WORKING TOGETHER TO ACHIEVE ECONOMIC AND ENVIRONMENTAL RESULTS

2015 CASE SUMMARIES

POLLUTION PREVENTION INTERN PROGRAM

15 YEARS

GEAR UP& GO GREEN with the POLLUTION PREVENTION INTERN PROGRAM

INTERNSHIPS

MECHANICAL

CHEMICAL

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2015 P2 Interns

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2015 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, institutions and government agencies.

The intern program places upper-level engineering 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:

"You really get to explore and find solutions on your own. You have a team of engineers and advisors helping along the way, but it is really up to you to go out there and do research, take data, explore options and recommend projects. It was rewarding knowing that everything I had worked hard on has been honestly considered. I feel like I really had an impact on the company. "

— Micah Rambo

"By participating in the Pollution Prevention Program, I received hands-on experience managing my own projects, and was able to see the positive impact that they had on both my host company and the environment."

— Dylan Friss

"This internship requires independent motivation and initiative. The intern is responsible for creating his or her own schedule, project ideas, research, and economic justification. The P2 program gives their interns a lot more responsibility than other intern programs. Speaking from my own experience, taking on these responsibilities has helped me to build confidence in my own abilities."

— Chelsea Lindelof

» Join the P2 INTERN PROGRAM in 2016!

FOR COMPANIES

Pollution Prevention Services is currently accepting requests for 2016 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, 2015 to be considered for 2016 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 2015.

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

FOR STUDENTS

Graduate and junior- or senior-level undergraduate engineering students are encouraged to submit the following documents for consideration:

- Application Form
- Résumé
- Cover Letter
- Unofficial copy of transcripts
- List of Fall 2015 and Spring of 2016 classes

Selection of 2016 interns will begin in October and continue into the spring until project assignments are finalized.

Pollution Prevention Services is offering internships for:

- 12-weeks (May 23-August 12, 2016)
- 24-weeks (May 23-November 11, 2016)

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
Phone: (515) 725-8363
Danielle.Dilks@dnr.iowa.gov

STUDENT APPLICATION & BUSINESS REQUEST FORMS ARE AVAILABLE ONLINE AT:

www.iowap2interns.com

Forms may be submitted electronically, faxed or mailed.

DIRECTOR'S NOTE

We are very proud of the accomplishments of the Department's Pollution Prevention Intern Program on its 15th Anniversary Year. The program has earned many state and national accolades, and is recognized as one of the premier P2 intern programs in the nation. The program continues to garner recognition from the Iowa businesses and students it serves, and serves as a model for other state's P2 intern programs. These accolades would not be possible without the collaborative efforts of US EPA, USDA, and Iowa businesses and students. The efforts of our collaborators generate opportunities to provide assistance, provide additional funding, and leverage the innovative ideas and perspectives of upper-level university students.

Each year new partnerships are added and existing partnerships are strengthened, bringing together colleges and universities, businesses and institutions, and government. Interns gain valuable hands-on job experience, and companies demonstrate that environmental projects can result in economic benefits.

Since 2001, more than 175 dedicated Iowa companies have saved more than $78.1 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, they create opportunities for employment, and most importantly, they reduce impacts to our environment.

Interns in this program are provided the opportunity to demonstrate their problem solving skills and professional abilities at their host companies. In turn, the projects help the interns establish and build professional networks through host company staff and contacts with vendors and suppliers. Historically, approximately 25 percent report they receive future employment opportunities as a result of their participation in the Pollution Prevention Intern Program.

This year we celebrate the 25th anniversary of the Pollution Prevention Act of 1990, which was established to help prevent or reduce pollution at the source whenever feasible. This act paved the way for this program and its many successes. 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 2016 Pollution Prevention Intern Program.

CHUCK GIPP

Chuck Gipp

ACTUAL POLLUTION/WASTE REDUCTION AND COST SAVINGS FROM INTERN PROJECTS			
CATEGORY	**REDUCTION**	**UNITS**	**COST SAVINGS**
WATER CONSERVATION	1,472,131,703	GALLONS	$6,252,550
SPECIAL WASTE	75,503	TONS	$908,154
SOLID WASTE	143,595	TONS	$15,314,053
HAZARDOUS WASTE	8,312	TONS	$13,613,597
MERCURY ABATED	42,817	GRAMS	
ENERGY	377,076,920 2,262,295 9,753,313	KWH MMBTU THERMS	$21,245,257 $7,176,792
OTHER			$13,668,259
			TOTAL: $78,178,662

*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_20**	**CFC**	**NO_x**	**VOC**	**PM_{10}**
235,767.92	1,101.63	107,308.53	14,581.62	2,668.83	580.48	1,551.24	162.90

Air emissions and greenhouse gases shown on this page represent implemented projects from 2001-2015.

2015 EXECUTIVE SUMMARY

Eighteen upper-level engineering students teamed with the Department of Natural Resources' 2015 Pollution Prevention Intern Program to help companies meet their environmental objectives.

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. This year, the interns identified opportunities that could save companies more than $4.33 million annually. Of these, projects estimated to save more than $459,000 annually were implemented or are in progress.

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. The interns offer a fresh perspective and innovative solutions while gaining valuable experience.

The program offers both 12-week and 24-week projects each year. Interns at Hy-Vee, Inc. and John Deere Ottumwa Works completed 24-week projects in November of 2014. The final results of these two projects are included in the following pages. Additional time on site allows interns to conduct more in-depth research, collect data over time, and evaluate systems through varying climates and conditions.

This year, six interns will continue to work on 24-week projects until November. A summary of the work being done on each of these projects is included in a special section of this booklet, following the completed 12-week projects. The final results of this year's 24-week projects will be posted to the department's website in January and highlighted in the next published case summary booklet in 2016.

The 2015 case summaries highlighted here show that outstanding results are possible when companies, students and the DNR work together to achieve common environmental goals.

2015 IMPLEMENTED SAVINGS			
CATEGORY	**REDUCTION**	**UNITS**	**COST SAVINGS**
WATER CONSERVATION	2,986,123	GALLONS	$17,596
SOLID WASTE	103	TONS	$67,161
HAZARDOUS WASTE	56	TONS	$35,657
ENERGY	4,682,994 16,820 8,374	KWH **MMBTU THERMS	$328,628 $6,548
OTHER			$3,500
			TOTAL: $459,090

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

CONVENTIONAL AIR POLLUTANTS AND GREENHOUSE GASES DIVERTED IN METRIC TONS										
TOTAL FOR ALL SECTORS										
CO_2	**SO_2**	**CH_4**	**N_20**	**CFC**	**NO_x**	**VOC**	**PM_{10}**	**$PM_{2.5}$**	**NH_3**	**$MTCO_2e$**
3,376.37	13.19	183.88	22.87	20.34	6.54	0.34	0.99	0.72	0.06	4102.42

NOTE:

> Air emissions and greenhouse gases shown in the following case summaries 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/conserve/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

ANDERSON ERICKSON DAIRY

DES MOINES

BRETT FRINK
MECHANICAL ENGINEERING
THE UNIVERSITY OF IOWA

COMPANY PROFILE
Anderson Erickson (AE) Dairy is a privately owned company which supplies milk and dairy products to the Midwestern United States. AE Dairy currently employs more than 400 people and is the largest private dairy in the state. The company's headquarters and production plant have been located in Des Moines since its creation in 1930.

PROJECT BACKGROUND
At Anderson Erickson Dairy, water is used to clean and sanitize food processing equipment and to clean product containers before shipment to consumers. An optimized water use and reuse program could allow AE Dairy to reduce water consumption and utility costs for the production plant. Additionally, expansions to the company's preventative maintenance programs would provide the company additional opportunities to reduce water usage and extend the life of equipment.

INCENTIVES TO CHANGE
AE Dairy is committed to reducing the environmental impacts of its operations by reducing the water used in their production processes. Reducing water demands and reusing water streams in the dairy plant will reduce the company's operating costs while allowing the company to make strides toward its sustainability goals.

RESULTS
Automate Container Rinses: Products packaged in bottles and cartons are transported on conveyors and pass beneath water spray manifolds to rinse any milk residue from the containers. These sprays are operated by manual valves, requiring water to flow from the manifolds continually throughout production runs. Installing sensors to trigger water flow only when containers are present could save $33,400 and 4 million gallons of water annually.

ESTIMATED CONVENTIONAL AIR POLLUTANTS DIVERTED IN METRIC TONS
For Recommendations in Recommended Status

TOTAL FOR ALL SECTORS						
CO_2	NH_3	NO_X	PM_{10}	$PM_{2.5}$	SO_2	VOC
99.93	0.01	0.15	0.04	0.02	0.19	0.16

ESTIMATED GREENHOUSE GASES DIVERTED IN METRIC TONS

TOTAL FOR ALL SECTORS			
$MTCO_2e$	CH_4	N_20	CFC
431.67	33.92	5.56	0.51

Reuse Homogenizer Coolant: All homogenizers at AE Dairy use water as a lubricant for pistons. Three of the homogenizer units also utilize water in single-pass, non-contact component cooling systems. Modifications could be made to the cooling water flow to reduce the water demand of the homogenizers without disrupting performance. Additionally, effluent cooling water from the units could be collected for reuse as boiler feedwater or to rinse container crates. These modifications could save 1.69 million gallons of water and $14,000 annually.

Low Flow Nozzles: Throughout the plant, hoses are used for cleaning and sanitation purposes. While many of these hoses have nozzles installed, there are several hoses that do not. Installing nozzles on all hoses in the plant, and replacing current nozzles with low flow nozzles, will save 1.03 million gallons per year and $8,500 annually.

Leak Repairs and Detection: Leaks account for 1.2 million gallons of water loss every year at AE Dairy. Most leaks occur at faulty valves or as pipe joints become corroded. Quickly documenting leaks as they occur will allow staff to maintain the piping throughout the plant to minimize losses. Two additional preventative maintenance recommendations include reporting leaks via maintenance orders through the maintenance software already in use on site, or conducting a monthly leak audit throughout the plant.

Case Wash Maintenance Program: While observing tunnel washers used to clean the milk crates in the plant, it was observed that float-activated valves allow water to flow while the equipment is shut down. Scheduled maintenance and adjustments to these valves could save 94,000 gallons of water annually and increase the life of the flooring in the case wash room.

PROJECT	ANNUAL COST SAVINGS	ENVIRONMENTAL RESULTS	STATUS
AUTOMATE CONTAINER RINSES	$33,400	4,000,000 GALLONS	RECOMMENDED
REUSE HOMOGENIZER COOLANT	$14,000	1,690,000 GALLONS	RECOMMENDED
LOW FLOW NOZZLES	$8,500	1,030,000 GALLONS	RECOMMENDED
LEAK REPAIR AND DETECTION	$9,500	1,200,000 GALLONS 1680 THERMS	RECOMMENDED
CASE WASH MAINTENANCE PROGRAM	$780	94,000 GALLONS	RECOMMENDED

BRIDGESTONE AMERICAS TIRE OPERATIONS

DES MOINES

MARK KRUTZFIELD
MECHANICAL ENGINEERING
THE UNIVERSITY OF IOWA

COMPANY PROFILE

Bridgestone is one of the world's leading tire producers. Their Des Moines facility produces Bridgestone and Firestone brand agriculture tires. This Bridgestone product is regarded as the highest quality agriculture tire available on the market. The Des Moines facility is the largest agricultural tire plant in the country and operates 24 hours a day, 7 days a week to meet demand.

PROJECT BACKGROUND

To support production needs, Bridgestone's Des Moines plant purchases on average more than 150 million gallons of water per year. Bridgestone is taking measures to optimize and conserve water usage with a corporate goal to reduce water usage by 13 percent, per unit of production. For the Des Moines location, this translates to a goal of achieving additional 7 percent reduction as compared to 2012 values.

INCENTIVES TO CHANGE

Bridgestone Corporation strives to improve their product and production processes in all ways, including continuous efforts to minimize their environmental impacts. Among other environmental improvement initiatives, the company is embarking on a water conservation program at all of their manufacturing facilities. In addition to their dedication to a sustainable manufacturing process, reducing water usage can generate a significant cost savings for Bridgestone.

RESULTS

Reverse Osmosis: A reverse osmosis system implemented to treat the boiler feed-water could allow for the boilers to increase their cycles of concentration from approximately 11 up to more than 50. This could save substantial amounts of water and reduce the amount of fuel the boilers consume to heat water that is ultimately rejected as blowdown.

Condensate Recovery: The plant's contact heaters account for approximately 90 percent of the plant's total steam usage. The contact heaters utilize directly injected steam as the energy supply to the system, which creates the need for significant excess makeup water. By closing off the steam loop and utilizing heat exchangers instead of direct injection, the condensate could be sent back to the boilers. This could dramatically reduce the makeup water required for the boilers and generate significant cost savings.

Cooling Tower Improvements: Improving the efficiency of the facility's cooling towers could provide significant environmental and cost savings. Repairing leaks and improving their overall operating efficiency could save more than 2 million gallons of water and more than $11,000 per year.

PROJECT	ANNUAL COST SAVINGS	ENVIRONMENTAL RESULTS	STATUS
REVERSE OSMOSIS	$57,451	7,712,258 GALLONS 137,924 THERMS	RECOMMENDED
CONDENSATE RECOVERY	$587,641	35,402,877 GALLONS 962,340 THERMS	RECOMMENDED
COOLING TOWER IMPROVEMENTS	$11,475	2,016,000 GALLONS	IN PROGRESS
RAINWATER HARVESTING	$134,788	23,680,000 GALLONS	RECOMMENDED
FIRE LOOP LEAK REPAIR	$12,700	2,231,250 GALLONS	RECOMMENDED

Rainwater Harvesting: The Bridgestone Des Moines plant has approximately two million square feet of rooftop. During a year of average rainfall, approximately 45 million gallons of rainwater falls on the roof and flows off into the creek next to the plant. It is estimated that as much as 31 million gallons of this rainwater could be captured and treated for use as boiler feed-water. Using this collection and reuse method could reduce the plant's water intake from the city by a conservative 15 percent.

Fire Loop Leak Repair: A study performed on the fire loop makeup line revealed that the system was leaking water. Repairing the leaks in the system could save more than 2 million gallons of water per year, at a cost savings to the facility of more than $12,000 annually.

ESTIMATED CONVENTIONAL AIR POLLUTANTS DIVERTED IN METRIC TONS

For Implemented and In Progress Recommendations

TOTAL FOR ALL SECTORS						
CO_2	NH_3	NO_x	PM_{10}	$PM_{2.5}$	SO_2	VOC
20.43	0.00	0.03	0.01	0.00	0.04	0.03

ESTIMATED GREENHOUSE GASES DIVERTED IN METRIC TONS

TOTAL FOR ALL SECTORS			
$MTCO_2e$	CH_2	N_20	CFC
89.73	6.93	1.16	0.10

ESTIMATED CONVENTIONAL AIR POLLUTANTS DIVERTED IN METRIC TONS

For Recommendations in Recommended Status

TOTAL FOR ALL SECTORS						
CO_2	NH_3	NO_x	PM_{10}	$PM_{2.5}$	SO_2	VOC
1,713.53	0.10	2.73	0.52	0.25	3.09	2.18

ESTIMATED GREENHOUSE GASES DIVERTED IN METRIC TONS

TOTAL FOR ALL SECTORS			
$MTCO_2e$	CH_4	N_20	CFC
3,940.92	590.97	42.28	8.42

BURKE CORPORATION

CHELSEA LINDELOF
MECHANICAL ENGINEERING
IOWA STATE UNIVERSITY

NEVADA

COMPANY PROFILE
In 1957, Burke Corporation started processing meat toppings for the pizza industry. Today, Burke still specializes in producing beef and pork pizza toppings and also produces taco meats, chicken strips, barbequed beef, meat balls, and many other customized meat products. As Burke Corporation continues to expand, the company maintains their long standing quality and customer centered approach through ensuring fully cooked meats are processed and delivered to the customer in a timely manner.

PROJECT BACKGROUND
Producers in the food industry use large amounts of water in their production of products. Historically, Burke has taken many measures to optimize and conserve water use, and was recognized for their efforts in 2010 and 2011 by their parent company, Hormel Food Corporation. They also received the Governor's Iowa Environmental Excellence award for their water efforts in 2013. This year, Burke Corporation teamed with the Pollution Prevention Intern Program to develop strategies to further reduce water consumption at the plant and assist with meeting corporate reduction goals for water and natural gas.

INCENTIVES TO CHANGE
The food production industry is one of the largest water-using industries due to the amount of water that is needed to process and cook the product, and sanitize the equipment. Additionally, the consistent need for hot water significantly increases energy usage. The increasing utility demand has led Burke to set a goal to reduce water usage at the plant by 5 percent and natural gas usage by 3 percent as compared to 2014.

RESULTS
Timed Automated Ball Valves: Installing timed ball valves on the oven and steam chamber belt washers would allow the belt washers to run more frequently in smaller time intervals than the current manual wash method. The frequency at which the belt washers need to run depends on the type of product that is on the line. Multiple settings can be utilized to ensure that the belts are sufficiently cleaned during production while minimizing water usage. This automated approach to cleaning the conveyor belts could significantly reduce water use.

PROJECT	ANNUAL COST SAVINGS	ENVIRONMENTAL RESULTS	STATUS
TIMED AUTOMATED BALL VALVES	$16,482	1,079,193 GALLONS 7,200 THERMS	RECOMMENDED
FLOOD BAR NOZZLES	$17,706	1,159,400 GALLONS 7,735 THERMS	RECOMMENDED
UPDATE NOZZLES ON SPRAY BARS	$87,141	5,705,807 GALLONS 38,069 THERMS	RECOMMENDED
ADDITIONAL SPRAY BAR ON OVEN BELT WASH	$965	63,217 GALLONS 422 THERMS	RECOMMENDED
FLOW METERS	$37,912	2,482,380 GALLONS 16,562 THERMS	RECOMMENDED

Flood Bar Nozzles: The flood bars use hot water to keep catch pans under the conveyor belts clear of coagulated grease. Adding flat spray nozzles to the flood bars could reduce the flow through the flood bars while effectively covering a larger area across the width of the catch pans. Estimations show that the addition of nozzles could reduce Burke's annual water use by more than 1.1 million gallons.

Update Nozzles on Spray Bars: Spray bars are used in multiple areas of the plant to keep the conveyor belts clean. Water can be saved by ensuring the types of nozzles used on each spray bar are accurately rated for the appropriate water pressure and flow. By ensuring nozzles are correctly applied and supplying the optimum amount of water needed to effectively clean the conveyor belts, Burke can save more than 5.7 million gallons of water annually.

Additional Spray Bar on Oven Belt Wash: After the product circulates and is removed from the belt, small amounts of residual protein can stick to the belt. The residual proteins can build up on the conveyor belt as it continuously rotates through the oven. Adding a second spray bar to hit the belts with water before reentering the ovens would reduce the amount of time the residual proteins remain on the belts and make the cleaning process more efficient. Optimizing the efficiency of the belt cleaning process, could reduce water use by more than 63,000 gallons annually.

Flow Meters: Flow meters strategically placed around the plant could allow Burke to localize and better monitor areas with high water use. Flow meters are an integral part of creating a wastewater prevention plan and help to hold employees accountable for water use. By sub-metering and more closely monitoring the plant's water use, Burke can save about 2.5 million gallons of water annually.

ESTIMATED CONVENTIONAL AIR POLLUTANTS DIVERTED IN METRIC TONS
For Recommendations in Recommended Status

TOTAL FOR ALL SECTORS						
CO_2	NH_3	NO_x	PM_{10}	$PM_{2.5}$	SO_2	VOC
308.16	0.03	0.48	0.12	0.05	0.56	0.44

ESTIMATED GREENHOUSE GASES DIVERTED IN METRIC TONS

TOTAL FOR ALL SECTORS			
$MTCO_2e$	CH_4	N_20	CFC
1,055.07	105.36	12.91	1.55

CLYSAR, LLC

CLINTON

ANDREW GUDE
MECHANICAL ENGINEERING
IOWA STATE UNIVERSITY

COMPANY PROFILE
Clysar, LLC, established in 1963 and headquartered in Clinton, Iowa, manufactures industry-leading polyolefin films. These high-performance shrink wraps are applied in the packaging of frozen pizzas, baked goods, produce, meat, poultry, hardware, office supplies, and a wide array of other consumer products. Clysar operates 24 hours per day, seven days per week, and employs more than 300 people.

PROJECT BACKGROUND
The primary focus of the project at Clysar was to reduce the environmental impact and expenses associated with solid waste generation and disposal. The items with the greatest potential for recycling are paper, cardboard, and plastics. The secondary focus of the project was to conduct an audit of Clysar's compressed air utility in order to reduce energy usage and promote cost savings.

INCENTIVES TO CHANGE
The management at Clysar is committed to sustainable growth and supports initiatives to divert landfilled waste, reduce energy usage, and address wasteful or inefficient practices. By implementing a campus-wide recycling program, the company will divert solid waste away from landfills while saving money on waste disposal costs. In addition, an audit and leak analysis of the compressed air system will help Clysar identify sources of energy waste and opportunities to improve efficiency.

RESULTS
Comprehensive Recycling Program: Implementation of a recycling program for a variety of solid wastes will allow Clysar to reduce disposal costs, create revenue from recycling/reuse opportunities, and reduce their environmental footprint. Office paper, mixed paper, cardboard, and assorted plastics will be collected and handed off to a recycling service who will return a percentage of the market value. As an added bonus, the same recycling service will accept scrap metal, fluorescent bulbs, ballasts, and old lighting fixtures among other wastes. Annually, Clysar will save $4,650 while diverting 98 tons of waste away from the landfill.

Compressed Air Leak Detection and Repair: Clysar uses four air compressors to supply their facility with compressed air. Air leaks in the utility's lines create artificial demand and force the compressors to run more often and use more energy. Using an ultrasonic leak detector, 111 leaks were located in the facility's compressed air lines. The leaks were measured, documented, and submitted to the maintenance department for repair. Repairing the compressed air leaks could reduce annual utility costs by $35,654, which represents more than 15 percent of the total cost to run the compressors.

PROJECT	ANNUAL COST SAVINGS	ENVIRONMENTAL RESULTS	STATUS
COMPREHENSIVE RECYCLING PROGRAM	$4,650	98 TONS	IN PROGRESS
COMPRESSED AIR LEAK DETECTION AND REPAIR	$35,654	600,233 KWH	IN PROGRESS
ELIMINATE USE OF POLYSTYRENE FOAM CUPS	$578	0.26 TONS	RECOMMENDED

Eliminate Use of Polystyrene Foam Cups: Operators working at Clysar are required to use only clear cups with lids at their stations; however, polystyrene foam cups are the only cups made available to operators in the break areas. The polystyrene foam cups are inconvenient for operators and generate a waste that is difficult for Clysar to recycle. It has been proposed that each operator be supplied with a clear acrylic tumbler and lid that can be used at their stations, washed, and reused. These tumblers are expected to offset the cost of using of disposable cups. The remaining polystyrene disposable cups in use could be replaced with recyclable paper cups. If the acrylic tumblers offset the use of disposable cups by two-thirds and the remaining foam cups are replaced with paper cups, the company could save an estimated $578 annually and divert 0.26 tons from the landfill each year.

ESTIMATED CONVENTIONAL AIR POLLUTANTS DIVERTED IN METRIC TONS
For Implemented and In Progress Recommendations

TOTAL FOR ALL SECTORS						
CO_2	NH_3	NO_X	PM_{10}	$PM_{2.5}$	SO_2	VOC
563.26	0.01	1.09	0.16	0.12	2.21	0.04

ESTIMATED GREENHOUSE GASES DIVERTED IN METRIC TONS

TOTAL FOR ALL SECTORS			
$MTCO_2e$	CH_4	N_20	CFC
632.81	20.80	3.46	3.38

ESTIMATED CONVENTIONAL AIR POLLUTANTS DIVERTED IN METRIC TONS
For Recommendations in Recommended Status

TOTAL FOR ALL SECTORS						
CO_2	NH_3	NO_X	PM_{10}	$PM_{2.5}$	SO_2	VOC
3.10	0.00	0.01	0.00	0.00	0.01	0.00

ESTIMATED GREENHOUSE GASES DIVERTED IN METRIC TONS

TOTAL FOR ALL SECTORS			
$MTCO_2e$	CH_4	N_20	CFC
3.48	0.11	0.02	0.02

CURRIES DIVISION OF AADG, INC.

DYLAN FRISS
ENVIRONMENTAL ENGINEERING
UNIVERSITY OF WISCONSIN-PLATTEVILLE

MASON CITY

COMPANY PROFILE
CURRIES Division of AADG, INC., located in Mason City, Iowa, is a leading manufacturer of non-residential steel and Fiberglass Reinforced Polyester (FRP) doors and steel and aluminum frames. Currently, CURRIES has 650 employees and operates door production 2 shifts per day, 5 days per week, with an average annual operation of 4,043 hours. Frame production operates 3 shifts per day, 5 days per week plus a weekend shift, with an average annual operation of 4,885 hours.

PROJECT BACKGROUND
CURRIES desires to reduce municipal water use and potentially reuse water from the rinse stages of the washer systems to eliminate water discharge. The purpose of the 2015 intern project is to pinpoint source reduction opportunities for water use and evaluate reuse opportunities in the wash stages of the production process to help meet environmental performance goals.

INCENTIVES TO CHANGE
CURRIES' parent company, ASSA ABLOY of Stockholm, Sweden, is committed to sustainable business practices such as minimizing waste generation and utilizing resources effectively. CURRIES' ISO 14001 certification reinforces the company's focus on continuous improvement. They have received the Governor's Iowa Environmental Excellence Awards three times for their high level of environmental performance. The 2015 intern project will provide framework to help Curries achieve a goal of reducing wastewater generation by 10 percent by the year 2020. Recommendations also offer opportunities to meet corporate goals to reduce water and energy usage.

RESULTS
Re-Plumbing of Frame Washer: Curries utilizes multi-stage parts washers to clean and phosphatize components used in door and frame construction. Opportunities exist to reuse water from the rinse stages of this process as make-up water in the wash tanks. Reuse of the rinse water could reduce water use at Curries by approximately 970,123 gallons and save $6,121 annually.

Install Oil Separator on Frame Washer: Oil removal from wash tanks is a cost effective method to increase the efficiency of cleaning the frame components. Improving the efficiency of the wash process could prevent re-contamination of the parts, extend fluid life, and reduce chemical purchasing costs. The intern researched oil separators and provided a recommendation based on small footprint, application of gravity flow, and minimal required maintenance. By installing an oil separator CURRIES could achieve an annual savings of $31,007 and a chemical reduction of 1,834 gallons.

Reverse Osmosis (RO) System: Based on analysis of current water usage, CURRIES annually uptakes and discharges roughly 12 million gallons of water for the frame and door parts washing processes. RO is ideal for treatment of wastewater from the parts washing process as it allows for both water and chemical reuse. Implementation of an RO recycling system could save 5,681,163 gallons of water and associated purchasing and disposal costs of both water and chemicals.

PROJECT	ANNUAL COST SAVINGS	ENVIRONMENTAL RESULTS	STATUS
RE-PLUMBING OF FRAME WASHER	$6,121	970,123 GALLONS	IN PROGRESS
INSTALL OIL SEPARATOR ON FRAME WASHER	$31,007	1,834 GALLONS OF CLEANER	IN PROGRESS
REVERSE OSMOSIS (RO) SYSTEM	$59,063	5,681,163 GALLONS	RECOMMENDED
VFDS AND PRESSURE SENSOR CONTROLS ON PUMP MOTORS	$25,151	320,615 KWH	IN PROGRESS
VFD ON AIR KNIFE SYSTEM	$6,037	77,008 KWH	IN PROGRESS

Variable Frequency Drives (VFDs) and Pressure Sensor Controls on Pump Motors: CURRIES utilizes motors that operate on a fixed speed drive to pump and pressurize water in stages of the Frame and Door Skin washer. Operational benefits of VFD application could result in a reduction of required maintenance, improved motor performance, and increased life-span of the pump motors. Installing VFDs and pressure sensors on the pump motors could result in an annual savings of $25,151 and 320,615 kWh.

VFD on Air Knife System: CURRIES utilizes a 50 hp motor for the air knife system on the Door Skin washer. The current motor operates at a fixed speed and at 100 percent capacity regardless of production rates. A VFD could be used as a soft starter to reduce shock from inrush of current, and to reduce electrical demand by decreasing starting motor current. Installing a VFD on the air knife system could result in an annual savings of $6,037 and 77,008 kWh.

ESTIMATED CONVENTIONAL AIR POLLUTANTS DIVERTED IN METRIC TONS
For Implemented and In Progress Recommendations

TOTAL FOR ALL SECTORS						
CO_2	NH_3	NO_X	PM_{10}	$PM_{2.5}$	SO_2	VOC
303.13	0.00	0.58	0.09	0.06	1.17	0.04

ESTIMATED GREENHOUSE GASES DIVERTED IN METRIC TONS

TOTAL FOR ALL SECTORS			
$MTCO_2e$	CH_4	N_20	CFC
376.18	14.49	2.41	1.81

ESTIMATED CONVENTIONAL AIR POLLUTANTS DIVERTED IN METRIC TONS
For Recommendations in Recommended Status

TOTAL FOR ALL SECTORS						
CO_2	NH_3	NO_X	PM_{10}	$PM_{2.5}$	SO_2	VOC
105.13	0.00	0.16	0.05	0.02	0.19	0.17

ESTIMATED GREENHOUSE GASES DIVERTED IN METRIC TONS

TOTAL FOR ALL SECTORS			
$MTCO_2e$	CH_4	N_20	CFC
461.88	35.67	5.97	0.54

HY-VEE, INC.

WEST DES MOINES

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

COMPANY PROFILE

Hy-Vee, Inc. is a supermarket chain with 235 retail locations in eight states. Founded in 1930, the company has grown to become one of the top 25 supermarket chains in the United States with about $8.7 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. More than 75,000 employees across the Midwest work to deliver the company's mission: "making lives easier, healthier, happier."

PROJECT BACKGROUND

The goal of the 24-week Pollution Prevention internship project was to increase recycling efforts at Hy-Vee's retail stores and to identify potential markets for recyclable materials. Waste volumes were measured, waste disposal costs were tabulated, and recyclable materials within the waste stream were identified. Further research was conducted into the logistics of transporting recovered materials, along with potential markets for the recycled items.

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 is already well on the path to sustainability, with a brand emphasis on healthy and sustainable living: each store has a registered dietitian, a HealthMarket, and sells sustainably harvested seafood. Hy-Vee is committed to sustainability, including initiatives such as green building, energy and resource conservation, and waste reduction, along with sustainable 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.

CONVENTIONAL AIR POLLUTANTS AND GREENHOUSE GASES DIVERTED IN METRIC TONS

For Recommendations in Recommended Status

TOTAL FOR ALL SECTORS								
CO_2	SO_2	CH_4	N_2O	CFC	NO_x	VOC	PM_{10}	$MTCO_2e$
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	34,910.00

RESULTS

To develop a profile of the waste materials being generated, audits were conducted at various Hy-Vee store locations. The information gathered from these audits reinforced the potential impact of the project, identifying significant opportunity for developing a program to divert and capture numerous recyclables.

Recycling resources such as staff, space, and recycling facilities can vary greatly among store locations, making it difficult to develop a standard collection program at the local level. A toolkit of best management practices was developed, outlining local reuse or recycling opportunities for all recyclable materials generated at Hy-Vee stores.

Consolidated collection of recyclables at the two 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 space to process and store recyclable materials is not currently available within the existing distribution centers. 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 and rigid plastics.

Potential challenges of a consolidated collection center may include the logistics necessary for backhauling recyclable waste streams to the distribution centers. Also, additional staff and equipment such as forklifts and balers may be required to process and store recyclables until picked up by vendors or haulers.

Rigid Plastics Recycling: Rigid plastic is most often in the form of high-density polyethylene (#2 HDPE), or polypropylene (#5 PP). These plastics are found in Hy-Vee stores in the form of bakery frosting buckets, deli salad tubs, pharmacy stock bottles, and other containers. The use and disposal of these rigid plastics is at a consistent rate within each store, however, opportunities to recycle rigid plastics are not available to all store locations at the local level. Across all stores, there are approximately 871 tons of rigid plastic that could be diverted from the landfill each year. Backhauling the plastic to the distribution centers for consolidated processing and pickup provides the greatest opportunity to divert rigid plastics from the landfill.

Waxed Cardboard Recycling: Most produce and meat is delivered to grocery stores in waxed cardboard boxes. The waxy coat deters the box from losing its shape when damp. Currently, these boxes cannot be recycled with regular corrugated cardboard and are landfilled with the rest of the waste stream.

A vendor was identified that collects waxed cardboard to create eco-friendly fire logs. Backhauling waxed cardboard to the distribution centers for consolidated processing and vendor pickup would optimize the recycling opportunities for this material. With this change, approximately 6,960 tons of waxed cardboard could be diverted from the landfill.

Food Waste Diversion: Food retailers account for a large amount of the food waste that is landfilled each year. Many Hy-Vee stores currently have a food diversion program. Using data collected from these stores, it is possible to estimate the potential impact if all Hy-Vee stores adopted their own food diversion programs. Pollution Prevention methodologies for diverting food waste from landfills include freezing and donating unexpired food, and composting of expired food. Through donations and composting, Hy-Vee could divert 13,804 tons of food waste from the landfill each year.

PROJECT	ANNUAL COST SAVINGS	ENVIRONMENTAL RESULTS	STATUS
RIGID PLASTICS RECYCLING	$221,234	871 TONS	RECOMMENDED
WAXED CARDBOARD RECYCLING	$375,840	6,960 TONS	RECOMMENDED
FOOD WASTE DIVERSION	$745,416	13,804 TONS	RECOMMENDED

HY-VEE DISTRIBUTION CENTER

KEVIN KASSEL
MECHANICAL ENGINEERING
IOWA STATE UNIVERSITY

COMPANY PROFILE

Hy-Vee is one of the nation's leading supermarket chains, with over 75,000 employees housed at their 235 stores, distribution centers, corporate office, and subsidiaries. The main distribution center located in Chariton, Iowa, operates two shifts per day to distribute products including dry goods, perishable goods, health and beauty items, and pharmaceuticals. This is the fourth year of participation in the Pollution Prevention Intern Program for Hy-Vee Distribution Center. Past projects have included solid waste reduction and recycling, and wastewater reuse. This year, the focus was on energy reduction in the perishable distribution building's refrigeration system.

PROJECT BACKGROUND

Hy-Vee's perishable distribution building houses all goods that require refrigeration. With the majority of refrigerated items passing through Hy-Vee's distribution center in Chariton, Iowa, the refrigerated space is relatively large at over 450,000 square feet. The space includes an industrial ice plant that consumes a fair amount of the refrigeration capacity to produce hundreds of thousands of pounds of ice a day.

INCENTIVES TO CHANGE

Hy-Vee seeks to continuously improve environmental performance while delivering a quality product to customers across the Midwest. The refrigeration process accounts for more than 70 percent of the energy consumption for the perishable distribution building. Increasing the efficiency of the refrigeration system would result in a significant reduction in electrical energy usage and associated emissions.

RESULTS

Doors and Windows: The perishable distribution building has more than 70 dock doors. Some of the trailers parked in the refrigerated dock area are not insulated. Keeping the dock doors closed whenever possible could prevent heat from the uninsulated trailers from moving into the building. About 75 percent of the dock doors do not have a window, which requires employees to open the doors to check occupancy. Future replacement doors should be ordered with windows to prevent heat loss from the door opening. Installing additional insulated doors to create temperature zones within the facility could increase system efficiency by reducing the transfer of hot and cold air between areas.

Signs: There are a few heated rooms within the building, and doors separating the heated and cooled spaces have been found propped open. The intern placed signs to discourage personnel from propping the doors open to maintain temperature set points.

Cleaning Coils, Defrost, and Compressors: Evaporators, devices used to cool the air, were found to be dirty, which reduces the efficiency. The intern recommended cleaning the evaporators to restore performance. The evaporators operating in the freezer portion of the building collect frost on them due to the physics of their operation. The frost reduces heat transfer and decreases efficiency. A defrost cycle is used to remove frost from the evaporators, but it can vaporize and refreeze on another evaporator nearby. Reprogramming the system to defrost units near each other at the same time could prevent the water vapor from refreezing instantly. Further programming to optimize the compressor sequence could increase system efficiency.

PROJECT	ANNUAL COST SAVINGS (DOLLARS)	ENVIRONMENTAL RESULTS	STATUS
DOORS AND WINDOWS	$26,600	492,592 KWH	RECOMMENDED
SIGNS	$340	6,296 KWH	IN PROGRESS
CLEANING COILS, DEFROST, AND COMPRESSORS	$15,500	287,037 KWH	RECOMMENDED
CLEANING TRAILERS	$1,000	18,519 KWH	RECOMMENDED
MAINTENANCE SCHEDULES AND PERSONNEL	$36,400	N/A	RECOMMENDED
LIGHTING	$60,000	1,111,111 KWH	RECOMMENDED
DISTRIBUTION AND PEAK HOURS	$53,000	981,481 KWH	RECOMMENDED

Cleaning Trailers: The trailers used to transport the products get dirty over time. Vacuuming the trailers instead of sweeping would reduce the amount of dust in the air to settle on the evaporator filters and could help increase system efficiency.

Maintenance Schedules and Personnel: A proactive preventative maintenance plan with checklists and completion dates to track equipment maintenance could extend the life of the equipment and avoid costly repairs and down time.

Lighting: The majority of the high bay lighting fixtures in the facility use fluorescent technology. Switching to LED lamps could result in energy reduction from the increased lighting efficiency and an energy reduction on the refrigeration system from the decreased heat load from the lights.

Distribution and Peak Hours: Some of the items currently distributed out of the perishable building do not require refrigeration. Moving these items and distributing them from the grocery warehouse could reduce the load on the refrigeration system and save energy. Also, the utility company charges higher rates for electricity used during daytime hours than during the nighttime hours, thus any processes that can be done at night, such as ice bagging, will cost substantially less in terms of electricity.

ESTIMATED CONVENTIONAL AIR POLLUTANTS DIVERTED IN METRIC TONS
For Implemented and In Progress Recommendations

TOTAL FOR ALL SECTORS						
CO_2	NH_3	NO_X	PM_{10}	$PM_{2.5}$	SO_2	VOC
3.19	0.00	0.01	0.00	0.00	0.01	0.00

ESTIMATED GREENHOUSE GASES DIVERTED IN METRIC TONS

TOTAL FOR ALL SECTORS			
$MTCO_2e$	CH_4	N_20	CFC
3.58	0.12	0.02	0.02

ESTIMATED CONVENTIONAL AIR POLLUTANTS DIVERTED IN METRIC TONS
For Recommendations in Recommended Status

TOTAL FOR ALL SECTORS						
CO_2	NH_3	NO_X	PM_{10}	$PM_{2.5}$	SO_2	VOC
1803.73	0.02	3.48	0.52	0.39	7.08	0.14

ESTIMATED GREENHOUSE GASES DIVERTED IN METRIC TONS

TOTAL FOR ALL SECTORS			
$MTCO_2e$	CH_4	N_20	CFC
2,026.45	66.61	11.07	10.84

JBS USA, LLC

TREVER TOLLIVER
MECHANICAL ENGINEERING
IOWA STATE UNIVERSITY

COMPANY PROFILE
JBS is the world's leading animal protein processor with more than 200,000 employees worldwide, more than 300 production facilities, and export customers in more than 150 countries. JBS was founded in 1953 and is headquartered in San Paulo, Brazil. The JBS pork processing facility, distribution center, and warehouse in Marshalltown, Iowa, provide fresh quality pork products to domestic and international customers. JBS Marshalltown is one of the largest pork processors in the nation and is continually innovating to improve their process.

PROJECT BACKGROUND
The goal of this project is to identify and recommend strategies to optimize the operating efficiency of the 12 compressed air systems at the plant. This project can help the facility reduce operating costs and associated environmental impacts while continuing to produce high quality products.

INCENTIVES TO CHANGE
JBS is highly committed to identifying opportunities that can improve production efficiency while reducing environmental impact. Compressed air is one of the most costly utilities due to the inefficiencies associated with the process. Compressed air accounts for approximately 11 percent of JBS' total electrical usage. With the critical need to meet the demands of production, identifying opportunities to optimize the efficiency of the system is a priority for JBS.

RESULTS
Compressed Air Leak Detection and Repair: Compressed air leaks contribute to demand within a system by putting strain on the compressors and negatively affecting equipment performance. Eliminating air leaks could significantly reduce energy usage and improve system performance. The intern used an ultrasonic leak detector to identify leaks throughout the system. By fixing the leaks identified, JBS has the potential to save nearly $26,000 annually.

Compressed Air Leak Detection Program: Regular monitoring of leaks is critical to keeping a compressed air system operating effectively. The intern developed a procedure to aid in the leak detection process with recommendations for purchase of associated equipment. Additionally, the intern developed a user-friendly spreadsheet to aid with recording leaks and calculating the saving potential of each leak thus allowing maintenance to easily prioritize which leaks to fix first.

Energy Efficient Drain Traps: Removing condensate is important for maintaining the appropriate air quality in the compressed air system. Significant air loss can occur in the process of removing condensate. Installing energy efficient drain traps after each compressor can reduce air consumption while maintaining the air quality needed.

PROJECT	ANNUAL COST SAVINGS	ENVIRONMENTAL RESULTS	STATUS
COMPRESSED AIR LEAK DETECTION AND REPAIR	$25,596	420,299 KWH	IN PROGRESS
COMPRESSED AIR LEAK DETECTION PROGRAM	$8,532	140,100 KWH	IN PROGRESS
ENERGY EFFICIENT DRAIN TRAPS	$5,292	86,894 KWH	RECOMMENDED
COOLER AIR SWITCH REMOVAL	$35,516	177,342 KWH	IN PROGRESS
TROLLEY BLOW OFF OPTIMIZATION	$3,406	18,640 KWH	RECOMMENDED
EFFICIENT NOZZLES FOR SANITATION EQUIPMENT	$88,193	1,448,159 KWH	IN PROGRESS
ADDED DEMAND STORAGE	$36,832	604,797 KWH	RECOMMENDED

Cooler Air Switch Removal: Many of the air leaks detected were in the air switch system, used to load and unload coolers at JBS. The current switches also require a significant amount of maintenance. Installing manual style switches would remedy the leaks within the system, require less maintenance and save more than $35,000 annually.

Trolley Blow off Optimization: Electronic flow control systems use a switch triggered by a conveying object to turn compressed air on when needed and off when the object passes by. Significant air savings could be achieved by implementing on-demand flow control.

Efficient Nozzles for Sanitation Equipment: The air wands currently used during the sanitation process require large volumes of air, place strain on the compressor, and reduce the supply for production startup. High-efficiency air nozzles combine compressed air and ambient air to produce the high velocity flow necessary for the process. Installing high-efficiency air nozzles, could reduce compressed air usage by more than 90 percent during the cleaning process.

Added Demand Storage: Sufficient storage helps smooth the peaks in demand creating a more stable compressed air supply. With the recent addition of another production line, adding storage is critical to meet production air needs. Installing larger air receivers mated with a flow control valve could gain improved system performance along with significant cost savings.

ESTIMATED CONVENTIONAL AIR POLLUTANTS DIVERTED IN METRIC TONS
For Implemented and In Progress Recommendations

TOTAL FOR ALL SECTORS						
CO_2	NH_3	NO_X	PM_{10}	$PM_{2.5}$	SO_2	VOC
1,478.93	0.02	2.86	0.43	0.32	5.81	0.11

ESTIMATED GREENHOUSE GASES DIVERTED IN METRIC TONS

TOTAL FOR ALL SECTORS			
$MTCO_2e$	CH_4	N_20	CFC
1,661.55	54.61	9.08	8.89

ESTIMATED CONVENTIONAL AIR POLLUTANTS DIVERTED IN METRIC TONS
For Recommendations in Recommended Status

TOTAL FOR ALL SECTORS						
CO_2	NH_3	NO_X	PM_{10}	$PM_{2.5}$	SO_2	VOC
1,730.81	0.02	3.34	0.50	0.37	6.80	0.13

ESTIMATED GREENHOUSE GASES DIVERTED IN METRIC TONS

TOTAL FOR ALL SECTORS			
$MTCO_2e$	CH_4	N_20	CFC
1,944.53	63.91	10.62	10.40

JOHN DEERE OTTUMWA WORKS

JOSH PLUMMER
MECHANICAL ENGINEERING
UNIVERSITY OF WISCONSIN - PLATTEVILLE

OTTUMWA

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 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 focus of the 24-week intern project was to conduct a plant wide motor survey to pinpoint utility use, evaluate possible energy saving updates, and develop recommendations for resource reduction on the paint lines and throughout the plant.

INCENTIVES TO CHANGE

In 2013, John Deere announced four company-wide eco-efficiency goals to reduce their environmental impact. One of these goals is to reduce greenhouse gas emissions and energy consumption per ton of production by 15 percent by 2018. As a result, Deere & Company is pushing facilities to find ways to trim energy usage. Due to energy consumption and inefficiency, the paint line motors and personal fans used at John Deere Ottumwa Works provide an opportunity to help achieve the 15 percent energy reduction goal.

RESULTS

Motor Drive Belts: The paint lines have many high-horsepower fan motors that run approximately 2500 hours per year, using roughly 20 percent of the plant's total electricity. The motors themselves are fairly efficient but operate with an older style belt-drive system. Upgrading the drive systems to a synchronous belt-drive design would increase operating efficiency of the motors by 3-5 percent. In the main paint line, there are 21 motors in need of drive system replacement. Upgrading these 21 motors with synchronous belt-drives could reduce annual electricity costs by approximately $8,783.

Installing Ceiling Fans in Dept. 250 and 254: Many individual fans are used around the facility to cool factory workers. It is more efficient to have a few large electric motors than a lot of small electric motors. Installing twelve 16' ceiling fans could provide more even air flow and reduce electricity consumption while maintaining worker comfort. Ceiling mounted fans also have the added benefit of destratification, or equalization, of the air temperature in the building which can reduce heating costs by up to 35 percent in the winter months.

Hot Water Pipe: 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.

Light Emitting Diode (LED) Flood Lights: The exterior flood lights around the facility generally consist of 250-watt and 400-watt metal halide lights. New 105-watt and 150-watt LED flood lights have emerged on the market as direct replacements for the current lights. Along with consuming almost a third of the power of the current lights, LEDs also provide a much whiter light that resembles natural light. Replacing six metal halide lights on the south main street lot with five staged LED lights could save up to 7,345 kilowatt hours per year. Replacing the seven metal halide lights, located outside of Department 74, with seven strategically placed LED lights could save up to 8,142 kilowatt hours per year while providing better light coverage of the area.

ESTIMATED CONVENTIONAL AIR POLLUTANTS DIVERTED IN METRIC TONS

For Implemented and In Progress Recommendations

TOTAL FOR ALL SECTORS						
CO_2	NH_3	NO_X	PM_{10}	$PM_{2.5}$	SO_2	VOC
93.67	0.001	0.18	0.03	0.02	0.37	0.01

ESTIMATED GREENHOUSE GASES DIVERTED IN METRIC TONS

TOTAL FOR ALL SECTORS			
$MTCO_2e$	CH_4	N_20	CFC
105.18	3.54	0.57	0.56

ESTIMATED CONVENTIONAL AIR POLLUTANTS DIVERTED IN METRIC TONS

For Recommendations in Recommended Status

TOTAL FOR ALL SECTORS						
CO_2	NH_3	NO_X	PM_{10}	$PM_{2.5}$	SO_2	VOC
94.95	0.00	0.18	0.03	0.12	0.31	0.03

ESTIMATED GREENHOUSE GASES DIVERTED IN METRIC TONS

TOTAL FOR ALL SECTORS			
$MTCO_2e$	CH_4	N_20	CFC
101.08	11.98	0.51	0.54

PROJECT	ANNUAL COST SAVINGS	ENVIRONMENTAL RESULTS	STATUS
MOTOR DRIVE BELTS	$8,783	106,143 kWh	RECOMMENDED
INSTALLING CEILING FANS IN DEPT. 250 AND 254	$18,416	41,830 kWh 21,390 therms	RECOMMENDED
HOT WATER PIPE	$108	2,650 therms	RECOMMENDED
LED FLOOD LIGHTS (SOUTH MAIN STREET)	$562	7,345 kWh	IN PROGRESS
LED FLOOD LIGHTS (OUTSIDE DEPT. 74)	$623	8,142 kWh	IN PROGRESS

KUM & GO

KURT DRUFFEL
MECHANICAL ENGINEERING
UNIVERSITY OF WISCONSIN-PLATTEVILLE

COMPANY PROFILE
Kum & Go is the fifth largest privately held convenience store chain in the United States. Based out of West Des Moines, Iowa, Kum & Go employs more than 4,700 associates throughout 430 convenience stores in 11 states. Kum & Go has more than 50 years of dedicated community commitment and shares 10 percent of annual profits with the community. Most notably, Kum & Go leads the industry in customer service and satisfaction.

PROJECT BACKGROUND
Kum & Go teamed up with Pollution Prevention Services to develop innovative solutions for reducing store energy consumption. Previous energy estimates indicated that the plug load equipment accounted for a high percentage of the total energy usage. The first objective was to conduct a plug load energy audit to identify specific equipment issues. A secondary objective was to evaluate other opportunities for energy reduction in the food preparation areas. Focus was placed on the standard 5K Store Design that accounts for 100 of all 430 Kum & Go stores. The intern collected data from multiple stores and gained insight into associate professional knowledge to find opportunities in energy reduction.

INCENTIVES TO CHANGE
Kum & Go is striving to become the top convenience retailer in the country by 2021 and a leader of sustainability practices in the convenience store sector. As the company has grown and added stores, they have continued to improve the efficiency of the buildings and the equipment used, which has resulted in a new store design and improved construction and operational practices. The more efficient stores are the highly-successful 5K-designed stores seen today. Kum & Go is looking to continue the trend of improving the efficiency of its stores.

RESULTS
Plug Load Audit: The intern monitored energy usage of food and beverage equipment in the stores over a period of several weeks. This was conducted through most traffic patterns that the site considered normal. After compiling energy usage and traffic pattern data, the audit showed that energy usage attributable to plug loads accounted for a much lower percentage than what previous estimates indicated.

Dynamic Tint Windows: The first energy reduction opportunity investigated was using dynamic window tinting for the current clear storefront windows. Replacing the current clear storefront windows with windows that are able to adjust tint based on the level of outside daylight could reduce heat loss or gain from direct sunlight and help maintain comfortable ambient air temperatures in the stores.

PROJECT	ANNUAL COST SAVINGS	ENVIRONMENTAL RESULTS	STATUS
PLUG LOAD AUDIT	$3,500 one time savings	--	IMPLEMENTED
DYNAMIC WINDOW TINT	$57,600	699,300 KWH	IN PROGRESS
EQUIPMENT UPDATE	$1,276,800	15,490,200 KWH	RECOMMENDED
THERMOSTAT RANGES	$107,500	1,304,800 KWH	RECOMMENDED

Equipment Update: The typical 5K-designed store is equipped with one convection oven and two conveyor ovens. These pieces of equipment are used to produce a multitude of food products sold out of the Kum & Go stores. To serve customer demand, the ovens run 17 hours a day. Replacing the current convection and conveyor ovens with newer, more energy efficient ovens could result in annual energy savings while maintaining full production capabilities.

Thermostat Ranges: Currently, in-store thermostats can be controlled by the store associates within defined ranges. There is also the ability for office staff to control thermostats remotely from the Kum & Go Store Support Center. Current ranges are set between 68°F to 72°F. This range is very small considering the amount of traffic keeping entry doors open and numerous other variables within the stores. Modifying the allowable range of in-store temperature settings to 66°F to 72°F in the winter months and to 68°F to 76°F through the summer months could save energy usage and associated costs.

ESTIMATED CONVENTIONAL AIR POLLUTANTS DIVERTED IN METRIC TONS
For Implemented and In Progress Recommendations

TOTAL FOR ALL SECTORS						
CO_2	NH_3	NO_X	PM_{10}	$PM_{2.5}$	SO_2	VOC
539.71	0.01	1.04	0.16	0.12	2.12	0.04

ESTIMATED GREENHOUSE GASES DIVERTED IN METRIC TONS

TOTAL FOR ALL SECTORS			
$MTCO_2e$	CH_4	N_20	CFC
606.36	19.93	3.31	3.24

ESTIMATED CONVENTIONAL AIR POLLUTANTS DIVERTED IN METRIC TONS
For Recommendations in Recommended Status

TOTAL FOR ALL SECTORS						
CO_2	NH_3	NO_X	PM_{10}	$PM_{2.5}$	SO_2	VOC
12,970.89	0.14	26.06	3.74	2.77	50.94	0.97

ESTIMATED CONVENTIONAL AIR POLLUTANTS DIVERTED IN METRIC TONS

TOTAL FOR ALL SECTORS			
$MTCO_2e$	CH_4	N_20	CFC
14,572.50	478.97	79.60	77.94

OSCEOLA FOOD, LLC

ALEXANDER GEORGE
CHEMICAL ENGINEERING
IOWA STATE UNIVERSITY

COMPANY PROFILE

Osceola Food, LLC, which was established 1995 in Osceola, Iowa, is a subsidiary company of Hormel Foods Corporation. Hormel Foods, headquartered in Austin, Minnesota, is a multinational manufacturer that produces brand name food and meat products for people around the world. Osceola Food focuses on the manufacturing of sliced bacon, hams, and sliced lunch meats. Covering 330,000 square feet, Osceola Food employs 800 people across three shifts and operates seven days a week

PROJECT BACKGROUND

As a subsidiary company of Hormel Foods, Osceola Food is committed to practicing environmental stewardship in all their daily operations and continually seeks ways to improve environmental performance. One of Hormel Foods' environmental goals is to reduce solid waste going to the landfill by 10 percent by the year 2020. This commitment prompted Osceola Food to team with the Pollution Prevention Intern Program to evaluate their waste streams and recommend strategies to first reduce the generation of waste at the plant and then to explore reuse and recycling opportunities.

INCENTIVES TO CHANGE

Osceola Food strives to continually analyze their waste streams and implement more sustainable practices that will help achieve their goal of becoming Zero Landfill. Reducing the amount of waste being sent to the landfill will create a positive environmental impact and can also have significant disposal savings.

RESULTS

Aerosol Can Recycling: Aerosol cans are commonly used around the facility at Osceola Food and have the potential to be recycled with scrap steel instead of being discarded. With the purchase of a device that can puncture aerosol cans, Osceola Food can recycle approximately 0.5 tons of empty aerosol cans annually.

Bulk Silicone Spray: Food grade silicone spray is currently purchased by Osceola Food in individual aerosol can sizes. Purchasing the silicone in bulk fifty-five gallon drums and utilizing reusable spray bottles could eliminate the aerosol can waste and significantly cut the company's purchasing costs.

Plastic Slip Sheet Reuse: Plastic slip sheets arrive on incoming pallets and are used to protect the cardboard totes that contain product for manufacturing. The slip sheets may be wet or contaminated with residue from food processing, which prevent the sheets from being recycled. More than 29 tons of waste could be diverted from the landfill if the slip sheets were washed, sanitized, and returned to the corporate office in Austin, MN for reuse.

PROJECT	ANNUAL COST SAVINGS	ENVIRONMENTAL RESULTS	STATUS
AEROSOL CAN RECYCLING	$237	0.5 TONS	IN PROGRESS
BULK SILICONE SPRAY	$14,983	0.5 TONS	RECOMMENDED
PLASTIC SLIP SHEET REUSE	$2,826	29.9 TONS	RECOMMENDED
CARDBOARD TOTE RECYCLING	$5,324	35.5 TONS	IMPLEMENTED
GREASE RECLAMATION	$6,819	12 TONS	RECOMMENDED

Cardboard Tote Recycling: Incoming product for processing arrives in cardboard totes. When the totes are emptied, the totes are used around the facility as waste and recycling containers. When the totes used as waste containers are full, they are placed in the waste compactor instead of being emptied and placed into the cardboard compactor. Switching to reusable steel baskets for waste collection could divert 35 tons of cardboard from the landfill.

Grease Reclamation: Grease is a byproduct of the pre-cooked bacon lines and can be sold into the renewable fuels industry. The intern researched opportunities for Osceola Food to capture more of the grease while maintaining the standards and efficiency of the cleaning and sanitation processes. A screen or basket installed underneath a potential drop point for bacon could capture an additional 12 tons of grease annually that could be beneficially reused and generate additional revenue.

ESTIMATED CONVENTIONAL AIR POLLUTANTS DIVERTED IN METRIC TONS

For Implemented and In Progress Recommendations

TOTAL FOR ALL SECTORS						
CO_2	NH_3	NO_x	PM_{10}	$PM_{2.5}$	SO_2	VOC
0.00	0.01	0.03	0.01	0.01	0.02	0.02

ESTIMATED GREENHOUSE GASES DIVERTED IN METRIC TONS

TOTAL FOR ALL SECTORS			
$MTCO_2e$	CH_4	N_20	CFC
133.00	44.20	0.61	0.12

ESTIMATED CONVENTIONAL AIR POLLUTANTS DIVERTED IN METRIC TONS

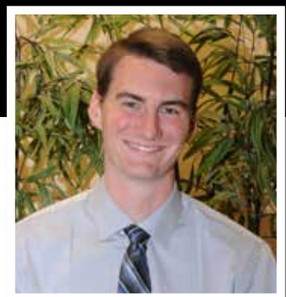
For Recommendations in Recommended Status

TOTAL FOR ALL SECTORS						
CO_2	NH_3	NO_x	PM_{10}	$PM_{2.5}$	SO_2	VOC
0.00	0.00	0.00	0.00	0.00	0.00	0.00

ESTIMATED GREENHOUSE GASES DIVERTED IN METRIC TONS

TOTAL FOR ALL SECTORS			
$MTCO_2e$	CH_4	N_20	CFC
73.00	0.00	0.00	0.00

SHEARER'S SNACKS



MICAH RAMBO
MECHANICAL ENGINEERING
IOWA STATE UNIVERSITY

COMPANY PROFILE

Shearer's Snacks is a privately owned, award-winning snack food manufacturer and distributor based out of Massillon, Ohio, and has facilities in five states as well as Canada. Shearer's Snacks products include potato chips, tortilla chips, pretzels, cookies, crackers, pork rinds, puffs and curls, and whole grain rice crisps. The facility in Burlington, Iowa, operates three shifts, 24 hours per day, seven days per week. More than 800 employees help produce their privately labeled saltine crackers, sandwich crème cookies, and wire-cut cookies.

PROJECT BACKGROUND

Compressed air is widely used throughout the plant because it is safe, reliable, and sanitary. While air system leakage does not contaminate the working environment, it does create an unnecessary demand increase and causes excess work for the compressors resulting in additional energy usage. Increased efficiency of the compressed air system could lead to lower costs and decreased energy usage.

INCENTIVES TO CHANGE

Shearer's Snacks is committed to making the best products at the most competitive price. Along with this commitment is the desire to reduce the environmental impact of its manufacturing processes. The Burlington facility is striving to reduce its total electrical energy usage by 3 percent per year. Increasing the efficiency of the compressed air system could decrease the electrical energy usage resulting in cost savings, emission reduction, and the achievement of sustainability goals.

RESULTS

Compressed Air Leaks: Compressed air is beneficial for the food industry because leaks in the system are neither hazardous nor harmful; however, these leaks put an artificial demand on the air compressors. A compressed air audit was conducted to evaluate compressed air usage, identify leak locations, and assess compressor storage. Eliminating leaks in the compressed air system could reduce the electrical energy demand by 15 percent.

Air Receiver Tanks: Air storage is a vital part to the compressed air system. Receivers can be used to cool air and condense water vapor prior to entering the dryer, which results in decreased dryer load. Placing air receivers near high-use applications can supply excess air when needed and protect the application from demand fluctuations. These storage tanks could also reduce the pressure drop caused by the compressed air lines, which would decrease demand on the compressors.

PROJECT	ANNUAL COST SAVINGS	ENVIRONMENTAL RESULTS	STATUS
COMPRESSED AIR LEAKS	$36,041	672,012 KWH	IMPLEMENTED
AIR RECEIVER TANKS	$7,564	132,880 KWH	RECOMMENDED
COMPRESSOR ROOM VENTILATION	$2,129	37,400 KWH	RECOMMENDED
REGENERATIVE BLOWERS	$16,082	301,309 KWH	RECOMMENDED

Compressor Room Ventilation: The compressor room contains all of the compressors, filters, dryers, and storage tanks. Due to the heat generated from the compressors and dryers, the room temperature can vary drastically from outside ambient temperatures. Air is easier to compress when it is at a higher pressure, a lower temperature, and when it is less humid. Installing a large industrial fan in the room could help equalize the temperature and the pressure allowing easier compression of the air resulting in a decrease in the electrical energy usage of the compressors.

Regenerative Blowers: Some applications require large amounts of compressed air to clean product prior to packaging. The operating costs of some applications could be drastically reduced by utilizing a dedicated high-efficiency blower. Because high velocity and not high pressure is required for these applications, a blower can provide a large air output at lower pressure for a fraction of the cost compared to traditional compressed air methods.

ESTIMATED CONVENTIONAL AIR POLLUTANTS DIVERTED IN METRIC TONS

For Implemented and In Progress Recommendations

TOTAL FOR ALL SECTORS						
CO_2	NH_3	NO_X	PM_{10}	$PM_{2.5}$	SO_2	VOC
358.41	0.00	0.69	0.10	0.08	1.41	0.03

ESTIMATED GREENHOUSE GASES DIVERTED IN METRIC TONS

TOTAL FOR ALL SECTORS			
$MTCO_2e$	CH_4	N_20	CFC
402.67	13.23	2.20	2.15

ESTIMATED CONVENTIONAL AIR POLLUTANTS DIVERTED IN METRIC TONS

For Recommendations in Recommended Status

TOTAL FOR ALL SECTORS						
CO_2	NH_3	NO_X	PM_{10}	$PM_{2.5}$	SO_2	VOC
251.52	0.00	0.49	0.07	0.05	0.99	0.02

ESTIMATED GREENHOUSE GASES DIVERTED IN METRIC TONS

TOTAL FOR ALL SECTORS			
$MTCO_2e$	CH_4	N_20	CFC
282.57	9.29	1.54	1.51

SNAP-ON TOOLS

ALGONA

KAITLIN SCHIELTZ
INDUSTRIAL ENGINEERING
IOWA STATE UNIVERSITY

COMPANY PROFILE

Snap-on Tools is a global innovator and manufacturer of tools and equipment that are known for their high quality and durability. At the Algona, Iowa, facility, they manufacture more than 95 different tool boxes of varying sizes and purposes and offer more than 27 different box colors. Their 400 employees in Algona work across two production shifts and one maintenance shift during weekdays with additional weekend hours utilized during peak demand.

PROJECT BACKGROUND

Snap-on Tools is committed to sustainable practices and safeguarding Iowa's natural resources. They have set an ambitious goal of reaching Zero Landfill status. To pursue this goal, Snap-on Tools participated in the Pollution Prevention Intern Program to develop and implement a solid waste diversion plan and raise environmental awareness at all levels of the plant. Also, Snap-on Tools wanted to investigate the possibilities for energy savings in their current lighting system.

INCENTIVES TO CHANGE

The disposal costs of solid waste materials continue to rise, and the environmental impacts of sending it to the landfill are well known. Snap-on Tools would like to expand their current recycling program to include additional waste streams and increase division from the landfill. Additionally, a significant amount of the electricity consumed at Snap-on Tools is utilized by the lighting system. Reducing the energy usage of the lighting system could greatly reduce overall energy consumption at the plant.

PROJECT	ANNUAL COST SAVINGS	ENVIRONMENTAL RESULTS	STATUS
SOLID WASTE RECYCLING PROGRAM	$61,600	67 TONS	IN PROGRESS
ENERGY EFFICIENT LIGHTING - OPTION A	$131,655	1,221,463 KWH	RECOMMENDED
ENERGY EFFICIENT LIGHTING - OPTION B	$148,109	1,374,118 KWH	RECOMMENDED

RESULTS

Solid Waste Recycling Program: Cardboard and some office paper are currently recycled, but plastics and other plant waste streams are landfilled. More than 30 percent of the waste currently sent to the landfill could be diverted to a sorted recycling program, facilitated by a third party recycler. With use of the new recycling program, Snap-on Tools could divert more than 67 tons of solid waste from the landfill and save more than $60,000 annually. In addition, the intern developed a comprehensive employee education and training program to educate staff on the new recycling program processes and procedures.

Energy Efficient Lighting: The lighting system at Snap-on Tools consists of a wide variety of bulbs and fixtures. Also, the current fixture layout of the plant had not been analyzed for optimal lighting performance. The intern conducted a comprehensive lighting audit to gather the number of fixtures, type and number of bulbs per fixture, watts per bulb, kilowatt hours per year, and light meter readings in LUX. After completing the audit, the intern recorded a total of 35 different types of fixtures throughout the plant and more than 2,500 individual fixtures with varying numbers of lamps. The intern developed two lighting recommendation options for Snap-on Tools.

Option A would be to conduct a one-for-one replacement of every existing fixture with a standardized, energy-efficient fixture with LED bulbs. Option A would reduce lighting costs and minimize associated maintenance costs.

Option B would be a more comprehensive revamp of the lighting system, which would still involve upgrading to the more efficient fixtures and LED bulbs. Option B would also include a new layout of the fixture locations, moving or eliminating some fixtures to improve the lighting quality for specific production applications. Option B optimizes the lighting layout while saving more energy than Option A. Option B also provides greater cost savings and quality of lighting overall but has higher initial costs and additional labor to achieve the new layout.

ESTIMATED CONVENTIONAL AIR POLLUTANTS DIVERTED IN METRIC TONS

For Implemented and In Progress Recommendations

TOTAL FOR ALL SECTORS						
CO_2	NH_3	NO_X	PM_{10}	$PM_{2.5}$	SO_2	VOC
0.00	0.00	0.00	0.00	0.00	0.00	0.00

ESTIMATED GREENHOUSE GASES DIVERTED IN METRIC TONS

TOTAL FOR ALL SECTORS			
$MTCO_2e$	CH_4	N_20	CFC
77.00	0.00	0.00	0.00

ESTIMATED CONVENTIONAL AIR POLLUTANTS DIVERTED IN METRIC TONS

For Recommendations in Recommended Status

TOTAL FOR ALL SECTORS						
CO_2	NH_3	NO_X	PM_{10}	$PM_{2.5}$	SO_2	VOC
1,388.00	0.02	2.68	0.40	0.30	5.45	0.10

ESTIMATED GREENHOUSE GASES DIVERTED IN METRIC TONS

TOTAL FOR ALL SECTORS			
$MTCO_2e$	CH_4	N_20	CFC
1,559.00	51.25	8.52	8.34

UNITYPOINT HEALTH DES MOINES

SHANNON STRUTTMANN
MECHANICAL ENGINEERING
THE UNIVERSITY OF IOWA

COMPANY PROFILE
UnityPoint Health Des Moines is an integrated health care system that includes the Iowa Methodist Medical Center, Iowa Lutheran Hospital, Blank Children's Hospital, Methodist West Hospital, more than 50 UnityPoint Clinic locations, and home health care services, UnityPoint at Home. They strive to provide "the best outcome for every patient every time." As of 2013, 1,033 physicians, 7,663 employees, and 1,069 volunteers served the Des Moines communities with UnityPoint Health – Des Moines. They provide extensive services such as cardiology, behavioral health, cancer treatment, pediatrics, nutrition, and emergency.

PROJECT BACKGROUND
UnityPoint Health Des Moines is an integrated health care system that includes the Iowa Methodist Medical Center, Iowa Lutheran Hospital, Blank Children's Hospital, Methodist West Hospital, more than 50 UnityPoint Clinic locations, and home health care services, UnityPoint at Home. They strive to provide "the best outcome for every patient every time." As of 2013, 1,033 physicians, 7,663 employees, and 1,069 volunteers served the Des Moines communities with UnityPoint Health – Des Moines. They provide extensive services such as cardiology, behavioral health, cancer treatment, pediatrics, nutrition, and emergency.

INCENTIVES TO CHANGE
By repairing leaks in the compressed air system and introducing a leak management plan, UnityPoint can reduce their operating costs and improve environmental impact. Upgrading outdated and leaky windows with higher efficiency windows could reduce the amount of heat transfer through the windows and lower the energy usage required for heating and cooling. The upgraded windows could also eliminate current condensation and infiltration issues that could result in greater patient and staff comfort.

RESULTS:
Repair Lutheran Compressed Air Leaks: During an audit of the compressed air system at the Lutheran facility, the intern found more than 40 leaks. Repairing these leaks could reduce the load on the system, improve overall efficiency, and increase the lifespan of the equipment. The cost of running the compressors could be lowered by as much as 50 percent, which could result in savings of $3,190 annually. The intern recommends that a leak management plan be implemented for all hospital campuses to maintain efficiency. It is estimated that the cost of an ultrasonic leak detector could be recovered after repair of leaks indentified in one survey of the compressed air system at each campus.

Window Analysis: Using an infrared imaging camera, the intern conducted a thermographic assessment of the windows at the Methodist and Lutheran hospital facilities. This assessment yielded valuable information on the relative energy efficiency of the windows installed at each hospital and identified opportunities for improvement, such as faulty seals or insulation. While precise savings estimates of window upgrades are impossible to calculate due to numerous variables, minimum annual savings for each hospital wing were calculated.

PROJECT	ANNUAL COST SAVINGS	ENVIRONMENTAL RESULTS	STATUS
REPAIR LUTHERAN COMPRESSED AIR LEAKS	$3,190	62,860 KWH	RECOMMENDED
YOUNKER WINDOW REPLACEMENT	$6,440	5,724 THERMS	IN PROGRESS
LUTHERAN WINDOW REPLACEMENT	$4,704	7,960 THERMS	RECOMMENDED
BLANK WINDOW REPLACEMENT	$1,889	3,290 THERMS	RECOMMENDED

Younker Window Replacement: The current windows in the Younker wing at Methodist Hospital are single pane windows that are more than 30 years old. These windows are ineffective at maintaining comfortable room temperatures and humidity. During winter months, condensation forms on the surface of the windows, creating additional challenges. Replacing the windows with double-pane, low-E coated, argon filled, fiberglass frame windows would improve room comfort for patients and staff and alleviate many of the maintenance challenges associated with the current inefficient windows. An estimated minimum annual savings of $6,440 in heating and cooling costs is expected.

Lutheran Window Replacement: Similar to the Younker wing, the East and West wing windows are inefficient and prime candidates for an upgrade. Analysis of these windows indicates noticeable heat loss, which can affect staff and patient comfort. East wing also has the highest volume of leaks from deteriorated seals of all the areas surveyed. As a result, the intern recommended that the East and West wing windows also be upgraded to double-pane, low-E coated, argon filled, fiberglass frame windows. An estimated minimum annual energy savings of $4,704 is possible in addition to the indirect benefits of improved room comfort for patients and staff.

Blank Window Replacement: Most of the windows at Blank Children's Hospital were installed in 1980 and are losing energy from heat loss, so a more energy efficient window replacement was recommended. While savings will be realized from this upgrade, the unique, custom nature of the Blank Hospital windows will yield a slightly longer payback period than those calculated for the other hospital wings. An estimated minimum annual energy savings of $1,889 could be achieved, along with the added benefits of improved room comfort for patients and staff.

ESTIMATED CONVENTIONAL AIR POLLUTANTS DIVERTED IN METRIC TONS
For Implemented and In Progress Recommendations

TOTAL FOR ALL SECTORS						
CO_2	NH_3	NO_X	PM_{10}	$PM_{2.5}$	SO_2	VOC
15.65	0.0	0.03	0.0	0.0	0.03	0.02

ESTIMATED GREENHOUSE GASES DIVERTED IN METRIC TONS

TOTAL FOR ALL SECTORS			
$MTCO_2e$	CH_4	N_20	CFC
14.37	5.46	0.05	0.07

ESTIMATED CONVENTIONAL AIR POLLUTANTS DIVERTED IN METRIC TONS
For Recommendations in Recommended Status

TOTAL FOR ALL SECTORS						
CO_2	NH_3	NO_X	PM_{10}	$PM_{2.5}$	SO_2	VOC
45.92	0.0	0.08	0.01	0.01	0.15	0.02

ESTIMATED GREENHOUSE GASES DIVERTED IN METRIC TONS

TOTAL FOR ALL SECTORS			
$MTCO_2e$	CH_4	N_20	CFC
48.29	6.69	0.24	0.26

2015

24-WEEK INTERNSHIP

CASE SUMMARIES

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

A 24-week intership 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 more complex projects.

Six 24-week projects are underway in 2015 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 2016 Case Summary Booklet.

CARGILL, INC.

CEDAR RAPIDS

DAVID NYTKO
MECHANICAL ENGINEERING
THE UNIVERSITY OF IOWA

COMPANY PROFILE

Cargill is a privately-owned business that began in 1865 as a grain storage facility. It has grown to be a global producer and marketer of food, agricultural, financial and industrial products and services. Cargill is committed to environmental stewardship and strives to be a good corporate citizen in the communities that it serves. The Cedar Rapids Corn Milling Plant works with customers and farmers to process raw corn into a diverse collection of marketable materials, foods, and ingredients. The Cedar Rapids, Iowa, plant operates three shifts per day and employs about 200 workers.

PROJECT BACKGROUND

The facility uses water from wells as a coolant for most of the machinery. As the coolant flows through the equipment, the coolant absorbs the heat and eventually discharges into the river. While the effluent is free of contaminants, the temperature can also impact the natural environment. The purpose of this 24-week project is to evaluate methods to lower the temperature of the effluent in order to alleviate the impact of the warmer water on the environment. The first part of the project is to gather water flow and temperature data throughout the process. This data will then be used to evaluate methods and make recommendations for improvements to the current process or the potential addition of a post-cooling system.

INCENTIVES TO CHANGE

In the future, there will be new, required calculations for determining allowable temperature parameters for water discharged into designated waterways. These new calculations are expected to require a substantial reduction in the temperature of the cooling water discharged into the river. Due to these upcoming calculations, Cargill would like to evaluate the current well water and cooling systems, research methodologies to improve the efficiency of the system, and determine areas of opportunity to modify the discharge temperatures.

RESULTS

Effluent Analysis: The intern catalogued all equipment that utilizes well water as a coolant. Documentation included the proper identifications, location, and pictures of the equipment for ease of distinction. Using this resource, the intern also identified the original manufacturer information of the equipment and contacted the manufacturers to collect the original drawings and specifications to be included in the equipment files. This catalogue of data will also be useful in the maintenance of equipment to ensure that the machinery is operating within its designed parameters. The intern created a flow diagram using software that allows for the visualization of the system and the monitoring of flows and temperatures of the well water at different locations in the plant. The intern also developed piping and instrumentation diagrams (P&IDs) to provide a detailed drawing of the equipment, valves, sensors, pipe sizes, and flows of the well water. The P&IDs will be an essential resource in the analysis of the current system and for the planning of process changes.

In addition to the equipment, the intern identified key areas for monitoring and recommended purchasing and installing flow and temperature sensors. The intern took daily measurements to establish trending during the hottest months, which helped to understand how much cooling capacity is required and where modifications in the system will be most effective.

Next Steps: During the second 12 weeks of the project, the intern will focus on completing the temperature and flow model and finish gathering any essential data. Once the intern has finished collecting this information and organized it into a usable model, the model will be used to analyze the heated water, providing valuable insight and guidance towards possible solutions. The intern will then research and evaluate strategies that could reduce the temperature of the discharge water. The intern will also research the implementation of various cooling systems and the possible elimination of single pass cooling in areas where recirculation is feasible.

The most feasible strategies for the reduction of discharge temperature will be further researched in areas such as capital investment and environmental impact. These will become recommendations, and the intern will write proposals describing each potential project.

PRINCIPAL FINANCIAL GROUP (THE PRINCIPAL)

DES MOINES

ROBERT SCANLON
MECHANICAL ENGINEERING
IOWA STATE UNIVERSITY

COMPANY PROFILE

Founded in 1879, the Principal Financial Group® (The Principal) is a global investment management leader. The Principal offers businesses, individuals and institutional clients a wide range of financial products and services including retirement, asset management and insurance. As a member of the FORTUNE 500®, The Principal has $519.3 billion in assets under management, serves some 20.1 million customers worldwide and is headquartered in Des Moines with 14,900 employees worldwide.

PROJECT BACKGROUND

The Principal has tasked its Pollution Prevention intern with identifying energy efficiency opportunities at its field office locations, and benchmarking the energy performance of a newly renovated corporate office in Des Moines. With this information, the intern will be able to make recommendations that will reduce energy usage and subsequent carbon emissions generated by The Principal.

INCENTIVES TO CHANGE

"Our company's core value of integrity drives its commitment to being an industry leader in sustainability. It's important to us because we know it's important to our shareholders, our customers, our employees and the communities where we operate," says Larry Zimpleman, chairman. The Principal strives to be a leader in sustainability by reducing carbon emissions and water usage and by increasing solid waste recycling.

RESULTS

During the first 12 weeks, the intern conducted energy audits at several field offices, compiled existing energy data from meters and bills, and began to research and test options for increasing energy efficiency throughout The Principal.

Field Office Energy Efficiency: The Principal leases more than 100 offices in the United States alone, six of which are located in Iowa. Although there are areas in which energy efficiency can be increased, it is difficult to apply efficiency measures across all offices because each office varies in size, design, lease type and other factors. The intern tested for efficiency increases in lighting, office plug loads and data center cooling units. In commercial office buildings, lighting often makes up nearly one third of energy usage. Adjusting lighting schedules and retrofitting current lighting with more efficient lighting will yield significant energy savings. Another major energy consumer at commercial offices is the electrical plug load. Implementing the use of smart power strips can reduce electric drain through plug loads that are not in use outside of normal office hours. Smart power strips can sense either load or occupancy to power off non-essential devices to save energy. Supplemental cooling units that serve data centers can also be large consumers of energy. Regularly servicing the units and verifying the unit is sized correctly for the heat load of the data center can yield significant energy savings.

Campus Blueprint Benchmarking: The Principal is currently undergoing a campus-wide renovation for its corporate offices in Des Moines. The first building to be renovated, 750 Park Avenue, was fully commissioned in early 2015. The intern is benchmarking the current energy performance of the building to determine where additional areas for energy efficiency improvements can be found. The benchmarking process includes accounting for changes in energy usage due to variables like weather, data center size, occupancy and space utilization. By benchmarking this building, additional recommendations for energy efficiency can be made for future building renovations.

Next Steps: With most of the data collection process completed, the intern can begin to further test and research specific energy efficiency opportunities to develop a set of detailed recommendations for The Principal. A key part of the next 12 weeks will be to develop a process that project managers or future interns can follow to ensure that The Principal continues to improve upon its energy efficiency and sustainability performance.

SIVYER STEEL CORPORATION

BETTENDORF

MADISON CURRIE
MECHANICAL ENGINEERING
IOWA STATE UNIVERSITY

COMPANY PROFILE

Sivyer Steel Corporation was founded in 1909 as one of the first big steel foundries in the United States. The company produces steel castings for various industries including mining, military, energy, agriculture, railroad, and construction. The company is an ISO 9001:2008 certified steel foundry devoted to safety and quality of the products and services the company provides. Sivyer Steel is also committed to continuous improvement of plant operations to ensure safety of the employees and to be a good steward of the environment. The plant is currently located in Bettendorf, Iowa, operates 24 hours per day, 5 days per week, and employs approximately 250 people.

PROJECT BACKGROUND

Sivyer Steel's metal casting process consists of several steps that can be broken down into three main stages: pre-casting, casting, and post-casting. The metal casting process requires large amounts of energy to power the equipment or in performance of the manufacturing function. Reducing energy intensity and establishing an energy management program will help Sivyer accomplish their energy reduction goals and support substantial decreases in annual energy costs for both electricity and natural gas.

INCENTIVES TO CHANGE

Sivyer Corporation has set a goal to reduce energy usage by 10 percent in the next five years. To achieve this goal, Sivyer entered into a partnership with the U.S. EPA's ENERGY STAR Program and has also committed to participation in the ENERGY STAR Challenge for Industry (The Challenge). This program encourages a team within the company to develop a strategic action plan for reducing energy usage, associated costs and environmental impacts. Having a strategic plan will help the company maintain a focus on continuous development of best practices for source reduction and energy efficient alternatives and achieve their reduction goals.

RESULTS

ENERGY STAR Involvement: Initially, the intern enrolled Sivyer in The Challenge and established a file containing all of the information necessary to verify the company's participation. Additionally, the intern developed an energy intensity tracking tool used to monitor Sivyer's progress based on BTUs consumed per pound of steel produced. This metric will allow Sivyer to monitor the plant's energy intensity over a five year period and make the necessary adjustments for meeting The Challenge.

Energy Audit: The intern is conducting a plant-wide assessment to determine energy usage of the equipment. The intern will collect all necessary specifications to determine the amount of energy consumed by each piece of equipment currently in operation. This analysis will determine where to focus energy reduction efforts in order to have the greatest impact.

Energy Efficient Lighting: The intern conducted a plant-wide assessment of the lighting system and researched energy efficient technologies to replace the metal halide fixtures. A variety of LED replacement options could maintain or improve lighting quality and reduce energy usage and associated costs. The intern will continue to research available rebates and incentives and provide a cost analysis that will include projected annual environmental and cost savings, a simple payback, and ROI calculations.

Solid Waste Reduction: The intern researched beneficial reuse opportunities for foundry sand and slag, and discovered the most prominent use to be in manufactured top-soils and peat moss. The intern will continue to identify and evaluate disposal alternatives for sand and slag.

Flow-Coat Reuse: Currently, excess paint drips into a collection trough where it is allowed to dry before being manually removed. If the flow-coat paint could be removed after each coating while still wet, it could be put back into the system for reuse. Returning the paint to the system for reuse could save significant purchasing and disposal costs.

Flow-Coat Alternative: The properties of the current flow-coating used at Sivyer require it to be in constant suspension to avoid hardening, which requires continuous operation of the motors used to mix the paint. These motors are air-powered and are approximately 1/2 hp each; however, they are run by a 300 hp air compressor. In a recent demonstration, a new alumina-silica coating showed improved casting quality, was easier to remix and showed no tendency to form "hard packing" after the mixer was turned off. The intern will continue to evaluate the alumina-silica flow-coating for use at Sivyer. If feasible, switching to the alumina-silica flow-coat could extend the life and quality of the paint itself and greatly reduce disposal costs. Additionally, allowing the air compressor to be turned off when the paint system is not in use will reduce energy usage and associated costs and emissions.

WEST LIBERTY FOODS, LLC

JUSTIN WILLIAMS
MECHANICAL ENGINEERING
THE UNIVERSITY OF IOWA

COMPANY PROFILE

West Liberty Foods is a meat processing and slicing company with four locations: West Liberty, Iowa; Mount Pleasant, Iowa; Tremonton, Utah; and Bolingbrook, Illinois. The West Liberty plant has 850 employees and is in operation 16 hours per day, 5 days per week with some weekend shifts, as required. All four plants have received ISO 14001:2004 certification. Additionally, three of the four plants have been third-party verified as "Landfill Free," meaning less than 1 percent of their waste is sent to the landfill. The newest facility in Bolingbrook is also approaching Landfill Free status.

PROJECT BACKGROUND

Currently, West Liberty Foods determines unit production cost by dividing total cost among the production lines based on the amount of product that is produced by each line. The purpose of the 24-week intern project is to create a template to determine the actual production costs and environmental and safety impacts of each production line. The template would allow West Liberty Foods to replicate the analysis and quantify the production costs and impacts of each product line.

INCENTIVES TO CHANGE

West Liberty Foods strives to be a good steward of the environment in all areas of their operations. The company has received numerous awards for outstanding environmental performance and continues to seek improvement opportunities. Gaining a better understanding of the environmental impacts of production will be useful as the company strives to maximize the efficiency in which it operates and achieve environmental excellence.

RESULTS

The production line for the cold-cut trio consists of eight distinct processes. These include Evisceration/Cutup, Pre-Blending, Blending, Stuffing, Cooking, Cooling, Slicing/Packaging and Ship-Out. This line was selected as the model for development of an assessment template that can be replicated across the remaining production lines by the company.

Life Cycle Analysis: The intern first created a process map to identify all the equipment associated with the cold-cut-trio production line. A life cycle and cost assessment was then conducted to quantify total operating costs of the process. Costs considered include energy usage, water treatment and disposal, compressed air, steam, refrigeration, plant ventilation, chemicals, and labor. Considerations for determining life cycle costs included purchasing, production and disposal.

Next Steps: During the second 12 weeks of the project, the intern will continue to take measurements to determine how much of each resource is attributed to the production of cold-cut-trio. The overall manufacturing of the cold-cut-trio is divided into eight distinct stages. The resource usage in each stage will be individually audited taking into account the source and destination. Upon completion, the life cycle impacts and true cost to manufacture this product will be understood.

The assessment data will be used to develop a model for calculating the life-cycle impacts and costs for the other product lines. The model will allow West Liberty Foods to replicate the analysis and quantify the production costs and impacts of each product line.

Understanding the resource usage and production costs could enable the company to maximize the efficiency of their production lines and improve bottom line savings.

WINNEBAGO INDUSTRIES

JESSE LUMPA
INDUSTRIAL ENGINEERING
IOWA STATE UNIVERSITY

FOREST CITY

COMPANY PROFILE

Winnebago Industries is a leading manufacturer of recreational vehicles (RVs) in the country. The company is headquartered in Forest City, Iowa, with a workforce of over 2,400 people. The production facility in Forest City covers more than 200 acres making it the largest production facility of RVs in the world. Additional production facilities are located in Charles City, Iowa, Lake Mills, Iowa, and Middlebury, Indiana. Winnebago differs from several other RV manufacturers because the bulk of the components used in the RVs are produced at Winnebago's main facility in Forest City.

PROJECT BACKGROUND

Winnebago has long been committed to reducing their environmental impact. This is the third year that Winnebago has participated in the Pollution Prevention Intern Program in order to help with their sustainability efforts. The company's current environmental project is to divert solid waste from the landfill. Winnebago currently diverts nearly 70 percent of their solid waste from the landfill, and the goal of the intern's project is to increase the amount diverted.

INCENTIVES TO CHANGE

RVs are built for people to enjoy the outdoors, and Winnebago is committed to helping their customers enjoy the environment by practicing sustainability and conservation in their manufacturing operations. Winnebago continues to strive towards a goal of Zero Landfill and grows closer each year. The company also recognizes the economic benefits of Zero Landfill as well. With landfill fees increasing across the state, there is even more opportunity for cost savings.

RESULTS

Wood Waste Recycling: Winnebago generates wood waste from broken pallets, packaging, and scrap material in their cabinet production area. Currently, all of the wood that Winnebago discards is put into separate containers and is delivered to the landfill. A wood waste recycling company has agreed to take all of the wood waste that Winnebago generates and grind it up for use as mulch and animal bedding. An exterior concrete pad will be constructed to store and separate the wood into various grades, which can then be loaded onto trucks. By recycling their wood waste using this new method, there will be significant cost savings for Winnebago.

Stitchcraft Recycling: Stitchcraft is responsible for the upholstery and carpeting in all of Winnebago's RVs. Kraft paper is used as the backing on certain fabrics to protect it from the conveyer belts. There are also cardboard tubes that the fabric and kraft paper is rolled on. Both the kraft paper and the tubes can be incorporated with the cardboard that is currently baled at the waste sort facility. By recycling these materials, Winnebago can divert additional solid waste currently being sent to the landfill and increase their cost savings.

Ceramic Tile Recycling: Ceramic tile is used for flooring in several RVs that Winnebago produces. Currently, all scrap ceramic tile is sent to the landfill. As an alternative, the intern is researching both short and long term options for diverting and beneficially reusing this material.

Sidewall Scrap Recycling (East Bertha Production Area): The side walls of RVs are composed of fiberglass and polystyrene. The materials are glued and pressed together, which makes recycling the scrap composite material very difficult. The compactor this material is loaded into is hauled to the landfill more than any other compactor at Winnebago because the sidewall scrap is a large volume, low density waste. The intern will conduct additional research during the second 12 weeks of the internship to determine how this material can be either recycled or disposed of more efficiently.

Motor Home Assembly Plant Waste Sorting (Bertha Production Area): After conducting a waste sort, the intern discovered that over 40% of the waste coming from the Motor Home Assembly plant has the potential to be recycled. During the second 12 weeks of the project, the intern will be researching different ways that recycling could be implemented in this part of the company campus.

ZOETIS

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COMPANY PROFILE

Zoetis is the largest producer of animal vaccines and health products in the world with 27 facilities globally. The Charles City, Iowa, facility employs more than 400 people. The facility runs 24 hours per day, 7 days per week although the majority of employees work Monday-Friday. Zoetis produces many different products such as vaccines, anti-infectives, and parasiticides. These products are used by farmers and pet owners primarily for chickens but also for many other animals such as dogs, cats, cattle, swine, poultry, and horses.

PROJECT BACKGROUND

Zoetis' energy bill is calculated from actual energy usage and the highest rate of demand in a month. Utility providers must maintain the capacity to provide energy without interruption when all facilities drawing on that source are operating at maximum energy usage. The cost of this stored energy is passed on to the consumer in the form of peak demand charges. The goal of this 24-week project is to identify key contributors to the electrical load and develop strategies to reduce energy consumption particularly during peak load hours.

INCENTIVES TO CHANGE

The production processes at Zoetis require a highly controlled environment. Maintaining such specific environmental conditions can be very energy intensive. Zoetis is continually seeking opportunities to improve the efficiency of its facility and improve environmental performance. Identifying and improving the efficiency of major energy users could significantly reduce energy costs and improve environmental impact.

RESULTS

Peak Demand Impacts: The greatest impact on peak demand of all of the analyzed criteria was dew point, which is a weather measurement that incorporates both temperature and humidity. The reason that dew point has such a significant impact on the facility's energy demand is that the air needs to be treated when either the temperature is high or humidity is high. Additionally, the equipment used to counter the heat and humidity conditions are large energy users such as chillers and air handling units.

The air handlers cool air to a designated set point when the outdoor air temperature is too high. To reduce humidity, the air handlers cool the air even further, which condenses moisture out of the air. The air is then heated back up to the temperature set point. Given this additional workload, dew point has large impact on the electrical demand from the chillers and air handlers.

In addition to the increased demand of dew point conditions, the billing rate also increases during the summer, which results in a significant increase in electricity costs for the summer months. The chillers account for a large portion of the energy use in the summer. These two findings suggest that improving the efficiency of the chillers and air handlers could significantly reduce energy usage and associated costs.

Freeze-dryers: Seven freeze-dryers are used in one of the production processes where energy usage is high. The freeze-dryers have a spike in energy usage when they start and another spike after they finish with a batch. Since the peak demand occurs in the afternoon, the freeze-dryer's early morning startup is not likely creating an increase in the peak-demand charges. The spike at the end of a cycle has been attributed to a very short process called the pump down. A review of the method used by Zoetis' utility provider for recording energy data revealed that the short duration of the energy spike during pump down is also not likely to have a significant impact on peak demand charges; however, improving the efficiency of the freeze-dryers would reduce the overall energy load thus reducing the amount of energy needed during peak demand hours.

The majority of opportunities to reduce energy demand during the afternoon hours appear to be with the chillers and air-handling units.

Next Steps: During the second 12 weeks of the project, the intern will research strategies to optimize the efficiency of these units and develop cost-effective recommendations to reduce energy consumption and associated demand charges.

The intern is currently testing the effects of changing room-air set points. The intern will also evaluate equipment shutdowns during periods of peak demand, setbacks, occupancy sensors, and improvements in equipment efficiency.

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