JBS USA

CODY BURBACH
MECHANICAL ENGINEERING, IOWA STATE UNIVERSITY

MARSHALLTOWN

COMPANY BACKGROUND

JBS is an international animal protein processing company headquartered in San Paulo, Brazil. The company has more than 120,000 employees in 140 different facilities and is the largest protein processing company in the world. JBS operates a pork processing plant located in Marshalltown, Iowa. The Marshalltown plant is the third largest pork processing facility in the United States, with more than 2,400 employees. The plant produces and distributes a wide variety of high quality pork products.

PROJECT BACKGROUND

In recent years, JBS made changes to the facility that required updated mapping of its refrigeration components and piping lines to aid in future system improvements, efficiencies and maintenance. An increase in system efficiencies can result in a reduction in the company's energy usage and associated costs. A full system assessment will take longer than this year's project term, so the intern's goal was to lay the groundwork for future work efforts.

INCENTIVES TO CHANGE

The JBS facility is refrigerated 24 hours a day to keep the product sanitary and safe. The piping and instrumental diagram (P & ID) for the plant's refrigeration system was outdated and needed to be updated to enable maintenance and contractors to work on the system and to facilitate future assessment work. Refrigeration is also the largest use of electricity in the plant, accounting for almost 70 percent of the electric bill. An increase in the efficiency of the refrigeration system would cause a significant reduction in electrical usage and provide significant cost savings.

RESULTS

Piping and Instrument Diagrams (P & IDs): Piping and instrument diagrams are required to map the layout of all the components and pipes in a system. The refrigeration system has been changed over the last few years as the facility has expanded, and new evaporative units have been added to the system. JBS will benefit from an updated P & ID of the refrigeration system so that maintenance can make repairs quickly and safely. The intern tracked all new areas and changes and used a CAD mapping program to update the P & IDs for the refrigeration system.

Fix Water Leaks: The intern identified a number of large water leaks while collecting data around the facility. Some of the leaks contained hot water, which is heated by the boilers. This increases the cost of the leak because gas is used to first heat the water. The intern quantified the leaks and found that, if the leaks were repaired, significant water and energy savings would result.

Heat Recovery: A considerable amount of energy used by a refrigeration system is lost as heat during condensation of ammonia gas. Much of this heat could be captured and used instead of being wasted to the atmosphere. A heat exchanger could be used to heat incoming city water for sanitation purposes, reducing the amount of fuel used by the boilers. This type of system could be used with both refrigeration systems at JBS, lowering natural gas demand greatly.

Reduce Discharge Pressure: The blast chill refrigeration system has a higher discharge pressure than recommended by industry professionals. The discharge pressure is set by the minimum approach temperature for the condensers to generate effective heat loss. The amount of surface area in the condensers is currently too low to decrease the discharge pressure. Although the cost of purchasing an additional condenser to reduce discharge pressure would be high, the cost could be offset by the savings resulting from decreased compressor energy usage. It is recommended that JBS continue research to determine if it is cost effective to purchase an additional condenser in order to reduce the discharge pressure.

Reduce Infiltration: Warm air entering the building through infiltration can cause a considerable increase in demand on a refrigeration system. The warm air can bring moisture into the building, which can reduce product quality and further increase refrigeration load. Using a thermographic imaging camera, the intern identified several areas of inadequate insulation and air leaks around the facility. Adding insulation and sealing the inefficient areas would eliminate future energy losses and reduce costs. Due to time constraints, the savings have not been fully calculated for this recommendation. However, since savings can be achieved with minimal capital investment, the return on investment would be almost instant, and this project is recommended.

CONVENTIONAL AIR POLLUTANTS AND GREENHOUSE GASES DIVERTED IN STANDARD TONS

Total for all sectors					
CO_2	SO_2	CH_4	N_20	CFC	PM_{10}
172.13	0.15	105.68	11.63	0.96	0.02

PROJECT	ANNUAL COST SAVINGS	ENVIRONMENTAL RESULTS	STATUS
P & ID (REFRIGERATION SYSTEM)	$14,000	-	IMPLEMENTED
FIX WATER LEAKS	$59,505	1,312,000 GALLONS 110,500 THERMS	RECOMMENDED
HEAT RECOVERY	-	-	ADDITIONAL RESEARCH NEEDED
REDUCE DISCHARGE PRESSURE	-	-	ADDITIONAL RESEARCH NEEDED
REDUCE INFILTRATION	-	-	RECOMMENDED