USING STACK HEAT EXCHANGER TO CAPTURE HEAT

The second type of exhaust gas heat recovery system is the direct condensing system, or condensing economizer. These are engineered systems that direct boiler exhaust gas across a heat exchanger to condense vapor and salvage both sensible and latent heat residual from the combustion process.

Such systems are situated downstream from the boiler economizer and have the potential to improve the overall boiler system efficiency by as much as 10%. The cooling stream for the heat exchanger is usually boiler makeup water, but could be any other plant water stream where the heat is used beneficially.

One manufacturer of such systems is Combustion & Energy Systems Ltd. of Markham, Ontario. According to Cameron Veitch from Combustion & Energy Systems, the condensing heat recovery option is important because typically 11.5% of the total heat released by the fuel is lost to the atmosphere. He indicates that the company’s ConDex heat recovery system captures nearly all of this heat.

FINNED TUBES FOR HEAT EXCHANGE

The ConDex unit has finned tubes of a proprietary design on the heat exchanger that capture enough energy from the exhaust gas to condense out the water vapor from the exhaust, releasing its heat of vaporization. The phase change alone recovers approximately 1,000 Btu for each pound of water condensed.

Veitch notes that in the ConDex design, the flue gas and the heat exchanger liquid are not in contact with each other, so the circulating water remains unchanged. For this reason, this process also can be used with dual-fuel boilers that burn both oil and gas, as well as with gas-only boilers. He also points out that because this type heat recovery allows less fuel to be burned, emissions of CO$_2$, a greenhouse gas, are reduced. For each million Btu of fuel saved, the emission of CO$_2$ is reduced by 118 lbs.

CIRCULATING WATER NOT CONTAMINATED

Veitch explains that the condensing economizer approach has an advantage over spray tower systems because it heats water to higher temperatures, not being limited by the dew point of the flue gas. Additionally, he says, there is no requirement for continuing treatment of the circulating water.

An example of an installed ConDex system is at a Dow Corning plant in Carrollton, Ky. Here the system heats process and makeup water from 55°F to 180°F and recovers an average of 6.3 million Btu per hour, for annual energy savings of $628,000. The installed payback for this system was achieved in one year.

In an installation on the district heating system of the University of Guelph in Ontario, a ConDex system is used to recover flue gases from multiple boilers, heating treated boiler makeup water from 65°F to 200°F. The University calculates that the system generates annual energy cost savings of $535,000.

Del Monte Corp. installed ConDex condensing economizers on boilers at two seasonal food processing factories in Rochelle, Ill., in December 2005. According to Del Monte spokesman Bill Riker, the results were obvious and immediate. He indicates, “Based on the successes during that first year, we have just completed the startup of ConDex systems at two other seasonal facilities, and have begun evaluating the potential for a fifth facility. The sixth and seventh facilities have already been identified.”

Riker notes that during the summer and fall processing seasons of 2006, natural gas consumption was reduced by 9.3%. He adds, “The average exit gas temperature was only 101.5°F.”

Riker also points out that the greater the flow of makeup water, the greater the heat recovery will be. He also says that the greater the boiler’s annual utilization factor, the greater will be the rate of return. “This is an important consideration, but we were able to justify projects for seasonal factories that operated only three months per year,” Riker says.