

WORKING TOGETHER TO ACHIEVE ECONOMIC AND ENVIRONMENTAL RESULTS

2014 CASE SUMMARIES POLLUTION PREVENTION INTERN PROGRAM





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2014 POLLUTION PREVENTION INTERNS



The Pollution Prevention Intern Program is an extension of DNR's Pollution Prevention Services, which offers no-cost, non-regulatory, confidential technical assistance through assessments, internships and other services to Iowa businesses, industries and institutions.

The intern program places upper-level engineering and science students from colleges and universities at Iowa companies to analyze the facilities' waste streams and to research and recommend process improvements that will lower operating costs while reducing negative environmental impacts. After a one-week training period, the students serve on-site at the host facilities for 12- or 24-week internships.

STUDENT PERSPECTIVES:



"This experience is unlike any other internship or job experience I have had and probably ever will have. It is a great mix of engineering skills, interpersonal soft skills, and business skills."

— **Bailey Hadnott**



"This internship gave me the opportunity to take ownership and responsibility of a project and be self-motivated for its completion. I gained more communication and public speaking skills during my P2 internship than any other internship I've been involved in."

— **Megan Melbye**



"Being able to manage your own project and see the impact your project has on both the company and the environment gives you a huge sense of accomplishment. Having all of the work you put into a project have a positive outcome is a good feeling."

— **Alex George**



"This is an internship where you have real responsibilities and will be constantly learning. This was an amazing experience in which I actually was able to make an impact on an issue that I am passionate about."

— **Kate Kennedy**



"As interns, helping industries become more environmentally conscious while saving thousands of dollars in solid waste, energy, or wastewater treatment costs during the process is tremendously fulfilling."

— **Kimberly Scherber**

COMPANY TESTIMONIALS:

"We could not be more pleased with the outcome of the project. The intern far exceeded the objectives by her diligent efforts. This is a great program and I'm thrilled we were able to participate."

— **Tonya Burgess, Sivyer Steel Corporation**

DIRECTOR'S NOTE



Iowa businesses care about our environment and are stewards of this land that we share. This summer's Pollution Prevention Intern Program companies are examples of just that. These businesses have come together to partner with the Department of Natural Resources and Academia to do more than they are required to do through permitting. These projects have led to big environmental gains now and in the future, as well as cost savings for the companies.

Each year new partnerships are added and existing partnerships are renewed bringing together colleges and universities, businesses and institutions, and government. Interns provide fresh ideas to Iowa companies while gaining valuable hands-on job experience. Companies realize that positive environmental impacts and reduced costs go hand in hand.

Since 2001, more than 171 dedicated companies have saved more than \$75.2 million by implementing environmentally progressive solutions recommended by Pollution Prevention Interns. These environmental and efficiency improvements save more than water, electricity and materials going to our landfills; they save jobs, create opportunities for employment and most importantly reduce impacts to our environment.

Interns in this program are provided the opportunity to demonstrate their professional abilities at their host companies. The interns establish and build professional networks through host company staff and contact with vendors and suppliers. Historically, approximately 25 percent of interns report future employment opportunities as a result of their participation in the Pollution Prevention Intern Program.

As you read the testimonials and project summaries that follow, I encourage you to consider partnering with our team of professionals as a host company for the summer of 2015 Pollution Prevention Intern Program.

CHUCK GIPP

ACTUAL POLLUTION/WASTE REDUCTION AND COST SAVINGS FROM INTERN PROJECTS			
CATEGORY	REDUCTION	UNITS	COST SAVINGS
WATER CONSERVATION	1,438,887,197	GALLONS	\$6,175,330
SPECIAL WASTE	75,324	TONS	\$873,033
SOLID WASTE	138,534	TONS	\$14,746,137
HAZARDOUS WASTE	8,025	TONS	\$12,202,993
MERCURY ABATED	42,817	GRAMS	
ENERGY	363,050,130	KWH	\$20,547,136
	2,159,555	MMBTU	
OTHER	9,204,653	THERMS	\$7,057,960
			\$13,622,422
			TOTAL: \$75,225,011

*MMBTUS ARE CALCULATED FROM KWH AND THERMS FOR SPECIAL REPORTING ONLY. ALL DOLLARS AND ACTUAL ENERGY SAVED ARE REPORTED UNDER KWH AND THERMS.

IMPLEMENTED AIR POLLUTANTS DIVERTED IN METRIC TONS							
TOTAL FOR ALL SECTORS							
CO ₂	SO ₂	CH ₄	N ₂ O	CFC	NO _x	VOC	PM ₁₀
232,391.55	1,088.44	107,124.65	14,558.75	2,648.49	573.94	1,550.90	161.91

Air emissions and greenhouse gases shown on this page represent implemented projects from 2001-2014.

2014 EXECUTIVE SUMMARY

Fourteen upper-level engineering students teamed with the Department of Natural Resources' 2014 Pollution Prevention Intern Program to help companies meet their environmental objectives. The intern program is an extension of DNR's Pollution Prevention Services, a non-regulatory program that offers confidential technical assistance to Iowa business and industry.

Working on-site at top Iowa companies, interns identify strategies to reduce solid and hazardous waste, water and energy use, air emissions, and greenhouse gases. Interns research and recommend process improvements that will lower operating costs and improve the environmental performance of host companies. The interns offer a fresh perspective and innovative solutions while gaining valuable experience.

This year, the interns identified opportunities that could save companies more than \$5.5 million annually. Of these, projects estimated to save \$1.6 million annually were implemented or are in progress.

The program offers both 12-week and 24-week projects each year. Interns at Johnson Controls, Inc. and Nutra-Flo Company completed 24-week projects in the past year. The extended project time on site allows interns to conduct more in-depth research, collect data over time and evaluate systems through varying conditions.

Two interns will continue to work on 24-week projects until November 2014. The final results of the two projects in progress will be posted to the department's website in January and highlighted in the next published case summary booklet in 2015.

The 2014 case summaries highlighted here show that outstanding results are possible when companies, students and the DNR work together to achieve common environmental goals.

2014 IMPLEMENTED SAVINGS			
CATEGORY	REDUCTION	UNITS	COST SAVINGS
WATER CONSERVATION	440,276	GALLONS	\$2,179
SPECIAL WASTE	179	TONS	\$35,121
SOLID WASTE	1,172	TONS	\$179,854
HAZARDOUS WASTE	219	TONS	\$1,343,111
ENERGY	1,509,764	KWH	\$62,884
	5,153	**MMBTU	
OTHER			\$6,400
			TOTAL: \$1,629,549

*MMBTUS ARE CALCULATED FROM KWH FOR SPECIAL REPORTING ONLY. ALL DOLLARS AND ACTUAL ENERGY SAVED ARE REPORTED UNDER KWH.

CONVENTIONAL AIR POLLUTANTS AND GREENHOUSE GASES DIVERTED IN METRIC TONS								
TOTAL FOR ALL SECTORS								
CO ₂	SO ₂	CH ₄	N ₂ O	CFC	NO _x	VOC	PM ₁₀	MTCO _{2e}
2,454.80	3.42	268.84	5.76	7.82	1.62	1.05	0.18	7,316.02

NOTE:

- > Air emissions and greenhouse gases shown in this book are life cycle estimates and include external activities such as purchasing utilities. Totals do not solely represent emissions generated at the plant sites.
- > Greenhouse gas estimates for solid waste reduction projects are derived from U.S. EPA, Waste Reduction Model (WARM), Version 12, Available at: http://www.epa.gov/wastes/conservation/tools/warm/Warm_Form.html

- > Life cycle air emissions and greenhouse gas estimates for all sectors except solid waste are calculated using Carnegie Mellon University Green Design Institute. Economic Input-Output Life Cycle Assessment (EIO-LCA), US 2002 Industry Benchmark model [Internet], Available from: <http://www.eiolca.net>



AMERICAN POP CORN COMPANY



ANTHONY JOHNSON
INDUSTRIAL ENGINEERING
THE UNIVERSITY OF IOWA

COMPANY PROFILE

American Pop Corn Company produces the globally recognized brand of Jolly Time® popcorn. Based in Sioux City, IA, Clold Smith founded the company in 1914 and has passed on his legacy to three generations in the Smith family. Over 180 employees make up the family-owned company, operating in several buildings across the campus. In celebration of the company's 100th birthday, a Kernels of Kindness™ campaign was developed, in which \$1,000 grants are awarded to 100 individuals who bring joy, happiness, and kindness to their communities.

PROJECT BACKGROUND

Solid waste reduction is an ongoing focus of American Pop Corn Company's environmental efforts. Various forms of raw materials are either wasted or discarded throughout the production process, including excess product, production by-products and packaging waste. An in-depth analysis could illuminate process improvements, inefficiencies, or other strategies to reduce the amount of waste generated.

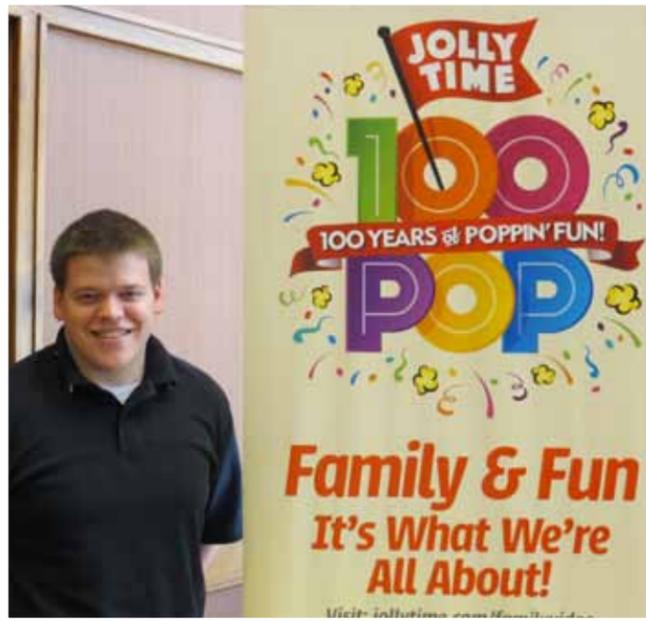
INCENTIVES TO CHANGE

American Pop Corn Company's interest in waste reduction grows out of a concern for the environment: a reduced carbon footprint has great value to the company in its efforts to continually pursue green operations. Furthermore, reducing waste can have significant implications to the company's bottom line. Efforts to increase efficiencies will lead to a higher profit margin for the company, while diverting recyclables from the landfill can create new revenue streams.

RESULTS

Net Weight Reduction: An analysis of production at American Pop Corn Company revealed that popcorn bags are often filled with product in excess of the specified product weight. An adjustment to avoid overfilling and achieve the set net product weight would optimize quality control. The quantity and cost of raw materials saved will result in an annual savings of more than \$8,000 for the initial adjustment, and 1.92 tons of recovered raw materials. After an initial adjustment to the filling process, additional adjustments will be possible, in turn increasing the savings.

Front Office Recycling: The front office of American Pop Corn Company is a high traffic area with 30 company employees and numerous daily corporate visitors. The addition of paper recycling to this office space would divert an additional 0.5 tons of recyclables from the landfill annually, and would align office practices with the company's commitment to sustainability.



Building 12 Recycling: Another expanded recycling opportunity on American Pop Corn Company's campus is presented in production Building 12. Although cardboard boxes from this location are currently recycled, cardboard tubes and plastic bags generated from product bag rolls could also be included. Increasing the recycling capacity of Building 12 to include these additional materials would reduce loads sent to the landfill by 10.11 tons a year.

Microwave Building Recycling: The same expanded recycling program developed for Building 12 can also be utilized in the microwaveable popcorn building. Similar to Building 12, this production area also produces both cardboard tubing and mixed plastics. Recycling containers strategically installed throughout the building will ensure the production flow is not interrupted by this change, and will divert 16.5 tons of waste from the landfill.

Oil Skimmer Belt: Production floors in the microwaveable popcorn building are washed thoroughly to remove residual oil. The water used to clean the floors must then go through an oil skimmer to remove the oil from the water before it is sent to sewer. By increasing the belt length in the oil skimmer by 3 feet, more belt surface area will have contact with the water, and will increase the amount of oil removed. Additionally, revenue will increase as more oil can be sold to the waste oil vendor.



CONVENTIONAL AIR POLLUTANTS AND GREENHOUSE GASES DIVERTED IN METRIC TONS

From Recommendations in Recommended Status

TOTAL FOR ALL SECTORS								
CO ₂	SO ₂	CH ₄	N ₂ O	CFC	NO _x	VOC	PM ₁₀	MTCO _{2e}
								244

PROJECT	ANNUAL COST SAVINGS	ENVIRONMENTAL RESULTS	STATUS
NET WEIGHT REDUCTION	\$8,108	1.92 TONS	RECOMMENDED
FRONT OFFICE RECYCLING	\$684	0.5 TONS	RECOMMENDED
BUILDING 12 RECYCLING	\$156	10.11 TONS	RECOMMENDED
MICROWAVE BUILDING RECYCLING	\$324	16.5 TONS	RECOMMENDED
OIL SKIMMER BELT	NOT QUANTIFIED	NOT QUANTIFIED	RECOMMENDED



BRIDGESTONE AMERICAS TIRE OPERATIONS



JOSEPH REINERT
MECHANICAL ENGINEERING
IOWA STATE UNIVERSITY

COMPANY PROFILE

Bridgestone Americas Tire Operations is a global leader in tire production. Across the Americas, the company has over 50 production facilities, operated by more than 43,000 employees. The largest agricultural tire plant in the country, Bridgestone's Des Moines facility produces Firestone brand tires. As the leader in agricultural tire manufacturing, the Des Moines plant operates 24/7 to meet demand.

PROJECT BACKGROUND

Bridgestone's Des Moines plant requires more than 157 million gallons of water per year. As an environmental steward, Bridgestone has identified a need to reduce its water usage. The Des Moines plant plans to reduce total water usage per ton of production by 13 percent. This means the overall water usage at the plant will need to decrease by roughly 20 million gallons.

INCENTIVES TO CHANGE

As a corporation committed to both its customers and to the environment, Bridgestone's mission statement reflects its priorities: "To offer the best for our customers and to society, not only in terms of our products, services and technology, but in all of our corporate activities". The company is dedicated to the continuous improvement of their products and processes, particularly in relation to its environmental footprint. Reducing water usage at the Des Moines plant would not only create a more sustainable manufacturing process, but would also offer a significant cost savings.

RESULTS

Curing Leak Repairs: The Des Moines plant's curing system utilizes high temperature steam to mold and vulcanize green tires. While steam is necessary for the production of tires, it negatively impacts facility infrastructure by corroding pipes. With more than 200 curing presses throughout the plant, corrosion is a major cause of water leaks. Dedicated pipe fitters, whose sole purpose is to repair leaks, could save an estimated \$100,000 annually, and roughly 2.8 million gallons of water.



CONVENTIONAL AIR POLLUTANTS AND GREENHOUSE GASES DIVERTED IN METRIC TONS

From Recommendations in Recommended Status

TOTAL FOR ALL SECTORS								
CO ₂	SO ₂	CH ₄	N ₂ O	CFC	NO _x	VOC	PM ₁₀	MTCO _{2e}
103.04	0.24	417.13	172.89	1.19	0.24	0.61	0.08	694.54



Cooling Tower Maintenance: Cooling towers are another location of regular leaks at the plant. Leaks in cooling towers have a variety of negative impacts, including water loss, loss of operational efficiency, and hazardous conditions created by large ice formations during colder months. By relying on a cooling tower supplier for annual maintenance, the plant could guarantee more effective and efficient functioning of the machinery, saving an estimated \$24,000 and 2.6 million gallons annually. In addition, the life cycle of the tower could be better anticipated.

Restroom Fixture Replacement: As with any aging facility, the Des Moines Firestone plant has areas of infrastructure that could be upgraded to improve efficiency. One area with the potential for great financial and environmental impact is the restrooms. Current environmental standards require a maximum of 1.6 gallons per flush; the fixtures at the Des Moines facility match the previous standards of 3.5 gallons per flush. A complete retrofit of the restroom fixtures would save the plant 1.6 million gallons of water each year, but the cost savings do not justify the immediate purchase of new fixtures. As old fixtures need to be replaced, more efficient fixtures should be installed in their place.

PROJECT	ANNUAL COST SAVINGS	ENVIRONMENTAL RESULTS	STATUS
CURING LEAK REPAIRS	\$102,803	2,719,740 GALLONS 70,375 THERMS	RECOMMENDED
COOLING TOWER MAINTENANCE	\$24,147	2,628,000 GALLONS	RECOMMENDED
RESTROOM FIXTURE REPLACEMENT	\$15,359	1,582,000 GALLONS	RECOMMENDED



JOHNSON CONTROLS, INC.



ROBERTO GARCIA
MECHANICAL ENGINEERING
IOWA STATE UNIVERSITY

COMPANY PROFILE

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 heat 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 other impacts. A modification to the filtration system and changes in maintenance procedures were recommended to help improve production and reduce costs.

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.

CONVENTIONAL AIR POLLUTANTS AND GREENHOUSE GASES DIVERTED IN METRIC TONS

From Implemented and In Progress recommendations

TOTAL FOR ALL SECTORS								
CO ₂	SO ₂	CH ₄	N ₂ O	CFC	NO _x	VOC	PM ₁₀	MTCO ₂ e
499.55	2.69	18.73	0.25	6.13	1.28	0.04	0.07	523.45

CONVENTIONAL AIR POLLUTANTS AND GREENHOUSE GASES DIVERTED IN METRIC TONS

From Recommendations in Recommended Status

TOTAL FOR ALL SECTORS								
CO ₂	SO ₂	CH ₄	N ₂ O	CFC	NO _x	VOC	PM ₁₀	MTCO ₂ e
183.22	0.99	6.89	0.09	2.25	0.47	0.01	0.02	192.48

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



NUTRA-FLO COMPANY



KIMBERLY SCHERBER
ENVIRONMENTAL ENGINEERING
IOWA STATE UNIVERSITY

COMPANY PROFILE

Kay Flo Industries, Inc. is a family-owned agribusiness company that manufactures high performance crop and animal nutrients. The company has six facilities throughout the Midwest, located in South Dakota, Nebraska and Iowa. Nutra-Flo, a Kay Flo Industries subsidiary, is one of the largest independent liquid fertilizer manufacturers in the Midwest. Fertilizer goods manufactured by Nutra-Flo include brands such as PureGrade Liquid Fertilizer® and MicroSolutions Micronutrients®, and are sold across the United States and in Canada. In addition to fertilizer products, the company makes high protein animal feed for global distribution.

PROJECT BACKGROUND

As a fertilizer manufacturer, Nutra-Flo produces total phosphorus waste. While discharge levels vary throughout the year, peak levels occur from March through May, when fertilizer production is highest. Nutra-Flo discharges its effluent to the Sioux City Wastewater Treatment Plant. The company would like to reduce phosphorus concentration in its wastewater, as well as reduce the concentration of total suspended solids discharged.

INCENTIVES TO CHANGE

The Sioux City Wastewater Treatment Plant has adopted the Iowa Nutrient Reduction Strategy, a pretreatment standard. Furthermore, Nutra-Flo must comply with existing pretreatment standards for daily total suspended solids and must maintain its wastewater pH within a designated range. Compliance with these standards would have tremendous economic benefit for Nutra-Flo. Tier 2 sewage fees would no longer apply, and enforcement actions from the Sioux City Wastewater Pretreatment Department could be avoided.

RESULTS

North Containment Storm Water Recapture Tank: Leaking pumps, valves and piping collect an estimated 40 percent of total phosphorus concentrations. These concentrations are flushed into a designated tank after rainfall of 1" or more. This storm water could be collected and stored in a storm water surge tank to recycle back into the fertilizer manufacturing process. This would eliminate 428,419 pounds of phosphorus discharge from the sewer. An annual savings of \$1,285,000 could be realized through the reduction of wastewater surcharge fees.



South Containment CPS Isolation and Storm Water Recapture: Additional phosphorus concentrations result when unloading products and materials from trucks. To collect storm water and any fertilizer spills from the loading area, it is recommended that all concentrated peptone soluble tank hoses be contained in a barrel or bin to prevent cross contamination. This change would reduce total phosphorus sent to the city sewer by an estimated 642,628 pounds, a \$2,000,000 savings annually in wastewater surcharge fees.

Replace Solids Media Shed: To reduce total suspended solids (TSS) discharged to the city sewer, it is recommended that the existing metal holding shed be replaced with an impermeable concrete shed. This change would reduce TSS discharge by 357,000 pounds annually. Payback period for the new concrete shed is roughly two years.

Dry Cleanup of Solids Media: To further reduce TSS, any solids media spilled during waste removal handling should be collected and returned to the used-solids media shed using dry cleanup methods.

Recycle Micronutrient Totes: Micronutrient totes are used to transport components that are vital to Nutra-Flo's production process. The totes could be returned to Nutra-Flo's supplier, which would eliminate one waste stream. The supplier is able to rinse the totes and recycle any micronutrient residuals back into the production process. Additionally, the supplier can reuse the totes for further micronutrient distribution.

Recycle Dryer Drum Steam Condensate: Current practices allow steam condensate with low total dissolved solids to be discharged into floor drains. It is recommended that this steam condensate be recycled back to the boilers for an annual \$67,000 savings in energy costs, and a 62,000 therms reduction.

Replace Chemical Scrubber with Bioscrubber: Nutra-Flo has employed a variety of chemical solutions to oxidize odorous compounds in the air. A new model bioscrubber and dry media polisher could reduce annual water consumption by more than 1,000 percent. In addition, \$115,000 could be saved annually in chemical costs, and the odors from hydrogen sulfide, volatile organic compounds, and organic matter could be minimized. The payback period for this unit is less than six years.

CONVENTIONAL AIR POLLUTANTS AND GREENHOUSE GASES DIVERTED IN METRIC TONS

From Implemented and In Progress recommendations

TOTAL FOR ALL SECTORS								
CO ₂	SO ₂	CH ₄	N ₂ O	CFC	NO _x	VOC	PM ₁₀	MTCO _{2e}
1.54	0.01	10.15	5.32	0.02	0.01	0.01	0.01	17.07

CONVENTIONAL AIR POLLUTANTS AND GREENHOUSE GASES DIVERTED IN METRIC TONS

From Recommendations in Recommended Status

TOTAL FOR ALL SECTORS								
CO ₂	SO ₂	CH ₄	N ₂ O	CFC	NO _x	VOC	PM ₁₀	MTCO _{2e}
256.74	0.49	934.78	95.97	2.76	0.80	16.38	1.43	1309.35

PROJECT	ANNUAL COST SAVINGS	ENVIRONMENTAL RESULTS	STATUS
NORTH CONTAINMENT STORM WATER RECAPTURE TANK	\$1,338,174	440,276 GALLONS WATER 428,419 LBS PHOSPHORUS 4,930 LBS MICRONUTRIENTS	IMPLEMENTED
SOUTH CONTAINMENT CPS ISOLATION AND STORM WATER RECAPTURE	\$2,005,458	296,341 GALLONS WATER 642,628 LBS PHOSPHORUS 7,397 LBS MICRONUTRIENTS	RECOMMENDED
REPLACE SOLIDS MEDIA SHED	\$35,121	357,159 LBS TSS	IMPLEMENTED
DRY CLEANUP OF SOLIDS MEDIA	\$28	285 LBS TSS	RECOMMENDED
RECYCLE MICRONUTRIENT TOTES	\$25,702	7,000 GALLONS WATER 318 LBS MICRONUTRIENTS 90 CHEMICAL TOTES	RECOMMENDED
RECYCLE DRYER DRUM STEAM CONDENSATE	\$70,090	620,700 GALLONS WATER 62,267 THERMS	RECOMMENDED
REPLACE CHEMICAL SCRUBBER WITH BIOSCRUBBER	\$148,789	6,830,610 GALLONS WATER 16,425 GALLONS HYDROGEN PEROXIDE	RECOMMENDED



PROCTER AND GAMBLE



LOGAN DERBY
MECHANICAL ENGINEERING
THE UNIVERSITY OF IOWA

COMPANY PROFILE

Founded in 1837, Procter and Gamble has grown to become the world's largest producer of consumer goods. Procter and Gamble's product line is vast, including beauty, health, and household care lines. In 1956, Procter and Gamble opened a plant in Iowa City, which now employs more than 600 people. The plant manufactures products for brands Head and Shoulders®, Herbal Essences®, Old Spice® and Scope®, along with other health and beauty products.

PROJECT BACKGROUND

At Procter & Gamble, water is cleaned for production using a reverse osmosis (RO) system. RO results in two streams of water: a clean permeate stream and a reject stream. With the help of an additional RO unit, the reject stream of water can be cleaned and used for production, lowering the amount of city water needed for manufacturing.

INCENTIVES TO CHANGE

Procter & Gamble is committed to reducing their environmental footprint. In 2010, the company set a strategic goal to reduce energy, waste, CO₂ and water usage by 20 percent over a ten-year period.

The Iowa City plant's focus on hair care and oral rinse products, both primarily water-based, means that water is a major cost for the plant. Utilizing an existing water stream that would otherwise be disposed of can increase efficiency. In addition, costs decrease for both incoming city water and outgoing wastewater treatment.

RESULTS

Additional RO Unit: An RO system works by filtering the solids out of water, concentrating the solids into a smaller "reject stream". Although the Iowa City plant's RO system is highly efficient, a large volume of reject water is still produced. By installing an additional RO unit to filter the reject stream, then sending that water to the start of the RO loop in a "double pass" system, less incoming city water is required. Furthermore, less wastewater is produced as water can be re-used.

More than 11 million gallons of water could be saved each year with an additional RO unit. The annual financial impact would be a savings of \$113,755 in water and sewage treatment bills. An additional benefit of a fourth RO unit is sustainability; the water sent through the entire RO system becomes cleaner. This lowers the rate of fouling on the RO membranes, thus reducing maintenance costs.



Heat Recovery from RO Water: In addition to savings in water and sewage treatment costs, a double pass RO system can also save money in water heating bills. To achieve maximum operating efficiency, water sent through the RO system should be 74°F. City water enters the plant at around 55°F and is sent through a heat exchanger attached to one of the plant's boilers. Water in the "reject stream" is much closer to the temperature required for RO. Mixing the recovered water with the city water feed will raise the incoming water temperature by more than one degree. As a result, \$7,897 could be saved in natural gas costs.

CONVENTIONAL AIR POLLUTANTS AND GREENHOUSE GASES DIVERTED IN METRIC TONS

From Recommendations in Recommended Status

TOTAL FOR ALL SECTORS								
CO ₂	SO ₂	CH ₄	N ₂ O	CFC	NO _x	VOC	PM ₁₀	MTCO ₂ e
30.76	0.06	202.87	106.24	0.30	0.05	0.17	0.04	340.43

PROJECT	ANNUAL COST SAVINGS	ENVIRONMENTAL RESULTS	STATUS
ADDITIONAL RO UNIT	\$113,755	10,437,210 GALLONS	RECOMMENDED
HEAT RECOVERY FROM RO WATER	\$7,897	15,261 THERMS	RECOMMENDED



RYKO SOLUTIONS, INC.



BAILEY HADNOTT
ENVIRONMENTAL ENGINEERING
THE UNIVERSITY OF IOWA

COMPANY PROFILE

Ryko Solutions, Inc. celebrates 40 years of business in 2014. The company is North America's leading car wash equipment and service provider. Ryko Solutions is also a major provider of technical services, car wash chemicals, cleaning products, and product marketing. At the company's Grimes, Iowa, headquarters, approximately 100 people work to create products for a global market. The Grimes facility operates most of its stations 40 hours per week, with 80 hours per week utilized for fabrication.

PROJECT BACKGROUND

Some of the general refuse discarded from Ryko Solutions' Grimes facility is recyclable. Such materials include product packaging and scraps from the fabrication and assembly process. Following a waste stream analysis, strategies were identified to reduce disposal costs and improve process efficiencies by integrating source reduction, reuse of materials, and recycling.

INCENTIVES TO CHANGE

Ryko Solutions' production process requires thousands of new parts each week. Each new part includes packaging material that contributes to the facility's solid waste stream. Various production processes during assembly create scraps that are currently discarded. Solvents and solutions are currently used with excess; guidelines for chemical use are needed to discourage waste.

By increasing recycling opportunities within its facility, Ryko Solutions plans to decrease effluent solid waste by 50 percent. Increased recycling efforts, integrated source reduction, and in-house reuse of materials are all part of the company's strategy.

RESULTS

Recycling Program: Metal and some cardboard are currently recycled at Ryko Solutions' Grimes facility, while plastics and paper are landfilled. More than 90 percent of the total waste stream currently sent to the landfill could be diverted with a sorted recycling program, facilitated by a local recycler. Over the course of a year, this change would mean more than 500 tons of recyclable material diverted from the landfill. Such a program would save Ryko Solutions more than \$65,000 annually as a result of reduced landfill costs and increased recycling revenue.



CONVENTIONAL AIR POLLUTANTS AND GREENHOUSE GASES DIVERTED IN METRIC TONS

From Implemented and In Progress recommendations

TOTAL FOR ALL SECTORS								
CO ₂	SO ₂	CH ₄	N ₂ O	CFC	NO _x	VOC	PM ₁₀	MTCO ₂ e
10.75	0.02	41.06	0.12	0.11	0.04	0.99	0.09	291.00

CONVENTIONAL AIR POLLUTANTS AND GREENHOUSE GASES DIVERTED IN METRIC TONS

From Recommendations in Recommended Status

TOTAL FOR ALL SECTORS								
CO ₂	SO ₂	CH ₄	N ₂ O	CFC	NO _x	VOC	PM ₁₀	MTCO ₂ e
								104.00

Efficient Acid Washing: Assessment of the company's acid washing process revealed an efficiency loss between raw material usage and final application. Because high-volume, low-pressure spray guns have higher transfer efficiencies, upgrading the current standard spray gun would provide improvements to the acid washing process. The spray gun upgrade, along with modified spraying techniques, could save 151 gallons of acid wash per year, for an annual financial savings of \$900.

Solvent Distillation System: After car wash parts are primed and painted, paint guns and pots are cleaned with acetone. The process has no measurement system in place, thus employees tend to use more primer or acetone than is required. A new procedure detailing the appropriate amount of solvent to use would reduce the company's primer and acetone disposal, currently a large portion of its hazardous waste stream. In addition, the installation of a solvent distillation system could recover up to 95 percent of the acetone for reuse. With the new procedures in place, over 450 gallons of hazardous waste could be diverted, saving more than \$7,000 annually.

Reuse Incoming Material: When products are received from vendors, plastic bags, bubble wrap and other packaging materials join Ryko's waste stream. While some packaging products are reused currently, such as cardboard boxes and wood pallets, an opportunity exists to increase reuse of shipping materials. Expanding the facility's reuse program could result in 11 tons of plastic diverted from its solid waste stream each year.



Reuse of Scrap Metal: The fabrication laser cutter at Ryko Solutions' Grimes facility uses a computer program to optimize both the placement and nesting of parts cutouts. The program does not allow for the possibility of parts sharing a common edge, thus creating an unnecessary amount of unusable "skeleton" material between each sheet. If parts were moved closer together during the printing process, and 10 percent of the raw material could be conserved, more than 50 tons of metal could be diverted from the landfill and saved for production.

PROJECT	ANNUAL COST SAVINGS	ENVIRONMENTAL RESULTS	STATUS
RECYCLING PROGRAM	\$65,537	200 TONS	IMPLEMENTED
EFFICIENT ACID WASHING	\$906	151 GALLONS	RECOMMENDED
SOLVENT DISTILLATION SYSTEM	\$7,116	2.15 TONS	IN PROGRESS
REUSE INCOMING MATERIAL	\$617	11 TONS	RECOMMENDED
REUSE OF SCRAP METAL	UNKNOWN	54.92 TONS	RECOMMENDED



CITY OF SIOUX CITY



KATE KENNEDY
MECHANICAL ENGINEERING
IOWA STATE UNIVERSITY

COMPANY PROFILE

The Sioux City Wastewater Treatment Plant serves communities in three states, including Sioux City, Iowa; Sergeant Bluff, Iowa; South Sioux City, Nebraska; Dakota Dunes, South Dakota; and North Sioux City, South Dakota. The plant processes an average of 12.5 million gallons of wastewater per day. In addition to serving communities, the plant also monitors wastewater from 37 local industries. Facets of engineering, biology, and chemistry combine to form the wastewater treatment process. As authorized by the Iowa Department of Natural Resources, treated wastewater is discharged into the Missouri River.

PROJECT BACKGROUND

Initiatives at the Sioux City Wastewater Treatment Plant are currently in place to decrease the facility's ecological footprint. For example, biogas is combusted in boilers and heat exchangers to produce heat for the plant. However, inefficiencies also exist at the plant. Pumps and blowers consume large amounts of electricity. Lighting often stays on when not needed. Identifying these major energy users to reduce their consumption is the next step in the Sioux City Wastewater Treatment Plant's journey toward sustainability.

INCENTIVES TO CHANGE

Over the past few years, the Sioux City plant has completed several large-scale projects, including renovations for better odor control, repair or replacement of old equipment, and improvements to the wastewater treatment process. Following these costly changes, the plant's focus is now on updates with a significant financial return on investment. In addition, the plant seeks opportunities to minimize the cost of processing wastewater, impacting both current and future taxpayers.

RESULTS

Metal Halide to LED: One improvement opportunity for the Sioux City WWTP involves lighting. The current interior and exterior lighting relies on metal halide bulbs, which must stay on due to prohibitive restrike times. Capitalizing on advancing LED technology, the plant can combine the efficiency of the new bulbs with occupancy sensors for significant energy savings of \$12,000 annually.



Occupancy Sensors on Fluorescent Lighting: Portions of the facility are subject to regular maintenance checks. The checks necessitate that the fluorescent lighting stay on at all times. Because the surveyed areas are primarily vacant, installation of new LEDs is not a cost-effective option. However, occupancy sensors installed on the existing fluorescent bulbs would provide an estimated annual savings of \$5,000.

Aeration Basin Blower Leaks: The blowers are supplying an unnecessary amount of air to the system due to open valves on external pipes. As a result, the motors consume much more power than is required. The repair of these leaks could save an estimated \$48,500 annually, and conserve 1,300,000 kWh of energy.

Gas Flow to Flare: A flow problem was detected that prevented the biogas from being scrubbed of corrosive compounds and flared. A theory was put forth by the intern and then tested. After surveying the combustion path, a large condensate bubble was located, which blocked the path of the biogas. After draining the bubble, the gas was then flared. In order to ensure the most ecological process possible, biogas must be combusted rather than exhausted, as the latter wields 21 times more global warming potential.

Pressure Relief Valve: Biogas is a valuable asset at the WWTP because biogas is used to run the boilers and the digester heat exchangers. One biogas leak was detected on the fourth digester's pressure relief valve. The valve leak may be caused by improper maintenance or a potential malfunction. Repairing or replacing this pressure relief valve could decrease the facility energy consumption by \$9,850 during cold months.

Install Combined Heat and Power (CHP) Unit: The WWTP capitalizes on biogas during winter months, powering boilers to heat its buildings. However, biogas is flared when not needed to power boilers. The installation of a combined heat and electricity-producing unit could have a major impact on both cost savings and environmental results. While the WWTP does not have enough biogas to warrant a CHP unit currently, a feasibility study was recommended to further explore the opportunity.



CONVENTIONAL AIR POLLUTANTS AND GREENHOUSE GASES DIVERTED IN METRIC TONS

From Implemented and In Progress recommendations

TOTAL FOR ALL SECTORS								
CO ₂	SO ₂	CH ₄	N ₂ O	CFC	NO _x	VOC	PM ₁₀	MTCO ₂ e
		194.00						4074.00

CONVENTIONAL AIR POLLUTANTS AND GREENHOUSE GASES DIVERTED IN METRIC TONS

From Recommendations in Recommended Status

TOTAL FOR ALL SECTORS								
CO ₂	SO ₂	CH ₄	N ₂ O	CFC	NO _x	VOC	PM ₁₀	MTCO ₂ e
3305.00	17.00	261.00	2.02	40.67	8.50	0.68	0.45	3635.32

PROJECT	ANNUAL COST SAVINGS	ENVIRONMENTAL RESULTS	STATUS
METAL HALIDE TO LED	\$12,000	188,000 KWH	RECOMMENDED
OCCUPANCY SENSORS ON FLUORESCENT LIGHTING	\$5,000	95,500 KWH	RECOMMENDED
AERATION BASIN BLOWER LEAKS	\$48,500	1,300,000 KWH	RECOMMENDED
GAS FLOW TO FLARE	NA	194 METRIC TONS CH ₄	IMPLEMENTED
PRESSURE RELIEF VALVE	\$9,850	15,500 THERMS 30 METRIC TONS CH ₄	RECOMMENDED
INSTALL CHP UNIT	\$328,000	7,008,000 KWH 110,800 THERMS	RECOMMENDED



SHEARER'S FOODS, INC

BURLINGTON



HENRY KELLEY
MECHANICAL ENGINEERING
IOWA STATE UNIVERSITY

COMPANY PROFILE

Shearer's Foods Inc. is a privately owned manufacturer of potato chips, pretzels, pork rinds, salsa con queso, tortilla chips, whole grain brown rice crisps, wire cut cookies, sandwich cookies, and saltine crackers. The West Burlington facility, recently purchased from Snyder's Lance, operates three shifts, 24-hours per day, five days per week and employs more than 800 people who help manufacture private-branded saltine crackers, wire-cut cookies and sandwich cookies.

PROJECT BACKGROUND

On each of the ten production lines, an oven bakes the product to certain product specifications. The estimated rate of energy leaving the facility through the 53 exhaust stacks is 180.5 therms per hour. Capturing this thermal energy could provide opportunities to reduce natural gas usage in other areas of the plant such as heating water and intake air and help achieve a closer air balance in the plant.

INCENTIVES TO CHANGE

Shearer's Foods Inc. strives to reduce the environmental impact of both its processes and facilities. This emphasis on sustainability will have positive economic and environmental implications for the West Burlington facility. Decreased dependency on natural gas will help the plant to significantly reduce its emissions and greenhouse gases, while also reducing utility costs.

RESULTS

Air to Water Economizers: The addition of four air to water economizers would have noteworthy economic and environmental impacts for the West Burlington Shearer's Foods Inc. These air to water systems could heat water using the thermal energy currently leaving the facility via exhaust stacks. Four new economizers could supply the energy required by the boilers and water heaters, reducing natural gas use by 127,860 therms and cutting natural gas costs by \$120,188 annually.

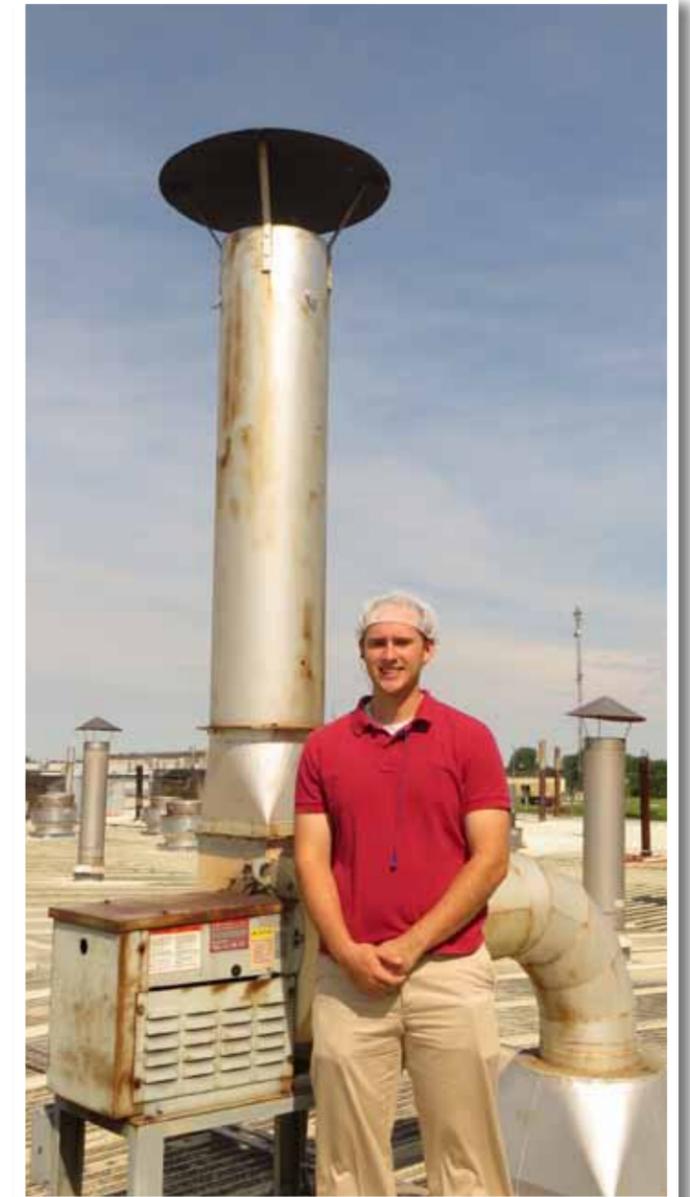
Air to Air Heat Exchangers - Roof top Heaters: Current operations at the West Burlington facility involve roof top heaters to heat air entering the building, which consume approximately 2.1 percent of the plant's annual natural gas use. With the installation of seven air to air heat exchangers, the facility could use 58,820 therms recovered from flues to warm incoming air. The installation of the air to air heat exchangers could save the company \$55,290 annually.

Air to Air Heat Exchangers - Oven Heat: After implementation of the first two recommendations, heat captured from the exhaust stacks could supply an additional 790,188 therms to be utilized via air to air recovery units to heat intake air for the production ovens. The total therms required annually to heat production ovens is 2,643,045. Incorporating an air to air heat exchanger could save approximately \$742,776 per year in utility costs.



Intake Air Vents

Exterior mounted intake air vents were moved into the building some time ago to alleviate maintenance issues caused by exposure to the environment. The indoor intake vents are now creating a negative air pressure. Negative air pressure can increase the heating and cooling load as air is drawn from outside the building. Moving the intake air vents back outside to an area protected from the elements could achieve a closer air balance in the plant and reduced costs.



CONVENTIONAL AIR POLLUTANTS AND GREENHOUSE GASES DIVERTED IN METRIC TONS

From Recommendations in Recommended Status

TOTAL FOR ALL SECTORS								
CO ₂	SO ₂	CH ₄	N ₂ O	CFC	NO _x	VOC	PM ₁₀	MTCO ₂ e
767.66	2.11	1,267.19	4.59	10.10	2.30	4.87	0.18	2,047.71

PROJECT	ANNUAL COST SAVINGS	ENVIRONMENTAL RESULTS	STATUS
AIR TO WATER ECONOMIZERS	\$120,188	127,860 THERMS	RECOMMENDED
AIR TO AIR HEAT EXCHANGERS (ROOF TOP HEATERS)	\$55,290	58,820 THERMS	RECOMMENDED
AIR TO AIR HEAT EXCHANGERS (OVEN HEAT)	\$742,776	790,188 THERMS	RECOMMENDED
INTAKE AIR VENTS	NOT QUANTIFIED	NOT QUANTIFIED	RECOMMENDED



SIVYER STEEL CORPORATION



MEGAN MELBYE
ENVIRONMENTAL ENGINEERING
UNIVERSITY OF WISCONSIN - PLATTEVILLE

COMPANY PROFILE

Sivyer Steel Corporation was established in 1909 as one of the first large steel foundries in the United States. The company develops custom steel castings and components for military, mining, energy, construction, railroad, perimeter security, and wear part use. Safety and quality are Sivyer Steel's priorities, with a mission to continually improve products and services to meet the customer's needs. Sivyer Steel operates its Bettendorf, Iowa, plant 24 hours a day, 5 days per week, utilizing 300 employees.



INCENTIVES TO CHANGE

Sivyer Steel has a strong commitment to reducing its carbon footprint, promising to be a safe and environmentally friendly facility for both its employees and for the community. As part of these commitments, a waste management assessment identified areas for improvement. With the goal of a 50 percent decrease in annual waste disposal expenses, a comprehensive waste management plan would include source reduction and reuse strategies. Such a plan would reduce waste disposal costs and environmental impacts by diverting waste from the landfill, along with providing a new revenue stream from the sale of reusable refuse.

RESULTS

Wood Recycling: Wood waste at Sivyer Steel's facility is primarily wooden pallets. Although wood waste at the plant is currently recycled, an audit revealed mixed waste streams. To boost the success of wood recycling, employee training sessions were conducted in tandem with the installation of signage in both English and Spanish to reinforce the policy. A successful wood-recycling program will divert 73 tons of wood from the landfill each year.

Single-Stream Recycling: Although a single-stream recycling program is in place at Sivyer Steel, an audit revealed large volumes of recyclable materials sent to the landfill. Employee training sessions on single-stream recycling were conducted, supported by recycling reference sheets to highlight acceptable materials and recycling bin locations. In order to make the policy convenient for employees, additional recycling bins were installed, and all bins were given a fixed location.

PROJECT BACKGROUND

Metal casting is a complex process that includes several stages. Significant waste is generated throughout the process, including sand, slag, baghouse dust, wood, cardboard, shrink wrap, super sacks, dried paint, and oily water. As a corporate steward, Sivyer Steel Corporation has committed to the long-term goal of adopting Zero-Landfill initiatives. Through the development of waste reduction and recycling strategies, the company will significantly decrease annual spending.

Cardboard, Shrink Wrap, and Super Sack Recycling:

Sivyer Steel uses silica, olivine, and chromite sands in their molding process, along with insulating and exothermic sleeves. These materials arrive at the plant with much packaging, including super sacks, shrink-wrap, and cardboard. With the aid of bailers, these materials could be recycled, diverting more than 200 tons of waste from the landfill. Furthermore, this stream, once considered waste, has the potential to be transformed into a revenue stream.

Nylon Banding: Steel bands wrap much of Sivyer Steel's incoming and outgoing materials. To ensure a safe work environment, steel banding should be phased out of use at the facility. Nylon banding could be used in place of steel, reducing safety hazards. Following the transition away from steel banding, a nylon banding recycling program, assisted by a banding chopper, could create profits from a previous waste stream.

Utilization of WTE System: A neighboring facility utilizes a waste-to-energy system in which the solid waste from surrounding industries is incinerated for heat energy. Sivyer Steel's long-term goal of adopting Zero-Landfill initiatives means even unrecyclable items must find a home. Contributing to the WTE system at the neighboring facility could be a more sustainable waste disposal method for personal protective equipment such as dust masks, gloves, and welding jackets.



CONVENTIONAL AIR POLLUTANTS AND GREENHOUSE GASES DIVERTED IN METRIC TONS

From Implemented and In Progress recommendations

TOTAL FOR ALL SECTORS								
CO ₂	SO ₂	CH ₄	N ₂ O	CFC	NO _x	VOC	PM ₁₀	MTCO ₂ e
								461.00

PROJECT	ANNUAL COST SAVINGS	ENVIRONMENTAL RESULTS	STATUS
WOOD RECYCLING	\$12,854	73 TONS	IMPLEMENTED
SINGLE-STREAM RECYCLING	\$747	7 TONS	IMPLEMENTED
CARDBOARD RECYCLING	\$16,130	72 TONS	IN PROGRESS
SHRINK WRAP RECYCLING	\$1,624	6 TONS	IN PROGRESS
SUPER SACK RECYCLING	\$3,487	13 TONS	IN PROGRESS
NYLON BANDING	\$2,684	7 TONS	IN PROGRESS
UTILIZATION OF WTE SYSTEM	\$3,830	29 TONS	RECOMMENDED



TYSON FOODS, INC.



STEVEN ZIMMERMAN
MECHANICAL ENGINEERING
IOWA STATE UNIVERSITY

COMPANY PROFILE

Tyson Foods, Inc. is one of the world's largest producers of meat and poultry goods. The company employs 115,000 people in more than 400 facilities worldwide. At the Council Bluffs plant, Tyson Fresh Meats employs 875 people. Tyson Fresh Meats turns raw beef and pork into packaged products that are ready for consumers. The Council Bluffs facility manufactures numerous products, including ground pork, beef steaks, and beef roasts.

PROJECT BACKGROUND

Over the next 10 years, Tyson Foods, Inc. plans to reduce energy usage by 10-20 percent at all of its plants. In order to achieve the corporate goals at the Tyson Fresh Meats-Council Bluffs facility, an audit was completed to establish a baseline. The compressed air system was evaluated, including an analysis of end-use efficiency, air storage capacity, and leak detection. An audit of the water pump system was also conducted to identify inefficiencies.

INCENTIVES TO CHANGE

Tyson Foods, Inc. has committed to reducing its environmental impact by reducing energy usage and water consumption. An optimized compressed air and water pump system would allow Tyson Fresh Meats-Council Bluffs to reduce its carbon footprint and save on operating costs. Furthermore, small tweaks to infrastructure and maintenance provide the opportunity for sustainable change.



RESULTS

Air Leaks: Air leaks decrease the amount of air available to machinery and put unnecessary load on air compressors. To ensure Tyson Fresh Meats-Council Bluffs operates at optimal efficiency, an ultrasonic leak detector was used to conduct a leak detection survey of the facility. The results of the survey concluded that leaks throughout the plant contribute to approximately 680 cubic feet of air lost per minute.

Repairing air leaks is an easy way to save on electrical energy usage and will result in significant cost savings for the company. By fixing the leaks, roughly 42 percent of the electrical energy used by the compressors could be saved. Additionally, improvements to maintenance programs will lessen the potential for leaks in the future.

Sealer Machines: Sealing machines have valves that allow air to flow through the machine when not in use. Tyson Fresh Meats-Council Bluffs shuts down operations at night to conduct a sanitation process. Many of the pneumatic sealing machines are left on idle overnight, which means that although they are not running, air is still being supplied.

By turning off the air supply to the sealing machines at night, airflow loss can be eliminated, saving 17 percent of the total electricity used by the compressors. This represents more than \$10,000 in annual energy cost savings.

Air Nozzles: During the factory's sanitation process, air is used to dry equipment after cleaning. The nozzles currently in use require high volumes of air, placing undue strain on the air compressors. Utilizing high-efficiency nozzles with airflow control features could save the company an estimated \$11,858 per year in utility costs. This update would represent approximately 18 percent less electric energy required by the compressors annually.

Daytime High-Pressure Pump: The plant's current system utilizes two pumps to transport high-pressured hot water throughout the plant. The full capacity of the pumps is not required for daytime production, but is vital to the nighttime sanitation process due to the large amount of water required. The addition of two smaller pumps for use during daytime production would eliminate the need to use the higher-powered system, yielding an annual savings of more than \$11,000 per year.



CONVENTIONAL AIR POLLUTANTS AND GREENHOUSE GASES DIVERTED IN METRIC TONS

From Implemented and In Progress recommendations

TOTAL FOR ALL SECTORS									
CO ₂	SO ₂	CH ₄	N ₂ O	CFC	NO _x	VOC	PM ₁₀	MTCO _{2e}	
111.82	0.60	4.20	0.06	1.37	0.29	0.01	0.01	117.41	

CONVENTIONAL AIR POLLUTANTS AND GREENHOUSE GASES DIVERTED IN METRIC TONS

From Recommendations in Recommended Status

TOTAL FOR ALL SECTORS									
CO ₂	SO ₂	CH ₄	N ₂ O	CFC	NO _x	VOC	PM ₁₀	MTCO _{2e}	
495.12	2.68	18.60	0.25	6.08	1.27	0.04	0.07	519.86	

PROJECT	ANNUAL COST SAVINGS	ENVIRONMENTAL RESULTS	STATUS
AIR LEAKS	\$26,719	607,250 KWH	RECOMMENDED
SEALER MACHINES	\$10,886	247,407 KWH	RECOMMENDED
AIR NOZZLES	\$11,858	269,502 KWH	RECOMMENDED
DAYTIME HIGH-PRESSURE PUMP	\$11,171	253,886 KWH	IN PROGRESS



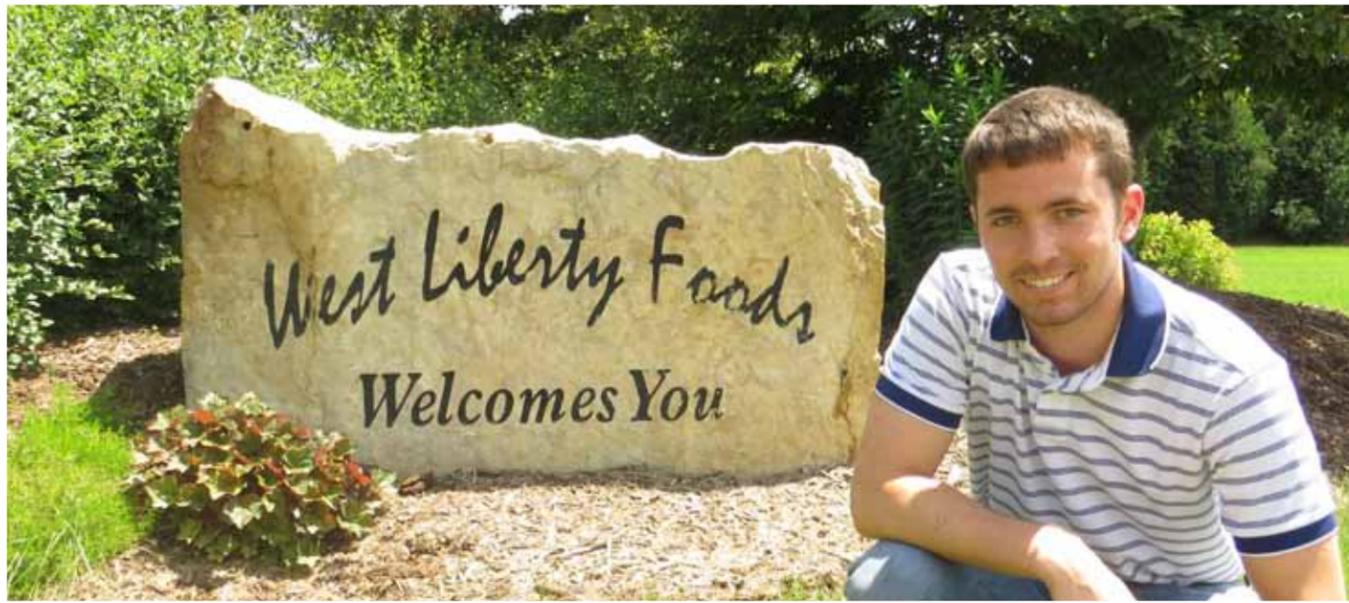
WEST LIBERTY FOODS, LLC



CRAIG SADLER
MECHANICAL ENGINEERING
THE UNIVERSITY OF IOWA

COMPANY PROFILE

West Liberty Foods was founded in 1997 by the Iowa Turkey Growers Cooperative. The West Liberty, Iowa, plant is one of four and also houses a research and development center and a state-of-the-art quality assurance lab. Along with processing turkeys, West Liberty Foods produces all types of cooked and ready-to-eat meat products. The West Liberty facility employs 850 people, and can process over 20,000 large turkeys per day.



PROJECT BACKGROUND

To increase sustainability, the West Liberty plant is focusing on reducing energy use. Last year, 31 million kWh of electricity was used to power the facility. An intern was placed at the company to conduct a motor efficiency analysis and recommend strategies to improve the operating efficiency and reduce utility costs at the West Liberty plant.

INCENTIVES TO CHANGE

West Liberty Foods is committed to preserving natural resources. West Liberty Foods' existing facilities are all third-party certified as landfill-free facilities. West Liberty Foods is also ISO 14001 certified which means the company is engaged in continuous-improvement strategies towards environmental excellence. Reducing electricity usage offers opportunities for West Liberty Foods to make strides toward their environmental goals while also lowering costs.

RESULTS

Motor Replacement: After compiling an analysis of the efficiency of all the motors in the plant, a focus was put on recommendations to optimize the efficiency of the motors with the highest usage and largest potential for savings. The capital expense often leads companies to place a lower priority on motor replacement and upgrades. Upgrading motors with NEMA-rated premium-efficiency motors can significantly reduce a company's energy usage and cut operating costs.

The analysis determined that the 17 largest motors at the plant, located in the engine room, had the potential for the quickest return on investment. Ranging from 75 to 800 horsepower, these motors operate compressors for either refrigeration or air compression. A list of motors targeted for replacement has been outlined and could provide an estimated annual cost savings of \$109,734.

Synchronous Belt Drives: The strategic replacement of motor drive systems provides another opportunity for improving operating efficiency. Many of the motors at the plant operate on a V-belt drive system that is based on tension. Belts that are too tight or too loose can cause the motor to run less efficiently. Synchronous belt drives are designed to resist slipping and are not affected by minor changes in tension, so they maintain their efficiency throughout the life of the belt. Converting the V-belt drive system to a synchronous-belt drive system can provide a cost-effective option for increasing efficiency of existing motors.

Two production machines in the plant are each run by two 75-horsepower motors with standard V-belt drives. Upgrading these four motors to a synchronous-belt system could save more than \$4,600 per year in energy costs.

Two large blenders, 8k and 10k, are used daily to blend the spices and meat together. The 8k has two 30-horsepower motors while the 10k has two 40-horsepower motors that keep them each running. Synchronous-belt drives are recommended for these four motors to increase the efficiency and reduce energy costs.



CONVENTIONAL AIR POLLUTANTS AND GREENHOUSE GASES DIVERTED IN METRIC TONS

From Recommendations in Recommended Status

TOTAL FOR ALL SECTORS									
CO ₂	SO ₂	CH ₄	N ₂ O	CFC	NO _x	VOC	PM ₁₀	MTCO _{2e}	
1174.60	6.33	44.03	0.59	14.40	3.01	0.09	0.16	1232.81	

PROJECT	ANNUAL COST SAVINGS	ENVIRONMENTAL RESULTS	STATUS
MOTOR REPLACEMENT	\$109,734	3,919,070 KWH	RECOMMENDED
SYNCHRONOUS BELT DRIVES	\$7,375	234,177 KWH	RECOMMENDED



WINNEBAGO INDUSTRIES



ALEX GEORGE
CHEMICAL ENGINEERING
IOWA STATE UNIVERSITY

COMPANY PROFILE

Winnebago Industries is one of the country's leading manufacturers of recreational vehicles (RVs). The company, headquartered in Forest City, Iowa, employs 2,680 people. Manufacturing takes place in three Iowa facilities (Forest City, Charles City, and Lake Mills), and in Middlebury, Indiana. The two million square-foot headquarter campus in Forest City includes 17 facilities. The majority of all RV components, such as holding tanks, bumpers, furniture and cabinets, are made from scratch on site.

PROJECT BACKGROUND

As a corporation, Winnebago Industries has committed to reducing its carbon footprint. Across its manufacturing facilities, 73 percent of all solid waste produced is recycled. This commitment to landfill diversion of solid waste led to further research into solid waste reduction strategies. Industry best practices related to waste sorting were compared to determine the best fits for the Forest City manufacturing lines.



INCENTIVES TO CHANGE

The target market for RVs is a consumer interested in enjoying the great outdoors. In alignment with the values of the population it serves, Winnebago's goal is to reduce and minimize its ecological impact, conserving the environment for generations to come.

As the industry moves toward a goal of "zero-landfill", Winnebago Industries pushes to be a leader in waste and landfill reduction at its plants. Reducing the amount of waste going to the landfill provides not only a positive environmental impact, but also a positive economic impact to the company's bottom line.

RESULTS

Waste Sorting on the Manufacturing Line: One third of the waste generated by Winnebago Industries comes from the primary motorhome manufacturing facility. A waste sort audit of the facility was conducted to identify opportunities for recycling. Following an audit of the plant, results indicated that 40 percent of the discarded material from the manufacturing line could be recycled.

Segregated waste containers allow recyclable materials like plastic, paper, and carpet to be diverted from the landfill stream and recycled appropriately. By separating the waste directly on the line, Winnebago can save \$67,000 annually, and divert 741 tons of waste from the landfill each year.

Acrylic Recycling: A by-product of sink, shower and tub production, scrap acrylic is included in Winnebago Industries' current recycling strategies. However, acrylic with chrome, weave or wood appearance was not included in the recycling plan. By expanding the existing acrylic recycling program to include these three additional types, \$6,554 could be recouped annually by selling the acrylic, and 18.25 tons of material would be diverted from the landfill.

Wood Recycling: Winnebago generates approximately 1,300 tons of scrap wood annually, including pallets, crates and plywood. With the installation of a grinder and biomass heating system, this wood waste could be used to provide heat to campus buildings, reducing the amount of natural gas required. The combined savings from reduced wood disposal and natural gas costs would be more than \$95,000 annually.

Awning Tubes: Most motorhomes produced by Winnebago include an awning for shade from the bright summer sun. The majority of awnings arrive at the facility in plastic tubes, which are sent back to the supplier for re-use. Special-order awnings must be shipped in heavy cardboard tubes that may not be reused by the supplier. Because the tubes are too large to discard with the traditional cardboard recycling, they are currently disposed of at the landfill. A chop saw would provide an effective means of resizing the awning tubes to fit into the cardboard baler. Recycling the 70,000 pounds of previously discarded cardboard tubes would have an annual impact of \$3,174 in savings.

Battery Recycling: An opportunity for improvement exists within Winnebago's battery recycling process. Currently, two different companies handle battery recycling for the corporation, and old or used batteries are not picked up with regularity. By selecting a different battery recycling company with a consistent collection schedule, Winnebago can save floor space in the recycling facility, and receive regular reimbursement for the recycled batteries.

CONVENTIONAL AIR POLLUTANTS AND GREENHOUSE GASES DIVERTED IN METRIC TONS

From Implemented and In Progress recommendations

TOTAL FOR ALL SECTORS								
CO ₂	SO ₂	CH ₄	N ₂ O	CFC	NO _x	VOC	PM ₁₀	MTCO ₂ e
								1,812.00

CONVENTIONAL AIR POLLUTANTS AND GREENHOUSE GASES DIVERTED IN METRIC TONS

From Recommendations in Recommended Status

TOTAL FOR ALL SECTORS								
CO ₂	SO ₂	CH ₄	N ₂ O	CFC	NO _x	VOC	PM ₁₀	MTCO ₂ e
27.00	0.07	44.57	0.16	0.36	0.08	0.17	0.01	72.02

PROJECT	ANNUAL COST SAVINGS	ENVIRONMENTAL RESULTS	STATUS
WASTE SORTING ON THE MANUFACTURING LINE	\$67,063	741 TONS	IN PROGRESS
ACRYLIC RECYCLING	\$6,554	18.25 TONS	IMPLEMENTED
WOOD RECYCLING	\$95,468	1,344 TONS 67,916 THERMS	RECOMMENDED
AWNING TUBES	\$3,174	35 TONS	IN PROGRESS
BATTERY RECYCLING	\$6,400	—	IMPLEMENTED





CHARLES CITY



ERIC IVERSEN
MECHANICAL ENGINEERING
THE UNIVERSITY OF IOWA

COMPANY PROFILE

Zoetis is a global animal health company that delivers quality medicines and vaccines, complemented by diagnostic product and genetics tests and supported by a range of services. The company sells its vaccines for a variety of animals, including poultry, cattle, swine, dogs, and cats. Production at its Charles City, Iowa, plant began in 1946. There are more than 400 employees at the plant, staffing the 24-hour operation of the facility five days a week.

PROJECT BACKGROUND

Compressed air is an important component of production at Zoetis in Charles City. Increasingly high production demands require that compressed air be available at all times and with reliability. To ensure the company operates at the highest efficiency possible, and to reduce energy usage, a comprehensive analysis of this key operational system was conducted. Through the analysis, potential air leaks were identified as the greatest opportunity to increase efficiencies and reduce waste.



INCENTIVES TO CHANGE

In a competitive animal health market, Zoetis strives to deliver a high quality product while reducing operating costs and environmental impact. A major focus of assessment is the compressor system, which makes up a major portion of electrical costs and includes multiple air compressors throughout the facility. The largest air compressor system has components that are past their mean lifespan. Minimizing air leaks and optimizing the system performance will provide a more accurate measure of the actual demand and allow replacements to be sized properly. These factors could validate the purchase of smaller, more efficient compressors. Changes to the air compressor system would result in a significant economic impact and improved environmental performance for Zoetis.

RESULTS

Compressed Air Leaks: Elimination of potential air leaks in the compressed air system could significantly reduce energy usage. Repairing air leaks in the system would reduce artificial load to the compressor, which can impact lifespan and efficiency. Nearly 40 percent of the annual cost to operate the compressor system could be saved with this change, for a financial impact of \$20,000.

Leak Management Plan: A more robust plan to regularly monitor and repair air leaks would provide significant cost savings for Zoetis. Employing a structured leak detection path throughout the facility reduces the time required for assessment, thus reducing labor costs. Additionally, the aid of an energy savings calculator shows the immediate potential impact of leak repair, and can help prioritize which leaks to fix first.

Reducing System Pressure: The correct pressure for the compressed air system helps save on electricity and increases the compressor lifespan. After a comprehensive review of the compressed air pressure, one of the systems was identified as a candidate for reduced pressure. By reducing the pressure to one unit, as much as ten pounds per square inch of air pressure could be alleviated without disrupting the manufacturing process.

Zero-Loss Condensate Drains: To ensure successful end use of compressed air and to maintain the health of the distribution network, condensate must be removed regularly. Installing zero-loss condensate drains in areas without the most efficient drainage is a low cost way to help reduce compressed air loss while ensuring condensate removal. The drains have no operating cost and can be installed in remote areas due to their small size.

High-Efficiency Fixtures: Costs to operate the compressed air system could be reduced with the installation of high efficiency nozzles and air amplifiers, used for product packaging and drying applications. High-efficiency fixtures combine compressed air and ambient air to produce a high force, high velocity flow without the use of any moving parts. Compressed air use could be reduced by as much as 85 percent in some segments of production with the installation of high-efficiency fixtures.



CONVENTIONAL AIR POLLUTANTS AND GREENHOUSE GASES DIVERTED IN METRIC TONS

From Implemented and In Progress recommendations

TOTAL FOR ALL SECTORS								
CO ₂	SO ₂	CH ₄	N ₂ O	CFC	NO _x	VOC	PM ₁₀	MTCO ₂ e
19.14	0.10	0.70	0.01	0.20	0.00	0.00	0.00	20.09

CONVENTIONAL AIR POLLUTANTS AND GREENHOUSE GASES DIVERTED IN METRIC TONS

From Recommendations in Recommended Status

TOTAL FOR ALL SECTORS								
CO ₂	SO ₂	CH ₄	N ₂ O	CFC	NO _x	VOC	PM ₁₀	MTCO ₂ e
280.00	1.51	10.50	0.14	3.43	0.72	0.02	0.04	293.87

PROJECT	ANNUAL COST SAVINGS	ENVIRONMENTAL RESULTS	STATUS
COMPRESSED AIR LEAKS	\$20,805	466,477 KWH	RECOMMENDED
LEAK MANAGEMENT PLAN	\$6,954	155,492 KWH	RECOMMENDED
REDUCING SYSTEM PRESSURE	\$157	3,374 KWH	RECOMMENDED
ZERO-LOSS CONDENSATE DRAINS	\$243	5,214 KWH	IN PROGRESS
HIGH-EFFICIENCY FIXTURES	\$1,665	37,339 KWH	IN PROGRESS



2014 24-WEEK INTERNSHIP CASE SUMMARIES

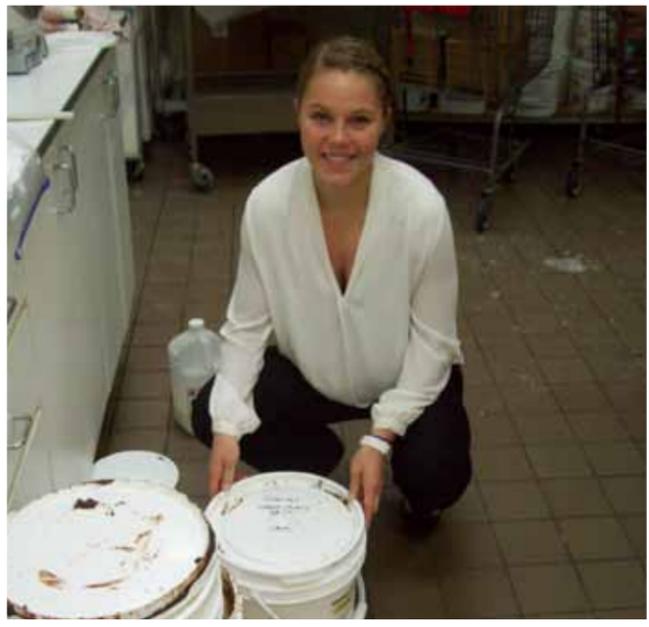


To better assist our clients, Pollution Prevention Services now offers 24-week internships. This additional time allows interns to explore more in-depth opportunities, such as setting up prototypes for testing alternative technologies, evaluating outcomes of trial runs and spearheading implementation of feasible strategies within the timeframe of the internship.

A 24-week internship can provide benefits to both companies and students. Companies have an opportunity to pursue projects that would otherwise be too time-consuming. Students get first-hand experience in learning about a complex system, and identifying and overcoming

challenges they would not encounter in a classroom or less extensive internship. While a 24-week internship is not a feasible time-frame for all projects or interns; it has proven to be a viable option for addressing larger projects.

Two 24-week projects are underway in 2014 and scheduled to finish in November. The following pages provide an overview of these projects and the work completed in the first 12 weeks. The final case summaries for these projects will be posted on the Pollution Prevention Intern Program website at www.iowap2interns.com in January and printed in the 2015 Case Summary Booklet.



HY-VEE, INC.



HAYLEY GIGOUS
SUSTAINABLE AND RENEWABLE ENERGY SYSTEMS
UNIVERSITY OF WISCONSIN - PLATTEVILLE



COMPANY PROFILE

Hy-Vee, Inc. is a national grocery store chain with over 240 retail locations in eight states. Founded in the 1930's, the company has grown to become one of the top 25 supermarket chains in the U.S. with more than \$8 billion in annual sales. Along with numerous Hy-Vee grocery stores, Iowa is home to two distribution centers, located in Chariton and Cherokee, and a corporate office in West Des Moines. Over 69,000 employees across the Midwest work to deliver the company's mission: "making lives easier, happier, and healthier."



INCENTIVES TO CHANGE

Recent shifts in consumer trends have caused shoppers to seek sustainable companies, which in turn motivates supermarkets to meet that demand. Hy-Vee, Inc. is already well on the path to sustainability, with a brand emphasis on healthy and sustainable living: each store has a registered dietitian, a health market, and sells sustainably harvested seafood. Hy-Vee has also made a broad commitment to sustainability through efforts in such areas as green building, energy and resource conservation, waste reduction, and sourcing and procurement. Opportunities for continued improvements exist for the corporation to increase landfill diversion and recycling efforts. These changes hold the potential for an additional revenue stream if recyclable materials are sold.

RESULTS

The intern first conducted a number of waste audits at various Hy-Vee, Inc. store locations to develop a profile of the materials being generated. The information gathered from these audits reinforced the potential impacts of the project, identifying significant opportunity for developing a program to divert and capture not only rigid plastics but also other recyclables. Further study was done to evaluate the benefits and challenges of processing recyclable materials at the store level versus consolidating the material at the distribution centers.

PROJECT BACKGROUND

The goal of this 24-week project is to increase recycling efforts at Hy-Vee, Inc.'s retail stores and to identify potential markets for the recyclable materials. Waste volumes were measured, waste disposal costs were tabulated, and recyclable materials within the waste stream were identified. Further research will be conducted into the logistics of transporting recovered materials, along with potential markets for the recycled items. Once recommendations are formulated, employee training sessions will help guide the implementation process.



Rigid Plastics Recycling: Rigid plastics were the original focus of the 24-week project and are found in Hy-Vee Inc. stores in the form of bakery frosting buckets, deli salad tubs, pharmacy stock bottles, and other various plastic containers. The containers are all made of rigid plastics, either in the form of high-density polyethylene, (#2 HDPE), or polypropylene, (#5 PP). The use and disposal of these rigid plastics is at a consistent rate within each store. A toolkit of best management practices was developed that will be provided to all stores, outlining local opportunities for recycling or reuse. However the recycling resources available at individual store locations vary greatly (staff, space, volumes, etc.), which can make it difficult to develop a feasible collection program at the local level.



Consolidated Recycling at Distribution Centers:

Consolidated collection of recyclables at the distribution centers could provide a long-term strategy to maximize collection efficiency, increase marketability of larger volumes of material, and yield higher revenue as a result. Adequate and appropriate space to process and store recyclable materials within the existing distribution centers is not currently available. However, the construction of a dedicated recycling facility at each distribution center would allow the company to process divertible materials common to all stores, such as waxed cardboard, white paper, and rigid plastics.

In the second 12-weeks of the project the intern will investigate solutions to the potential challenges of a consolidated collection center, such as logistics necessary for backhauling recyclable waste streams to the distribution centers. The intern will develop an analysis of the infrastructure and operating costs to implement a consolidated process. Research will be conducted to identify and evaluate markets and potential revenues for the recycled materials.



JOHN DEERE OTTUMWA WORKS



JOSH PLUMMER
MECHANICAL ENGINEERING
UNIVERSITY OF WISCONSIN - PLATTEVILLE

COMPANY PROFILE

Deere & Company began in 1837 as a one-man blacksmith shop. It has since become a Fortune Global 500 company, employing more than 67,000 people globally. In 2012, Deere & Company celebrated its 175th anniversary with record net sales of \$36.2 billion, and record net revenues of \$3.1 billion. The company produces a variety of heavy machinery that is used around the world in agriculture, turf management, construction and forestry. At the company's Ottumwa, Iowa, plant, the focus is on agricultural equipment, including windrowers, mower conditioners, round balers, and square balers.

PROJECT BACKGROUND

As part of the Deere & Company family, the John Deere Ottumwa Works facility implements sustainable environmental practices, including energy reduction projects. The two paint systems consume a large amount of natural gas and approximately 20 percent of the plant's total electricity. The focus of the 24-week intern project is to pinpoint utility use and develop recommendations for resource reduction on the paint lines and throughout the plant.

INCENTIVES TO CHANGE

In 2013, Deere & Company announced four eco-efficiency goals to reduce its environmental footprint. Energy consumption is one of these goals: By 2018, the company plans to reduce energy consumption by 15 percent. The John Deere Ottumwa Works location supports the corporate eco-efficiency goals, and thus looks to trim energy use at the plant. Two inefficiencies identified are personal fans and paint system motors, which both provide an opportunity for reduced energy consumption.

RESULTS

Hot Water Tank: Hot water is required in the manufacturing process at John Deere Ottumwa Works for pretreatment in the paint system. Insulating the water storage tank could ensure a steady water temperature and reduce the amount of energy used. Furthermore, temperature sensors installed on the tank's exhaust stack could regulate the burners that heat the water, resulting in a steady water temperature with less energy required.



Personal Fans: Fans at individual workstations are used throughout the John Deere Ottumwa Works facility to ensure employee comfort. Although not a major energy consumer individually, hundreds of fans throughout the facility require a significant amount of electricity. Installing ceiling- and column-mounted fans to replace the personal fans would reduce energy use while providing the same level of comfort for employees. Additionally, winter heating costs are anticipated to decrease, because ceiling-mounted fans operating year-round would provide a more comfortable air temperature.

Motor Drive Belts: The paint system at the Ottumwa facility utilizes 45 high-horsepower electric motors, all of which are high-efficiency models with variable frequency drives (VFD). However, the drive system used to operate the electric motors is a V-belt system. V-belt systems initially perform at 95 percent efficiency, but that efficiency is reduced over time. Synchronous-belt drives maintain a consistent efficiency throughout the life of the drive. Replacement of the drive systems with synchronous-belt drives, combined with the existing VFDs would optimize the operating efficiency of the motors, reduce wear on the belts, and create significant energy savings.

Paint Line Adjustments: The settings of John Deere Ottumwa Works' two paint systems and related equipment could be adjusted and monitored to optimize efficiency and reduce energy usage. In the next 12 weeks, the intern will be evaluating various settings and automated controls to pinpoint areas of opportunity. For example, the speed of motors may be automatically reduced during breaks or system shutdowns. A thorough analysis will be conducted to identify all viable opportunities to increase efficiencies and reduce energy consumption with paint line equipment settings.





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POLLUTION PREVENTION INTERN PROGRAM

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- Johnson Controls, Inc.
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WATER USE REDUCTION

- Bridgestone Americas Tire Operations
- Nutra-Flo Company
- Procter and Gamble



» Join the **P2 INTERN PROGRAM** in 2015!



STUDENT APPLICATION & BUSINESS REQUEST FORMS are available online at:

www.iowap2interns.com

Forms may be submitted electronically, faxed or mailed.

FOR COMPANIES

Pollution Prevention Services is currently accepting requests for 2015 intern projects. Companies must submit a project request that identifies a focus project and outlines the desired objectives and deliverables. Requests must be submitted by December 1, 2014 to be considered for 2015 intern placement.

Requests will be reviewed upon receipt and companies contacted within two weeks for additional project development. Final determination of acceptance will be made within 30 days after project development is completed. Intern assignments for finalized projects will begin in **OCTOBER OF 2014.**

Please note: Students are not trained in or qualified to assess regulatory compliance issues.

FOR STUDENTS

Graduate and junior or senior-level undergraduate students enrolled in engineering, environmental science or physical science disciplines are encouraged to submit the following documents for consideration:

- Application Form
- Résumé
- Cover Letter
- Unofficial copy of transcripts
- List of Fall 2014 and Spring of 2015 classes

Selection of 2015 interns will begin in October and continue into the spring until project assignments are finalized.

Pollution Prevention internship sessions offered in 2015 are:

- 12-weeks (May 19-August 8)
- 24-weeks (May 19-November 7)

Selected applicants will be matched to a project based on academic performance, relative experience and technical skills.

SUBMIT PROJECT REQUESTS & APPLICATIONS TO:

DANIELLE DILKS, P2 Intern Program Coordinator
Iowa Dept. of Natural Resources
502 East Ninth Street
Des Moines, IA 50319-0034

2014 Phone: (515) 281.5353 | Note our number is
2015 Phone: (515) 725.8363 | changing next year.

Danielle.Dilks@dnr.iowa.gov



GEAR UP & GO GREEN

with the

POLLUTION PREVENTION INTERN PROGRAM

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