 1980s, nearly all burner fuel and draft controls operated through mechanical linkages. These used levers, jackshafts, cams, chains and gears. They were often adjusted with set-screws and spring tension. Under the best designs, there was inevitably some "play" in the control mechanism. Combustion could be optimized at one or a few points of the firing rate, but there were always points of less than perfect excess air control.

Perhaps most importantly, with repeated operation and changing environmental conditions, the linkages would drift out of calibration. From a process standpoint, the only feedback loop was the occasional check of combustion efficiency and exhaust gas conditions by a diligent operator, and not all operators did that with great frequency.

Beginning a few decades ago, manufacturers started using increasingly reliable and affordable microprocessors and sensors to create controls that always stayed in calibration and were sensitive to the smallest change in combustion or fuel conditions. The day of linkageless controls had arrived. John Devine, Vice President Sales and Marketing from Fireye Inc., compares traditional mechanical linkage controls with linkageless systems being like an old-fashioned carburetor to the precision of modern fuel injection.

Optimizing Combustion

Benefits of microprocessor-driven linkageless burner controls include optimized combustion, repeatability, improved safety control, maximum turndown, fuel and energy savings, and reduced emissions. Modern linkageless control systems include combustion sensing equipment, precise modulators for fuel and air and, ideally, an exhaust gas analysis feedback system, or "oxygen trim." Zaidi notes, "Additional savings can be achieved if an oxygen trim is installed in conjunction with linkageless controls."

Without oxygen trim, most boiler codes require a minimum of 15% excess air (3% oxygen). With an operating trim system, the boiler can often be operated more closely to an ideal fuel-air-mixture. Yet the oxygen trim capability is not inexpensive and can only react to instantaneous boiler load conditions. Thus for rapidly changing steam demand situations, oxygen trim may not be the best control option. A boiler consultant or linkageless control provider can advise you when the addition of oxygen trim can provide improved operations and energy cost savings.

According to Dennis Wood from Autoflame, a major manufacturer of these controls, emission reductions with linkageless systems can be significant. He cites a recent industrial installation where the system reduced NO_x emissions 30% and carbon monoxide emissions by 92%. By improving combustion efficiency, the plant's total carbon footprint is reduced.

MORE info

AUTOFLAME
www.autoflame.com

CLEAVER-BROOKS
www.cleaver-brooks.com

FIREYE INC.
www.fireye.com

HONEYWELL
www51.honeywell.com

STERLING COMBUSTION, INC.
www.sterlingcombustion.com

The Added Benefit of Digital Controls

The status of the control system and the conditions of combustion are usually shown on an electronic display. Digital boiler controls also add additional safety features and many have data logging capabilities, allowing evaluation of boiler operations and often providing data to support preventive maintenance.

Linkageless controls, whether in a new boiler or in a sound older unit, can save energy, extend the life of the boiler, and reduce emissions. In a recent presentation at a Technology and Market Assessment Forum sponsored by the Energy Solutions Center, Carl Manoogian from Honeywell noted that of an installed base of 571,000 boilers in commercial and industrial service in the U.S. and Canada, fewer than 5% currently have linkageless systems installed. The opportunities for major improvements are great, Mechanical linkage combustion control is rapidly becoming obsolete. Now may be your time for a change. **GT**