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EC79-2303 Strategies for Minimizing Boiler Energy Use

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STRATEGIES for MINIMIZING BOILER ENERGY USE



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STRATEGIES for MINIMIZING BOILER ENERGY USE

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Heating costs can be reduced and profits improved by more effective use of energy even in the face of sharply increasing energy costs. Now that the cost of the fuel burned each year may be 10 times the cost of the boiler burning it, it makes good economic sense to spend whatever you must to improve boiler efficiency.

Boiler systems are the most obvious industry energy operation to which energy conservation can be applied since many industries, particularly food processors, have large steam and/or hot water requirements. Generation of steam is susceptible to appreciable energy losses and, therefore, many steam systems operate at efficiencies lower than necessary.

This publication brings together some of the situations and techniques a boiler operator should be aware of and ways to improve the efficiency of a steam generation operation. It is not meant to be an exhaustive list but rather one including many of the more obvious and more easily controllable factors. Any one, or combination of many, of these factors should result in more efficient operation, both in terms of fuel consumption and breakdown time.

1. Increase fuel combustion efficiency by:

- Preheating combustion air (i.e., with flue gas).
- Optimizing flow of air to burners.
- Maintaining burners and injection systems (cleaning).
- Improving oil atomization.
- Using compressed air rather than steam to atomize oil.
- Heating oil to proper temperature for atomization.
- Replacing obsolete burners with more efficient ones.
- Converting combustion to more efficient fuel.
- Limiting secondary combustion air to amount required for proper furnace operation.
- Establishing a program to monitor boiler efficiency as a tool to control energy waste.

2. Recover heat from:

- Flue gas with stack economizers (for large water tube type boilers only).
- Condensate (use for boiler feed or replacement water)—if condensate is contaminated, evaluate possible cleanup.
- Hot cleaning solutions with heat exchanger.
- Blow down steam and water. Note: Recovered heat can be used for generating

low pressure steam; generating hot water; preheating boiler feedwater; or space heating.

3. Reduce energy loss by:

- Using water softeners to treat feedwater and thereby minimize boiler blowdown.
- Keeping boiler tubes clean (waterside and fireside).
- Repairing steam leaks in: lines; valves; and traps.
- Adding additional insulation to or replacing old insulation around steam and condensate lines as well as the boiler.
- Installing shut-off valves on infrequently used lines.
- Reducing steam line pressure to the minimum required—lowering pressure by a pressure reducing valve offers no savings in energy.
- Replacing steam use with high temperature water to eliminate steam losses.
- Reducing hot water temperature to the minimum required.
- Installing automatic valves to reduce hot water and steam use for cleanup and production.
- Shutting down boiler when steam is not needed.
- Eliminating unnecessary "hot" standby boilers—arrange to shut down when not being used.

l. Replacing worn out boiler with boiler of optimum capacity.

m. Replacing steam jets on vacuum systems with electric motor driven vacuum pumps.

n. Using steam pressure reduction to generate power.

o. Standing by at reduced temperatures when production is interrupted. Note, however, that there are considerations other than energy savings which affect the optimum standby temperature.

p. Establishing a program for regular inspection, testing and repairing of steam traps.

q. Having the proper number and size of steam traps.

SUGGESTED PRELIMINARY APPROACHES

Stop Steam Leaks

A starting point for improving boiler efficiency is to stop steam leaks. Survey steam lines for leaks using appropriate acoustic and temperature probes. Examples of hidden steam leaks include: leaking or stuck traps, or by-pass valves discharging to sewer or condensate system; leaking valves leading to idle equipment; leaks in heater or other equipment connected to the steam system.

A regular inspection program to detect hidden leaks and prompt repair of detected steam leaks are obvious ways to reduce energy loss through steam leaks. Shutting off steam to equipment whenever it is taken out of

service and the rerouting of piping so that leaks will be visible represent additional strategies for reducing steam loss.

Inspect and Repair Steam Traps

Initial inspections commonly reveal that as high as seven percent of the traps in a system are leaking. By careful maintenance and frequent inspection this can be reduced to one percent. Weekly inspection and testing should provide answers to the following questions:

- a. Is the trap removing all of the condensate?
- b. Does it shut off tight after operation?
- c. Is by-pass, or separate discharge, closed and free of leaks?
- d. Is frequency of discharge in an acceptable range? Too frequent discharge indicates possible undercapacity; too infrequent discharge indicates possible overcapacity and inefficiency.

Recover Boiler Flue Gas Heat for Space Heating and Feedwater Preheating

Twenty-five percent of the heat from combustion of fuel gas is lost in the flue gas. Considering that it is possible to recover 75% of the heat loss in the stack, investigate the possibility of installing heat recovery systems on boilers not so equipped. Evaluate recovery of heat from flue gases for preheating combustion air or boiler feedwater, or for heating hot water or low pressure steam for space heating or process use.

Standby at Reduced Temperature

When heating equipment is temporarily not used because production is interrupted or because of the nature of the process, energy can usually be saved by allowing the equipment to cool down and then reheating. For maximum energy saving, the heating and cooling characteristics of the equipment must be known so that cooling can be allowed to drop the operating temperature to the lowest practical level and reheat started to attain operating temperature no sooner than necessary. There are no general rules of thumb for all cases, but the necessary heating and cooling rate data on major heating equipment are not difficult to obtain. Such data can be used to schedule standby periods.

Proper Temperature for Fuel Oil Atomization

Check fuel oil supply temperature and compare with burner manufacturer's recommendations for the fuel specification used.

In closing, the efficient operation of a boiler depends on regular service to the equipment. The operation and maintenance procedures should be clearly defined and made available to all operators in the form of a log book. The log book should contain instructions and forms pertaining to daily, weekly, monthly, and yearly procedures. A very important link in the efficiency chain is a boiler operator who is knowledgeable about boilers and auxiliary equipment and their operation and maintenance.

The energy situation is a national concern. It can also be viewed as an exciting challenge.

Those companies that move quickly to meet the challenge will contribute substantially to the solution of a national problem—and make money doing it.

Some recent references on boilers are:

Energy Conservation Program Guide for Industry and Commerce. NBS Handbook 115, U.S. Department of Commerce.

Boiler Room Questions and Answers. A. Higgins and S. M. Elonka. McGraw. 1975.



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