Pollution Prevention Institute

GREAT PLAINS MANUFACTURING

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Company background
Great Plains Manufacturing is a Kansas-based agricultural manufacturing company that is owned by Kubota North America Corporation. Great Plains has 13 facilities, including 10 in Kansas and three internationally, and employs more than 2,000 people. Great Plains produces tillage implements, grain drills, planters, sprayers, tillage equipment, mowers, seeders, rakes, rollers, scrapers, construction equipment, material handling products and other varieties of agricultural equipment.

Project background
Great Plains partnered with the K-State Pollution Prevention Institute to reduce, prevent and eliminate pollution and waste at its source. Pollution Prevention, or P2, entails changing the material, process or technology of a system. Great Plains set up projects before the intern's arrival that deal with energy conservation, material changes and source reduction of pollution.

Incentives to change
The need to respond to climate change from the industry has increased, and Kubota wants to reduce its carbon emissions by 9% across all companies by 2025, and to be carbon neutral by 2050. Being more efficient, using less energy and responsibly sourcing energy all contribute to these goals. Changing some of the processes in place at Great Plains can not only reduce the company's carbon footprint, but also save money.

PROJECTS REVIEWED FOR P2 POTENTIAL

Oven efficiencies

In the process of producing agricultural machinery, the parts are painted with solvent or powder paint and then sent through an oven to cure. Curing is the process in which paint fully bonds to the material beneath it. At Great Plains, there are two types of ovens used to cure painted parts, convection and infrared, or IR. The intern was tasked with determining if one of these oven types was more efficient than the other. Convection ovens heat material by circulating hot air around the part, while IR ovens heat material by sending infrared light from lamps to the surface of the material. While inherently more efficient due to the method in which it heats materials, IR ovens are limited in that they only directly heat areas that the light waves can reach. Hidden areas or the undersides of parts are not heated by the IR waves, but by residual heat in the oven. Paint cures to a material by being held above a certain elevated temperature for a certain amount of time. In order to observe how the ovens heat material, temperature measurements were taken of pieces as they went through the oven with the Sheen Curvex Oven Logger. Various thicknesses of metal were tested as well as painted parts. Using the time vs. temperature data measurements that were taken, a curve model was performed for each data set. This curve model established how fast each material was able to be heated by each oven. The gas-powered IR oven was able to heat the metal in the shortest amount of time. After this an energy analysis was done to establish which oven was able to heat the material by consuming the least amount of energy. Once again, the gas-powered IR proved most efficient. Using this information, the intern determined that the gas-powered IR oven was the most efficient in use at Great Plains. The intern then evaluated how this gas-powered IR oven could be implemented across the company while maintaining the quality of products at each location. If implemented at all locations, the company could reduce its energy usage by more than 14 billion BTUs, saving $25,661 per year. These impacts, along with the total savings, can be seen in the recommendations table at the end of this document.

Green energy

Great Plains is interested in offsetting its electrical usage through a green energy source. The company would then produce energy by buying electricity from the general energy grid that uses renewable resources instead of coal power as its source of energy. Previously, employees had

researched solar power but determined it was not a good option for the company with solar energy's long payback period. With this information, the intern researched the implementation of wind turbines at company facilities. Turbines rely on wind speed and blade length to generate energy. Several wind turbine manufacturers and products were investigated to determine if they could satisfy the energy needs of the Great Plains facilities. City zoning restrictions also had to be considered, along with the utility company's self-generating-energy requirements. To assist with the investment and cost of a wind system, the intern researched many financial incentives offered by the state and federal government. A site visit was held with a turbine installer and a discussion was held about how much energy Great Plains would need to produce and where the best site for implementation would be. It was determined that manufacturing facilities would not be ideal locations to implement wind turbines due to the high electrical demand at those facilities. The impact that the turbines would have on electrical costs would be limited. The turbine installer recommended implementing six of their 15 kW turbines at a non-manufacturing facility. These turbines would provide the facility with 272,946 kWh of energy per year and reduce the cost of electricity by $27,296 per year, with a payback period of three years. These impacts, along with the total savings, can be seen in the recommendations table at the end of this document.

VOC reduction

Combined with sunlight and other industrial byproducts, VOCs can cause serious harm to humans and the environment through the production of ozone. The intern was tasked with researching methods to reduce the production of VOCs at Great Plains. After investigating, the intern determined the best way to improve VOC emissions is to limit the amount of solvent used in the painting process. This can be accomplished by increasing transfer efficiency, decreasing rework and changing paint materials. Electrostatic paint sprayers are currently in use across the company. To improve these sprayer's effectiveness, the painting line needs to be properly electrically grounded and this grounding should be checked frequently. Great Plains could also switch entirely over to powder paints, instead of solvent-based paints, as powder paints have virtually no VOC emissions. More research is needed for this project.

SUMMARY OF 2022 P2 INTERN RECOMMENDATIONS

Project	Annual estimated environmental impact	Estimated cost savings ($/year)	Status
Oven efficiencies	14,381,893,419 BTUs 4,437 $MTCO_2e$	$25,661	Recommended
Green energy	272,946 kWh 287 $MTCO_2e$	$27,296	Recommended
VOC reduction	30 tons of VOC	---	More research is needed
Total[1]	**14,381,893,419 BTUs 272,946 kWh**	**$52,957**	
GHG reductions[1,2]	**4,724 $MTCO_2e$**		

[1]Does not include projects where "more research is needed."
[2]EPA P2 GHG Calculator with Cost, 7 April 2016