

Squeezing \$\$ Out of Boiler Water

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The monetary value of boiler water consists of:

- Water cost
- Fuel cost
- Pretreatment cost
- Treatment Chemical Cost
- Sewer cost

By far, the largest contributor on this list is fuel cost as is also illustrated in Figure 1. The amount of heat energy contained in boiler water is a very valuable asset. Natural gas prices are around \$6.10/Mcf and show no signs of decreasing as shown in Figure 2. Coal is at \$50/ton. With ever increasing fuel prices, this is an asset that becomes more and more important to conserve everyday. This is not to belittle the other items on the list. Each is very important in its own right, and it is often found that what minimizes one item will also minimize another.

Consider a basic boiler system with minimal water and energy conservation measures such as a boiler system that uses softened city makeup to produce 225 psig steam at 20 cycles (or 5% blowdown) with 25% condensate return. How can more value be squeezed out of every pound of boiler water?

There are multiple ways to conserve the value of boiler water. Each presents its own unique requirements and should be evaluated on a case-by-case basis. A brief description of each follows.

Figure 1: Boiler System Operation Costs

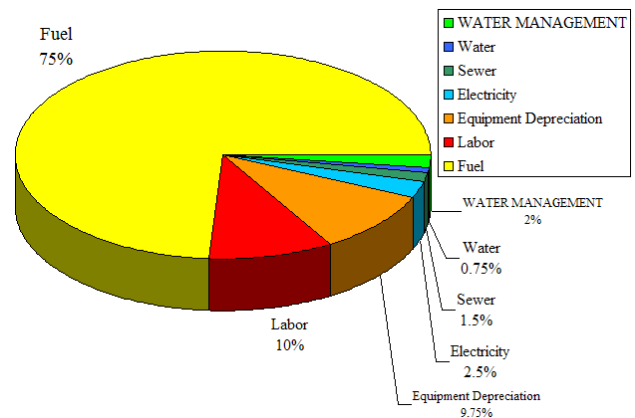
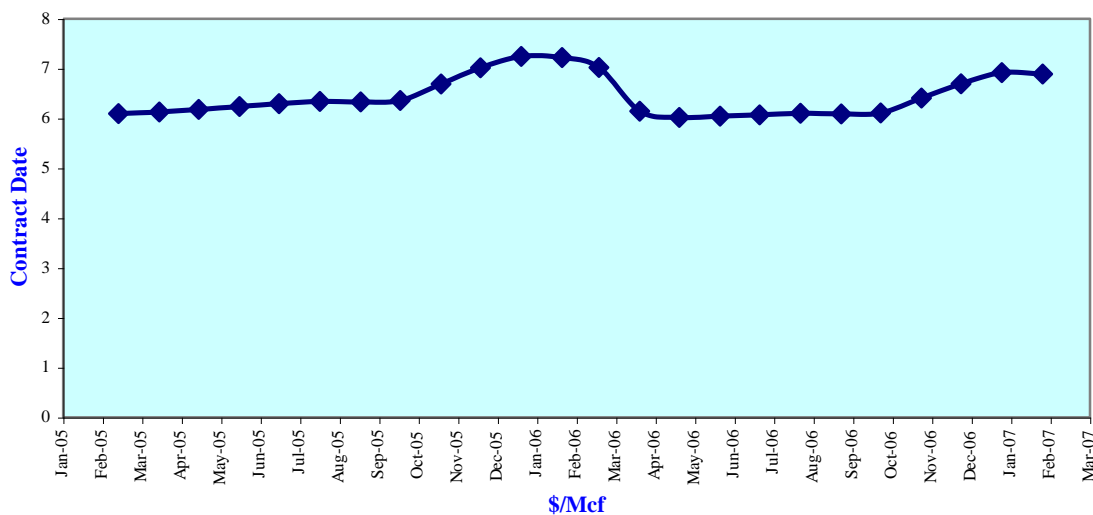


Figure 2: Henry Hub Forward Natural Gas Price Table



Conserving \$\$

Maximize Cycles of Concentration

By maximizing the cycles of concentration at which a boiler can operate, less makeup water, less fuel, less chemical usage, less pretreatment costs, and less blowdown sewer costs will be realized. According to the American Society of Mechanical Engineers guidebook on boiler operation, the maximum recommended number of cycles is 100. Cycles of concentration can be increased by:

- **Maximizing Condensate Return:** For every gallon of additional condensate returned, one less gallon of makeup will be required. Increasing condensate return increases boiler cycles, decreases chemical usage, decreases blowdown, and conserves the heat value of the high temperature condensate. Maximizing condensate return may involve repairing a condensate pumping system, replacing pipe, or eliminating condensate contamination.
- **Improving Makeup Water Quality:** There are various technologies to pretreat boiler water including softeners, reverse osmosis, and demineralization. The higher the quality of water produced, the higher the number of cycles a boiler can operate. The economic savings of each technology can be calculated for evaluation.

Maximize Control of Cycles

Boilers are dynamic machines with swinging steam loads and changing parameters. Maintaining the water quality at the proper cycles or conductivity can be a labor-intensive process. Automatic blowdown control can be a real money saving device.

If the boiler is manually controlled at an average conductivity below the setpoint, then money is being wasted with increased blowdown, chemical usage, makeup, and fuel consumption. The key to a reliable automatic blowdown controller is using a cooled sample and taking the time to tune the controller to the system.

Economizers

Not all the heat energy from the combusted fuel is absorbed by the boiler water in the boiler itself. Some of the energy is lost out the stack. An economizer allows some of this otherwise lost energy to be recovered by using a heat exchanger located on the stack to heat boiler feedwater. For every 40° to 50° F drop in stack temperature, a 1% gain in boiler efficiency is realized.

Blowdown Flash Tank & Heat Exchanger

Even at 100 cycles, a boiler has some blowdown to control dissolved solids. This blowdown contains a significant amount of heat energy that can still be recovered. A blowdown flash tank allows the high-pressure blowdown to flash to a lower pressure steam that can be used as a steam source to the deaerator. Once the blowdown passes through the flash tank, more energy can be recovered from the remaining liquid with a heat exchanger to preheat the makeup water.

Typically, 80% of the waste heat in blowdown can be recovered with such a flash steam heat exchange system. Over half this savings comes from the flash steam generation alone.

Conclusion

Each of the methods described can have a positive impact on the economics of running a boiler. For more information, please consult your local Water Management Specialist. ☞

