WORKING TOGETHER TO ACHIEVE ECONOMIC AND ENVIRONMENTAL RESULTS

POLLUTION PREVENTION

INTERN PROGRAM

2013
CASE SUMMARIES

www.iowap2services.com

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CONTENTS

2013 POLLUTION PREVENTION INTERNS

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

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

STUDENT PERSPECTIVES:

"It is rewarding to have real responsibility in a professional setting where interns are challenged to be self-motivated and responsible for completing real projects."

— **Olin Postlethwait, Iowa State University**

"Building your ideas, amassing the information, and developing alternative actions, products, or processes into a recommendation on which you can answer almost any question is highly rewarding."

— **Callie Schultes, Iowa State University**

"This program gives interns an opportunity to exercise engineering knowledge they have learned in class and practice critical thinking through an environmental and economical lens. This is really a great service to interns and companies alike."

— **Kimberly Scherber, Iowa State University**

"After seeing how much of an impact something I did will have, I am much more confident in my abilities to take ownership of a project and really contribute and make a difference."

— **John Baumhover, University of Iowa**

COMPANY TESTIMONIALS:

"This project fully met our needs and occurred at a time when resources were committed to other projects. The timing and depth of research could not have been better. This program has been an extremely valuable resource to CNH."

— **Mike Nelson, CNH America, LLC**

"We had an excellent experience. We saved thousands of dollars and advanced toward our green goals."

— **Brian Kumm, Hormel Foods**

DIRECTOR'S NOTE

The quote "…Alone we can do so little, Together we can do so much." by Helen Keller is truly representative of the Department and the Pollution Prevention Intern Program. The Department and the Pollution Prevention Intern Program rely on business and academic partnerships to accomplish the economic and environmental results as shown in the following pages and to preserve our natural resources.

Each year new partnerships are added bringing together colleges and universities, business and institutions, and government. Interns provide fresh perspectives to Iowa companies and at the same time gain valuable hands-on job experience. Companies realize that the benefits of reduced costs and positive environmental impact do fit together.

Since 2001, more than 166 dedicated companies have saved more than $71.7 million by implementing the solutions provided by Pollution Prevention Interns. The environmental and efficiency improvements save more than water, electricity and materials going to the landfill; they save jobs and often create opportunities to expand and hire additional staff. These strong and efficient Iowa companies give the entire state an advantage in the competitive global marketplace.

Interns in this program are provided the opportunity to demonstrate their professional abilities at their host companies. These students also establish and build professional networks through host company staff and contact with vendors and suppliers. Approximately 25% of the interns are introduced to an employment opportunity as a result of their Pollution Prevention Internship.

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 2014 Pollution Prevention Intern Program.

CHUCK GIPP

Chuck Gipp

TOTAL IMPLEMENTED ACTUAL SAVINGS 2001 - 2013		
CATEGORY	**REDUCTION**	**COST SAVINGS**
WATER CONSERVATION	1,347,180,975 GALLONS	$5,971,196
SPECIAL WASTE	75,146 TONS	$837,912
SOLID WASTE	132,459 TONS	$14,129,731
HAZARDOUS WASTE	7732 TONS	$10,783,046
MERCURY ABATED	42,817 GRAMS	
ENERGY	349,269,427 KWH 2,037,872 *MMBTU 8,458,155 THERMS	$19,830,716 $6,823,046
OTHER		$13,336,200
BOD	104	$26,640
		TOTAL: $71,738,487

*MMBTUS are calculated from kWh and therms for special reporting only. All dollars and actual energy saved are reported under therms and kWh.

IMPLEMENTED AIR POLLUTANTS DIVERTED IN METRIC TONS							
TOTAL FOR ALL SECTORS							
CO_2	**SO_2**	**CH_4**	**N_20**	**CFC**	**NOX**	**VOC**	**PM_{10}**
229,937.75	1,085.02	106,765.81	14,552.99	2,640.67	572.32	1,549.85	161.73

Air emissions and greenhouse gases shown on this page represent implemented projects from 2001-2013.

2013 EXECUTIVE SUMMARY

Eighteen upper-level engineering students teamed with the Department of Natural Resources' 2013 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 $2.8 million annually. Of these, projects estimated to save $865,000 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.

In 2012, four interns committed to 24-week projects that finished up in November. The results of these extended 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 conditions.

Final results of this year's 24-week project will be posted to the department's website in January and highlighted in the next published case summary booklet in 2014.

Collectively, these case summaries show that outstanding results are possible when companies, students and the DNR work together to achieve common environmental goals.

The following chart shows the implemented results of the summer of 2013 program, including the conventional air pollutants and greenhouse gases diverted.

2013 IMPLEMENTED SAVINGS		
CATEGORY	**REDUCTION**	**COST SAVINGS**
WATER CONSERVATION	29,818,107 GALLONS	$57,445
SOLID WASTE	3787 TONS	$320,901
HAZARDOUS WASTE	12 TONS	$31,836
ENERGY	7,834,032 KWH 80,766 *MMBTU 540,286THERMS	$306,609 $112,284
OTHER		$35,937
		TOTAL: $865,012

*MMBtus are calculated from kWh and therms for special reporting only. All dollars and 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**	**NOX**	**VOC**	**PM_{10}**
2,5823.84	71.28	2,904.64	229.98	173.27	37.17	10.95	3.11

NOTE:

> Air emissions and greenhouse gases shown in this book are life cycle estimates and include external activities such as purchasing utilities. Totals do not solely represent emissions generated at the plant sites.

> Greenhouse gas estimates for solid waste reduction projects are derived from U.S. EPA, Waste Reduction Model (WARM), Version 12, Available at: http://www.epa.gov/wastes/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

BRIDGESTONE AMERICAS TIRE OPERATIONS

ADDISON ARDOLINO
INDUSTRIAL ENGINEERING
THE UNIVERSITY OF IOWA

COMPANY BACKGROUND

Firestone Agricultural Tires is a branch of Bridgestone Americas Tire Operations, which specializes in the production of agricultural and forestry tires. Sitting on nearly 120 acres in Des Moines, Iowa, with more than two million square feet underneath one roof, the plant is the largest agricultural tire manufacturing facility in the country. The production from this plant supplies a significant percentage of original equipment and replacement tires in the global agricultural market.

PROJECT BACKGROUND

Recyclable waste streams exist within the facility but some are not being captured in the manufacturing process. The company requested assistance in researching outlets for rubber waste streams and re-structuring the layout of recycling receptacles to divert additional recyclable materials from the landfill.

INCENTIVES TO CHANGE

Currently, two Bridgestone plants in the United States are zero landfill operations. These operations have served as environmental models for the company. The Bridgestone agricultural tire plant is supported by a customer base of farmers and field workers who value air, land, and water quality. To meet customer demand, the company holds each of their facilities responsible for maintaining business practices that promote these values. The plant is also working toward a goal of zero-landfill status.

RESULTS

Dump-Grade Rubber Recycling: Standard procedures for grading non-conforming rubbers, which are not suited to be re-milled in the Bridgestone process, have been evaluated and updated to match a larger customer base. These customers are interested in the material and are equipped with newer technologies to process the scrap. Without an outlet for this material, 240 tons per year was sent to the landfill. It has recently gained value as a raw material for making rubber car accessories and high-grade railway crossings. Diverting this waste stream from the landfill could provide an estimated savings of $13,680 per year.

LDPE Recycling: The capacity for polyethylene recycling on the plant floor has been doubled to accommodate specific areas that generate high quantities of recyclable low-density polyethylene films (LDPE). The films are generated as a result of various quality processes used to protect the tires during transportation and storage throughout the manufacturing process. The expanded collection program is expected to provide a cost benefit of $13,300 through revenue from recyclable plastics and savings from diverted landfill fees.

Trim Rubber Recycling: Trim rubber is a process waste generated in the Final Finish department. These trim pieces were identified as a recyclable waste stream. A separate collection system has been developed to send the trim rubber to a local rubber recycling facility rather than compacting and sending it to the landfill. While it does not yet generate a cost savings, it does divert nearly 54 tons of material from the landfill each year.

Green Tire Recycling: Bridgestone defines tires that have not been vulcanized as "green tires." This waste stream was being sent to the landfill during the initial waste audit. Multiple rubber processing facilities in the Midwest have shown interest and are evaluating test material that's been shipped to their facilities. Annually, up to 480 tons of green tires is expected to be diverted from the landfill once negotiations have been completed for terms of delivery. The savings from diverting these scrap tires from the landfill is approximately $27,360.

Tire Room Paper Recycling: Additions to the paper-recycling infrastructure were made to expand paper collection to new areas of the plant, namely the tire room office staff. These efforts are expected to double the current paper recycling stream, diverting 12 tons per year from landfills and saving an additional $700/year.

Cured Butyl Recycling: Butyl rubber trimmings are generated as a result of the curing process for the production of tire bladders. Additional research is needed to identify a market to recycle these trimmings. If a suitable alternative can be located for this rubber, 24 tons of cured butyl rubber compounds could be diverted from the landfill.

CONVENTIONAL AIR POLLUTANTS AND GREENHOUSE GASES DIVERTED IN METRIC TONS

TOTAL FOR ALL SECTORS							
CO_2	SO_2	CH_4	N_2O	CFC	NO_X	VOC	PM_{10}
233							

PROJECT	ANNUAL COST SAVINGS	ENVIRONMENTAL RESULTS	STATUS
DUMP-GRADE RUBBER RECYCLING	$13,680	240 TONS	IN PROGRESS
LDPE RECYCLING	$13,300	140 TONS	IN PROGRESS
TRIM RUBBER RECYCLING	N/A	54 TONS	IN PROGRESS
GREEN TIRE RECYCLING	$27,360	480 TONS	IN PROGRESS
TIRE ROOM PAPER RECYCLING	$700	12 TONS	IN PROGRESS
CURED BUTYL RECYCLING	N/A	24 TONS	RECOMMENDED

CNH AMERICA, LLC

OLIN POSTLETHWAIT
MECHANICAL ENGINEERING
IOWA STATE UNIVERSITY

COMPANY BACKGROUND

CNH America, LLC (Case) is a global manufacturer of heavy construction and agricultural machinery. Established in 1937, the Burlington, Iowa, plant specializes in producing tractor-loader backhoes, tractor-loader landscapers, and rough-terrain forklifts for Case and New Holland. The plant, which employs more than 400 people, is credited with making Burlington known as "The Backhoe Capital of the World".

PROJECT BACKGROUND

A previous intern with the Pollution Prevention Intern Program provided the Case plant with an energy map. This analysis showed that electricity consumption had great opportunities for improvement, especially in the production areas of the plant. Case's industrial curing ovens are a large part of the plant and account for a major portion of the energy consumed. The current intern focused on identifying opportunities in the production equipment, primarily in the ovens and their components, to reduce energy usage and associated costs.

INCENTIVES TO CHANGE

Case is part of the Fiat Industrial group, which has worked extensively to implement sustainability initiatives worldwide and was the first on the Dow Jones Sustainability Index. The Burlington plant, certified by International Organization for Standardization (ISO) 14001, strives to continuously exceed their established reduction goals for energy, water use, solid waste generation and emissions. Reducing energy usage would help the company meet their environmental performance goals and save money.

RESULTS

Pre-treat Motors: The oven system at the plant is nearly 30 years old. There has been much advancement in technology since the original installation, especially for motors. Motors rated as "Premium®" by the National Electrical Manufacturers Association (NEMA) are more energy efficient and require less maintenance. Replacing pre-treat motors with NEMA-rated motors would save energy, but the return on investment does not justify immediate implementation. It is recommended that as motors become inoperable that they be replaced with motors labeled by NEMA.

Circulation Blower Motors: Replacement of recirculation blower motors with NEMA Premium® motors show similar results. Although replacement of the motors would lead to energy savings the return on investment was not feasible. It is recommended the circulation blower motors also be replaced with NEMA-labeled motors as they become inoperable.

Insulation: Insulation is necessary for minimizing heat losses. Over time, insulation can become ineffective due to wear and tear and other factors. One oven in the E-coat paint process has lost most of its original insulation. Installing new insulated oven panels on the outer wall could lead to significant energy savings of more than 441,000 therms.

Replacing the insulation would also increase the production efficiency of the oven with faster start-up times and a shorter system run time. Lower demand on the motors, burners, belts and blowers could reduce costly repairs and down time. A reduction in energy usage, fewer maintenance issues, and prolonged system life would provide substantial cost savings.

Preventative Maintenance Plan: A preventative maintenance plan (PMP) keeps the system running at maximum efficiency and prolongs the useful life of the equipment. When a regular maintenance plan is followed, problems can be identified and scheduled for repair. Often this can help avoid unexpected breakdowns, costly repairs and loss of production.

Implementing a PMP for the oven system will ensure it is running at maximum efficiency and reduce energy usage. Additional data is needed to quantify the specific results pertaining to the Burlington plant, but documentation of the benefits can be found within the industry.

CONVENTIONAL AIR POLLUTANTS AND GREENHOUSE GASES DIVERTED IN METRIC TONS

TOTAL FOR ALL SECTORS							
CO_2	SO_2	CH_4	N_2O	CFC	NO_X	VOC	PM_{10}
501.11	1.73	614.55	2.27	6.48	1.44	2.35	0.11

PROJECT	ANNUAL COST SAVINGS	ENVIRONMENTAL RESULTS	STATUS
PRE-TREAT MOTORS	$276	3,168 KWH	RECOMMENDED
CIRCULATION BLOWER MOTORS	$872	10,000 KWH	RECOMMENDED
INSULATION	$70,863	441,742 THERMS	IN PROGRESS
PREVENTATIVE MAINTENANCE PLAN	$600	TBD	RECOMMENDED

DANFOSS POWER SOLUTIONS INC.

AUSTIN RUTHERFORD
MECHANICAL ENGINEERING
THE UNIVERSITY OF IOWA

COMPANY BACKGROUND

Danfoss Power Solutions Inc. is a world leader in the design, manufacture and sale of engineered hydraulics. Most of the electric systems and components are used in mobile equipment. Danfoss Power Solutions, located in Ames, Iowa, is the North America headquarters of these operations. The facility employs more than 1,000 people on 3 shifts, 24 hours a day/5 days a week. The company strives to be a good corporate citizen and demonstrates a concern for the wellbeing of employees, communities, and the environment, in addition to the customers they serve.

PROJECT BACKGROUND

Danfoss Power Solutions Inc. is currently in the planning phase of implementing an environmental management system (EMS). The EMS calls for an attitude of continuous improvement on environmental concerns, which matches nicely with the focus of this summer's projects. The warehouse recycling project focused on diversion of solid waste from the landfill. The goal of the compressed air projects was to reduce energy use while avoiding any negative effects on productivity.

INCENTIVES TO CHANGE

Danfoss Power Solutions Inc. changed hands recently and the new owners have a strong passion for the environment. Along with the environmental benefits of the projects there is a space benefit. The warehouse facility is generating seven to twelve dumpsters filled with three yards of solid waste per day, and space for more dumpsters is limited. Implementation of a recycling program and baling the recyclable materials would ease the overall need for additional space and increase landfill diversion.

RESULTS

Warehouse Recycling: Danfoss Power Solutions Inc. operates a warehouse facility that ships and receives parts from all around the world. The facility attempts to reuse as many of the packaging materials as they can. Due to the large volume of shipments, much of the materials remain unused and are discarded as solid waste. A commercial single-stream recycling program will be put in place at the warehouse facility, diverting more than 100 tons of cardboard and plastic to an area recycler. The resulting savings could be $11,640.

Warehouse Recycling – Phase II: A second phase to this project would be to further separate the cardboard from the single-stream materials. Baling the cardboard separately would create a marketable product and could generate savings of more than $17,364.

Compressed Air System
The cost to run the compressed air system at the main facility is estimated to be more than $180,000. As a result, even a small change on this system will result in substantial cost savings.

Warehouse Air Leaks: A leak detection survey was conducted on the three-year-old compressed air system at the warehouse facility. An ultra-sonic leak detector was used to identify leaks, record them into a log and tag them for repair. Repairing the leaks could reduce the load on a 75HP compressor and save more than $5,000 a year. A preventative maintenance program will be set up with the main facility to minimize future losses due to leaks.

Leak Tracking System: An air leak tracking system was created for the main facility that tracks which production cells generate the most leaks, allowing maintenance crews the opportunity to focus on areas that are more prone to leaking. Along with this benefit, the log will display the total amount of money saved per year and the cumulative total.

Parts Washers: Stand-alone parts washers are used to clean parts at various stages in the production process and are major users of compressed air. Adjustments were made to cycle times and rate of air consumption to increase efficiency and reduce associated costs.

Blow-off Guns: A more efficient air nozzle was installed on blow-off guns to increase pressure and reduce the volume of air needed for optimum efficiency. This additional pressure will also decrease the amount of time needed to clean each part, creating a notable increase in productivity. This is expected to add an additional $6,120 in revenue generated by that work cell. Several other areas of production were evaluated for use of the efficient nozzle. However, custom parts would be needed to retrofit the guns and the added cost would make this change less cost effective in the other work areas.

CONVENTIONAL AIR POLLUTANTS AND GREENHOUSE GASES DIVERTED IN METRIC TONS

TOTAL FOR ALL SECTORS							
CO_2	SO_2	CH_4	N_2O	CFC	NO_X	VOC	PM_{10}
387.51	0.68	4.71	0.06	1.54	0.32	0.01	0.02

PROJECT	ANNUAL COST SAVINGS	ENVIRONMENTAL RESULTS	STATUS
WAREHOUSE RECYCLING	$11,640	100 TONS	IN PROGRESS
WAREHOUSE RECYCLING – PHASE II	$17,364	105 TONS	RECOMMENDED
WAREHOUSE AIR LEAKS	$5,856	87,402 KWH	IMPLEMENTED
LEAK TRACKING SYSTEM	$2,425	25,373 KWH	IMPLEMENTED
PARTS WASHERS	$1,811	27,029 KWH	IMPLEMENTED
BLOW-OFF GUNS	$9,524	49,014 KWH	IN PROGRESS

2012 24-WEEK INTERNSHIP

DUPONT PIONEER

JAKE BRENNEMAN
MECHANICAL ENGINEERING
IOWA STATE UNIVERSITY

COMPANY BACKGROUND

DuPont Pioneer (www.pioneer.com), headquartered in Des Moines, Iowa, is the world's leading developer and supplier of plant genetics, providing high-quality seeds to farmers in more than 90 countries. Pioneer provides agronomic support and services to help increase farmer productivity and profitability and strives to develop sustainable agricultural systems for people everywhere.

PROJECT BACKGROUND

Research and production at Pioneer's operations in Johnston, Iowa, generate approximately two million pounds of discard corn products, which must be incinerated in accordance with state regulations and company policy. Pioneer's discard seed is currently transported to two locations that burn Pioneer's agricultural waste with other fuels in order to provide heat for their operations. Pioneer's objective is to bring the incineration process in house, utilizing its corn seed and cobs for fuel in a biomass boiler.

INCENTIVES TO CHANGE

Transportation and incineration of agricultural waste costs Pioneer approximately $90,000 annually, a figure that could be greatly reduced if much of the incineration process were kept on campus. Utilizing the corn as a fuel would also help Pioneer to reduce energy consumption and utility costs, providing even greater savings and environmental benefits. DuPont Pioneer considers environmental stewardship to be a Core Value and is always looking for ways to benefit the environment while simultaneously improving operations.

RESULTS

Corn Boiler: With approximately two million pounds of corn seed and corn cobs at its disposal every year, Pioneer has the capacity to offset over 3.5 million kilowatt-hours of energy by utilizing a three million BTU per hour corn boiler to supplement the load on the existing boiler system at the company's new greenhouse expansion. By bringing the entire discard disposal process in house, Pioneer would also see significant savings in the cost of incineration, as it has relied on several outside parties to incinerate discard in the past. By utilizing all of the available cobs and seed, it is estimated that the cost and environmental impact of 52 semi-truck loads would be diverted, entirely eliminating the incineration needs of some facilities and leaving others with only one or two loads per year. Because implementation of the corn boiler would allow Pioneer to have a greatly reduced dependence on the practices and procedures of outside parties, the project mitigates risk in both the handling of regulated seed and unpredictable disposal fees.

Necessary equipment purchases, process changes and project site layouts were developed in collaboration with Pioneer leadership. Seed generated outside of the heating season can be stored in a 500 ton hopper connected directly to the corn boiler. Facilities would be able to divert loads of discard at either reduced cost or no cost to the on-campus boiler site at the greenhouses. Process changes would involve new storage and transportation practices, as well as the installation and usage of specialized machinery for removing seeds from storage packets and grinding dried corn cobs down to a pellet-like size. Employees would be trained in the operation of this machinery, in addition to receiving additional education on what can be used as fuel, what must still be sent to external incinerators and what can be discarded in more conventional waste streams or recycled.

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}
1,243.90	6.71	46.63	0.62	15.25	3.19	0.10	0.17

Replace Incandescent Light Bulbs: Lighting audits were performed throughout facilities on Pioneer's main campus to identify areas where energy usage could be reduced by upgrading lighting fixtures to lower wattage lamps. More than 275 incandescent bulbs were identified in conference rooms with power ratings from 65 to 100 watts. These bulbs have since been replaced with more efficient, longer lasting 11 watt LED lamps. This upgrade will offset over 13,000 kilowatt-hours per year and will greatly reduce the annual cost and number of replacement bulbs needed, as well as maintenance time and costs.

Replace 42 Watt CFLs: Higher wattage compact fluorescent lamps were also targeted in the lighting audits. It is estimated that Pioneer could further offset maintenance and utilities costs if 164 42-watt CFLs in Pioneer's hallways and dining areas were upgraded. By replacing these lamps with 9-watt LED fixtures, Pioneer could reduce lighting energy usage by another 23,500 kilowatt-hours.

PROJECT	ANNUAL COST SAVINGS	ENVIRONMENTAL RESULTS	STATUS
CORN BOILER	$214,929	3.5 MILLION KWH 967 TONS	RECOMMENDED
REPLACE INCANDESCENT LIGHT BULBS	$1,007	13,609 KWH	IMPLEMENTED
REPLACE 42 WATT CFLS	$2,253	23,564 KWH	IN PROGRESS

EATON CORPORATION

JAY STEINES
MECHANICAL ENGINEERING
UNIVERSITY OF WISCONSIN-PLATTEVILLE

COMPANY BACKGROUND

Eaton Corporation is a leading global manufacturer specializing in electrical and industrial products. The electrical sector produces circuit breakers, switchgear, and related electrical products, while the industrial sector creates hydraulic, aerospace, and vehicle products. The Shenandoah, Iowa, plant is part of Eaton Corporation's vehicle group and supplies transmissions for several major manufacturers of heavy-duty trucks.

PROJECT BACKGROUND

Heat-treat furnaces in the Shenandoah plant, used to treat parts for the transmissions, have been in use since production began at the plant more than 40 years ago. Aging has resulted in reduced efficiency and more energy (natural gas) required for operation. The intern researched ways to improve the operating efficiency of the furnaces to reduce natural gas usage and overall emissions at the plant.

INCENTIVES TO CHANGE

Eaton Corporation has a high commitment to sustainable practices and strives to exceed environmental goals whenever possible. To achieve this goal, the company has a focus on reducing the use of natural resources, including natural gas. The furnaces used in the heat-treat process account for a major portion of natural gas used at the plant. Increasing the operating efficiency of the furnaces will reduce consumption of natural gas and help the company achieve their environmental goals.

RESULTS

Prioritizing Furnace Usage: The intern collected data to calculate the efficiency of each individual furnace. The data shows that while the furnaces are all the same make and model, they are not operating at the same level of efficiency. Staging the furnace usage based on operating efficiency would keep the most efficient furnace operating full-time and allow the less efficient machines to be turned down to 'idle' when not in use. This process modification could result in an annual savings of $3,610.

Additional savings could be achieved by determining an ideal idling temperature for the furnaces. This would minimize gas usage in idle mode yet allow the furnace to reach full-temperature in a short amount of time to meet production demands. Heat-recovery from the furnace exhaust could also provide additional savings and should be evaluated once operating efficiency is optimized.

Replacing Outer Doors: The outer doors of the furnaces are not sealing properly and a large amount of heat is lost around the seals. Replacing the outer doors is very costly and numerous variables can affect the energy usage, therefore the actual savings is not quantifiable at this time. The company has begun to replace the outer doors and metering is in place to quantify the reduction in natural gas usage and actual cost savings associated with this improvement.

Investigating Furnaces: Since all of Eaton's furnaces are the same make and model, theoretically they all have the capacity to operate at the same efficiency. Improvements being addressed to correct the variances include re-insulating, and optimizing the air-to-gas mixture. The expected annual savings is $21,590.

Dedicated Air Line: Opportunities to reduce energy usage at the plant were also identified in the compressed air system. Installing a dedicated air line directly to the furnaces would enable a reduction in the overall air pressure supplied to the remaining plant systems.

Compressor Heat Recovery: Recovering the heat from the air compressors for use elsewhere in the process could save approximately 69,230 therms annually.

CONVENTIONAL AIR POLLUTANTS AND GREENHOUSE GASES DIVERTED IN METRIC TONS

TOTAL FOR ALL SECTORS							
CO_2	SO_2	CH_4	N_2O	CFC	NO_X	VOC	PM_{10}
3.01	0.09	4.98	0.02	0.04	0.01	0.02	0.01

PROJECT	ANNUAL COST SAVINGS	ENVIRONMENTAL RESULTS	STATUS
PRIORITIZING FURNACE USAGE	$3,610	9,110 THERMS	IMPLEMENTED
REPLACING OUTER DOORS	UNKNOWN	UNKNOWN	IN PROGRESS
OPTIMIZING FURNACES	$21,590	54,530 THERMS	FURTHER RESEARCH NEEDED
DEDICATED AIR LINE	$6,500	138,500 KWH	RECOMMENDED
COMPRESSOR HEAT RECOVERY	$27,388	69,230 THERMS	FURTHER RESEARCH NEEDED

GOLDEN CRISP PREMIUM FOODS, INC.

ZACH CARTER
MECHANICAL ENGINEERING
THE UNIVERSITY OF IOWA

COMPANY BACKGROUND

Golden Crisp Premium Foods, Inc. is a division of Patrick Cudahy LLC, headquartered in Milwaukee, Wisconsin. The Sioux Center, Iowa, facility is 107,000 square feet and employs 425 people. The Golden Crisp team processes fresh pork bellies into smoked, sliced, cooked and ready-to-eat bacon products for both food service and retail customers. Golden Crisp is dedicated to sustainable practices and strives for continuous improvement.

PROJECT BACKGROUND

Although notably efficient in their operations, Golden Crisp generates waste streams largely comprised of recyclable materials. Much of this waste is fibrous or plastic packaging. Employees have initiated some recycling efforts, including cardboard and plastic conveyor belts, but an employee dedicated to establishing a comprehensive recycling project is not a possibility. An intern was placed at the Golden Crisp facility through the Pollution Prevention Intern Program to research and implement a comprehensive recycling project.

INCENTIVES TO CHANGE

The goal of the waste management project at Golden Crisp was to maximize waste reduction and recycling efforts, and reduce landfilling and associated costs. Objectives include identifying the facility's waste profile and recyclable waste streams, finding local markets for these materials, reducing the amount of waste generated at the source, and minimizing the time and people-power required for handling the waste sustainably. A strong underlying goal is to positively affect behavioral changes throughout the company and grow the culture of sustainability.

CONVENTIONAL AIR POLLUTANTS AND GREENHOUSE GASES DIVERTED IN METRIC TONS

TOTAL FOR ALL SECTORS							
CO_2	SO_2	CH_4	N_2O	CFC	NO_X	VOC	PM_{10}
589							

RESULTS

With work shifts that differ between the two sides of production (Raw and Ready-to-Eat), a series of waste audits were conducted on a by-shift and by-production-side basis that cumulatively composed a 24-hour plant-wide waste audit. Several recycling service providers were contacted, resulting in a variety of value offered. Three refurbished balers will be purchased with the assistance of a forgivable loan from the Iowa Department of Natural Resources' Solid Waste Alternative Program. New carts and receptacles will also be purchased. This project is economically net positive with a simple payback of less than one year.

Plastics Diversion: Plastic waste comprises a substantial portion of Golden Crisp's waste stream. Two general types were identified: stretchy and non-stretchy. The former was found to be easily recyclable when clean. However, 98 tons of one particular stretchy-plastic waste stream is consistently contaminated with meat residues, rendering it undesirable to recyclers. Rinsing this material is not economically feasible. Recycling vendors do assure, however, that because this waste is common in the meat processing industry, a multi-company collaboration on a local shred-and-rinse process is in development. Non-stretchy plastic, or film, is more difficult to recycle due to its composition of multiple, differing layers. Landfill diversion options such as waste-to-energy facilities would reduce disposal costs until a viable reuse or recycle option is available.

Fiber Diversion: Fibrous materials also comprise a substantial portion of Golden Crisp's waste profile. Fiberboard tubes from materials that come into the plant on rolls account for more than 51 tons of waste annually. Other recyclable fibrous materials such as corrugated cardboard, brown Kraft bags and various paper materials can all be comingled through the recommended vendor.

Wood Diversion: Golden Crisp recycles 22,000 non-contracted pallets annually. However, a vendor located closer to the facility was identified that offered higher rebates and runs a landfill free operation, whereas the current vendor landfills all scrap wood. Switching vendors will generate annual savings of more than $14,000 through revenue and reduced disposal costs.

The most substantial amount of wood wastes are hardwood chips used in the meat smoking process, at more than 42 tons per year. A partnership was initiated with a local landscaper to blend these with mulch or compost.

Rubber Diversion: More than two tons of rubber boots are used throughout the production floor annually. A local rubber-recycling vendor made an easy alternative outlet for these, as well as comingling with all other rubber-based waste from the facility, such as belts and hoses. Although no rebate was offered, avoided landfill costs will generate a cost savings for the company.

PROJECT	ANNUAL COST SAVINGS	ENVIRONMENTAL RESULTS	STATUS
PLASTICS DIVERSION	$10,300	106.8 TONS	IN PROGRESS
FIBER DIVERSION	$12,000	107.2 TONS	IN PROGRESS
WOOD DIVERSION	$16,700	43.8 TONS	IN PROGRESS
RUBBER DIVERSION	$150	2.5 TONS	IMPLEMENTED

GRINNELL COLLEGE

DANIELLE UNDERWOOD
INDUSTRIAL ENGINEERING
IOWA STATE UNIVERSITY

COMPANY BACKGROUND

Grinnell College is a private college founded in 1846 and is located in Grinnell, Iowa. The college has 64 buildings on 120 acres, along with 365 acres for environmental research. The mission of Grinnell College is to provide students with a broad, deep, and life-enhancing education. This liberal arts college offers 26 majors and 10 interdisciplinary concentrations to approximately 1,600 students through the help of 600 faculty and staff.

PROJECT BACKGROUND

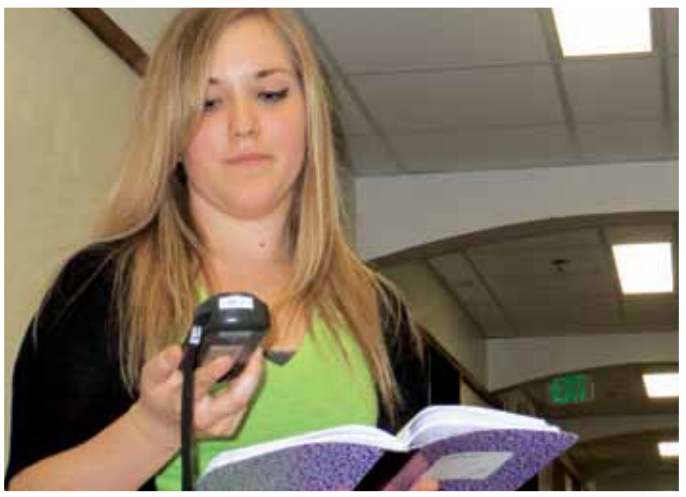
Grinnell College had a campus wide lighting audit performed recently which identified 20,552 lighting fixtures. By conducting a detailed energy survey of various buildings on campus, suggestions were made in order to reduce emissions, upgrade fixtures or bulbs, and estimate how much electricity is being used on campus.

INCENTIVES TO CHANGE

The Grinnell College campus operates year-round, although campus use decreases during the summer months. Due to the large amount of building space relative to the size of the student body, the college has a high energy use per capita. Conversely, the energy usage per square foot is relatively low. The ultimate goal is to further their commitment and success towards becoming carbon neutral, following the values of students, faculty and staff, along with meeting The American College & University Presidents' Climate Commitment.

RESULTS

The goal of this lighting project was to decrease the energy used throughout the campus by the lighting systems. The intern was tasked with developing a usable method to document the lamp use, type, location and wattage, along with potential savings options. The data was compiled into a spreadsheet that will help manage and control inventory of the various lamps. The intern calculated upgrade and replacement costs with standard-practice control methods, energy usage and maintenance savings.



Lighting Upgrades: Eight types of lights were found to be in use throughout the 18 dormitories. Fluorescent lamps were common in all the buildings. An option for upgrading fluorescent lamps to improve efficiency is to retrofit the fixture with a light-emitting diode (LED) lamp. Incandescent lamps throughout the dorms could save energy by changing to an equivalent compact-fluorescent lamp or LED bulb. Fixtures with t12 linear fluorescent lamps could be retrofit to t8 fluorescent lamps or t8 LED lamps.

HID Metal Halide Lights: Four of the buildings are using High Intensity Discharge (HID) metal-halide lamps. The HID metal halide lamps could be replaced with a six-lamp linear t8 fixture, with either fluorescents or LED lamps. The current HID lamps are not preferable partly due to operational issues with that type of lighting. Installing a more efficient light will provide energy and maintenance savings and will also increase the comfort level of the areas.

Occupancy Sensors: Occupancy-controlled sensors are recommended throughout the campus for most of the corridors, lounges, restrooms and other areas with intermittent area use. The sensors would ensure lights are turned off when the area lighting is not required. This would provide additional energy savings for the college.

CONVENTIONAL AIR POLLUTANTS AND GREENHOUSE GASES DIVERTED IN METRIC TONS

TOTAL FOR ALL SECTORS							
CO_2	SO_2	CH_4	N_2O	CFC	NO_X	VOC	PM_{10}
6125.62	33.04	229.63	3.05	75.12	15.70	0.49	0.82

PROJECT	ANNUAL COST SAVINGS	ENVIRONMENTAL RESULTS	STATUS
LIGHTING UPGRADES WITH OCCUPANCY SENSORS	$610,730	9,542,661 KWH	RECOMMENDED

GRUNDY COUNTY MEMORIAL HOSPITAL

GRUNDY CENTER

NICOLE UNDERWOOD
MECHANICAL ENGINEERING
IOWA STATE UNIVERSITY

COMPANY BACKGROUND

Grundy County Memorial Hospital (GCMH), Grundy Center, successfully combines the values of personal care and friendliness with a high standard for health care often found only in much larger communities. Founded 61 years ago, the hospital has grown to serve four counties and to employ 213 people. The hospital has a regional reputation for its orthopedic services, including total knee and total hip replacement surgery, and the variety of outpatient services it makes available to the residents of the rural communities it serves. The hospital has been recognized with the Summit Award™ for Patient Satisfaction for its Emergency and Outpatient departments, and has been named a Top Twenty Most Recommended critical access hospital by the National Rural Health Association for 2012 and 2013.

PROJECT BACKGROUND

Steam is a widely used utility at GCMH. Two fire-tube boilers serve the facility needs, one as standby and the other (which runs 85 percent of the year) producing the steam that is used for several processes in the building. In addition, an electric boiler is not currently used because it is unable to handle the necessary demand when the main boiler is down for maintenance.

INCENTIVES TO CHANGE

The current boiler system was installed in 1969. Several additions to the original structure have increased the demand on the aging boiler system. The purpose of this project is to optimize the operating efficiency of the boiler and steam systems to reduce associated costs and emissions. Funding options and financial incentives were researched to help make the system improvements more cost effective.

RESULTS

Reduce Boiler Pressure: The main boiler is run at a pressure of 70 psi to power two sterilizers in the surgical area. All other processes require a pressure of 20 psi or less. If the electric boiler were used to supply steam to the two sterilizers, which run about twenty hours per week, pressure on the gas-fired boiler could be reduced to 25 psi to provide the other steam needs for the facility.

Duct Warm Air to Boiler Intake: The boilers are located in a separate building so the high temperature does not heat up the rest of the facility. Installing ductwork to recover the heat from the ceiling of the boiler building and return it to the boiler intake would increase the intake air temperature. Combustion efficiency will increase one percent for every 40° F increase in air intake temperature.

Air-Fuel Ratio: A proper air-fuel ratio is necessary for optimum combustion efficiency. If there is a lack of or excess of air to the system the fuel is unable to burn at its full potential. Currently this boiler has been producing soot, which indicates that the air-to-fuel ratio is off. Correcting the air-fuel ratio will increase the combustion efficiency and reduce gas usage.

Steam Traps: Approximately 60 small steam traps are located on room heaters, and 40 larger steam traps are part of the distribution system located throughout the facility. Steam traps that are in need of repair or replacement can fail in the closed, open, or partially open position. A trap failing partially open or open is difficult to detect because the process will still work but will lose efficiency with each failed trap. A maintenance schedule will help to detect failed traps and improve system efficiency.

Steam and Condensate Leaks: The condensate returned to the boiler system is tested quarterly and on average has a 60 percent return rate, which means there are system losses. This indicates there are steam leaks and steam traps not functioning properly, which increase the load carried by the boiler. Fixing steam and condensate leaks will decrease the amount of steam the boiler must produce and the amount of make-up water the boiler must use, resulting in reduced natural gas usage.

Insulate Pipes: There are a small number of pipes around the facility without insulation. It appears that when maintenance was done on these pipe sections, insulation was removed and not replaced. Replacing lost insulation reduces the amount of heat loss throughout the steam system.

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}
45.78	0.12	82.01	4.77	0.60	0.14	0.29	0.01

PROJECT	ANNUAL COST SAVINGS	ENVIRONMENTAL RESULTS	STATUS
REDUCE BOILER PRESSURE	$18,028	47,125 THERMS	RECOMMENDED
DUCT WARM AIR TO BOILER INTAKE	$1,545	4,038 THERMS	RECOMMENDED
AIR-FUEL RATIO	$4,600	12,025 THERMS	IMPLEMENTED
STEAM TRAPS-SMALL	$8,186	5,666 THERMS	RECOMMENDED
STEAM TRAPS-LARGE	$18,742	12,970 THERMS	RECOMMENDED
STEAM AND CONDENSATE LEAKS	$3,857	5,262 THERMS 52,815 GALLONS	RECOMMENDED
INSULATE PIPES	$86	225 THERMS	RECOMMENDED

HORMEL FOODS

JOHN BAUMHOVER
MECHANICAL ENGINEERING
THE UNIVERSITY OF IOWA

COMPANY BACKGROUND

Hormel Foods produces the top selling brand of pepperoni in the nation, including both classic *Hormel*® brand pepperoni in a variety of different packaging options, as well as specialty-recipe pepperoni. The Algona, Iowa, plant is approximately 166,000 square feet with a workforce of 195 employees. Pork and spices are mixed, cured, sliced and packaged to the desired specifications at this location.

PROJECT BACKGROUND

Currently, the Algona Plant has high-energy-use lighting primarily in rarely occupied areas, as well as some ineffectively placed fixtures. Recycling is also a focus in the Algona Plant, with approximately 80 percent of the landfill waste coming from casings and various plastics.

INCENTIVES TO CHANGE

Hormel Foods is conscious of their rising energy costs. A major factor in the rising cost of electricity is peak demand charge. The company has previously identified lighting and compressed air as potential areas to cut costs. Hormel Foods also has a long-standing interest in diversions of solid waste from the landfill. By finding an alternative to landfilling for certain items, the company will reduce costs and could potentially generate new revenue from responsible waste management.

RESULTS

Lighting Replacement: By analyzing lighting of freezers and refrigerated rooms of the plant, the intern identified methods to reduce annual energy consumption by more than 233,500 kWh. While this would result in a significant savings, the capital cost of the new fixtures is too high to make the investment financially feasible at this time. As technology improves, the cost of higher-efficiency lights will decrease. It is recommended that the Algona Plant revisit the project in a few years as capital costs decrease and/or lighting efficiencies improve.

Solid Waste-Recycling: The Algona Plant has been paying to transport recyclable materials to a facility in Mason City, Iowa. With the incentive to get as much weight as possible onto the trailer, recycling lightweight items such as plastics has been difficult. The intern identified a new recycling vendor who will provide transportation to their facility at no cost. This vendor also takes all types of plastics, and would pay for certain types of plastic and the company's cardboard. This system incentivized all forms of recycling for the plant.

Solid Waste-Casings: The new recycling vendor also helped the Algona Plant find an alternative for pepperoni casings that would otherwise be landfilled. The alternative vendor would incinerate the casings and recover the energy. This opportunity would reduce the plant's landfill waste by more than 50 percent, resulting in substantial savings.

Reduced Waste Hauling: The current company that transports waste to the landfill for the Algona Plant drives from Mason City and back. A local company provides the same service at a lower cost and the close proximity to the plant would reduce transportation emissions.

Solid Waste-Plastic Baling: Baled film plastics can be sold for $200 per ton. Adopting this method of collection could also reduce transportation emissions by decreasing the number of trips needed for recycling.

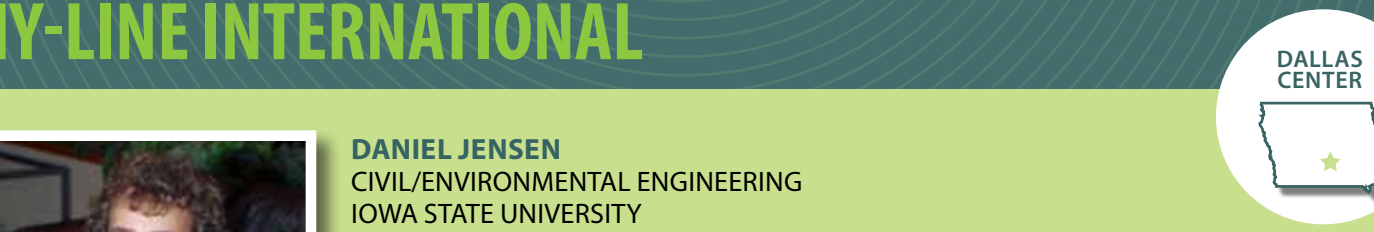
CONVENTIONAL AIR POLLUTANTS AND GREENHOUSE GASES DIVERTED IN METRIC TONS

TOTAL FOR ALL SECTORS							
CO_2	SO_2	CH_4	N_2O	CFC	NO_x	VOC	PM_{10}
713.70	0.59	4.09	0.20	1.33	0.33	0.07	0.02

PROJECT	ANNUAL COST SAVINGS	ENVIRONMENTAL RESULTS	STATUS
LIGHTING REPLACEMENT	$10,903	233,597 KWH	RECOMMENDED
SOLID WASTE-RECYCLING	$72,292	86 TONS	IMPLEMENTED
SOLID WASTE-CASINGS	$53,990	429 TONS	IN PROGRESS
REDUCED WASTE HAULING	$6,095	1,700 GALLONS DIESEL	RECOMMENDED
SOLID WASTE-PLASTIC BALING	$20,760	-	RECOMMENDED

2012 24-WEEK INTERNSHIP

HY-LINE INTERNATIONAL



DANIEL JENSEN
CIVIL/ENVIRONMENTAL ENGINEERING
IOWA STATE UNIVERSITY

COMPANY BACKGROUND

Hy-Line International is a poultry company that specializes in genetic breeding stock. Hy-Line brand laying hens produce 44 percent of the world's eggs and 85 percent of the nation's white eggs at locations worldwide. Regionally, Hy-Line employs approximately 150 people in Dallas County and has hundreds of other locations nationally and internationally. The facilities consist of three main production areas: hatchery, research farms, and cooperator farms. In 2011, Hy-Line in Dallas Center shipped more than 3.6 million live female chicks, 540,000 live male chicks and millions of hatching eggs.

PROJECT BACKGROUND

Hy-Line generates a wide variety of wastes associated with poultry production. The company produces and disposes of hatchery waste, whole eggs, liquid eggs, spent hens, manure, and manure slurry. Current waste management procedures consist of rendering, field application, incineration, feed additives, and landfilling. In this 24-week project, the intern evaluated current organic waste management practices and researched alternative solutions to minimize costs and produce environmental benefits.

INCENTIVES TO CHANGE

The goal of the internship project is to cut disposal costs by 50 percent and convert wastes to value-added products that can be used locally or internally. The resulting products could help neighboring farmers and greatly reduce disposal costs associated with Hy-Line's organic waste.

RESULTS

An organic waste baseline was generated to analyze the volumes of waste produced and how it is managed. This baseline was then used to determine the benefits of various alternatives identified. In the future, it is recommended that all organic waste continue to be tracked in a spreadsheet with costs, destinations and dates.

Anaerobic Digestion: The intern recommended that Hy-Line should investigate installing an anaerobic digester at the facility. Anaerobic digestion is the decomposition of organic materials in the absence of oxygen. It would allow for a closed-loop disposal plan for all of the company's organics. In addition to reducing costs, a digester would produce biogas capable of powering a 225 kW generator. The power produced could be used on site to significantly reduce energy bills. A digester would also produce liquid fertilizer and digestate (solid soil amendment). These products can be sold to provide additional economic benefit and are also a richer, more stable form of fertilizer than direct application of raw manure to farmland. A professional feasibility study will be done by a third-party consultant to confirm the project's viability.

In-Vessel Compost System: An alternative option for managing Hy-Line's organic waste is an in-vessel composting system. The identified system would manage all of Hy-Line's organic waste streams, avoid odor, and generate a high-quality compost product that could be used internally or marketed to other parties. Less expensive composting methods could manage Hy-Line's organic waste streams, but they do not offer such benefits as complete odor control.

Whole Eggs: Hy-Line recently became subject to a new U.S. Food and Drug Administration regulation which has resulted in more than 14 million whole eggs that can no longer be sold due to a change in storage temperature requirements. The intern identified a compost facility that can take the eggs for a fee, which could divert 1,030 tons of special waste from the landfill annually.

LED Lighting: The intern investigated the potential energy savings associated with an LED lighting retrofit in various barns and facility buildings. Experimentation was conducted to determine if LED lighting had adverse affects on a bird's health or production. The project will significantly reduce energy costs for lighting in areas where experimentation results proved favorable.

Thermal Curtain at Egg Transfer: The intern utilized a thermographic imaging camera to identify energy saving opportunities for Hy-Line's egg transfer cooler facility. Additional insulation and improved door and dock seals were recommended to reduce energy loss. Installation of an insulated curtain wall to partition the cooler would reduce the square footage being cooled and increase energy savings.

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}
6,900.00	0.16	1.08	0.01	0.35	0.07	0.01	0.01

PROJECT	ANNUAL COST SAVINGS	ENVIRONMENTAL RESULTS	STATUS
ANAEROBIC DIGESTION	$239,568	10,635 TONS	RECOMMENDED
IN-VESSEL COMPOST SYSTEM	$208,732	3,580 TONS	RECOMMENDED
WHOLE EGGS	--------	1,030 TONS	IMPLEMENTED
LED LIGHTING	$2,023	18,688 KWH	RECOMMENDED
THERMAL CURTAIN AT EGG TRANSFER	$850	9,281 KWH	IN PROGRESS

JELD-WEN WINDOWS

KELSEY OLSON
INDUSTRIAL ENGINEERING
BRADLEY UNIVERSITY

COMPANY BACKGROUND

JELD-WEN, formerly known as WENCO, was started in 1969 and is located in Grinnell, Iowa. The 240,000 square feet facility is located on 18 acres of land. In 2004, corporate leadership branded the name JELD-WEN for all subsidiaries. JELD-WEN Windows moved to the current facility in 2005 and manufactures vinyl windows and sliding patio doors for new construction and remodels in the residential sector. The company supplies products to Menards, Home Depot, and other lumber companies and builders. JELD-WEN Windows presently employs 550 people.

PROJECT BACKGROUND

A waste stream analysis was conducted for each of the manufacturing steps within the facility. The current waste streams sent to the landfill were mapped and measured. The intern worked with personnel and managers to recommend placement of waste collection containers to best facilitate the workflow in each area. Recommendations were provided for process changes that could result in waste reduction. Reuse and possible revenue generation opportunities were researched for the production scrap. Recycling sources were researched and provided for the remaining waste streams.

INCENTIVES TO CHANGE

The solid waste reduction project at JELD-WEN Windows will help the facility meet environmental goals. Reducing the amount of scrap generated in the production processes and increasing recycling efforts will help lower the volume of waste currently being sent to the landfill. Locating markets for recyclable waste streams would provide a source of revenue in addition to the cost savings from reduced disposal costs.

RESULTS

A waste stream analysis showed which waste streams were coming from each manufacturing process. Waste reduction and recycling opportunities were identified and collection procedures were put into place. A presentation was created to help educate employees on the recycling policies at JELD-WEN. Color coded slides were created with pictures of each item and labels in both English and Spanish. These color coded slides could be used as signs on the factory floor to properly identify the bins and assist employees with the recycling process.

Wood Waste Diversion: Wood waste, including production scrap and pallets, accounts for approximately 281 tons of the waste going to the landfill each year. Installation of a wood shredder would allow wood waste to be shredded and hauled away for use as animal bedding. A local agricultural company would provide hauling making this option more appealing. A second option evaluated was to haul the wood to a nearby wood recycler. Both the hauler and recycler would charge a fee, so the annual savings associated with this option is much less.

Cardboard Recycling: Cardboard is used underneath the glazing tables to catch dripping glaze. This creates a constant stream of contaminated cardboard that cannot be recycled. Black ultra-high-molecular-weight (UHMW) polyethylene drip trays would provide a more permanent solution and reduce the amount of cardboard going to the landfill.

Plastic Recycling: Raw materials are bundled in a plastic shipping material that is currently baled and recycled. Finished product is wrapped in plastic wrap for shipping. The excess plastic wrap, plastic bottles and caulk tubes can also be recycled.

CONVENTIONAL AIR POLLUTANTS AND GREENHOUSE GASES DIVERTED IN METRIC TONS

TOTAL FOR ALL SECTORS							
CO_2	SO_2	CH_4	N_2O	CFC	NO_X	VOC	PM_{10}
1,013							

Bottle and Can Recycling: Beverage containers used by employees are currently tossed in large blue dumpsters with other recyclables, but contaminate the collected materials due to liquid residue. Collection bins specifically for these beverage containers were purchased to ensure all materials are successfully separated and recycled.

Paper Waste Recycling: Paper waste is generated from the offices and the manufacturing floor. A recycling program is in place but a substantial amount of paper is still going to the landfill. Additional collection bins conveniently placed throughout the plant would help capture the remaining paper waste for recycling.

Vinyl Recycling: Vinyl waste is generated through various stages of production. Dust vacuums attached to the saws to collect vinyl saw dust as well as collection bins attached under the punches would help to collect this material for recycling. Weekly weld plate tests to ensure the plates are calibrated correctly would minimize bad welds, reduce production scrap and improve quality control, contributing to both cost savings and additional revenue for the company.

Metal Recycling: Metal barrels are used to collect purged material from the glazing pumps and butyl guns used in production, but trash and other debris are also frequently thrown in, causing the recyclable waste to become contaminated. Covers were created for the barrels that allow the purged material to go in but help keep them free of debris.

PROJECT	ANNUAL COST SAVINGS	ENVIRONMENTAL RESULTS	STATUS
WOOD WASTE DIVERSION - SHREDDER	$28,489	281 TONS	RECOMMENDED
WOOD WASTE DIVERSION - RECYCLER	$4,489	281 TONS	RECOMMENDED
CARDBOARD RECYCLING	$8,429	83 TONS	RECOMMENDED
PLASTIC RECYCLING	$4,636	46 TONS	RECOMMENDED
PAPER RECYCLING	$4,609	46 TONS	RECOMMENDED
VINYL RECYCLING	$3,424	34 TONS	RECOMMENDED
METAL RECYCLING	$790	8 TONS	RECOMMENDED

JOHN DEERE DAVENPORT WORKS

AARON STRAND
MECHANICAL ENGINEERING
UNIVERSITY OF WISCONSIN-PLATTEVILLE

COMPANY BACKGROUND

John Deere Davenport Works is approximately 2.2 million square feet, located on a property of 883 acres just north of Davenport, Iowa. This land includes the production plant, a training center and a shipping facility. Davenport Works employs a total of 1,400 employees who operate five product lines: skidders, wheeled feller-bunchers, four-wheel-drive loaders, articulated dump trucks and motor graders. In a separate building, the cab division produces cabs for these product lines as well as backhoes, tracked feller-bunchers, loaders and knuckle-boom loaders.

PROJECT BACKGROUND

The intern worked to analyze and optimize electricity use at John Deere Davenport Works plant. The first priority was to produce an inventory of all electric motors in use at the plant in order to identify energy savings opportunities. Improvements included upgrading to premium efficient motors, upgrading traditional V-belt drives to synchronous belt drives, and turning off equipment when not in use.

INCENTIVES TO CHANGE

John Deere corporate goals call for a 15 percent reduction in greenhouse gas emissions by 2018. The intern's approach and priorities were designed to work towards meeting the stated goal by reducing electrical energy use. The opportunities described here translate directly into reduced greenhouse gas emissions and overhead costs, and the realization of John Deere corporate goals.

RESULTS

Heating and Ventilation (HV) Units-Synchronous Belts: The galleries contain 72 HV-units. In most HV-units a 15-horsepower motor powers the air return, and another 30-horsepower motor powers the air supply. Reducing the run-time or speed is not an option for energy savings, because lowered air exchange rates would compromise indoor air quality. The blowers are driven through V-belt drives. Synchronous belts would have less resistance to bending due to their thinner profile, and provide positive engagement with the rotating sheaves to eliminate belt slip under load. A synchronous belt upgrade has an industry-accepted efficiency gain of 5 percent.

CONVENTIONAL AIR POLLUTANTS AND GREENHOUSE GASES DIVERTED IN METRIC TONS

TOTAL FOR ALL SECTORS							
CO_2	SO_2	CH_4	N_2O	CFC	NO_x	VOC	PM_{10}
1070.00	5.76	40.00	0.53	13.10	2.74	0.085	0.14

HV Units-Premium Efficiency Motors: Many motors are high or premium efficiency, but some of the remaining older motors have high annual run time and are less efficient to operate. Payback periods are longer for motor upgrades, so it is recommended to upgrade equipment with premium efficiency motors when existing motors wear out.

Compressed Air System: Compressed air is used for many processes throughout the plant. A new high efficiency rotary screw compressor and three centrifugal compressors provide plant air. Numerous air leaks were observed around the plant. An ongoing leak detection program with a goal to eliminate half of existing air leakage could result in significant energy savings.

Paint System Belts and Motors: The plant is currently installing a new paint system, which will run in addition to the existing system for the near future. Upgrading V-belt drives to synchronous belt drives on fans and blowers, and upgrading to premium efficiency motors as existing motors are replaced would increase the efficiency of the current system.

Exhaust Fans: Two 20-hp fans used for exhausting engine fumes were found to run excessively. Turning off these two fans for one shift daily when not in use could save 94,000 kwh annually.

Shot Blast Motors: The shot blast units clean and surface prep cut steel parts before fabrication. Many of the motors on this equipment are low efficiency. No existing motors justify immediate replacement, but upgrading to premium efficiency motors when replacement becomes necessary would reduce energy usage.

Machining Centers: The fabrication areas include many machining centers in a range of sizes and capacities. Most centers do not run three shifts, but equipment is not completely powered down when not in use. Hydraulic pumps and related equipment continue to run when machines are idle. Shutting off hydraulics when not in use provides a great opportunity for energy savings.

Personnel Fans: There are many fans throughout the plant to provide localized air circulation for employee comfort. A single 1/4-hp fan does not consume a great deal of power, but more than 800 small fans are in use which may not be shut off when workers leave. Encouraging employees to turn off fans and other equipment would provide immediate savings and help to instill a company culture that promotes further energy savings.

PROJECT	ANNUAL COST SAVINGS	ENVIRONMENTAL RESULTS	STATUS
HV UNITS-SYNCHRONOUS BELTS	$ 40,300	794,000 KWH	RECOMMENDED
HV UNITS-PREMIUM EFFICIENCY MOTORS	$7,460	147,000 KWH	RECOMMENDED
COMPRESSED AIR SYSTEM	$20,370	401,000 KWH	RECOMMENDED
PAINT SYSTEM BELTS AND MOTORS	$4,458	87,740 KWH	RECOMMENDED
EXHAUST FANS	$4,775	94,000 KWH	IMPLEMENTED
SHOT BLAST MOTORS	$1,005	19,775 KWH	RECOMMENDED
MACHINING CENTERS	$19,297	379,860 KWH	RECOMMENDED
PERSONNEL FANS	$8,770	172,490 KWH	RECOMMENDED

2012 24-WEEK INTERNSHIP

PROCTER & GAMBLE

JUSTIN MCANINCH
MECHANICAL ENGINEERING
THE UNIVERSITY OF IOWA

COMPANY BACKGROUND

Procter & Gamble started in 1837 as a small soap and candle company based in Cincinnati, Ohio. It has since grown to a multi-billion dollar Fortune 500 company with facilities worldwide and products ranging from beauty and grooming to household care. The Procter & Gamble facility in Iowa City began operation in 1956 and manufactures shampoos and conditioners, oral rinse products, and body wash. The brands produced are Pantene®, Head & Shoulders®, Herbal Essences®, Aussie®, Gillette®, Scope®, Crest Pro Health®, Olay®, Old Spice®, and Ivory®. The plant employs approximately 630 people in its manufacturing facility.

PROJECT BACKGROUND

The Procter & Gamble Hair Care site in Iowa City, Iowa, has waste heat sources spread throughout the facility. The purpose of the 24-week intern project at Procter & Gamble was to assess and research technologies to recapture, transfer and store heat energy, identify inefficiencies in the steam trap program and optimize boiler efficiency. .

INCENTIVES TO CHANGE

In an effort to improve the environmental profile of its operations, Procter & Gamble's goal is to reduce production of energy, waste, CO2, and water usage by 20 percent in 2012, as compared to 2007 data. While the company has achieved a reduction per unit of production of 57 percent in waste and 22 percent in water usage, energy and CO2 have only been reduced by 16 percent and 12 percent respectively.

Therefore, the goal of the Procter & Gamble Iowa City site is to reduce electricity and natural gas usage by 20 percent. Accomplishing this goal will not only support Procter & Gamble as a whole, but will also reduce utilities costs and emissions.

RESULTS

Replace Failed Steam Traps: Surveys have been conducted for 257 of the estimated 550 steam traps at the facility with 31 traps testing as failed. It is estimated that $700-$1,600 per year can be saved for each steam trap replaced. $156,443 in steam cost can be saved per year by installing new traps.

Removable Steam Trap Insulation: Currently, most steam traps are not insulated. Upon investigation, it was found that only float style traps are generally recommended for insulation as the function of the trap will not be affected. While installing removable insulation on all float style steam traps will save energy, the most cost effective solution is to focus on insulating steam traps on 100 psi steam lines. This option will save $161 per year and a total of $1,821 during the lifetime of the insulation.

Comprehensive Steam Trap Program: Steam energy is currently being lost to leaks and failed steam traps. The intern worked with utilities personnel to implement a comprehensive steam trap maintenance program including steam trap testing techniques, a rotating schedule for trap surveys, established protocols for trap replacement, standards for trap installation, equipment training, and resource materials creation. Steam trap maps were created for the areas of the facility surveyed in summer 2012 for ease of future trap surveys. Training was organized for ultrasonic measurement in steam trap surveys. A consistent steam trap maintenance program with rapid replacement of failed steam traps will result in an additional $30,836 of energy savings per year.

Condensate Return Line Insulation: During investigation of the steam system, a condensate line was discovered to have no insulation. Insulating the condensate line will save $3,150 in steam production cost.

Improve Sulfation (SLS) Mixing Process: The current process for mixing SLS utilizes hot reverse osmosis (RO) water and is cooled using a low temperature water source. A recently installed cold RO line for this system has presented an opportunity to mix cold and hot RO to approach the target temperature. Changing the process will save $26,028 per year in hot RO energy costs.

Boiler Economizers: Two of Procter & Gamble's boilers currently have no economizers. Installing economizers on these two boilers to preheat boiler feed water could save $99,410 per year in natural gas cost.

Catalogued Waste Heat Recovery Opportunities: Waste energy sources and possible energy sinks were investigated throughout the facility. If all sources and sinks could be utilized, there is a potential for $618,447 of savings per year. Due to the many intermittent sources and sinks present, more development is needed to devise systems to store and transfer this energy.

Scrubber Pit Energy for City Water Preheating: One of the waste energy sources investigated was scrubber pit water going to the sewer. Using this energy to preheat city water going into the facility can save $34,503 per year, with a payback of less than two years on the installation.

CONVENTIONAL AIR POLLUTANTS AND GREENHOUSE GASES DIVERTED IN METRIC TONS

TOTAL FOR ALL SECTORS							
CO_2	SO_2	CH_4	N_2O	CFC	NO_X	VOC	PM_{10}
810.09	2.23	1337.23	4.84	10.66	2.42	5.14	0.19

PROJECT	ANNUAL COST SAVINGS	ENVIRONMENTAL RESULTS	STATUS
REPLACE FAILED STEAM TRAPS	$156,443	372,484 THERMS	RECOMMENDED
REMOVABLE STEAM TRAP INSULATION	$161	384 THERMS	RECOMMENDED
COMPREHENSIVE STEAM TRAP PROGRAM	$30,836	73,419 THERMS	IN PROGRESS
CONDENSATE RETURN LINE INSULATION	$3,150	7,499 THERMS	RECOMMENDED
IMPROVE SULFATION (SLS) MIXING PROCESS	$26,028	61,970 THERMS	RECOMMENDED
BOILER ECONOMIZERS	$99,410	236,691 THERMS	RECOMMENDED
CATALOGUED WASTE HEAT RECOVERY OPPORTUNITIES	$618,477	1,472,565 THERMS	ADDITIONAL DEVELOPMENT RECOMMENDED
SCRUBBER PIT ENERGY FOR CITY WATER PREHEATING	$34,503	82,152 THERMS	RECOMMENDED

2012 24-WEEK INTERNSHIP

ROSENBOOM MACHINE AND TOOL

SHELDON AND SPIRIT LAKE

BRANDON HUTH
CHEMICAL ENGINEERING
IOWA STATE UNIVERSITY

COMPANY BACKGROUND

Rosenboom Machine & Tool manufactures custom hydraulic cylinders for a variety of markets. The Sheldon, Iowa, plant is home to the corporate headquarters and includes a 200,000-square-foot manufacturing plant. The company has added a 250,000-square-foot plant in Spirit Lake, Iowa. These two plants operate 22 hours per day, six days per week. Raw material enters the plant and is turned, milled, welded, and assembled into cylinders. The cylinders are then pressure tested and painted per customer requirements.

PROJECT BACKGROUND

The intern conducted a waste audit of both the Sheldon and Spirit Lake manufacturing facilities. The key contributors to the waste steam were identified and prioritized according to potential savings. After identifying the large contributors, the intern identified solutions to reduce the amount of waste generated or to increase the marketability of the scrap that is unable to be reduced.

INCENTIVES TO CHANGE

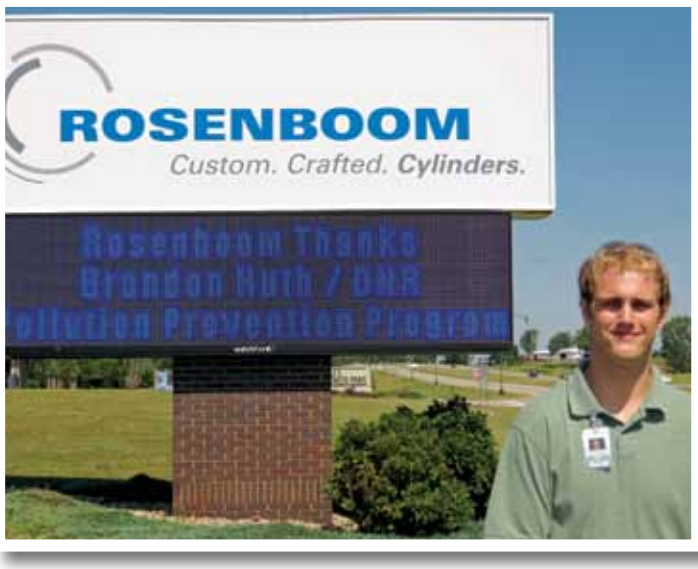
Rosenboom Machine & Tool teamed with the Pollution Prevention Intern Program for 24 weeks to strengthen its environmental stewardship and to lower operating costs at its Spirit Lake and Sheldon facilities. Solid waste going to the municipal landfills represents a large expenditure that could be reduced through source reduction and recycling. With a bit of careful planning, 90 percent of the current trash volume could be diverted from the landfill. Additionally, reducing clean solvent usage from the paint lines will help reduce Rosenboom's operating expenses and regulatory burdens.

RESULTS

Cardboard Recycling: Over the last year, Rosenboom disposed of 200 tons of corrugated cardboard, cardboard cores and Kraft paper from the Spirit Lake production facility and 150 tons of these materials from the Sheldon facility. Much of this tonnage will be recyclable once appropriate markets are found. The intern worked to identify a market, establish a recycling framework, and identify necessary equipment and employee training. The project will be implemented in the Spirit Lake facility, and will be later expanded to Sheldon.

Office Paper: White office paper is an easily recyclable item that is generated in most office settings. After a baler is in place at Spirit Lake, the facility will be able to recycle its office paper. The Sheldon facility plans to install a baler once the Spirit Lake recycling program is implemented. The volume of material is low but the price paid per ton by recyclers provides a strong incentive to separate and recycle the material.

Low Density Polyethylene (LDPE) Recycling: Low density polyethylene (LDPE) in the form of shrink wrap and plastic bags protect and keep parts clean as they enter the plant. LDPE is a recyclable item if it can be segregated. The facility generates 20 tons of this material annually. Capturing this material would reduce the amount of waste going to the landfill.



Pallet Recycling: Last year, Spirit Lake sent 37 tons and Sheldon sent 35 tons of broken or off-sized wood pallets to the landfill. This material can be diverted and reclaimed into new pallets. The intern identified a company that can provide pallet recycling services to the Spirit Lake facility. More research is needed to find a pallet recycler to handle Sheldon's unique set of pallets.

Solvent Source Reduction and Recycling: Solvent is used in the paint lines of both facilities for cleaning after the paint process. The intern focused on the paint line in Spirit Lake and identified ways to reduce the amount of solvent used per color change and shut down. A solvent recycler was installed to clean and reuse solvent on site, further reducing operating expenses and regulatory burdens. This combination of source reduction and on-site recycling will cut the solvent costs for the paint line by 51 percent.

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}
2240.93	0.01	7.63	10.26	1.83	0.13	0.10	0.02

PROJECT	ANNUAL COST SAVINGS	ENVIRONMENTAL RESULTS	STATUS
CARDBOARD RECYCLING-SPIRIT LAKE	$22,000	200 TONS	IN PROGRESS
CARDBOARD RECYCLING-SHELDON	$13,000	150 TONS	RECOMMENDED
OFFICE PAPER RECYCLING-SPIRIT LAKE	$2,900	10 TONS	RECOMMENDED
OFFICE PAPER RECYCLING-SHELDON	$2,100	8 TONS	RECOMMENDED
LDPE RECYCLING	$1,500	20 TONS	RECOMMENDED
PALLET RECYCLING-SPIRIT LAKE	$4,900	37 TONS	IMPLEMENTED
PALLET RECYCLING-SHELDON	$2,400	35 TONS	MORE RESEARCH NEEDED
SOLVENT SOURCE REDUCTION-SPIRIT LAKE	$18,600	820 GALLONS OF HAZARDOUS WASTE	RECOMMENDED
SOLVENT RECYCLING-SPIRIT LAKE	$17,400	2,420 GALLONS OF HAZARDOUS WASTE	IMPLEMENTED

STANLEY ENGINEERED FASTENING

BRIANI CAREY
MECHANICAL ENGINEERING
THE UNIVERSITY OF IOWA

COMPANY BACKGROUND

Founded in 1969, Stanley Engineered Fastening, formerly Infastech, is one of the world's largest manufacturers of engineered mechanical fasteners and cold-formed components. The company provides fasteners for use in a diverse range of applications including automotive and commercial technologies, electronics, construction and industrial use. Primary plant processes include heading, pointing, threading, plating, cold-forming, sorting, packaging, and heat treating. The Decorah, Iowa, facility has 500 employees and serves customers around the world in more than 150 different countries.

PROJECT BACKGROUND

This project first involved an audit of the compressed air system, including leak detection and analysis of the compressor control system. The intern developed and recommended a plan to reduce energy costs and emissions through repairs and efficiency optimization. A preventative maintenance plan was also recommended for the compressed air system. A comparison and cost analysis was also provided to evaluate a lighting retrofit at the plant.

INCENTIVES TO CHANGE

Stanley is committed to sustainable business policies, reducing environmental impact and improving community quality. The company's green goals include reducing water consumption, energy use, and waste generation.

Compressed air and lighting are large energy consumers at the plant. Leaks can account for up to 35 percent of the air used, increasing the demand on the compressors. Since it is expensive to produce, repairing leaks and optimizing the operating efficiency of the compressed air system could provide significant cost savings to the company.

The original lighting system uses high wattage lamps that consume large quantities of energy. By switching to a more efficient, longer-lasting bulb, costs associated with maintenance and energy use could be reduced.

RESULTS

Compressed air accounts for an estimated 25 percent of the company's electricity usage. The plant has one variable speed drive and four rotary-screw type compressors that provide 90 to 100 psi to more than 400 machines. The compressed air is used to run conveyor belts, as a blow off on rails, and for moving, cooling, cleaning and drying parts.

Repair Air Leaks: Ultrasonic leak detection was conducted in two of the four departments. This resulted in more than 700 leaks being tagged and recorded, which accounted for a loss of more than 1000 cubic feet per minute. Leaks decrease the amount of air supplied to the machines, which in turn necessitates running compressors at higher pressure. Repairing the leaks will result in a significant reduction of energy usage and associated costs, and a 200hp compressor could be eliminated from the system.

CONVENTIONAL AIR POLLUTANTS AND GREENHOUSE GASES DIVERTED IN METRIC TONS

TOTAL FOR ALL SECTORS							
CO_2	SO_2	CH_4	N_2O	CFC	NO_x	VOC	PM_{10}
1,671.16	9.01	62.64	0.83	20.49	4.28	0.13	0.22

Maintenance Plan: An ongoing leak detection plan was formulated and presented to the company. The proposed plan would involve purchasing an ultrasonic leak detector and conducting detection on one of the four departments each year.

Update Flo-Trol: Four of the five compressors are regulated by a flow-based control system. This eliminates the need to designate a lead compressor, increases system efficiency and reduces air waste. The screw compressors run at full load nearly all the time and the variable speed kicks in as needed to supplement pressure. The system also tracks data useful for calculations including energy, pressure and temperature. Reprogramming the control system to include a fifth compressor that is currently manually controlled would reduce run-time and help to optimize the operating efficiency of the overall system.

Light-Emitting Diode (LED) Lighting Retrofit: The original lighting system used 400-watt metal halide bulbs that are resilient to heat and impact. They provide a high lumen output, but require a lot of energy. To be more efficient, the company started replacing these with fixtures that house six four-foot T8 fluorescent tubes. Fluorescents give off high quality light, use less energy, and have a longer lifetime, but are not as resistant to heat, and due to their mercury content require special disposal. LED retrofit tubes were recommended for increased savings on maintenance, waste disposal, and energy. LED lamps have a much longer life than the fluorescents and will save more than one million kilowatt hours annually.

PROJECT	ANNUAL COST SAVINGS	ENVIRONMENTAL RESULTS	STATUS
REPAIR AIR LEAKS	$55,671	856,477 KWH	IN PROGRESS
MAINTENANCE PLAN	$38,970	599,534 KWH	RECOMMENDED
UPDATE FLO-TROL	$4,786	68,375 KWH	IN PROGRESS
LED LIGHTING RETROFIT	$67,189	1,033,680 KWH	RECOMMENDED

TYSON DELI, INC.

KIM SCHERBER
CIVIL ENGINEERING
IOWA STATE UNIVERSITY

COMPANY BACKGROUND

Tyson Foods, Inc. is a major producer of chicken, beef, and pork products for consumers globally. The company has more than 400 facilities and offices worldwide. In Cherokee, Iowa, Tyson Foods has a Tyson Deli plant that employs 745 team members to receive and process raw meat into ready-to-eat products by adding spices, smoking, and cooking the meat. Some of the products that the Tyson-Cherokee plant manufactures are hotdogs and shaved beef, pork, and turkey lunchmeat.

PROJECT BACKGROUND

Tyson Deli-Cherokee currently uses about 411,000 gallons of water per day, or 3 to 4 million gallons per week. Due to a recent corporate initiative, all Tyson plants that use more than 1 million gallons per week must reduce water consumption by 10 percent. Thus, the goal of this project was to reach or exceed these standards. The intern completed a water audit to pinpoint areas of opportunity for water and energy savings and outlined improvements to meet the reduction goal.

INCENTIVES TO CHANGE

If Tyson Deli-Cherokee were to reduce water consumption by at least 10 percent, the plant has the possibility to save hundreds of thousands of dollars in costs associated with water, pumping, heating, and treatment. In addition, complying with corporate initiatives will improve Tyson Deli-Cherokee's position within the prepared foods division.

RESULTS

Reconfigure Rotary Screen Nozzles: Tyson currently uses 36,000 gallons per day of 140° F hot water through spray nozzles on a rotary screen in the pretreatment wastewater room. If Tyson were to fix the solenoid valve on the screens and allow for cold water to clean the screen through the spray nozzles, more than 13 million gallons of water could be conserved each year along with 2.5 million kWh. This could save the company $51,519 per year in utility costs. Furthermore, switching from hot water to cold water will preserve the integrity of the rotary screen and prevent screen blinding from occurring.

CONVENTIONAL AIR POLLUTANTS AND GREENHOUSE GASES DIVERTED IN METRIC TONS

TOTAL FOR ALL SECTORS							
CO_2	SO_2	CH_4	N_2O	CFC	NO_x	VOC	PM_{10}
58.05	0.11	383.13	200.69	0.57	0.90	0.31	0.82

Eliminate Pretreatment Wastewater Hose: A hot water hose runs beneath the rotary screen to wash away meat that has fallen from the auger. A modification and adjustment to the auger would ensure the meat all falls into its intended hopper resulting in a reduction of 3,705,137 gallons of water and 711,266 kWh per year, saving the company $14,648 in associated costs.

Replacement of Hydraulic Power Packs: Seven percent of Tyson's daily water consumption is run through five power packs that cool the hydraulic fluid before it enters the processing equipment. Installing air-cooled power packs could reduce water usage by 11,137,914 gallons per year, saving $17,590 in water costs.

Stack Economizer: An economizer installed on the boiler would capture the heat off the boiler stack and could be used to heat water. An economizer could heat 62.5 gallons per minute at 127° F for plant hot water purposes, saving Tyson Deli 7,982,790 kWh a year and $110,751 in energy costs.

Roll Table Conversion: A stainless steel table utilizes a stream of water to slide meat logs from a casing machine. A partial-gravity roller-table would allow meat logs to move on rollers without the use of water, reducing water consumption by 717,468 gallons per year, saving $925 in annual water costs.

Turn off Unneeded Water: Turning off excess water used in equipment like constant-flush urinals would amount to a savings of $674 per year and a reduction of 501,569 gallons. The simple payback period for installing waterless urinals is less than six months.

PROJECT	ANNUAL COST SAVINGS	ENVIRONMENTAL RESULTS	STATUS
RECONFIGURE ROTARY SCREEN NOZZLES	$51,519	13,032,000 GALLONS 2,503,103 KWH	IN PROGRESS
ELIMINATE PRETREATMENT WASTEWATER HOSE	$14,648	3,705,137 GALLONS 711,266 KWH	IN PROGRESS
REPLACEMENT OF HYDRAULIC POWER PACKS	$17,590	11,137,914 GALLONS	IN PROGRESS
STACK ECONOMIZER	$110,751	7,982,790 KWH	RECOMMENDED
ROLL TABLE CONVERSION	$925	717,468 GALLONS	RECOMMENDED
TURN OFF UNNEEDED WATER	$674	501,569 GALLONS	RECOMMENDED

UNITYPOINT HEALTH - DES MOINES

CALLIE SCHULTES
CHEMICAL ENGINEERING
IOWA STATE UNIVERSITY

COMPANY BACKGROUND

UnityPoint Health is an integrated healthcare system that encompasses 15 hospitals and more than 280 clinics throughout Iowa and western Illinois. UnityPoint Health - Des Moines is part of that network and includes Iowa Methodist Medical Center, Blank Children's Hospital, Iowa Lutheran Hospital, and Methodist West Hospital. UnityPoint Health - Des Moines prides itself on the treatment it provides in the areas of cancer, cardiology, trauma and emergency, physical rehabilitation, maternity care, behavioral health, orthopedics, weight loss, pediatrics, sports medicine, and radiology.

PROJECT BACKGROUND

The objective of the project was to reduce the amount of hazardous waste generated and lessen the environmental impacts resulting from incineration of the waste. Two of the largest sectors of the hazardous waste stream are pharmaceutical waste and aerosol waste. The intern examined both of these components for reductions and also identified opportunities to impact the solid waste stream at the facility.

INCENTIVES TO CHANGE

UnityPoint Health - Des Moines strives to be an environmentally friendly institution and has implemented several waste-reduction and green initiatives. The pharmaceutical waste program is relatively new and has not been examined for improvement. There are both economic and environmental benefits to improving waste segregation and reducing the volume of the waste stream. Hazardous waste disposal costs approximately 77 times more than regular trash and is incinerated instead of being landfilled.

RESULTS

Liners in Hazardous Waste Containers: In the pharmacies at UnityPoint Health - Des Moines, 18-gallon bins are used to collect pharmaceutical waste including half-used vials of drugs. These bins are incinerated along with the waste after only a single use. By using liners and then re-using the bins, UnityPoint Health - Des Moines could save $5,303 and 0.33 tons of pharmaceutical waste each year.

Education Campaign: Clear signage in waste segregation areas could help clarify segregation procedures of the hazardous and non-hazardous waste streams. Keeping non-hazardous materials from the hazardous waste collection containers could save the facility $8,676 annually in disposal fees.

Pyxis Drug Relocation: Pyxis machines are located on nursing floors and automatically dispense the correct drug when a nurse keys in their credentials and selects the patient. Expiration of drugs is a significant problem in these machines, resulting in drugs being disposed of before use. The intern recommended a system for relocating 18 high-cost and high-expiration-rate drugs to floors with frequent use. This could save Iowa Methodist Medical Center $39,842 each year in pharmaceutical costs. Cost of disposal adds an additional $3,785.

Aerosol Recycling: Throughout the facilities at UnityPoint Health - Des Moines there are several thousand wall-mounted aerosol hand sanitizers. When empty, these are disposed of through the solid waste stream. The intern recommended these sanitizers be recycled. This would have negligible economic savings, but would save 0.8 tons of solid waste each year from the landfill.

PVC-Free IV bags : PVC production, use, and destruction can present several health and environmental risks. Changing just 6 types of IV bags at the facilities over to PVC-free alternatives would greatly reduce these risks and cut the solid waste stream by 7.05 tons each year. While there is no tangible economic benefit to this change, there are substantial intangible benefits that make this project worth pursuing.

CONVENTIONAL AIR POLLUTANTS AND GREENHOUSE GASES DIVERTED IN METRIC TONS

TOTAL FOR ALL SECTORS							
CO_2	SO_2	CH_4	N_2O	CFC	NO_x	VOC	PM_{10}
32.10	0.04	2.02	0.78	0.69	0.04	0.03	0.01

PROJECT	ANNUAL COST SAVINGS	ENVIRONMENTAL RESULTS	STATUS
LINERS IN HAZARDOUS WASTE CONTAINERS	$5,860	0.33 TONS	IN PROGRESS
EDUCATION CAMPAIGN	$8,676	1.11 TONS	IN PROGRESS
PYXIS DRUG RELOCATION	$43,627	0.55 TONS	RECOMMENDED
AEROSOL RECYCLING	NEGLIGIBLE	0.8 TONS	RECOMMENDED
PVC-FREE IV BAGS	—	7.05 TONS	RECOMMENDED

WEST LIBERTY FOODS, LLC

LUCAS BLACK
MECHANICAL ENGINEERING
UNIVERSITY OF WISCONSIN-PLATTEVILLE

COMPANY BACKGROUND

West Liberty Foods, LLC strives to be a leading food manufacturer by converting needs, ideas, and expertise into value for their members, business partners, and consumers. With achievements such as the SUBWAY 2012 Vendor of Year Award and the 2012 Progressive Grocer's Store Brands Supplier Pacesetter Award, West Liberty Foods has proven its dedication to producing quality products. West Liberty Foods has also displayed its concern for the environment by becoming landfill free, and is now working to prevent pollution by reducing their energy consumption.

PROJECT BACKGROUND

To supply the plant in West Liberty, Iowa, with compressed air needed for their pneumatic equipment, West Liberty Foods operates two compressors simultaneously. High-quality compressed air is essential for production and for meeting company standards. An audit of the complete compressed air system was done to identify inefficiencies and quantify opportunities to save energy and associated costs.

INCENTIVES TO CHANGE

Due to the age of the facility and the fact that air is non-hazardous, the compressed air system at West Liberty Foods had been neglected. With more than 100 air leaks detected, an ineffective distribution system, and no way to control the pressure downstream of the receivers, there were many opportunities to improve the efficiency of the system and reduce energy consumption. As compressed air is one of the company's highest utility costs, it deserves to be monitored closely and updated regularly.

RESULTS

West Liberty Leak Survey: An audit of the compressed air system was completed using an ultrasonic leak detector. Close to 120 leaks were detected. The intern took pictures of each leak, quantified them, and then prioritized the leaks into three groups so that the most severe leaks could be repaired first. When all leaks are repaired there is a potential for almost $40,000 in annual savings.

Distribution System: The compressed air dryers in the West Liberty plant were manufactured in 1988. They are non-cycling and consume unnecessary energy. The dryers are hooked in parallel but are undersized for needed air flow and room heat. This resulted in excess moisture throughout the distribution system, which can do significant damage to pneumatic equipment. Installing a new, properly sized dryer could save more than $16,000 annually.

Demand-side air storage can be beneficial for machines that require a high volume of intermittent air. Instead of drawing high-volume flow from the primary receivers and increasing the load on the compressors, machines would have secondary receivers on site. These would create an initial volume of air for the machine to use before it demands air from the primary receivers, providing a good buffer if demand throughout the plant is high. The result is a lower pressure required from the compressor, decreasing its operating time and consuming less energy. It is expected to reduce pressure demand by about 5 pounds per square inch, saving more than $2,800 annually.

Control System: The control system for West Liberty Foods' rotary screw compressors is a simple load/unload system. This means the compressors are programmed to maintain a certain range of pressure at all times and to operate at 100 percent load when compressing. Load/unload controls are very common for rotary screw compressors and are the most efficient at 100 percent load. Variable frequency drive controls are often thought to be more efficient. However, this only applies to partial loads, and high temperatures in the engine room may prevent this as an option.

Installing a pressure/flow controller to regulate the pressure downstream of the primary receivers would reduce artificial demand from leaks and unregulated processes. This modification would decrease compressor operating time and energy consumption, and could save more than $9,000 per year.

Mount Pleasant Leak Survey: A leak survey of the compressed air system at the Mount Pleasant plant was done using the same process followed at the West Liberty plant. Repair of the forty leaks that were found will save an estimated $20,000 annually.

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}
882.70	4.76	33.10	0.44	10.80	2.26	0.07	0.18

PROJECT	ANNUAL COST SAVINGS	ENVIRONMENTAL RESULTS	STATUS
WEST LIBERTY LEAK SURVEY*	$39,410	637,702 KWH	IMPLEMENTED
DISTRIBUTION SYSTEM**	$19,199	141,036 KWH	RECOMMENDED
CONTROL SYSTEM	$9,397	152,098 KWH	RECOMMENDED
MOUNT PLEASANT LEAK SURVEY	$20,000	323,625 KWH	IN PROGRESS

* ASSUMING AIR IS SUPPLIED TO ALL LEAKS 24/7/365
** ASSUMING ELECTRONIC VALVE FAILURES ARE A CAUSE OF EXCESS MOISTURE IN COMPRESSED AIR

WESTERN IOWA TECH COMMUNITY COLLEGE

SIOUX CITY

NICHOLAS ZAHNER
CONSTRUCTION ENGINEERING, MECHANICAL EMPHASIS
IOWA STATE UNIVERSITY

COMPANY BACKGROUND

Western Iowa Tech is a community college located in Sioux City, Iowa. Founded in 1966, the college has since added remote campus locations in other western Iowa communities. More than 70 degree options are currently offered, and more than 7,000 students are seeking college credit with another 17,000 students enrolled for non-credit learning experiences. Western Iowa Tech employs approximately 325 employees at their main campus in Sioux City.

PROJECT BACKGROUND

The goal of the project was to find ways to reduce energy usage through modifications to the heating, ventilation and air conditioning (HVAC) equipment. The intern focused on changing the constant volume system to variable air volume and improvements to the 20-year-old equipment, some of which is nearing the end of its useful life. These represented the leading areas of energy consumption for the two oldest buildings on campus.

INCENTIVES TO CHANGE

Over the last 20 years the air distribution and hydronic systems have been "pieced" together due to constant use. Most of the equipment is nearing the end of its useful life, and as equipment ages it tends to be less efficient and consume more energy. Additionally, there are numerous ongoing performance and maintenance issues with the system throughout campus. The intern was charged with researching solutions that could save money and energy.

RESULTS

The intern project focused on buildings A and D on the Western Iowa Tech campus. These were identified as the buildings with the oldest equipment and the most potential for savings.

Variable Frequency Drives: Constant-volume HVAC systems run at full speed without a variable speed option to throttle back and use less unnecessary energy. Since the occupancy of educational facilities varies greatly throughout the year, a variable frequency drive (VFD) would be an efficient addition. The VFD would allow the motor to slow down, resulting in less energy consumed. For the air distribution system, a variable air volume box is added with a built-in damper that decreases airflow and increases the air pressure. The motor will then slow down to reduce the overall system pressure. For the hydronic system, the use of two-way valves will reduce the flow and increase system pressure to achieve the desired result.

Chiller Replacement: The current chillers in buildings A and D have a total capacity of 710 tons of cooling. As the chillers are now twenty years old, the estimated energy efficiency ratio (EER) is 8. The chillers also have high maintenance costs, and both use R-22 refrigerant, which is being phased out by the year 2020. It was recommended to invest in new chillers to improve both capacity and energy efficiency. With an EER as high as 24 with a 25 percent load, the new chillers also will eliminate non-routine maintenance costs and will use a more environmentally friendly refrigerant.

Window Retrofit: Window replacement is an easy way for immediate impact. The current windows on the two buildings assessed are single glazed with a U-value of 1. This is the highest and least efficient value for glass. As the U-value approaches zero, the glass will allow less energy through, thus improving energy usage by reducing the internal heating and cooling loads. A retrofit would fit inside the sill of the current window and could improve the U-value to 0.17.

CONVENTIONAL AIR POLLUTANTS AND GREENHOUSE GASES DIVERTED IN METRIC TONS

TOTAL FOR ALL SECTORS							
CO_2	SO_2	CH_4	N_2O	CFC	NO_x	VOC	PM_{10}
1137.42	6.14	45.18	0.58	13.98	2.92	0.10	0.15

PROJECT	ANNUAL COST SAVINGS	ENVIRONMENTAL RESULTS	STATUS
VARIABLE FREQUENCY DRIVES	$49,000	1,138,000 KWH	RECOMMENDED
CHILLER REPLACEMENT	$110,000	1,442,000 KWH	RECOMMENDED
WINDOW RETROFIT	$4,300	3,200 THERMS 59,000 KWH	RECOMMENDED

WINNEBAGO INDUSTRIES, INC.

ANDREW JARVEY
INDUSTRIAL ENGINEERING
IOWA STATE UNIVERSITY

COMPANY BACKGROUND

Winnebago Industries operates the largest facility for motor home production in the United States (U.S.) and is a leading U.S. Class A and Class C recreational vehicle (RV) manufacturer. Incorporated in 1958, Winnebago Industries' headquarters are in Forest City, Iowa. The Forest City campus houses more than 17 industrial buildings with more than 2.2 million square feet under roof on 22 acres. Ten of these large facilities produce the majority of components for each motor home produced. Winnebago Industries also operates manufacturing facilities in Charles City, Iowa, and Middlebury, Indiana, with approximately 2,500 total employees.

PROJECT BACKGROUND

Diverting waste from Iowa's landfills is a priority for Winnebago Industries. In the last ten years, Winnebago Industries has implemented numerous programs that reuse and recycle millions of pounds of solid waste annually. Winnebago Industries' Forest City plant recycles 71 percent of all solid waste generated. The intern worked to support Winnebago Industries' ongoing environmental efforts by investigating additional recycling opportunities.

INCENTIVES TO CHANGE

RVs are designed to enhance the customer's experience with the outdoors. As a motor home manufacturer, Winnebago Industries works to continuously reduce the ecological impact of their manufacturing processes to protect the environment their customers enjoy.

Recent advertisements indicate that rival motor home manufacturers are adopting zero landfill initiatives. The industry-wide push toward environmental sustainability provides a strategic impetus for Winnebago Industries to reduce their waste stream.

RESULTS

Acrylic Recycling: The Plastics Building produces plastic components for Winnebago Industries' RVs. Plastic scrap is generated at mold trimming stations and reused. Winnebago Industries produces about 50,000 pounds of acrylic scrap each year that is sent to the landfill. The intern established a system for selling scrap acrylic trimmings. At a market value of $0.25 per pound, the gain from selling acrylic material and the landfill savings total $14,125 annually.

Kraft Paper Recycling: The Stitchcraft Building manufactures upholstered furniture and other textile goods for motor home interiors. Brown Kraft paper is used throughout the facility in fabric cutting processes. The facility uses 51,000 pounds of Kraft paper each year. The intern worked with Stitchcraft Building managers and material handlers to implement a system for collecting scrap Kraft paper. Kraft paper will be baled with cardboard and shipped to the current recycler. Annual gains from recycling Kraft paper total $3,665.

Consolidated Shipping: Winnebago Industries sends units of scrap material directly to recyclers. Most recycling companies require a minimum shipping weight. Winnebago Industries holds inventories of recyclables until minimum shipping weights are accumulated, and when enough of a specific material is collected, a trailer is loaded and delivered to the recycler. Inventory is constraining the expansion of recycling programs and causing numerous other problems.

A local recycler is willing to provide a dropped trailer wherein materials can be loaded with no minimum weight requirement. Multiple materials can be loaded with no segregation within the trailer, including acrylic scrap. Consolidating the shipment of low-value materials by placing them all on the same dropped trailer can eliminate 100 units of material from inventory and free 718 square feet of floor space. The value of this freed space by eliminating inventory totals nearly $36,000.

Additional Projects: Managers at Winnebago Industries are working to educate and motivate employees regarding what materials can be recycled. In the near future, Winnebago Industries plans to implement new waste containers for sorting recyclables on the motor home production line.

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}
130							

PROJECT	ANNUAL COST SAVINGS	ENVIRONMENTAL RESULTS	STATUS
ACRYLIC RECYCLING	$14,125	25 TONS	IN PROGRESS
KRAFT PAPER RECYCLING	$3,665	25.5 TONS	IMPLEMENTED
CONSOLIDATED SHIPPING	$35,937	STRATEGIC	IN PROGRESS

ZOETIS

BRYCE NEUMAN
MECHANICAL ENGINEERING
UNIVERSITY OF WISCONSIN PLATTEVILLE

COMPANY BACKGROUND

Zoetis discovers, develops, manufactures and commercializes a diverse portfolio of animal health medicines and vaccines designed to meet the real-world needs of veterinarians and the livestock farmers and companion animal owners they support. The Zoetis manufacturing site in Charles City, Iowa, produces vaccines for cattle, swine, poultry, and companion animals. Production of animal vaccines at this facility began more than 90 years ago under the lead of Dr. Joseph Salsbury. Ownership and names have changed a few times since then but the facility in Charles City, Iowa, has always been a producer of animal health products. The current facility includes 600,000 square feet of buildings located on 256 acres and employs approximately 440 people.

PROJECT BACKGROUND

Zoetis uses domestic water for a large portion of their process cooling throughout the facility. Zoetis' current water use is more than 60 million gallons per year. Many processes currently utilize one-pass cooling. This provides one area of opportunity to meet the goal of 5 percent reduction in water consumption.

INCENTIVES FOR CHANGE

Zoetis supports the reduction of waste and efficient utilization of resources. The water and sewer charge is projected to increase 3.5 percent annually, making this an important utility to consider conserving and reusing where feasible.

RESULTS

Clean Steam Generator: One of the clean steam generators had a continuous blow down of purified hot water. This blow down amounted to 0.75 gallons per minute (gpm) of 85° Celsius water. The hot blow down water is now being captured and mixed with plant steam condensate and returned back to the boilers. This project will save the company approximately 547,000 gallons in Reverse Osmosis water and more than 3,900 therms in natural gas annually.

Blend Vessels: The blend vessels have a standard operating procedure using city water that permits the operator to choose a cooling temperature between 16° and 20° Celsius. This range of temperature is problematic as the city water temperature may be warmer, leading to excessive water use. Training the operators to always use a set point of 20° Celsius could save an estimated 279,000 gallons per year.

Autoclave Condensate Cooling: An autoclave in the isolation building is run once per day on average. Currently the flow rate for the condensate cooling is 1.75 gpm, running continuously 24 hours per day, 7 days per week. A switch that connects the control panel to an on-line valve would allow it to open and close only through the operation of a program. This modification could reduce water usage by 2,200 gallons per day.

Decorative Fountain: The Research and Administration building on the Zoetis campus utilizes a decorative fountain. This fountain is operated from 7 am to 5 pm Monday through Friday approximately 7 months per year. Approximately 1,500 gallons of water are added to the fountain per day indicating a leak in the system. Repair of the leak could save more than 335,000 gallons per year.

Freeze Dryers: Five of the Hull freeze dryers use high temperatures for sanitation requiring a shelf fluid temperature of 121° Celsius. After the temperature is obtained, it must be cooled to between 20° and 25° Celsius which is accomplished by using city water in one-pass cooling. One cool down of this system can use more than 5,000 gallons. However, during operation these Hulls have closed-loop cooling systems for the compressors. It is recommended to tie into these loops for the initial shelf cooling to avoid city water use and save more than 1.3 million gallons of water per year.

CONVENTIONAL AIR POLLUTANTS AND GREENHOUSE GASES DIVERTED IN METRIC TONS

TOTAL FOR ALL SECTORS							
CO_2	SO_2	CH_4	N_2O	CFC	NO_X	VOC	PM_{10}
35.87	0.19	6.03	0.02	0.44	0.09	0.02	0.01

PROJECT	ENVIRONMENTAL RESULTS	STATUS
CLEAN STEAM GENERATOR	547,500 GALLONS OF WATER 3,990 THERMS	IN PROGRESS
BLEND VESSELS	279,000 GALLONS OF WATER	RECOMMENDED
AUTOCLAVE CONDENSATE COOLING	804,825 GALLONS OF WATER	RECOMMENDED
DECORATIVE FOUNTAIN	335,343 GALLONS OF WATER	RECOMMENDED
FREEZE DRYERS	1,395,556 GALLONS OF WATER	IN PROGRESS

2013

24-WEEK INTERNSHIP

CASE SUMMARIES

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

A 24-week internship can provide benefits to both companies and students. Companies have an opportunity to pursue projects that would otherwise be too time-consuming. Students get first-hand experience in learning about a complex system, and identifying and overcoming challenges they would not encounter in a classroom or less extensive internship. While a 24-week internship is not a feasible time-frame for all projects or interns; it has proven to be a viable option for addressing larger projects.

One 24-week project is underway in 2013 and scheduled to finish in November. The following pages provide an overview of this project and the work completed in the first 12 weeks. The final case summary for this project will be posted on the Pollution Prevention Intern Program website www.iowap2services.com in January and printed in the 2014 Case Summary Booklet.

JOHNSON CONTROLS, INC.

ROBERTO JESUS GARCIA
MECHANICAL ENGINEERING
IOWA STATE UNIVERSITY

COMPANY BACKGROUND

Johnson Controls Inc. is a global corporation that formed in 1885 with the invention of the thermostat. They have since expanded into three different areas: building efficiency, power solutions and automotive experience. The facility in Red Oak, Iowa, is part of the Power Solutions division and specializes in production of battery grids. Established in 2003, the facility is 90,000 square feet and employs over 60 people. The fiscal year 2012 global sales for Johnson Controls Inc. were $42 billion.

PROJECT BACKGROUND

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

INCENTIVES TO CHANGE

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

RESULTS

Insulation: The heat exchangers are not currently insulated. This can cause the coolant to gain heat during the heat-transfer process through the heat exchangers. A test is being conducted to quantify the benefits of adding additional insulation to the heat exchangers and distribution system.

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

Pump flow regulation: The process coolant pumps are being metered to detail the flow rates of the plant's current system configuration. Lowering the rate of flow from the process water tanks would reduce demand on the process water pumps and reduce the need for cooling.

Water regulation: During the summer, when demand on the chillers is high, a water misting system is used to cool the condenser and help the chillers keep up with demand. This irrigation water is left running during the night when the chillers are cooled by the lower ambient temperatures. Turning the irrigation water off during the cooler night hours would provide immediate savings.

Free Cooling: Based on the available cold weather during the winter, there is an opportunity to take advantage of free-cooling. This technology redirects the cooling liquid through dry air coolers that are cooled by the outside ambient air. Free-cooling technology is a cost saving option that is preferable to operating the energy-driven chillers at the plant.

**This summary represents the findings of the intern and does not necessarily represent the views of Johnson Controls.*

2013 PROJECT INDEX
POLLUTION PREVENTION INTERN PROGRAM

ALTERNATIVE ENERGY SOURCES
- DuPont Pioneer

BOILER EFFICIENCY
- DuPont Pioneer
- Grundy County Memorial Hospital
- Procter and Gamble

COMPRESSED AIR
- Danfoss Power Solutions Inc.
- Stanley Engineered Fastening
- West Liberty Foods, LLC

ENERGY REDUCTION
- CNH America LLC
- Danfoss Power Solutions Inc.
- Eaton Corporation
- Grinnell College
- Grundy County Memorial Hospital
- Hy-Line International
- John Deere Davenport Works
- Johnson Controls Inc.
- Procter and Gamble
- Stanley Engineered Fastenings
- Tyson Deli, Inc.
- West Liberty Foods, LLC
- Western Iowa Tech Community College

HAZARDOUS WASTE
- Rosenboom Machine and Tool
- UnityPoint Health - Des Moines

HEAT RECOVERY
- Eaton Corporation
- Tyson Deli, Inc.
- Procter and Gamble

HVAC
- Western Iowa Tech Community College

LIGHTING
- DuPont Pioneer
- Grinnell College
- Hormel® Foods
- Hy-Line International
- Stanley Engineered Fastening

ORGANIC WASTE MANAGEMENT
- Hy-Line International

PROCESS IMPROVEMENT
- Eaton Corporation
- JELD-WEN Windows
- John Deere Davenport Works
- Procter and Gamble
- UnityPoint Health - Des Moines
- Winnebago Industries, Inc
- Tyson Deli, Inc.

SOLID WASTE MANAGEMENT
- Bridgestone Americas Tire Operations
- Danfoss Power Solutions Inc.
- DuPont Pioneer
- Golden Crisp Premium Foods, Inc.
- Hormel® Foods
- Hy-Line International
- JELD-WEN Windows
- Rosenboom Machine and Tool
- UnityPoint Health - Des Moines
- Winnebago Industries, Inc

WATER USE REDUCTION
- Tyson Deli, Inc.
- Zoetis

» Join the P2 INTERN PROGRAM in 2014!

STUDENT APPLICATION & BUSINESS REQUEST FORMS are available online at:
www.iowap2interns.com
Forms may be submitted electronically, faxed or mailed.

FOR COMPANIES

Pollution Prevention Services is currently accepting requests for 2014 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, 2013 to be considered for 2014 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 2013.

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

FOR STUDENTS

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

- Application Form
- Résumé
- Cover Letter
- Unofficial copy of transcripts
- List of Fall 2013 and Spring of 2014 classes

Selection of 2014 interns will begin in October and continue into the spring until project assignments are finalized.

Pollution Prevention internship sessions offered in 2014 are:

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

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

SUBMIT PROJECT REQUESTS & APPLICATIONS TO:

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

P: 515.281.8063 | F: 515.281.8895
Danielle.Dilks@dnr.iowa.gov

pollution prevention services

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