

Minimize Boiler Blowdown

Minimizing your blowdown rate can substantially reduce energy losses, as the temperature of the blown-down liquid is the same as that of the steam generated in the boiler. Minimizing blowdown will also reduce makeup water and chemical treatment costs.

As water evaporates in the boiler steam drum, solids present in the feedwater are left behind. The suspended solids form sludge or sediments in the boiler, which degrades heat transfer. Dissolved solids promote foaming and carryover of boiler water into the steam. To reduce the levels of suspended and total dissolved solids (TDS) to acceptable limits, water is periodically discharged or blown down from the boiler. Mud or bottom blowdown is usually a manual procedure done for a few seconds on intervals of several hours. It is designed to remove suspended solids that settle out of the boiler water and form a heavy sludge. Surface or skimming blowdown is designed to remove the dissolved solids that concentrate near the liquid surface. Surface blowdown is often a continuous process.

Insufficient blowdown may lead to carryover of boiler water into the steam, or the formation of deposits. Excessive blowdown will waste energy, water, and chemicals. The optimum blowdown rate is determined by various factors including the boiler type, operating pressure, water treatment, and quality of makeup water. Blowdown rates typically range from 4% to 8% of boiler feedwater flow rate, but can be as high as 10% when makeup water has a high solids content.

Example

Assume that the installation of an automatic blowdown control system (see page 2) reduces your blowdown rate from 8% to 6%. This example assumes a continuously operating natural gas-fired, 150-psig, 100,000-pound-per-hour (lb/hr) steam boiler. Assume a makeup water temperature of 60°F, boiler efficiency of 80%, with fuel valued at \$8.00 per million Btu (\$8.00/MMBtu), and the total water, sewage, and treatment costs at \$0.004 per gallon. Calculate the total annual cost savings.

Boiler Feedwater: Initial =	$\frac{100,000}{(1 - 0.08)}$	Final =	$\frac{100,000}{(1 - 0.06)}$
	= 108,696 lb/hr		= 106,383 lb/hr
Makeup Water Savings =	108,696 - 106,383 = 2,313 lb/hr		
Enthalpy of Boiler Water =	338.5 Btu/lb; for makeup water at 60°F=28 Btu/lb		
Thermal Energy Savings =	338.5 - 28 = 310.5 Btu/lb		
Annual Fuel Savings =	$2,313 \text{ lb/hr} \times 8,760 \text{ hr/year} \times 310.5 \text{ Btu/lb} \times \$8.00 / \text{MMBtu} / (0.80 \times 10^6 \text{ Btu/MMBtu})$ = \$62,913		
Annual Water and Chemical Savings =	$2,313 \text{ lb/hr} \times 8,760 \text{ hr/yr} \times \$0.004 / \text{gal}$ 8.34 lb/gal = \$9,718		
Annual Cost Savings =	\$62,913 + \$9,718 = \$72,631		

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Suggested Actions

- Review your blowdown practices to identify energy saving opportunities.
- Examine operating practices for boiler feedwater and blowdown rates developed by the American Society of Mechanical Engineers (ASME).
- Considerations include operating pressure, steam purity, and deposition control.
- Consider an automatic blowdown control system (see page 2).

Best Practice Tip Sheet information is adapted from information provided by the Industrial Energy Extension Service of Georgia Tech and reviewed by the DOE Best Practices Steam Technical Subcommittee. For additional information on industrial steam system efficiency, contact the ERE Information Center

