JOHNSON CONTROLS, INC.

RED OAK

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COMPANY BACKGROUND

Johnson Controls Inc. is a global corporation that formed in 1885 with the invention of the thermostat. They have since expanded into three different areas: building efficiency, power solutions and automotive experience. The facility in Red Oak, Iowa, is part of the Power Solutions division and specializes in production of battery grids. Established in 2003, the facility is 90,000 square feet and employs more than 60 people.

PROJECT BACKGROUND

The project goal was to conduct a facility-wide audit researching methods to increase the efficiency of the process cooling system and other processes. The battery grids produced at the facility require a specific cooling consistency for quality and customer specification purposes. This becomes difficult during the summer when the facility's production demands larger amounts of cooling. Left unchecked, these issues are capable of shutting down the process cooling pump.

INCENTIVES TO CHANGE

A corporate goal is to reduce utility usage and to regain the ranking of 1 among 100 of the Best Corporate Citizens. Improving the efficiency of the process cooling system is a priority to reduce utility costs. Optimizing the efficiency will also minimize costly downtime caused by current process conditions. Utilizing free cooling technology in the winter months could generate significant energy savings and reduce emissions.

RESULTS

Insulation: There are a total of 10 heat exchangers at the facility; two on each of the five production lines. The heat exchangers are not currently insulated. This can cause the coolant to gain heat during the transfer process through the heat exchangers. Insulating the heat exchangers will prevent this heat gain and provide an opportunity for energy savings. Since the heat exchangers require occasional maintenance, a removable form of insulation is recommended.

Filtration: Machines on various lines use water as a coolant in the production process. Surface erosion has degraded the quality of the water feeding this process. This is problematic since it can cause additional damage to the machine, and increase costs associated with maintenance and water treatment. Another machine uses a mixture of water and a lubricant, which is creating a sludge build-up. The intern tested various methodologies to evaluate the effectiveness and impacts on the system. A modification to the filtration system and changes in maintenance procedures were recommended to help improve production and reduce costs.

CONVENTIONAL AIR POLLUTANTS AND GREENHOUSE GASES DIVERTED IN METRIC TONS

TOTAL FOR ALL SECTORS							
CO_2	SO_2	CH_4	N_2O	CFC	NO_X	VOC	PM_{10}
681.87	3.69	25.61	0.34	8.38	1.75	.051	0.09

Process Flow Rate: Process cooling at the plant is designed to work on a cooling cycle. The machine is allowed to heat up to a certain temperature before the pump activates to cycle and cool the liquid until the tank returns to the specified temperature. Production at the plant has increased and a production line has been added since the cooling system was originally installed. When operating at full load, the equipment is undersized for the demand.

Adjusting the flow rate to the lines based on production and heat generation, would maximize the volume of cooling available and increase the efficiency of the chillers. This recommendation would require frequent monitoring and manual adjustments or a tool developed that would synchronize flow rates with production schedules to maintain temperature set points. Additional development is recommended to further evaluate the impacts.

Free Cooling: Free-cooling technology is a cost saving option that redirects the cooling liquid through dry air coolers that are cooled using the outside ambient air. The intern evaluated equipment options to integrate free-cooling at the plant. A chiller with an added economizer, would provide the greatest energy savings. This piece of equipment utilizes the atmospheric temperatures to begin the cooling process of the liquid before going to the compressors. Using a variable drive function, this process gradually allows the compressors to run at lower loads until they eventually shut down and allow free-cooling to handle the whole load. Based on the average winter temperatures, integrating free-cooling technologies will provide significant energy and cost savings.

PROJECT	ANNUAL COST SAVINGS	ENVIRONMENTAL RESULTS	STATUS
INSULATION	$6,244	152,105 kWh	Recommended
FILTRATION	$12,070	294,041 kWh	Recommended
PROCESS FLOW RATE	TBD	TBD	Recommended
FREE COOLING	$49,805	1,213,325 kWh	Implemented