



ZACH DIXON

SCHOOL: Iowa State University
MAJOR: Chemical Engineering

JBS USA, LLC

MARSHALLTOWN

COMPANY PROFILE:

JBS USA, LLC in Marshalltown, Iowa, is part of JBS USA, a leading American food company and a subsidiary of the global protein giant JBS S.A., headquartered in Brazil. The Marshalltown plant is a pork processing facility, distribution center, and warehouse that delivers pork products to brands such as Swift® and La Herencia™. It runs 24/7 on three shifts: two production and one sanitation. It employs more than 2,400 team members and processes more than 5 million hogs annually.

PROJECT BACKGROUND

Pork processing is a water-intensive process. JBS requested a P2 intern to identify opportunities for water optimization and reduction in their process operations. The project focused on analyzing opportunities to reduce water usage, improve process efficiencies, and reuse water. First, the intern completed a comprehensive baseline for the large water users in the plant to determine flow rates and opportunities for optimization. Next, the intern ran a cost analysis on the procurement and treatment of water as it entered and exited the plant. Finally, the intern analyzed opportunities and made recommendations with favorable financial paybacks.

INCENTIVES TO CHANGE

JBS is striving to set the food industry standard for profitable and sustainable food production for a growing planet. Efficient water use is a key pillar of their sustainability plan. They have established a corporate goal of reducing water usage by 30 percent by 2030, as compared to each JBS plant's 2019 baseline. Additionally, the Marshalltown plant seeks to minimize their tracked water metric of gallons of water used per hog processed. The value of reducing water usage also lies in the high costs associated with water use and treatment.



Reducing water consumption will conserve water resources, lower energy demands, and ultimately reduce the plant's environmental footprint.

RESULTS

Bone Crusher Cooling Water Reduction

The ham boning line sends hams to a bone crusher, which breaks the bones into smaller pieces before a second machine separates the meat from the bones. Both machines require water to cool their oil tanks, which is done via a water line that uses a T-valve to supply separate cooling lines to each. The valve on the main line is always fully open to ensure both units receive sufficient water, but the resulting supply to each machine exceeds their needed individual flow rates. Replacing the current T-valve cooling flow feed with a single hose line that can cool both pieces of equipment will allow for better optimization of cooling water usage. The second piece of equipment requires more cooling water than the first, so the flow can be set to meet its higher requirements. The water temperature will be sufficient to successfully cool both pieces. Installation of a flow control valve will ensure the optimal flow rate is not exceeded. Internal maintenance staff will be able to implement this change upon management approval.

Singer Cooling Line Modifications

During production the hogs are carried on a rail system and pass through singers that remove surface contaminants and any remaining hair before processing. Due to the high temperatures above the singers, there are tanks above the rails that supply a constant flow of cooling water to prevent the metal from deforming. However, with the supply tank resting above the rail, the cooling process is not as effective as possible, resulting in excess water being required. It is recommended that the current system be replaced with an I-beam, air blowers, shields, and a single water line. An I-beam will allow the cooling water

line to run directly on the rail itself, providing more direct cooling. Furthermore, shields on the open ends of each singer would prevent heat losses, and three blowers would cool each shield as well as the I-beam. The cooling effect of air would also reduce the demand for cooling water, thus reducing water consumption. After management approval, contractors can be hired to remove the current water tank structure and replace it with the suggested equipment and supplies.

Non-Production Water Shutoff

The singers have a cooling line where water constantly flows, also feeding a rinse cabinet downstream. During non-production times, both units are typically left running, consuming excess water. Assigning specific workers the responsibility of shutting down water flow before leaving the area during these times will provide better flow control. Further, assigning specific supervisors the task of verifying the water has been shut off will ensure accountability to the new process. Ultimately, this implementation affords the plant significant water savings while granting immediate financial payback.

Additional Water Submetering

Within each department of the plant, real-time flow meters



measure flow rate and consumption, enabling operators and managers to monitor and adjust water usage throughout the facility. Investing in water submetering is crucial for optimizing water use, as it allows facilities to track and record process-specific data over time, helping to identify issues like leaks or unnecessary waste. Several widely cited studies highlight that submetering can yield up to 5 percent of utility savings for a facility. This data can guide management, operational, and investment decisions regarding plant areas where utility use is metered. Strategically implementing these water flow meters provides management oversight and promotes water conservation.

Given these benefits, it is recommended that additional water submetering be implemented in specific areas of the plant including the scald tank, the wash cabinet, pan table sprays, and the singer cooling line. Upon approval, JBS can work with their existing metering vendor to purchase and install the additional units.

ENVIRONMENTAL AND ECONOMIC SAVINGS TABLE

| PROJECT | ANNUAL COST SAVINGS | ANNUAL ENVIRONMENTAL RESULTS | STATUS |
|--------------------------------------|---------------------|------------------------------|-------------|
| BONE CRUSHER COOLING WATER REDUCTION | \$40,009 | 4,909,086 gallons | RECOMMENDED |
| SINGER COOLING LINE MODIFICATIONS | \$21,024 | 8,406,972 gallons | RECOMMENDED |
| NON-PRODUCTION WATER SHUTOFF | \$43,987 | 8,625,043 gallons | RECOMMENDED |
| ADDITIONAL WATER SUBMETERING | \$1,862 | 433,112 gallons | RECOMMENDED |