Pollution Prevention Institute

GREAT PLAINS MANUFACTURING

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Company background

Great Plains Manufacturing Inc., or GPM, is a Kansas-based company specializing in agricultural and landscape equipment. Established in 1976 by founder Roy Applequist, the company's mission is centered around customer satisfaction, employee well-being and financial stability. With divisions including Great Plains Agriculture, Land Pride, Construction Equipment, Great Plains International and Great Plains Trucking, GPM operates from its Salina, Kansas, headquarters. Employing over 1,500 individuals across 13 facilities covering 1.6 million square feet, GPM manufactures a wide array of agricultural and tillage equipment, including mowers, sprayers, scrapers, planters and construction machinery. In 2016, Great Plains was acquired by Kubota, a multinational corporation headquartered in Osaka, Japan.

Project background

Great Plains partnered with the Kansas State University Pollution Prevention Institute to identify, prevent and eliminate sources of pollution and energy waste at GPM manufacturing plants. To achieve this goal, the interns sought to change the materials, processes and technologies used in the Great Plains manufacturing plants. Great Plains established frameworks for the interns to identify sources of waste and recommend projects that could reduce pollution and conserve energy.

Incentives to change

Kubota has demonstrated a strong commitment to reducing carbon emissions and improving energy efficiency as a response to climate change. The company's ultimate objective is to achieve carbon neutrality by 2050, with an interim target of 50% reduction in carbon emissions by 2030. As a subsidiary of Kubota, Great Plains aligns with these goals and is actively pursuing measures to reduce its impact on the environment through pollution prevention, or P2. This pursuit of pollution prevention not only helps Great Plains reach Kubota's carbon emission targets, but also provides cost savings.

PROJECTS REVIEWED FOR P2 POTENTIAL

Energy mapping

The first step to increasing energy efficiency is identifying the most energy-intensive areas and equipment through development of an energy map. Once the map is completed, efforts can be focused on devising solutions to reduce energy waste. Two energy maps were completed for GPM; one at the plant in Kipp, Kansas, and one at the plant in Abilene, Kansas. To complete the maps, all devices at these plants that consume energy have their consumption levels and location documented in a spreadsheet. The data-filled spreadsheet generates an energy map in the form of a pie graph, with each slice representing an area or process within the plant. While the energy mapping project did not have any direct environmental or cost benefits, it did pave a path for other P2 initiatives to be directed at areas that were identified to be the most energy intensive.

Wash line conservation

The wash line at Kipp is part of the paint area, which consumes the most energy in the plant. The wash line consisted of two stages of washers and dry blowers at the end. The second-stage washer is the rinse station and operates the entire time the paint line is running – 16 hours a day on average. However, objects are not on the paint line for the entire time – meaning a waste of water and energy during periods when there is nothing on the line. A sensor system was recommended to be installed for the rinse station to conserve water and electricity through the water pump and the dry blowers. Similarly, there was also a 32-foot length of uninsulated pipe bringing hot water to the washer from a boiler. The boiler was set at a thermostat temperature of 180°F, while the water coming out of the boiler was only 103°F. A simple 1" fiberglass insulation was recommended for the pipeline to fix this problem. The estimated annual savings from both these measures amounted to 61 $MTCO_2e$ and $9,868.

Oven efficiencies

The paint cure oven is one of the major energy consumers at the plant in Kipp. The oven uses both convection and infrared light to transfer heat to the freshly painted parts. To find what was causing the greatest losses of heat in the oven, a simplified mathematical model of the oven was developed. After thoroughly analyzing many potential sources of heat loss, it was determined that the exchange of hot air for cold air was the largest waste of energy in the oven, followed by the loss of infrared light through the open faces at the front and rear of the oven. It was determined that operating a pair of air seals, one at each opening in the oven, and installing a single reflective heat curtain in the rear of the oven would significantly reduce these sources of energy loss. In total, it is predicted that implementing both of these solutions would save $10,000 and 44 $MTCO_2e$ in emissions annually.

Fan and lights

In a conversation with the maintenance staff at the plant in Abilene, it was mentioned that the lights and floor fans operate 24 hours a day, seven days a week with a few exceptions. While the entire plant is operating for 20 hours each day during the week (Monday through Thursday), many areas are completely vacant during the remaining shifts. Maintenance staff provided information about the areas that do not operate during every shift, along with estimates for how often lights and fans were turned off in these areas. Using staff estimates, energy consumption data gathered during the Abilene energy mapping project and information detailing the count and energy consumption of the lighting in the plant, an estimate of how much energy is wasted by leaving lights and fans on in vacant areas was made. The estimate showed that implementing this project can save $27,900 and 307 $MTCO_2e$ annually.

SUMMARY OF 2023 P2 INTERN RECOMMENDATIONS

Project	Annual estimated environmental impact	Estimated cost savings ($/year)	Status
Energy mapping	---	---	Completed
Wash line conservation	61,326 kWh 28,563 gallons water 24,010 MBTUs 61 $MTCO_2e$	$9,868	Recommended
Cure oven heat retention	32,000 kWh 166,000 MBTU (C_3H_8) 44 $MTCO_2e$	$10,000	Recommended
Fans and lights	328,000 kWh 307 $MTCO_2e$	$27,900	Recommended
Total[1]	**421,326 kWh 28,563 gallons water 190,010 MBTUs**	**$47,768**	
GHG reductions[1,2]	**413 metric tons CO_2e**		

[1]Does not include projects "not recommended" or where "more research needed."

[2]EPA P2 GHG Calculator with Cost, 29 November 2022