



BADRINATH BALASUBRAMANIAM

MECHANICAL ENGINEERING
IOWA STATE UNIVERSITY

COMPANY PROFILE

JBS USA is a food processing company and a subsidiary of JBS S.A, which is a leading processor of beef, pork and lamb in the United States. It is headquartered in Greeley, Colorado, and has multiple facilities in the United States and abroad. They have a total of approximately 235,000 employees, with more than 2,200 working at the Marshalltown, Iowa, pork processing facility. About 21,000 hogs are processed daily and the products are shipped to domestic and international customers in countries including Hong Kong, Japan, Mexico and China.

PROJECT BACKGROUND

JBS Marshalltown produces nearly 600 million pounds of steam annually from three boilers. The plant uses steam in a variety of production systems and has a vast distribution system. The aim of this project is to conduct an assessment of the steam system and end use applications, and optimize the efficiency of steam usage throughout the plant.

INCENTIVES TO CHANGE

The company has a broad set of corporate environmental goals including a 20 percent reduction of natural gas usage and greenhouse gas emission intensity by 2020 as compared to 2015 baselines. They also seek to reduce electricity use by 12 percent and water use intensity by 10 percent. The focus of the 2018 project ties directly into JBS' environmental goals, since recommendations will lead to a reduction in the natural gas and water used by the boilers to produce steam.

RESULTS

Dehair System Improvements: The dehair unit removes hair from the hogs using hot water that is maintained at 140°F by steam. Water from four tanks is sprayed onto the hogs as they move through chambers in the unit. While the first three tanks use hot 140°F water, the fourth tank uses a separate cold water supply as a rinse. The water from all four tanks, including the cold rinse water, is collected in an overflow tank where it is reheated and reused in the same dehair process. Additionally, a second cold water source coming from the singer is also introduced into the overflow tank. Re-routing these two cold water sources to different plant operations, would significantly reduce the amount of steam needed to reheat the remaining overflow water.

One alternate use, the scrubbers, currently use city water as make-up water, so replacing that make-up water with the new cold-water reuse stream would generate additional water

savings. Covering and insulating the overflow tank could reduce heat loss and lead to additional steam savings. To implement this project, funding will need to be approved and budgeted, piping will need to be rerouted, and equipment and insulation procured and installed.

Dehair Unit and Hair Room Tank Steam Turn Off: The steam supply to the dehair unit and the hair room tank is left on during the sanitation shift, creating steam demand when it is not needed. Turning off the steam supply during sanitation would generate immediate energy and water savings. Sanitation and production managers will be key to successfully implementing this new procedure change.



Shrink Tunnel Process Improvement: The shrink tunnels heat cold water up to 200°F and spray it onto packaged meat to vacuum seal it. The water is heated using steam injection. It is recommended that the cold water in the shrink tunnels be replaced with a portion of the excess 140°F water that is currently already produced by the facility as a byproduct of their rendering cooker. This generates water savings, water treatment savings and cuts the temperature to which the water must be heated by more than 50 percent, leading to a significant reduction in steam consumption. After allocating funding to this project, piping and plumbing work would be needed to implement the change.

Rendering Cooker Steam Reduction: The rendering cooker receives inedible pieces and scraps from multiple parts of the facility and converts them into dried meat and bone meal. The cooker requires a significant amount of steam to dry out the wet scrap and create a marketable product. The inedible scraps feed into a dual incline auger that empties them into a raw bin prior to being fed into the cooker. The auger has dewatering pans to help remove excess moisture from the scraps prior to the cooker, but these pans are regularly clogged by meat and fat, leading to ineffective dewatering. Hosing down the dewatering pans at specified intervals would lead to a significant reduction of moisture content in the scraps, which would further reduce steam and water use by the cooker. JBS could realize immediate results when this step is added to the rendering process.

Steam Leak Repair: Several steam leaks were identified in various parts of the facility. They cause a loss in steam and also a pressure drop in the line, leading to wasted energy and the possibility of equipment malfunction. It is recommended that the leaks be repaired as soon as possible to maximize savings and reduce the risk of damage to the equipment.



Steam Trap Preventative Maintenance: Steam traps aid in ensuring the efficiency of the steam system. Steam trap management is a vital component for every facility with a steam system. Failed traps cause energy loss and increased costs. It is recommended that JBS contract with an external vendor for bi-monthly steam trap surveys. Although using a vendor would be an ongoing expense, it would lighten the load on the facility's maintenance staff and still net significant cost savings from an efficient running system. The costs of contracting with a vendor were subtracted from the annual savings calculations when evaluating this recommendation. If ongoing funds are approved, the company can contract with an identified vendor and establish a survey schedule.

PROJECT	ANNUAL COST SAVINGS	ENVIRONMENTAL RESULTS	STATUS
DEHAIR SYSTEM IMPROVEMENTS	\$114,165	14,282,718 gallons of water 110,520 therms	RECOMMENDED
DEHAIR UNIT AND HAIR ROOM TANK STEAM TURN OFF	\$1,144	15,485 gallons of water 2651 therms	RECOMMENDED
SHRINK TUNNEL: PROCESS IMPROVEMENT	\$126,607	18,640,659 gallons 89,730 therms	RECOMMENDED
RENDERING COOKER STEAM REDUCTION	\$120,755	19,491,481 gallons of water 131,420 therms	RECOMMENDED
STEAM LEAK REPAIR	\$11,824	159,988 gallons of water 27,339 therms	RECOMMENDED
STEAM TRAP PREVENTATIVE MAINTENANCE	\$76,695	1,372,488 gallons of water 210,855 therms	RECOMMENDED

