Seven Ways to Optimize Your Process Heat System

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For most industries, process heating accounts for a high percentage of energy use, which means most plants can benefit from efforts to optimize their process heating systems. As natural gas prices continue to escalate, efficiency measures provide a means to save energy and curb energy costs. Beyond improving the bottom line, efficient process heating systems go a long way toward reducing emissions, such as nitrogen oxide (NO_x) and carbon dioxide (CO_2).

When it comes to optimizing heat process systems, an industrial facility has plenty of incentive to take action. So the question might not be "Should we make improvements?" but "Which improvements should we make?" One answer is to begin with the tried and true—the activities that have been done before with excellent energy-saving and pollution-reducing results. Consider those that can be easily accomplished using existing hardware and components and yield the best paybacks.

Efficiency measures such as these do exist. The table below is a guide to some process heating activities industrial companies can begin to implement in the near term. By addressing these changes to key process heating components today, your plant could be on its way to better system performance, and the plant-wide benefits will be apparent in the not-too-distant future. ●

Process Heating: Best Bets for System Savings and Improvements

Process Heating Component	Energy Saving Method	Energy Savings Potential (% of current use)	Typical Implementation Period	Typical Payback	Example Activities
1. Heat Generation	Efficient combustion (burners) and operation of other heat generating equipment	5%–25%	1 week to 2 months	1 to 6 months	Maintain minimum required free oxygen (typically 1%–3%) in combustion products from burners for fuel-fired process heating equipment. Control air-fuel ration to eliminate formation of excess carbon monoxide (CO), typically more than 30–50 ppm, or unburned hydrocarbons. Eliminate or minimize air leakage into the direct-fired furnaces or ovens.
2. Heat Transfer	Design, operation, and maintenance of furnaces and heating systems to increase heat transfer from heat source to process or load	5%–15%	3 months to 1 year	6 months to 1 year	Select burners and design furnaces that allow use of high convection or radiation in processes and loads. Clean heat transfer surfaces frequently in indirectly heated systems, such as stream coils, radiant tubes, and electrical elements. Replace indirectly heated systems, such as radiant tubes, and enclosed electrical heating elements, where possible.
3. Heat Containment	Reduction of heat losses	2%–15%	4 weeks to 3 months	3 months to 1 year	Use adequate and optimum insulation for the equipment. Conduct regular repair and maintenance of insulation.
4. Heat Recovery	Flue gas heat recovery	10%–25%	3 to 6 months	6 months to 2 years	Preheat combustion air. Preheat and/or dry the charge load. Cascade heat from exhaust gases to the lower temperature process heating equipment.
5. Sensors and Controls	Improved process measurements, controls, and process management	5%–10%	1 to 10 weeks	1 to 6 months	Develop procedures for regular operation, calibration, and maintenance of process sensors (i.e. pressure, temperature, and flow) and controllers.
6. Process Models and Tools	Process models and design simulation to optimize equipment design and operations	5%–10%	2 weeks to 6 months	1 month to 2 years	Set appropriate operating temperatures for part load operations to avoid long "soak" or overheating.
7. Advanced Materials	Reduction of nonproductive loads	10%–25%	2 weeks to 3 months	3 months to 2 years	Use improved materials, design, and applications of load support (fixtures, trays, baskets, etc.) and other material systems.