

**S**team is one of the principal forms of energy used in industrial processes. Nationwide, approximately 35 percent of the total energy used in industrial production is in the form of steam. In Wisconsin, steam boilers annually consume an estimated 800 million therms of natural gas—valued at \$480 million per year at the current fuel price of \$0.60/therm. A typical industrial facility can save as much as 20 percent of its fuel cost through implementation of the steam system best practices presented here.

### 1) MAINTAIN STEAM TRAPS

Develop and implement a Steam Trap Management Program that incorporates the following activities:

- Personnel training – on entire boiler systems, not just for steam traps
- Identify and inventory steam traps
- Trap inspection and testing procedure – must have a written Standard Operating Procedure (SOP)
- Trap correction processes – included in the SOP
- Trap database and reporting tool. Malfunctioning steam traps waste steam and result in higher boiler fuel consumption. Potential savings for this practice range from five percent to ten percent of boiler fuel use. The simple payback for a steam trap maintenance program is often one year or less.

### 2) REDUCE SYSTEM LEAKS

Repair leaks in steam piping, condensate return lines and fittings. Leaks cause both higher fuel use and increased make-up water consumption. The energy savings potential, especially in higher-pressure systems, increases proportionally with steam loss. Implementing a proactive steam leak management program can reduce a facility's energy usage by one percent.



### 3) ADD INSULATION TO REDUCE HEAT LOSS

Add new insulation where original insulation is damaged, where the original insulation was removed as part of an asbestos abatement program and not replaced, and to new piping and valves. Often, the original integrity of insulation decreases on steam and condensate system piping, equipment and tanks. Lack of insulation increases heat loss, resulting in higher boiler fuel consumption. As a general rule, proper insulation on hot surfaces will reduce heat loss by 90 percent. Insulation is inexpensive and simple paybacks are within one year.

### 4) TUNE UP BOILERS EVERY THREE TO SIX MONTHS

Perform regular boiler tune-ups. A boiler tune-up includes reducing excess air, cleaning boiler tubes and recalibrating boiler controls. The proper combustion air-to-fuel ratio directly affects combustion efficiency. Inadequate air supply yields unburned combustibles (fuel, soot, smoke and carbon monoxide) while excess air causes heat loss from increased flue gas flow – lowering the boiler's fuel-to-steam efficiency. Generally, boiler efficiency will increase by one percent for each 15 percent reduction in excess air. Implementing a routine boiler maintenance program can reduce your facility's energy use by two percent and quickly pay for itself.

**Incentives are available for Steam System Best**

**Practices. Contact Focus on Energy**

**for more information at 800.762.7077**

## 5) ADD BOILER STACK ECONOMIZERS

Install feedwater economizers to recover stack gas wasted heat. Recovered energy may be used to heat process water, preheat boiler feed water or preheat combustion air. Fuel requirements can be reduced by one percent for each 40°F reduction in stack temperature. Use sensible heat recovery economizers (non-condensing type) to recover heat for boiler feed water where the flow is continuous. Recover both sensible heat and latent heat with condensing-type economizers. Condensing economizers pay for themselves when used for processes that require hot water with temperatures under 180°F. The typical payback for an economizer is two to three years.

## 6) MAXIMIZE CONDENSATE RETURN

Install piping to return condensate from the steam end-use equipment back to the boiler. Condensate is clean, treated hot water (condensed from boiler steam) that should be returned to the boiler for re-use whenever practical. Returning condensate reduces the amount of untreated, cold make-up water that would have to be replenished and heated. Facilities that require large quantities of chemical treatment will also reduce their chemical requirements and blow-down rates.

Properly size and insulate condensate piping for maximum benefit. The energy savings equals one BTU for each pound of condensate returned to the boiler for each degree (°F) of temperature difference between the condensate and makeup water. Additional benefits include lower water consumption and wastewater charges.

## 7) AUTOMATE BLOWDOWN AND RECOVER HEAT FROM BLOWDOWN STREAM

Convert manual blow-down to automated blow-down to save about a half percent in typical boiler fuel usage. Continuous surface blow-down removes dissolved and suspended solids from boiler water that can cause foaming and carryover and, in extreme circumstances, results in deposits on heat transfer surfaces.

Recover heat from blow-down stream to get additional efficiency gains. Blow-down heat recovery can reduce boiler fuel consumption by about one percent.



The Industrial Technologies Program (ITP) of U.S. DOE strives to improve the energy intensity of the U.S. industrial sector through coordinated research and development, validation, and dissemination of energy efficiency technologies and practices. BestPractices Steam promotes a systems approach in designing, purchasing, installing, and managing boilers, steam distribution systems, and steam applications.

[www.oit.doe.gov/bestpractices/steam/](http://www.oit.doe.gov/bestpractices/steam/)

## NEXT STEPS

To see which Best Practice opportunities will work for your facility, contact an equipment or service supplier to perform an evaluation for your facility.

To find out more about Focus on Energy incentives and technical assistance, call: 1-800-762-7077  
Ask for a member of the Industrial Team.

For more information on steam system energy efficiency, check out the BestPractices Steam website of U.S.DOE's Industrial Technology Program: [www.oit.doe.gov/bestpractices/steam/](http://www.oit.doe.gov/bestpractices/steam/)

## 8) RECOVER FLASH STEAM HEAT

Use a vent condenser to recover vent steam heat from the condensate receiver, especially when heating processes can use hot water (typically less than 180°F). When hot condensate passes through a steam trap from the high pressure to the low pressure side, a percentage will flash to steam. This steam contains latent and sensible heat energy that can be recovered. The recovered heat can be used in different ways, often to heat make-up water or process water.

## 9) INSTALL AUTOMATIC BURNER CONTROLS

Install oxygen trim systems to automatically adjust fuel and air to the ratio curve needed for optimum combustion efficiency over the operating range of the boiler. When boilers operate at partial load, the air-to-fuel ratio may not be set for efficient operation. The oxygen trim system adjusts the excess air levels to the already established fuel air ratio curve. Applying a properly designed oxygen trim system can reduce boiler fuel consumption. Best candidates are boilers that produce in excess of 25,000 lb/hr of steam.

## VENDOR INFORMATION



Focus on Energy is a public-private partnership offering energy information and services to energy utility customers throughout Wisconsin. The goals of this program are to encourage energy efficiency and use of renewable energy, enhance the environment and ensure the future supply of energy for Wisconsin.  
800.762.7077 [focusonenergy.com](http://focusonenergy.com)  
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