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Don't Let It Go Up Your Stack

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Minimize heat losses by cooling flue gas from heaters and boilers and use that recovered energy to heat your low temperature process.

In thermal processes, there are always heat losses - processes without waste heat dissipations are purely theoretical and do not exist in the real world. But, although heat losses always exist, it is important to evaluate the size of the loss, in relation to what is considered reasonable from an economical and environmental point, when considering whether to invest in heat recovery.

Modern boilers, heaters and heating systems are developed with only modest heat losses - they have high efficiency. The term efficiency tells how much of the total potential energy is being utilized for the main purpose. A modern boiler, for instance, can have an efficiency of 0.8 to 0.9, or 80 to 90%. This means the boiler has losses - mainly due to chimney loss - of 10 to 20%. By contrast, an older boiler might have an efficiency of only 0.6 to 0.7, or 60 to 70%, with heat losses of 30 to 40%.

Still, heat losses can be large even in modern boilers, when both the amount of loss itself and the amount of loss as it relates to the potential total energy (efficiency) is considered. There are many reasons for this, but common to most existing industrial heating systems is the fact that they originally were designed to the demands present at the time they were erected, and those demands have changed over time. For instance, a production plant expansion might result in a demand for a larger amount and/or other types of process heating.

The Advantages of Heat Recovery

Heat losses from a fired boiler or heater primarily are dissipated through the chimney - that is, the hot flue gas. The amount and temperature of flue gases are proportional to the heat losses. Often, a considerable economical advantage can be achieved by cooling the flue gas and utilizing the energy that, under normal circumstances, would have been let out as heat losses.

In industrial production plants, a large amount of energy is used for process heating, and quite high temperatures characterize it. The heating media can be steam, thermal fluid (hot circulating oil), pressurized or unpressurized hot water, or air/gas as well as more sophisticated heating media for special tasks.

Generally, a high temperature heating media means a high chimney temperature (flue gas temperature). Consequently, large oil- or gas-fired boilers or heaters often make heat recovery an efficient, attractive solution. By inserting a heat exchanger in the flue gas flow just before the chimney, process heat can be generated at almost no cost.

In most production plants, it is advantageous to establish a secondary heating system - for instance, to produce low pressure steam for low temperature applications. This can be accomplished either indirectly (preheating of air, liquid or oils) or directly (by injection of steam in tanks and reactors, or for cleaning and sterilization).

Nevertheless, in many installations, the recovered heat can be used in the primary heating system. This means a better utilization of fuel, which gives a higher overall efficiency - either by a higher amount of heat produced from the same amount of fuel, or by the same amount of heat produced from a smaller amount of fuel.

Is It Worth the Investment?

You often gain a lot when investing in heat recovery. Still, it should be evaluated carefully to avoid unpleasant surprises. Special circumstances might disturb a nice picture of heat recovery.

Generally, the first step is to weigh how much potential the present heat losses have to provide energy for heat recovery. In other words, consider how much flue gas is available, and how much higher the temperature of the flue gas is compared to the temperature of the existing or new heating system. The questions in the sidebar will help you define your process more clearly.

Heat recovery can be, of course, healthy for the company's bottom line. In environmental terms, heat recovery contributes to less emissions, and that has made the public interested in heat recovery, too. In many countries or regions, it is possible to get subsidies (economical support) for stimulating heat recovery initiatives.

Sidebar:
4 Questions to Ask Before Adding a Heat Recuperator

Carefully evaluating your process will allow you to determine whether your company can benefit from heat recovery. Ask the following questions about your process:

1. What heat-carrying fluid is required in the recuperator? What is preferred (steam, thermal fluid, water, or gas/air)?

2. To what temperature level do you wish to heat the heat-carrying fluid? How does this relate to the flue gas temperature?

Remember that the desired heat-carrying temperature cannot be the same or higher than the flue gas temperature, and it may need to be significantly lower.

3. Is the primary heat recovery aim to reduce the fuel consumption with the same heat output? Or, is the heat recovery focused on providing a larger heat output and maintaining the fuel consumption?

4. Is a new secondary system acceptable, if it is economical (better utilization of the recuperator)? Or, should only heat recovery within the limit of the existing heating system be considered?

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