FINAL Public Report for the Energy Savings Assessment for ESA-025

Introduction: This assessment was conducted at Rahr Malting Co's. Shakopee, MN facility. This plant, the largest single-site malting facility in the world, operates 5 malthouses to produce malted barley for the brewing industry. Each malthouse is a large multi-story building in which the grain is steeped in water to initiate sprouting, transferred to a germination room where germination continues under controlled conditions and then heated in a kiln to stop germination and dry the malt. The largest of these malthouses can process batches of 1 million pounds of wet malt.

The process requires large amounts of water at carefully controlled temperatures. Seven kilns, which dry the malt, require large volumes of air at temperatures from 145 to 185°F. This air is provided by three air-to-air and four glycol-to-air heat exchangers, all fired by natural gas burners.

Objective of ESA: To identify opportunities for energy savings on company's malting kilns.

Focus of Assessment: Two glycol heaters of different designs and one air-to-air heater. Areas of investigation included flue gas temperatures and oxygen levels and glycol heater shell temperatures.

Approach for ESA:

1. Combine field test data with corporate energy use and production records on three representative malting kiln heaters.
2. Identify any equipment/operating conditions, which, if corrected or changed, can enhance energy efficiency.
3. Train plant engineer in the use of PHAST to analyze the remaining heating equipment in this plant.

General Observations of Potential Opportunities:

Total plant natural gas consumption for 2005 was 1,100,000 Mcf. At the current natural gas cost of $8.50 per Mcf, this represents an annual outlay of $9,450,000.

Electrical consumption over the same period was 66,000,000 kWh. Current electrical cost is $0.066 per kWh, yielding an annual expenditure of $4,356,000.

This plant is exceptionally efficient in its energy use. This is due to three major factors -- the nature of malthouse operation, which is highly integrated and allows waste energy to be recycled without leaving the process, the relatively low temperatures employed in the malting process and Rahr's pursuit of energy conservation opportunities.
As an example, the exhaust gases from the glycol heaters (essentially boilers) are used for various preheating duties. One of them was monitored at 340°F, and the others probably are in that same temperature range. Efficiencies on the three heaters studied in this assessment ranged from 82.5 to over 88%.

Two of the other glycol heaters are situated in a room where process return air is collected. This reduces the differential temperature between the heater shells and process air, minimizing wall losses, as well as giving the process air a small temperature boost.

There are limited opportunities to make any significant improvements in the energy efficiency of the malthouses -- most of them have already been exploited. However, we did identify one potential opportunity.

Near Term Opportunity.

Reduce the excess oxygen (excess air) in the flue gases of the Kiln 6 No. 10 Heater. The exhaust from the fired side of this air-to-air heat exchanger was monitored at 16.4%. Although the exhaust gas temperature was low (103°F), some efficiency improvement might be gained by lowering the O2 a modest amount. This has to be done with care -- the tubes in the exchanger are a mixture of stainless steel and Pyrex, and they and their seals can't be exposed to excessive temperatures.

If the O2 content can be lowered to 14%, input to the heater can be reduced by 674,000 Btu/hr, 1.8% of its maximum firing rate. Over a one year period, this would amount to a saving of 5664 Mcf of gas, worth $48,150. This equals 0.51% of annual plant consumption.

Management Support and Comments:

Mr. Bennett conducted a very focused review of three of our systems. Provided a detailed agenda and followed it. The training in the use of PHAST was excellent. Especially, the understanding of the tools that are provided in PHAST.

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