

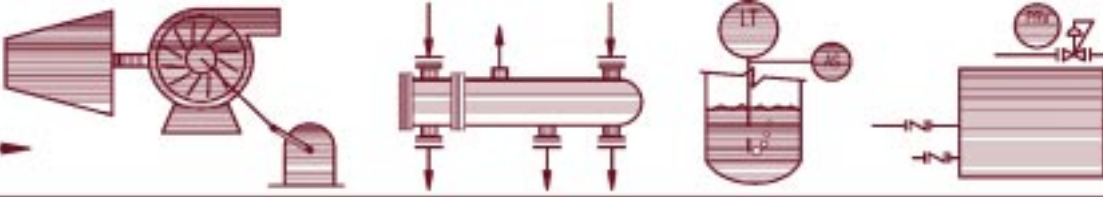
ENERGY SOURCE

A Newsletter published by

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for Industrial Steam and Power Users

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A NEW TECHNOLOGY FOR ENHANCING THE VALUE OF FLY ASH

By: *Joe W. Cochran, Vice President, Progress Materials, Inc.*
Thomas Wassel, Project Manager, ESI

For the past 30 years, the only constant in the electric utility business has been that dramatic evolutionary change is inevitable. In the 70's, high natural gas and oil prices defined the main operational thrust of the industry which led to improving coal-fired combustion technology. These technological advancements improved plant heat rates, reduced operating and maintenance costs, and lowered SO₂, TSP, and CO emissions. The goal was to generate as hot a flame as possible with a proper shape to promote excellent combustion while minimizing excess air.

In the past few years, the industry has finally come full circle as coal combustion technology advancements have primarily focused on one objective - reduction of NO_x emissions. The most common way to reduce NO_x emissions is to reverse the technical advancements of the 70's and do a poorer job of burning the coal. Any field engineer of the 70's would definitely recognize the difference between the appearance of the burner flame today and the one of his era. State-of-the-technology low NO_x burner technology simply reduces the temperature of the flame and the simultaneous presence of excess oxygen, thereby reducing the two key parameters that drive the formation of NO_x.

Besides the slight degradation of overall boiler efficiency, there is one giant

drawback to retrofitting existing pulverized coal-fired boilers with new low NO_x burners. Suddenly, the fly ash markets and relationships that utilities have spent years developing are in jeopardy due to high carbon content in the fly ash. The fly ash produced from low NO_x burners often has a carbon content between 9-15%, sometimes even greater. The ASTM standard limit of carbon in fly ash is 6% carbon content, above which, its use is prohibited as an additive to concrete. Unfortunately, this is the largest single market of coal utility fly ash and the loss of this market generally has a substantial financial impact on a coal-fired power station.

To resolve this problem several options exist. The first option is to do nothing and just send the fly ash to a landfill. This is a poor option because not only is revenue lost from selling the

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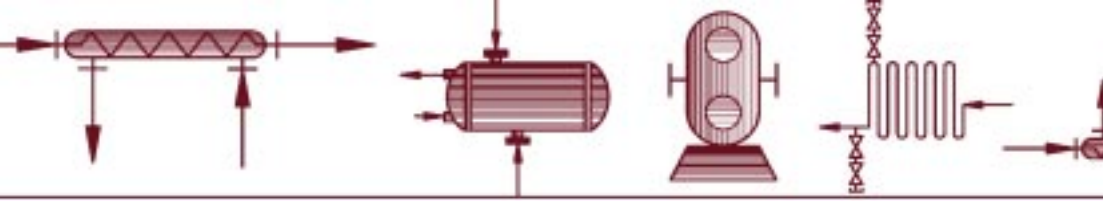
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fly ash, but costs are incurred from transportation and landfilling. Other options include removing the carbon from the fly ash by combustion, mechanical separation, or separation using electrical properties.

Progress Materials, Inc. (PMI), a non-regulated subsidiary of Florida Progress Corporation, recognized the benefits of using combustion technology to transform high-carbon content fly ash into a marketable product. PMI subsequently developed a proprietary technology and patented process which removes the majority of the carbon content from fly ash while capturing the energy associated with this carbon content to improve the overall plant heat rate of the utility station.

PMI developed a specially designed, low velocity bubbling fluidized bed combustor which is the heart of their Carbon Burn-Out (CBO) technology. The bed fluidizing air is preheated to initiate the burnout process. Once the burnout process starts, the preheat of the fluidizing/combustion air is eliminated. The CBO process is self-sustaining within certain parameters of the feedstock material once the bed is ignited. The production rate of the CBO plant is determined by the amount of carbon in the fly ash and the velocity of the fluidizing air in the bed. Cooled low carbon ash is recycled to regulate the CBO bed temperature. From the original research performed, it is known that if the temperature of the bed is allowed to become too great, the fly ash becomes sticky and agglomerates. Subsequently, rock-like agglomerates form in the bed, creating operational and maintenance problems. Should the temperature or carbon content in the bed drop below minimum requirements to self-sustain combustion, the CBO process will stop.

One of the toughest equipment application challenges in the CBO technology is the heat recovery heat exchanger. The fly ash laden hot gas stream leaving the combustor passes through this specially designed heat exchanger. This heat exchanger cools the fly ash and recovers the heat energy into the utility boiler condensate stream.

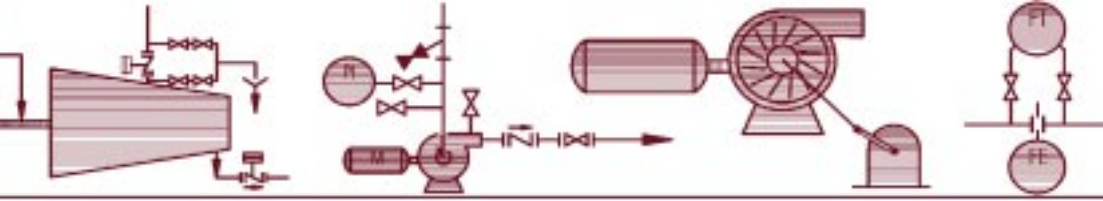
The fly ash produced from the CBO technology has normal carbon levels around 2%. Testing of the fly ash from the first commercial CBO plant has demonstrated that this concrete additive is superior to the previous feedstock prior to low NOx burner conversion. The injected amount of entrainment additive needed to use this fly ash is the same as that required for cement. **This results in a significant savings for the end user.**

Progress Materials, Inc., contracted with ESI to provide design, engineering, procurement, and construction services for this first commercial CBO plant. The

design and construction of this first commercial installation required overcoming several obstacles including material handling, separation, and product storage issues. The next issue of the *Energy Source* will include a case study on this project which is located at the South Carolina Electric and Gas Wateree Station.



First Commercial Carbon Burn-Out Plant



WHO IS ESI?

Recently, ESI has been informed by several people who have been reading the *ENERGY SOURCE* for years that they are unaware of all of the services we provide. Hopefully, the following information will prove helpful in answering any questions you may have about our capabilities.

ESI is an engineering and construction firm that specializes in steam and power projects for industrial and utility clients.

ESI has expertise in all aspects of steam and power generating projects including:

➤ **Material Handling Systems**

Including paper mill sludge, wood-waste, coal, sand, and ash handling systems. Both pneumatic and mechanical conveying and storage systems.

➤ **Control Systems**

Including plant wide DCS & pneumatic to electronic conversions.

➤ **Environmental Compliance**

Including particulate clean-up, SNCR, SCR, and CEM installations.

➤ **Water Treatment Systems**

Including water softeners, demineralization systems, and reverse osmosis systems.

➤ **Retrofits**

Including conversions of recovery and power boilers to bubbling fluidized bed boilers and burner modifications.

➤ **Electrical Generation Equipment**

Including combustion and steam turbine-generator sets.

In addition to our gas, oil, and coal capabilities, ESI has experience combusting a wide range of “plant opportunity fuels” including:

➤ **Paper Mill Sludge**

➤ **Wood-waste**

➤ **Tire Derived Fuel**

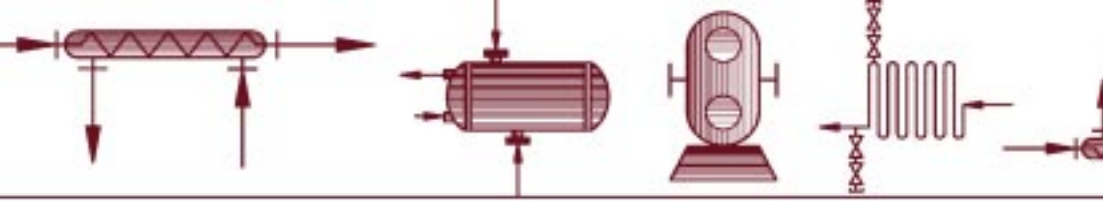
➤ **Landfill Gas**

➤ **Fly Ash**

For a typical project, ESI will assemble the best available technology to meet the customer’s exact needs. Our approach enables us to evaluate standard industry technology and apply it in unique ways. ESI has performed several “first-of-a-kind” projects including the design and construction of the Fox Valley Glass Aggregate Plant which burns 1300 tons/day of paper mill sludge, thus producing steam for a host mill and a glass aggregate product (an article about this project is in the Summer 1998 issue of the *ENERGY SOURCE*), and the design and construction management of a fly ash Carbon Burn-Out Facility which is briefly discussed in this issue.

If you are considering any project in your steam or power area - ESI is the company to call. We would welcome the opportunity to discuss your particular needs and help you solve any of your steam, power, or waste problems.

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Y2K

ARE YOU AS PREPARED AS YOU THINK?

By: Jeffrey L. Youmans, P.E., Control Systems Engineering Supervisor, ESI

As you have been preparing your company network and computer systems for the now famous Y2K problems, have you spent an appropriate amount of time verifying the Y2K compliance of your control system and instrumentation? Hopefully you have, and you can feel confident that your plant will not experience any downtime due to this potential problem. Otherwise, you could be in for some long days come January 1, 2000.

What potential problems could occur because of your control system and field instrumentation? The answer to this question depends on several factors such as: (1) what type of equipment you have, (2) the age of your equipment, and (3) the functions your equipment is performing.

Some of the most obvious systems that may have problems with the year 2000 are data acquisition systems, historical archiving systems, alarm logs, CEMS, and computer software. Almost all data acquisition systems, historical archiving systems, alarm logs, and CEMS time and date stamp the data that they collect. This, of course, is what leads to the potential problem with the year 2000.

Have you checked with the manufacturers of your systems to verify whether the revisions that you have are Y2K compliant or not? The good news is that all of the major control system and instrumentation manufacturers have done extensive testing of their equipment's Y2K compliance. Most of these suppliers have posted the results of their Y2K testing on their Internet websites.

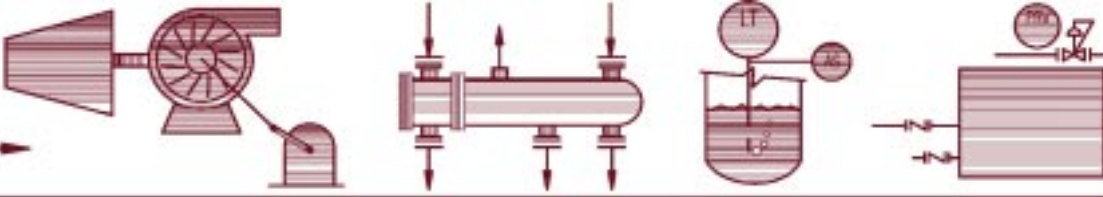
In assessing your plant systems, the first thing that you need to do is develop a list of all your equipment along with model numbers and revision levels. Then you can use these websites to determine whether or not your equipment is Y2K compliant. If your equipment is relatively new, you may find that it is already Y2K compliant. However, do not make this assumption, because some systems sold even in the last year are **NOT** Y2K compliant.

If you find that some of your equipment is not compliant, you will need to contact your local sales representative and find out what actions need to be taken in order to correct the problem. This may consist of upgrading the entire system, or just upgrading to a newer firmware and/or software revision. In ESI's research regarding this issue, we have found that most systems which are not compliant simply need to be upgraded to a newer firmware and/or software revision. In this case, you will need to schedule a field service technician to come to your site and perform the work. Don't delay in making these arrangements, because most control vendor field service personnel are already scheduled for several months in advance.

Do not forget when preparing your equipment list to include both the hardware and software for your DCS, PLC's, single loop controllers, operator stations, CEM, all field instrumentation, and any communication interfaces. Also, remember to include all of your handheld interfaces (i.e., HART). We have found several handhelds that are not Y2K compliant.

Good luck in preparing your plant for YEAR 2000!

 **Check us out at www.esitenn.com.**



RENTAL BOILER UPGRADES

By: Deanna B. Melvin, Sales Engineer, ESI

When ESI entered the rental boiler business in 1993, our goal was to provide state-of-the-art equipment combined with the same level of customer service we provide in our core design/build business.

To accomplish this, our boilers were designed to include features not found on other rental equipment. However, we did use the manufacturer's standard front-wall construction. After years of service and maintenance history, ESI has replaced this standard refractory front wall on two of our boilers with a state-of-the-art, membrane, water-cooled front wall.

A completely water-cooled, membrane furnace enclosure will give our rental boiler customers the following benefits:

- Improved reliability and availability by avoiding shutdowns due to casing hot spots, etc.
- Faster boiler "ramp up" rates from a cold start
- Cooler furnace and potentially reduced emissions

ESI plans to continually upgrade our rental equipment so we can provide our customers with state-of-the-art rental equipment and continued satisfaction. For additional information on our rental equipment, please call Deanna Melvin at 1-800-990-0374 or visit us on the web at www.rentalboilers.com.



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WHO IS ESI? *Continued from Page 3*

If you already have a project in mind, there is no need to "reinvent the wheel". ESI evaluates dozens of projects and potential projects each month. This keeps us current with environmental regulations, permitting requirements, and perhaps most importantly, equipment costs both designed and installed. If you are considering a project, ESI would be happy to assist you in your evaluation by preparing a $\pm 20\%$ budget proposal, at no cost or obligation. However, if you have several alternatives and are seeking the most viable option, ESI could perform an Engineering Study. For a typical Engineering Study, ESI would visit your plant, do a site survey, and talk to your engineers and operators about the needs and requirements of the potential project. We would then prepare the report which would include an outline of all possible scenarios, along with the pros, cons, and a budget cost of each. If you are interested in ESI preparing a budget proposal or performing an engineering study, please call Jeff White at 1-800-654-2512.