

WVU POLLUTION PREVENTION NEWSLETTER

JANUARY 2026

TURNING HEAT LOSSES INTO SAVINGS: PROCESS HEATING & BOILER EFFICIENCY

Welcome to this edition of the WVU Pollution Prevention Newsletter. This issue focuses on high-impact energy savings opportunities in industrial thermal systems, specifically process heating, heat recovery, and boiler system efficiency. Process heating is one of the largest energy users in the industry, and significant losses often occur through hot exhaust streams, hot surfaces, and steam system issues. By improving combustion and controls, reducing heat losses, and recovering usable waste heat (such as through economizers and heat exchangers), facilities can reduce fuel use, lower operating costs, and improve reliability. We also highlight practical boiler efficiency strategies, combustion tuning, insulation improvements, steam trap maintenance, and leak repair that often deliver strong returns with straightforward implementation.

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WHAT IS POLLUTION PREVENTION



Pollution Prevention (P2) is one of the key approaches towards an initiative to improve the energy efficiency and productivity of key industries while prioritizing environmental sustainability. The initiative focuses on reducing or preventing pollution at its source.

The primary objective of our Pollution Prevention program is to provide technical assistance to Small and Medium Enterprises in **key industries** in West Virginia by assisting with the identification, development, and implementation of P2 methods. The recommendations provided to the industries are designed to help the business lower operational costs by reducing expenditures, water and energy usage, waste, and disposal costs, while at the same time maintaining and often improving productivity.

Key Industries:

1. Food and Beverage Manufacturing and Processing
2. Chemical Manufacturing, Processing, and Formulation
3. Automotive Manufacturing and Maintenance
4. Aerospace Product and Parts Manufacturing and Maintenance
5. Metal Manufacturing and Fabrication

OUR SERVICES

1. **Pollution Prevention Assessments:** The project team will make a planned visit to your facility to assess and gather data on energy, water, material, and personnel use. Assessment data, along with input from the facility managers, will be used to develop P2 recommendations. A detailed report based on the findings will be submitted to the facility shortly after the on-site assessment.
2. **Energy Audits/Assessments:** Applying for a USDA-REAP grant and need an assessment? Want to save money? The project team will visit your facility and identify opportunities to improve energy efficiency. A detailed report will be provided to the business, including estimates of implementation costs, energy use savings, energy cost savings, and simple payback period for each identified opportunity.
3. **Training Workshops:** Training workshops will be conducted to help businesses learn P2 Best Practices, tools, techniques, and resources available, and how to modify their process or site to improve energy efficiency, productivity, and environmental sustainability.
4. **Technical Assistance:** The project team can provide on-site or off-site technical assistance on a variety of industrial concerns related to topics including pollution prevention, energy efficiency, sustainability, environmental impact, and process improvement. Contact us for assistance!
5. **USDA-REAP Application Assistance:** Applying for grant funding can be a challenge, especially for the small businesses that do not have an expert at grant-writing on the payroll. Our project team can help you navigate the application process and assist with completing the application for USDA-REAP funding.

POLLUTION PREVENTION FOCUS

Process Heating & Waste Heat Recovery

Industrial process heating is the use of thermal energy to produce, treat, or alter manufactured goods. It is one of the largest energy users in the industry, accounting for [approximately 50% of all onsite energy use](#), and it plays a significant role in both operating costs and emissions.

How Process Heating Uses Energy

In a typical heating system, energy is transferred from a heat source (such as burners or electric heaters) to the product or material. Materials move through the system using handling equipment, and enclosures (furnaces, ovens, kilns, heaters) help control heat delivery and reduce losses. Key components commonly include:

- **Heating devices** that generate and supply heat
- **Heat transfer devices** that move heat to the product
- **Heat containment equipment** (furnaces, ovens, kilns, heaters)
- **Heat recovery devices** that capture usable energy from exhaust streams

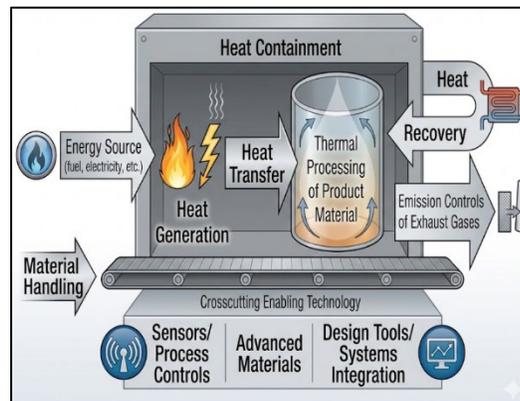


Figure 1: Process Heating Components

Process heating is utilized in various operations, including drying, heat treating, melting, curing/forming, metal heating, and calcining, across industries such as food and beverage, steel, cement, electronics, and textiles.

Opportunities to Improve Process Heating Efficiency

Energy savings opportunities often exist at multiple points in the system—combustion, heat transfer, containment, and recovery:

- **Combustion and control improvements**
Many high-temperature systems operate with excess air for safety and combustion quality; however, excess air that is too high increases stack losses. Monitoring oxygen/excess air and tuning burners can reduce fuel use while maintaining safe operation.
- **Heat transfer and heat containment improvements**
Reducing losses from the enclosure and improving transfer to the load can significantly cut energy waste. Practical actions include reducing air infiltration, controlling furnace pressure, minimizing radiation losses, and maintaining heat transfer surfaces.
- **Operational improvements at the load level**
Facilities can often reduce energy use by preheating loads, maintaining stable feed rates near rated capacity, and reducing unnecessary heating of fixtures or return conveyors.
- **Waste Heat Recovery (WHR)**
Waste heat is thermal energy released from industrial processes (exhaust gases, cooling streams, hot surfaces) that is not used productively.

Waste Heat Recovery

Waste heat is thermal energy released from industrial processes (exhaust gases, cooling streams, hot surfaces) that is not used productively. Waste heat recovery is the process of “heat integration”, that is, reusing heat energy that would otherwise be disposed of or simply released into the atmosphere. Waste heat recovery captures this energy and reuses it, often reducing fuel costs and emissions while improving overall efficiency.

Common Waste Heat Recovery options include:

- **Boiler feedwater economizers**, which can improve boiler thermal efficiency and [reduce fuel consumption by 5-10%](#).
- **Waste heat boilers (WHB)** to generate steam from furnace or reaction heat for process use or power generation support.
- **Heat Recovery Steam Generators (HRSG)** to convert hot gas streams into useful steam.
- **Absorption chillers** use waste heat to produce cooling for buildings or industrial processes.

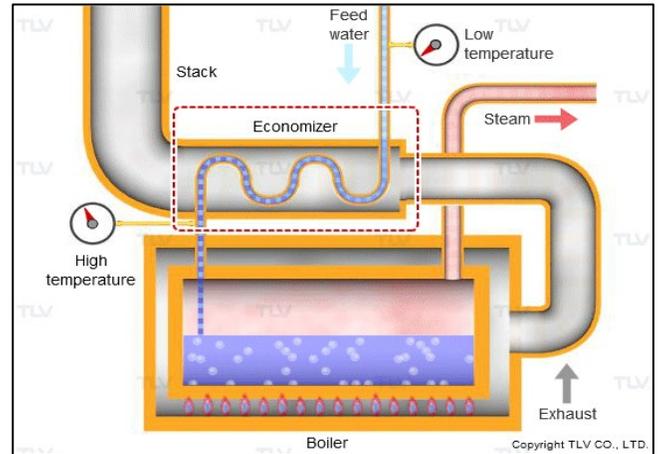


Figure: Schematic of a Boiler Economizer for Waste Heat Recovery

Common Process Heating Efficiency Measures

Facilities often see strong results by implementing a combination of the following measures:

- Check and tune burner air-to-fuel ratios and monitor flue-gas oxygen
- Reduce air infiltration and improve sealing/pressure control in furnaces
- Reduce radiation losses and maintain insulation and refractory conditions
- Maintain/clean heat transfer surfaces for better thermal performance
- Install waste heat recovery systems such as economizers, heat exchangers, WHB, and HRSG.
- Use exhaust heat to preheat combustion air or preheat loads when feasible.

Why Process Heating Efficiency Matters

A major reason process heating is such a high-impact opportunity is that a large share of industrial energy input can be lost as waste heat (hot exhaust gases, cooling water, hot surfaces, and heated products). Estimates suggest [20-50% of industrial energy](#) input may be lost this way. Improving process heating efficiency and implementing waste heat recovery can lower fuel consumption, reduce emissions, improve temperature control and reliability, and deliver strong payback, making it one of the most practical pollution prevention strategies for energy-intensive facilities.

Boiler Systems & Energy Efficiency

Boiler systems play a central role in industrial operations, producing steam and hot water for process heating, sanitation, and facility needs. Because they convert fuel directly into thermal energy, boilers often represent one of the highest energy uses in a plant. Improving boiler efficiency reduces fuel costs, lowers emissions, and enhances system reliability, making it a core pollution prevention and sustainability opportunity.

What Actually Drives Boiler Energy Use?

Boilers burn fuel to heat water, but their actual energy use depends on how well the entire system operates. Even an efficient boiler can waste fuel when cycling to meet inconsistent demand, compensating for steam losses, or responding to uneven airflow. Common causes of avoidable energy waste include outdated burner controls, soot or scale buildup that restricts heat transfer, distribution bottlenecks, poor insulation, and low condensate return. In round-the-clock facilities, these inefficiencies compound quickly, driving up fuel consumption and operating costs.

Opportunities to Improve Boiler System Efficiency

Input-Level Improvements

- [Optimize air-to-fuel ratio](#): Combustion tuning ensures complete fuel burn and minimizes stack heat losses. Even [a 10% increase in excess air can reduce boiler efficiency by 1%](#), according to the U.S. Department of Energy. Regular burner inspection with a combustion analyzer helps maintain stable, efficient performance.

Process-Level Improvements

- [Install economizers](#): Economizers recover heat from flue gases and preheat boiler feedwater, reducing fuel needs and improving overall efficiency. By recovering waste heat from flue gas, boiler efficiency can often be improved by [5–10%](#), with potential paybacks in less than two years.
- [Improve insulation](#): Uninsulated steam lines and fittings are a major source of energy loss. Insulating boiler surfaces, steam lines, and condensate return piping reduces heat losses and helps maintain steam quality.

Output-Level Improvements

- [Maintain steam traps](#): Failed traps can release live steam or leave condensate in the system, both of which waste energy and lower performance.
- [Repair steam leaks](#): Leaks waste fuel continuously and can cause pressure instability; early detection and repair provide fast payback.

Boiler Management & Maintenance

A structured boiler management program helps facilities determine when to tune, repair, or upgrade equipment. The U.S. Department of Energy's [MEASUR software](#) provides tools for evaluating combustion efficiency, heat losses, and boiler performance. Preventive maintenance, including cleaning heat-transfer surfaces, testing safety and control systems, and using diagnostics such as infrared imaging or ultrasonic leak detection, helps identify inefficiencies early.

Why It Matters

A well-optimized boiler system delivers more than energy savings. It stabilizes production, reduces environmental impact, extends equipment life, and strengthens resilience against fuel price volatility. As industrial facilities modernize, boiler systems are emerging as a high-value opportunity for both economic and environmental performance. For further details about **Boiler Systems and Energy Efficiency**, check out our [webinar](#).

HIGHLIGHTING OUR IMPACT

The WVU Pollution Prevention (P2) team takes great pride in the impact we have within the borders of West Virginia since January of 2023. From energy savings to CO₂ reduction, the recommendations we develop for these businesses not only help these businesses improve their sustainability, but also their bottom line!

Look at the impact of the opportunities we have found! →

35 Energy Efficiency/P2 Assessments

89 Recommendations

With Annual Savings of...

\$957,893 in Energy Costs

7,345 MWh of Electricity

18,150 MMBtu of Natural Gas

5,933 Metric Ton CO₂ Equivalent

CONTACT US

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P2 Website



Inquire about or services



Questions or Comments?