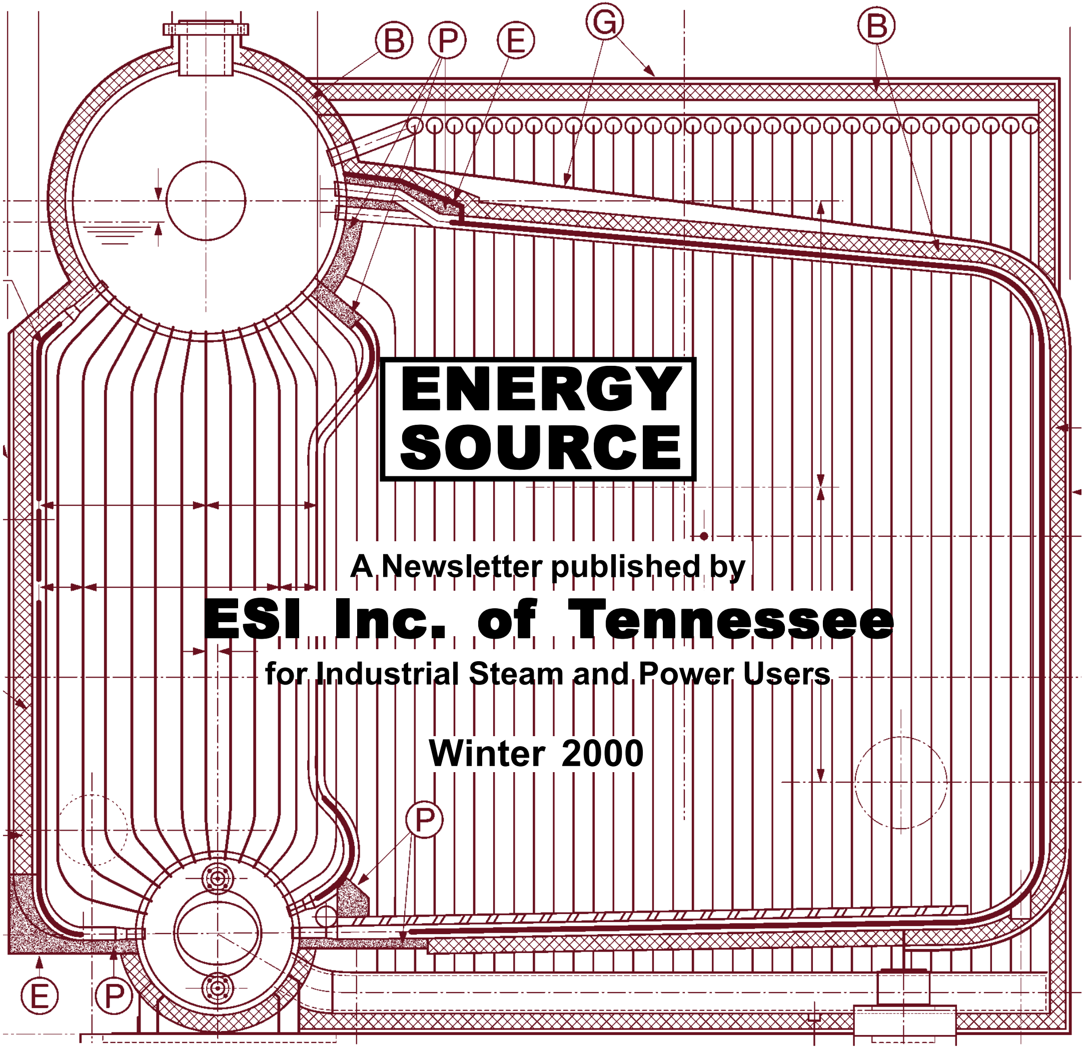


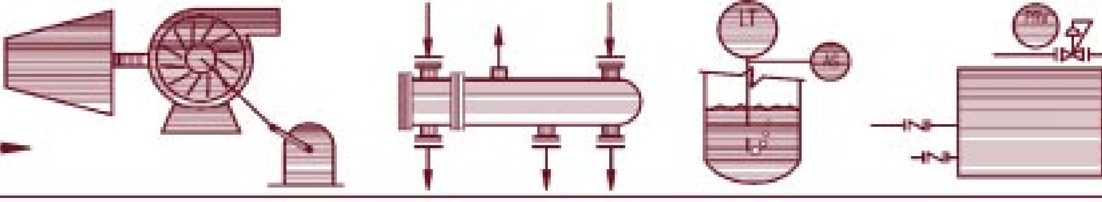
ENERGY SOURCE

A Newsletter published by

ESI Inc. of Tennessee

for Industrial Steam and Power Users

Winter 2000



Pneumatic Boiler Controls vs. A Distributed Control System

By: Mark D. Lassetter, P.E., Manager of Electrical & Control Systems, ESI

Almost every plant in the country has had at least one distributed control system (DCS) installed in the 1980's or 1990's, but most have been installed in the production area or as most companies refer to it as the "money making side" of the plant. On the utility side, many plants still utilize pneumatic control systems, some of which are over 30 years old!

When evaluating whether or not to replace your plant's pneumatic boiler controls, it simply boils down to the cost of the DCS versus the advantages of the DCS. A few of the advantages that a DCS offers compared to a conventional pneumatic control system are: easier operator interface and monitoring, system redundancy, expansion flexibility, and easier maintenance and troubleshooting.

Operator Interface and Monitoring

In some older power houses, the boilers and associated auxiliary equipment are controlled from panels located in the control room or on the plant floor. These control panels sometimes represent over 300 ft^2 of front panel space equipped with multiple annunciators, draft gauges, circular chart recorders, push buttons, meters, and pneumatic control stations. With the installation of a DCS, this 300 ft^2 of "operator interface" can be reduced to two (2) desktop computers with 21" monitors. This allows all system data to be accessible to the operator in a more "user friendly" format.

When a DCS is utilized, field-mounted electronic transmitters and analyzers provide the system with up-to-date information on the process such as pressure, level, flow, and temperature. All of this information is available to the processor and can be utilized in many ways. To aid the operator in monitoring the plant, the system can be programmed to categorize alarms into priority levels so that the operator is alerted to higher priority alarms first during multiple alarm conditions, thus reducing operator response time. Effective graphics can be designed to focus the operator's attention on those high priority conditions to expedite correction. In addition, these same graphics can be designed to provide the operator with emergency instruction and display immediate status on the process variable under alarm (i.e., drum level). Operator understanding and visualization of a graphic (and thus the process) can be enhanced by effective use of colors. For example, the display of a motor color can change due to its status (green-off, red-on, yellow-tripped). DCS manufacturers offer multiple colors that can be used in customized graphics to match a plant's standards and preferences.

ENERGY SOURCE

The *ENERGY SOURCE* is published quarterly for customers, employees, and friends of ESI Inc. of Tennessee.

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

Complimentary subscriptions to the *ENERGY SOURCE* are available by calling 770-427-6200 or visiting our web site at www.esitenn.com. If you have any suggestions or comments about the newsletter, feel free to call us or e-mail us at energysource@esitenn.com.

Happy New Year

Deanna Melvin
Managing Editor

Pneumatic Boiler Controls vs. A Distributed Control System

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One widely used graphic display being utilized in the boiler control industry is the process graphic showing pictorially all process equipment, piping, valves, and the dynamic process data associated with a control loop. For example, one display would show all three elements of drum level control which include: drum level, steam flow, and feedwater flow. Also, the boiler feedwater pumps, feedwater control valve, and actual boiler drum would be displayed. The operator on a quick glance could determine if the boiler feedwater pump was on, whether the feedwater valve was open, and determine if the level in the drum was safe.

This distributed control system allows one operator to control all critical controls operations in this modern

Trends and trend recording have been greatly enhanced by the DCS. Any process analog data can be displayed on a trend with multiple other process variables. With the "time scroll" feature, the operator can scroll back to the time of a system upset and retrieve all historical data that occurred (i.e., low drum level trip). The trend itself can be changed by a single keystroke to display various units of time such as minutes or hours.

System Redundancy

An unscheduled outage of a boiler can result in costly downtime for a plant. The hardware architecture of a DCS allows for the system to be installed with an extremely high level of redundancy. This redundancy allows for any primary component to fail, while keeping the DCS on-line. In the case of a primary component failure, the back-up component would take over and the process would continue uninterrupted. An alarm would be generated to alert the operator. Common DCS components that are made redundant include the main process controller, power supplies, data highways, and the operator console electronics.

Expansion Flexibility

Another advantage of DCS hardware architecture is the flexibility to expand the system for future needs. A DCS utilizes a communication network commonly called a data highway. This data highway provides substantial flexibility to the DCS - flexibility to communicate with other control devices (DCS, PLC, host computers) and to expand its own system. Therefore, process areas not connected to the DCS at the time of installation can easily be added in the future (i.e., water treatment, ash handling, etc.). In addition, new graphics can also be added to the operator stations to facilitate monitoring and control of the new Inputs/Outputs.

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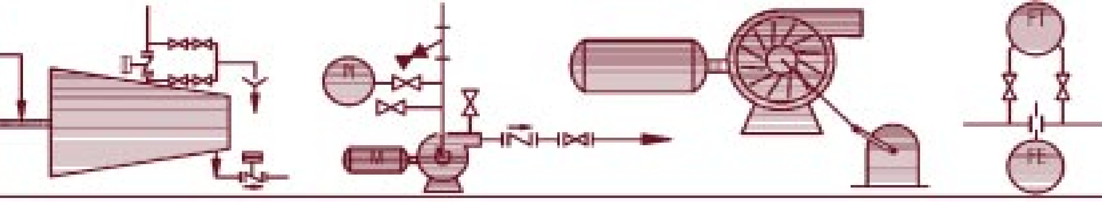

Ask An Engineer!

Question Can you give me a ball park estimate of what it would cost to build a carbon burn out (CBO) facility where I could burn my high carbon content fly ash? We burn about 250 tpd of stoker coal, ash produced is about 40% carbon.

Answer Your application is similar to many we know about, but unfortunately the quantity of your available fly ash even at 40% carbon is only about 15-20% of what is required to make this a viable project. The smallest of these plants have been estimated to cost over $5,000,000. The best solution, if feasible, is to group several coal users in an area and develop a central CBO plant to serve them all.

Question What is the appropriate procedure for blowing down the water column?

Answer Clark-Reliance recommends blowing down the water column and water gages on a weekly basis, or as necessary, based on water quality. They suggest the following blowdown procedure:

1. Close both the steam and water valves between the boiler drum and the water column or water gage.
2. Open the drain valve fully on the bottom of the water column or water gage.
3. Crack open the steam valve and allow a gentle rush of steam to pass through the water column or water gage for no longer than 20 seconds.
4. Close the steam valve.
5. Inspect the water gage to insure that all foreign matter is flushed from the glass or mica. If the gage is not visually clean, repeat steps 3 and 4.
6. Close the blowdown valve and simultaneously open the steam and water valves, slowly bringing the equipment back to a normal operating level.

ESI specializes in the design and construction of steam and power plants for industrial and utility clients. If you have a technical question about your steam or power facility - **Ask an Engineer!** Call Deanna Melvin at 770-427-6200 or e-mail us at energysource@esitenn.com.

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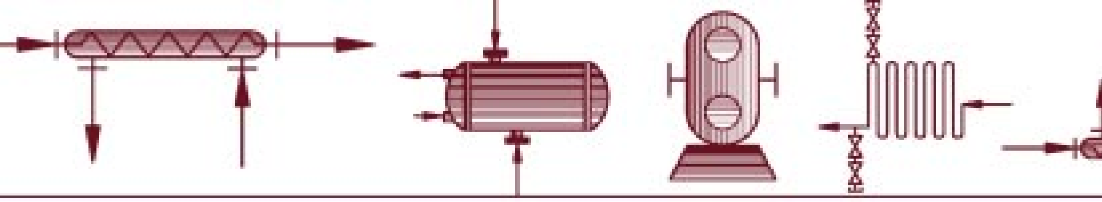

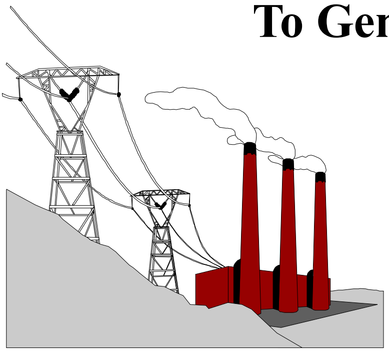

To Generate or Not Generate?

That is the question

By: Jeffrey H. White, Sales Manager, ESI

In this day of utility de-regulation and the need to stay competitive in a global economy, a common question asked of ESI is "Can my facility cost effectively generate electricity?" Our response is always the same, "It depends".

The economic viability of cogeneration depends upon the facility and the situation. By performing a quick analysis of key operating parameters, generally, the decision to consider a power generation project can quickly be determined. Self-generating electricity is simply a cost versus benefits analysis. By properly determining the costs and comparing these to the savings, the answer becomes evident.

By far the largest factor in this analysis is the differential between the cost of purchased electricity compared to the cost of available fuel. In simple terms, in order for a generation project to be economically viable, the cost of purchased power must be much greater than the cost of fuel. However, the analysis must be made using a common unit of measure such as $/mmbtu or $/kw. Obviously, the greater the difference in costs, the more attractive generation becomes. Once these differences are determined in today's terms, consideration must then be made as to how these costs compare, considering realistic escalation projections in future years.

With the fuel/power differential established, the next criteria is to determine the feasibility of cogeneration, or to utilize the "extra" energy. Standard utility power generation is only about 38% efficient because a substantial amount of the energy is wasted in the condenser and cooling water cycle. Cogeneration is by definition, the simultaneous generation of both electrical power and thermal energy. Instead of wasting all of the thermal energy in the condenser/cooling water system, the energy is converted into a usable form. Therefore, cogeneration feasibility depends upon whether the facility is able to use both the power and thermal ("extra") energy produced. Cogeneration thermal cycle efficiencies up to 70% are possible. Consequently, even though the public utility generally enjoys a lower cost of fuel and higher steam turbine efficiency due to the operating pressure, the overall better efficiency of a cogeneration system makes it more financially attractive.

Other key parameters that can substantially affect cogeneration feasibility are the costs of back-up power, changes in the power rate due to increased demand charges, increased or decreased costs for maintenance of new and existing equipment, cost impact of operations staff, and increased cost for water and wastewater. Each of these costs can have a significant impact on whether electrical generation is right for a given facility.

The last important element in the analysis is the selection and pricing of the appropriate technology for electrical and energy production. The best technology will be one which considers the operation of the facility, the lowest cost fuels available, the annual operating and maintenance costs, the space available for the installation of the technology, and any infrastructure upgrades which may be required. Infrastructure upgrades can include: improved water quality, increased gas pressure, and higher fuel consumption. Technology selection would not be

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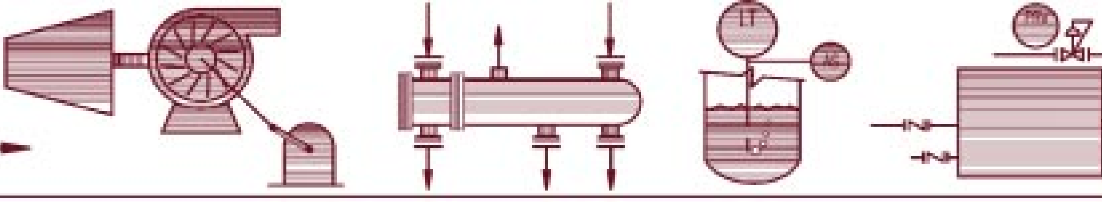

To Generate or Not Generate? That is the Question

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complete without an accurate determination of the installed cost. Items which must be considered include not only the cost of capital equipment, but also the design, engineering and installation costs for a safely started up and fully operational facility.

Evaluating the question “To Generate or Not Generate?”, can be a complicated undertaking; however, just like any other problem, if you break it down into small enough pieces it becomes quite manageable. ESI has performed a number of these types of analyses and would be happy to perform a low cost engineering study to assist you in evaluating whether your facility is a candidate for self-generation of electricity. For information about this service or if you have any other questions, please feel free to call Jeff White at 770-427-6200.

Pneumatic Boiler Controls vs. A Distributed Control System

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Maintenance and Troubleshooting

One of the major drawbacks in relying on pneumatic boiler controls is the difficulty with performing maintenance and troubleshooting. The availability of instrumentation technicians skilled in pneumatic system maintenance is becoming an epidemic problem in industry. Most plant I/C technicians are trained in the troubleshooting and repair of electronic transmitters and control systems. Most have never even seen or been required to work on pneumatic devices. To get service on pneumatic systems, most plants must rely on outside resources, which are becoming scarcer each year. The major control systems manufacturers are not much assistance because they are spending all of their time and money to enhance their electronic transmitters and control systems. This leads to very few certified pneumatic technicians. In some cases, there may only be one certified pneumatics technician in a multi-state area. A plant can literally be held “hostage” by the availability of these technicians.

Due to the fact that there are ample technicians trained on electronic transmitter and control systems, a DCS is much easier to troubleshoot and have maintenance performed. Most plant I/C technicians are easily trained to perform routine maintenance on electronic transmitters and control systems. Also, the control systems vendors can provide support with their own field service representatives.

Another advantage of the DCS that simplifies troubleshooting and maintenance is the fact that a DCS has a built-in diagnostics system which allows the control system to determine when something has malfunctioned and alert the operator. The most common malfunctions include a bad quality signal from a transmitter or a processor card failure. This feature is extremely helpful when in a “must have steam” situation because, while the built-in redundancy will resolve most problems and keep the process online, other problems, like a bad transmitter that requires maintenance, will be identified faster and easier. If the problem is with a component of the DCS, quite often the simplest solution from a maintenance viewpoint is to remove the problem component and replace it with another “spare” component.

Conclusion

These advantages alone make it well worth your time to explore converting your pneumatic boiler controls. Now that Year 2000 has arrived, it is time to consider upgrading the controls in your power house. If you have pneumatics or older electronic controls and are interested in upgrading to a DCS, please feel free to contact Mark Lassetter at 770-427-6200 to assist you in evaluating your potential project. ESI has performed a wide range of controls projects including new DCS installations and controls upgrades to existing facilities.