INFASTECH DECORAH LLC

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DECORAH

COMPANY BACKGROUND

Infastech Decorah LLC has been making fasteners since 1969. The facility produces fasteners of all size and types, from miniature fasteners used in cell phones, to large fasteners used in construction equipment. Consumers of Infastech fasteners include automotive, construction and electronics industries. Manufacturing processes at the facility include cold forming, heading, threading, heat treating, electroplating, and packaging. Fasteners are produced from beginning to end without leaving the plant.

PROJECT BACKGROUND

The Decorah facility houses three heat treatment furnaces that strengthen the fasteners. Exhaust from the furnaces is vented to the atmosphere through several stacks. This exhaust is at an elevated temperature and results in energy that is lost to the environment. This energy can be recovered before it is vented and reused instead of being wasted. The furnaces operate 24 hours a day, seven days a week.

INCENTIVES TO CHANGE

Infastech Decorah has participated in the Pollution Prevention Intern Program for the past 8 years with much success. In the past, heat recovery from the heat treatment furnaces had been examined, but this is the first year that it is a primary focus. The facility renewed its ISO 14001 certification in 2011. The environmental policy at Infastech includes pollution prevention, continual improvement and ongoing compliance with regulations.

RESULTS

Analysis of Amount of Recoverable Power: A detailed analysis of the temperature and velocity of the exhaust gas was conducted. Based on the analysis, the amount of recoverable power was calculated to be approximately 50 kW per furnace. Subsequently, a heat exchanger able to recover this power was designed and quoted by an outside company. Methods of heat exchanger installation that would not affect the furnace operation were then determined.

Heat Recovery Methods: Various heat recovery methods for the heat treatment furnaces were investigated. Options included hot water, steam, or electricity production. Electricity production was determined to be the most economical option.

Several different methods of producing electricity from waste heat were then analyzed. The Organic Rankine Cycle (ORC) was determined to be the best fit for the heat treatment furnaces at the Decorah Operations plant. The intern compared the option of purchasing a prebuilt ORC system versus designing a new system. Designing a new system was determined to be the best option, as it allowed for a cycle that could be tailored to fit the specific situation and would reduce the overall cost of the system.

Design of Organic Rankine Cycle: The main components of Organic Rankine Cycle systems are very similar to conventional steam Rankine Cycle systems. The only difference is that the working fluid is organic instead of water.

Thermodynamic analysis of the Organic Rankine Cycle was conducted in order to optimize the system. From the optimum conditions, an ORC system was designed. This system recovers energy from the natural gas burner exhaust from one furnace and produces approximately 6 kW of electricity. If the system were installed on only one furnace, annual savings would be $3,391. If the ORC system were installed on all three furnaces, the annual savings would be $10,173, with a payback period of 4.08 years.

Insulation: The temperature of the furnace walls exceeds 100 °C, due to energy lost through them. This energy loss was estimated at approximately 0.6 therms per hour for each furnace. Extra insulation could be added to reduce this loss, but the insulation could cause the temperature of the existing furnace walls to increase, which may affect the structure of the walls. More research must be conducted to determine if the addition of insulation would have any negative effects on the walls.

CONVENTIONAL AIR POLLUTANTS AND GREENHOUSE GASES DIVERTED IN STANDARD TONS

Total for all sectors					
CO_2	SO_2	CH_4	N_2O	CFC	PM_{10}
137.00	0.65	12.37	0.03	1.51	0.02

PROJECT	ANNUAL COST SAVINGS	ENVIRONMENTAL RESULTS	STATUS
DESIGN OF ORGANIC RANKINE CYCLE	$10,173	147,420 KWH	RECOMMENDED
INSULATION	$5,500	15,768 THERMS	ADDITIONAL RESEARCH NEEDED