THE POLLUTION PREVENTION INSTITUTE'S INTERN PROGRAM

POLLUTION PREVENTION INSTITUTE
KANSAS STATE UNIVERSITY

2006, 2007, AND 2008 CASE SUMMARIES

Pollution Prevention Institute
Kansas State University

Source Reduction
Recycle
Treatment
Disposal

Case summaries written by
Energy Efficiency (E2) Pollution Prevention (P2) and Hospitals for a Healthy Environment (H2E) Interns

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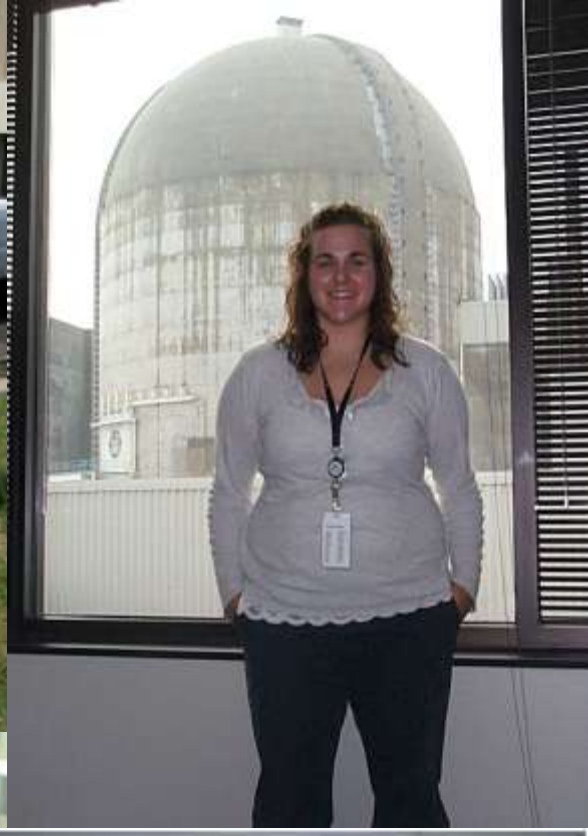
About the Pollution Prevention Institute:

The Pollution Prevention Institute (PPI) is an agency within Engineering Extension at Kansas State University. PPI provides confidential, technical, environmental pollution prevention and compliance assistance to businesses and institutions. PPI also provides resources for development of environmental management systems (EMS); energy efficiency; and other assistance to communities, hospitals, colleges, and large businesses.

PPI's vision is for a healthy Kansas environment that fosters economic and environmental sustainability and growth. PPI's mission is to promote sustainability through environmental education and services to industry and institutions. These services include environmental compliance and pollution prevention technical assistance.


Haldex
Haldex Brake Products Corporation
Iola Division




SAINT-GOBAIN
INSULATION
CertainTeed Corporation
Insulation Group
Kansas City Plant

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DIRECTOR'S NOTE

Larson

Director's Note

The E2/P2 Intern Program is a nonregulatory, summer program designed to link top-level engineering and environmental sciences students with business and industry. Collaborations focus on projects to reduce energy use, emissions, and wastes, benefiting the company bottom line and the Kansas environment. Students are matched with an industry host, trained on campus, then placed at the host industry site for about 10 weeks during the summer. PPI specialists and university partners support the projects as technical advisors, while students work with host companies to research E2/P2 projects that eliminate or reduce—

- energy use
- air emissions
- hazardous and solid wastes
- water contaminants
- employee risks
- water consumption
- costs

Since 2006, implementation of the E2/P2 Intern Program has recommended savings of more than 214 million gallons of water; 4,100 tons of waste; 35 million kilowatt hours for a total savings of more than $5 million per year.

Here is what our host companies say:

"Sign us up for next year."

"We had a very positive experience. Just days after his arrival, I was placed on a project to relocate a facility. The intern was patient and understanding with my time resources and was able to work with little instruction. He has an extremely bright future ahead of him."

PPI also hosts hospital-specific interns call Hospitals for a Healthy Environment or H2E Interns. The H2E program is managed similarly to the E2/P2 program. These intern programs are made possible through funding and support from EPA Region 7 and our state partners the Kansas Department of Health and Environment.

I encourage you to read the 2006, 2007, and 2008 case studies that follow. You too can partner with the Kansas Pollution Prevention Institute for our summer E2/P2 Intern Program and H2E Intern Program.

E2/P2 intern and host company applications are due each January and can be found at www.sbeap.org. The program does require that industry cost-share interns' salaries, an investment that generally has a very quick payback period.

EXECUTIVE SUMMARY

Table 1a: Summary of E2/P2 intern recommendations from 2006, 2007, and 2008

Category	Annual Reductions	Annual Cost Savings
Energy	6,365,964 kWh	$1,072,005
Waste	6,948 tons	$709,732
Water	212,539,165 gallons	$2,273,665
Mercury	1026 mg	---
Total		**$4,112,439**

Table 1b: Summary of H2E intern recommendations from 2007 and 2008

Category	Annual Reductions	Annual Cost Savings
Energy	28,496,249 kWh	$1,329,275
Waste	1,290 tons	$117,668
Water	---	---
Mercury	7030 mg	---
Total		**$1,446,943**

Greenhouse gases diverted in metric tons

	Total Tons
CO2	31,578

Note: Greenhouse gases shown were calculated at the following Website http://www.epa.gov/cleanenergy/energy-resources/calculator.html.
Note 2: To convert energy in kWh to MBTU use kWh*3.14/1000.

E2/P2 Case Summaries
2006-2008

2006 Summary

In 2006, the Pollution Prevention Institute teamed up with the Kansas State University College of Engineering and other Kansas schools to start the Pollution Prevention Intern Program. Four interns recommended projects that would save the participating companies $441,817 per year. These projects would also reduce 1,025 tons of waste and save more than 1.5 million kWh per year.

The 2006 interns were placed in various industries throughout Kansas to focus on a wide range of E2/P2 projects including conducting an air audit to identify and repair air leaks, finding uses for used or waste materials, conducting and creating a chemical inventory, providing E2/P2 training for employees, researching methods of erosion control, studying the feasibility of wind energy, and performing a detailed light audit and relamping project.

Table 2: Summary of 2006 E2/P2 intern recommendations

Category	Annual Reductions	Annual Cost Savings
Energy	1,533,201 kWh	$202,817
Waste	1,025 tons	$219,200
Mercury	2174 mg	—
Total		**$422,017**

2006 Case Study

Columbian Chemical Company

Nathan Fritz
Chemical Engineering
Kansas State University

Hickok, Kansas

Company Background

Columbian Chemicals Company is a global leader in the safe and quality production of carbon black, a fine powder used as a pigment and reinforcing agent in rubber. Carbon black is produced from a hydrocarbon feedstock known as carbon black oil. This feedstock is fed into an oil furnace where high temperatures and lack of oxygen work to chemically decompose the mixture into carbon. The plant began operation in 1946 and employs 50 people.

Project Background

Columbian Chemicals Company is committed to the production of safe, environmentally friendly carbon black. Nathan Fritz, PPI intern, took the opportunity to work on several pollution prevention projects, which included conducting air audits to reduce energy waste due to air leaks, performing an analysis of fuel-grade carbon black in an effort to decrease landfill disposal, reducing unnecessary chemicals through a plant-wide chemical inventory, and providing environmental training for employees.

Incentives to Change

Columbian Chemicals Company has created an environmental management system, achieved ISO 14001 certification, and set a goal for zero pollution production. The plant chose to participate in the PPI Intern Program to further its goal of zero waste and emissions.

Projects Reviewed for E2/P2 Potential

1. Leak Detection in the Air Compressor System

   Through an air audit of the plant's air compressor system, Fritz found 73 air leaks, which cost the company approximately $36,200 each year. By repairing these air leaks, the Columbian Chemicals Company can avoid this cost and save more than 602,925 kWh of energy per year.

   As of winter 2009, Colombian Chemicals Company had completed the plant air audit and continues to repair leaks when they are found. Currently it is saving $27,831 and 713,275 kWh per year.

2. Air Audit of Facility Atomizers

   Fritz performed a second audit on the air compressors used for the facility's atomizers, and analyzed several options to reduce or recycle vented air used in this process. First, atomization could be accomplished through steam, plant air, or a blower, depending on the grade of carbon black being produced, which would decrease use of the atomizers. Vented air is able to be reintroduced into the plant air system or used to agitate the cooling tower pit to prevent clogging. Implementation of these options would save up to 116,666 kWh of energy and between $7,000 and $90,000 annually, depending on the option chosen.

   As of winter 2009, Columbian Chemical Company had implemented an upgrade to its atomizer air system. They bought a fifth air compressor that is used when demand on the atomizer system is low. Information on the savings is unknown, because it has not been operational long enough to produce reliable data.

3. Using Scrap Carbon Black as a Fuel Source

   Each year, the Columbian Chemicals Company generates approximately 400,000 lbs of scrap (fuel grade) carbon black, a portion of which is landfilled on site and available as an alternative fuel source.

Air compressor

Energy content for this fuel-grade carbon black is approximately 14,200 BTU/lb, making it a viable source of energy. By allowing other companies to use this carbon black as a fuel source, $15,200 per year in landfill costs could be avoided. Barriers to implementation are transportation costs and the carbon black being in powder form.

As of 2008, Columbian Chemicals Company had been unable to find a company to take its carbon black. Instead, it installed a filter that cleans all the carbon black, so its waste of 2 million lbs/year is reduced by 95%. It is saving approximately $1,000,000 per year by being able to reuse the carbon black.

4. Steam Leaks

While searching for air leaks, Fritz noticed several steam leaks. Finding nine that he tagged to be repaired. If Columbian repairs the leaks, it will save $16,300 per year.

Columbian has repaired all the steam leaks. But is not saving any money, because it now has a free source of steam at its facility.

4. Chemical Inventory

Fritz also conducted a thorough inventory of chemicals located at Columbian Chemicals Company in order to keep the material safety data sheet (MSDS) list current. Through the inventory, 20 unnecessary chemicals were removed from the plant and reused, recycled, or properly disposed. By creating an electronic MSDS database within the company, rather than employing a third party to perform this task, Columbian Chemicals Company will save approximately $3,500 annually.

5. E2/P2 Education

While at the Columbian Chemicals Company, Fritz took the opportunity to develop and present environmental training at employee meetings, discussing issues such as source reduction and environmental issues related to the company.

Table 3: Summary of 2006 E2/P2 intern recommendations for Columbian Chemicals Company; updated winter 2009

Project Description	Annual Estimated Impact	Annual Estimated Cost Savings	Status	Annual Actual Impact	Annual Actual Cost Savings
Plant Air Audit	602,925 kWh	$36,200	Partially Implemented	713,275 kWh	$27,831
Atomizer Audit	116,666 kWh	$7,000-$90,000	Implemented	Unknown	Unknown
Fuel Grade	200 tons waste	$15,200	Altered	1,000 tons waste	$1,000,000
Steam Leaks	Reduce water and energy use	$16,300	Implemented	Reduce water and energy	—-
Chemical Inventory	Reduce 20 chemicals	$3,500	Implemented	Reduce 20 chemicals	$3,500
E2/P2 Plant Training	Education	—-	Implemented	Education	—-

Frontier El Dorado Refining Company

Ryan Hamel
Biological and Agricultural Engineering
Kansas State University

El Dorado, Kansas

Company Background

Frontier El Dorado Refining Company (FEDRC) is one of two petroleum refineries owned by Frontier Oil Corporation and is the largest petroleum refinery in Kansas. This 1,000-acre site, which began operation in 1917, is strategically situated with direct access to pipelines from both Canada and Oklahoma and produces a variety of petroleum-based products including gasoline, diesel fuels, aviation fuels, and asphalt. Employing 400 personnel and 100 contractors at any give time, FEDRC processes 130,000 barrels of crude oil per day.

Project Background

Erosion at FEDRC has become an issue of increasing concern, mostly due to its role in primary sludge generation at the on-site wastewater treatment plant (WWTP). As storm water flows through open storm water channels on the refinery's tank farm, soil is eroded and transported into the storm water sewer system. Upon reaching the WWTP, this sediment becomes known as primary sludge, a listed hazardous waste under the Resource Conservation Recovery Act (RCRA). Because primary sludge is an oil-bearing sludge, it can be recycled into the refining process, entering a unit known as the coker. This unit produces coke, a heavy carbon material used as a fuel source. Unfortunately, there is limited capacity for recycling primary sludge into the coker because the unit must also process heavier petroleum solids from other sections of the refining process.

Incentives to Change

FEDRC chose to work with PPI to determine feasibility and possible options for erosion control in order to decrease primary sludge generation. FEDRC wanted to research this erosion-control project because eroded sediment is a major source of the listed RCRA hazardous waste primary sludge. FEDRC would like to generate less primary sludge in order to increase the ability to recycle other oil-bearing sludge through the refining process, decrease storage and disposal costs, and improve WWTP efficiency.

Projects Reviewed for E2/P2 Potential

1. Erosion Control

   Ryan Hamel analyzed FEDRC's tank farm and determined that approximately 125 cubic yards of soil are being eroded each year, generating roughly 1,250,000 pounds of primary sludge annually. This is nearly 10% of total annual sludge production at the on-site WWTP. By regrading and stabilizing storm water channels and the areas adjacent to them, a significant amount

of erosion can be reduced. Possible erosion-control methods include vegetative groundcover, rock armoring, a soil-hardening mixture, or more likely, a combination of the three. Erosion control will also result in a cost savings of $177,635/year due to a reduction in storage costs and the ability to recycle other oil-bearing solids, rather than dispose of them as hazardous waste. Based on conservative contractor estimates, implementing this type of erosion control would cost between $165,000 and $300,000, depending on material usage and extent of the project. Assuming no further erosion, this would make the payback period for this erosion-control project one to two years. Additional benefits not included in this value are the improved stability of pipe-rack foundations in the tank farm and improved WWTP efficiency.

FEDRC has implemented small amounts of the recommended erosion control. Due to the small scope, it is difficult for the company to determine the current erosion rate or if the erosion control has had any impact.

Table 4: Summary of 2006 E2/P2 intern recommendations for Frontier El Dorado Refining Company; updated winter 2009

Project Description	Annual Estimated Impact	Annual Estimated Cost Savings	Status	Annual Actual Impact	Annual Actual Cost Savings
Erosion Control	625 tons	$175,000	Partially implemented	Unknown	Unknown

Haldex Brake

Ignacio Sala
Industrial Engineering
Kansas State University

Iola, Kansas

Company Background

Haldex Braking Controls Division is part of Haldex Brake, a global company that focuses on products for the vehicle industry. Headquartered in Stockholm, Sweden, Haldex Brake employs 4,600 people worldwide. The Iola plant, a 232-person operation, is part of the commercial vehicle systems business section, manufacturing heavy-duty trucks, air brakes, valves, and air actuators.

Project Background

Lighting in the workplace plays a vital role in productivity, cost control, and environmental responsibility. With increasing environmental regulations, fluctuating energy prices, concerns for health and safety, and an aging workforce, selecting the appropriate lighting type and layout is essential.

Over the course of several years, Haldex Brake incorporated a variety of lamp types into its lighting system, ranging from high-pressure sodium to metal-halide bulbs. Although many of these changes positively affected energy efficiency and the color-rendering index, recent advances in lighting systems can further improve these characteristics. This project examined the possibility of a renovation in the lighting system at the Iola plant.

Incentives to Change

Haldex Braking Controls Division desired to improve plant lighting to reduce energy usage, associated maintenance costs, and disposal of universal waste associated with the current lighting system. With an 80% increase in the cost of electricity in 2006, the decision to reduce energy usage became increasingly important. Working with the PPI Intern Program was an efficient, cost-beneficial method for Haldex to achieve its goal.

Projects Reviewed for E2/P2 Potential

1. Replace Current Lighting System

After conducting a thorough review of lighting alternatives, Sala found T5HO fluorescent lamps and remote occupancy sensors to be the best option to replace the company's existing 1,000-watt/400-watt metal-halide fixtures. This lighting alternative used half the energy of the previous system, while increasing lighting by 25%, and reducing universal waste and greenhouse gases associated with energy consumption. A yearly reduction of 550,752 kWh of energy and 1,026 mg of mercury will be realized. The value for the reduction of mercury does not take into account the low levels of mercury found in the replacement fixtures. In addition, lighting conditions for employees will be improved, less maintenance will be required for replacing the longer-lasting bulbs, and less energy will be used due to the lower emission of heat from lighting fixtures. Haldex Brake will see an estimated annual savings of $54,973 through the reduction of energy usage and disposal costs, and improvement in bulb life.

Haldex has implemented all the lighting upgrade recommendations, and has seen an estimated savings of 1,200,000 kWh and $65,000 per year based on their calculations. Haldex's entire lighting upgrade had a payback of only 1.14 years.

2. Replace Current Emergency Exit Lights
While at Haldex, Sala also had the opportunity to examine the emergency exit lighting system. Because LEDs are significantly more energy efficient, these emergency exit lights will require smaller battery supplies, which then reduces the amount of hazardous materials. By switching to an LED system, Haldex can reduce the amount of lead in its emergency exit lighting system by 1,148 mg/year and the amount of sulfuric acid by 326 mg/year.

Haldex is in the process of implementing the LED exit lighting, by installing the new bulbs as the current bulbs burn out. Once they are all completed, Haldex will see a savings of $550 and 4,000 kWh a year.

Table 5: Summary of 2006 E2/P2 intern recommendations for Haldex Brake; updated winter 2009

Project Description	Annual Estimated Impact	Annual Estimated Cost Savings	Status	Annual Actual Impact	Annual Actual Cost Savings
Replace Current Lighting System	550,752 kWh 1,026 mg mercury	$55,500	Implemented	1,200,000 kWh	$65,000
Emergency Exit Lights	4,000 kWh 1,146 mg mercury	$540	In progress	4,000 kWh	$550

The Monarch Cement Company

Christopher Frampton
Chemical Engineering
Kansas State University

Humboldt, Kansas

Company Background

The Monarch Cement Company was incorporated in 1913 by The Monarch Portland Cement Company. Since this time, it has continued to produce high-quality cement, increasing production from 282,000 to 1,100,000 tons per year. The company produces two types of cement: Portland cement and masonry cement. Portland cement consists of a mixture of limestone and shale and is mixed with water, while masonry cement contains an additional admixture which improves masonry properties. The masonry cement is then mixed with sand and water for use in a variety of blocks and bricks.

Project Background

As a PPI intern, Christopher Frampton focused on four different projects during his internship at Monarch Cement. He first examined potential nonhazardous alternative fuels to be used in the cement manufacturing process. The second project was a lighting audit of the facility to determine potential benefits of lighting alternatives. Frampton then researched options for recycling used refractory brick, which is removed from the kiln system each year. Recycling these bricks reduces wastes and is considered a feasible alternative raw material source for The Monarch Cement Company. The fourth project was a feasibility study of using wind energy as an electricity source.

Incentives to Change

The cement manufacturing process is an extremely energy-intensive process, which makes energy reduction and alternative fuel sources highly important to The Monarch Cement Company. The company also wanted to avoid disposing of used refractory bricks through an on-site demolition waste permit and was looking for more efficient methods to recycle this waste or to reuse it as an alternative raw material source.

Projects Reviewed for E2/P2 Potential

1. Alternative Kiln Fuels

Frampton researched several nonhazardous alternative kiln fuels, including bone meal, municipal solid waste, and carbon black, to be used as fossil fuel alternatives. He collaborated with Nathan Fritz, PPI intern at Columbian Chemicals Company, to determine the feasibility of using its scrap carbon black as an energy source in the cement manufacturing process. By partnering together, 250,000 lbs/year of scrap carbon black could replace traditional fossil fuels used at The Monarch Cement Company, resulting in 15% less fuel usage.

As of winter 2009, Monarch had not found an alternate kiln energy source due to high transportation costs.

2. Light Audit

Through a brief light audit, Frampton recommended using daylight sensors to reduce energy usage by up to 258,858 kWh annually, resulting in a savings of $20,577. This savings would be accomplished primarily through installation of daylight sensors on approximately 360 lights.

Monarch estimates it has implemented 90% of the recommended lights with daylight sensors. This amounts to approximately 320 lights. Monarch is saving approximately $9,320 and 232,972 kWh per year in electricity. It is also saving about $8,400 per year in bulb expenses and $800 in maintenance.

3. Recycling of Refractory Brick

Frampton researched all aspects of recycling used refractory brick from the kiln system, including methods of on- and off-site recycling and cost of landfilling this waste. Through this research, he was able to make recommendations to Monarch Cement. First, Frampton recommended phasing out the type of refractory brick currently being used and begin on-site recycling. Off-site recycling was not recommended due to the liability associated with passing this waste on to someone else and the uncertainty of its ultimate disposition. By recycling this current waste, The Monarch Cement Company would avoid landfilling 200 tons of brick, eliminate $10,000 in landfill costs, and earn approximately $19,000 profit per year by incorporating the material into the limestone feed used to produce cement.

Monarch has implemented an on-site recycling program for its refractory brick. It is reusing approximately 250 tons of raw feed per year. This is a savings of $24,000 per year from recycling and $10,000 in landfilling costs.

4. Wind Energy

Frampton examined the possibility of installing a wind turbine on site to generate energy for Monarch. While a wind turbine could potentially reduce the company's energy costs, this project was not recommended due to the long payback period of the investment.

Table 6: Summary of 2006 E2/P2 intern recommendations for Monarch Cement Company; updated winter 2009

Project Description	Annual Estimated Impact	Annual Estimated Cost Savings	Status	Annual Recorded Impact	Annual Recorded Cost Savings
Alternative Kiln Fuels	250,000 lbs	—-	Not recommended	—-	—-
Daylight Sensors	258,858 kWh	$20,577	Implemented	232,972 kWh	$18,520
On-Site Recycling	200 tons	$29,000	Implemented	250 tons	$34,000
Wind Energy	—-	—-	Not recommended	—-	—-

2006 Conclusion

The success of the 2006 pilot E2/P2 Intern Program has resulted in decreased environmental footprints for Kansas industries, thousands of dollars in cost savings, and an increased awareness of environmental engineering career opportunities for our graduating engineers. Success of the 2006 pilot program also led to a 2007 intern year with nine interns working across the state of Kansas.

The table below shows results for the 2006 interns after a follow-up study was conducted in 2008. As seen below, 91% of the recommended projects have been implemented at the participating companies.

Table 7: Summary of 2006 E2/P2 intern results as of winter 2009

Category	Annual Reductions	Annual Cost Savings	Project Status
Energy	2,150,247 kWh	$111,901	5 of 6 Implemented
Waste	1,250 tons	$1,037,500	4 of 5 Implemented
Mercury	1,026 mg	—-	1 of 1 Implemented
Total		**$1,149,401**	**10 of 12 Implemented; 1 in progress**

What the 2006 interns said about their experience:

"This [experience] represents a significant achievement in my professional career."

"Being in a plant and working with all departments gave me a chance not only to develop the project but also broaden my background in engineering."

"This internship provides environmental training not usually given in other core curricula or internships."

"You get real industry experience. There is no limit to what you can approach, and you have an amazing opportunity to possibly enact change within the community."

2007 Summary

In 2007, the Pollution Prevention Institute teamed up with students from Kansas State University and Emporia State University to participate in the second year of the Pollution Prevention Intern Program. This year there were seven pollution prevention interns. In 2007, the interns recommended projects that would save the participating companies $1.2 million per year. These projects would also reduce 5,506 tons of waste, save 25.3 million gallons of water, and reduce 1.6 million kWh per year. The program also had one repeat company, Haldex Brake, from the 2006 intern program.

The 2007 interns were placed in various industries throughout Kansas to focus on a wide range of E2/P2 projects including conducting an air audit to identify and repair air leaks, lighting upgrade, mercury reduction, and water reduction through installation of water-restrictor devices and smart practices.

Table 8: Summary of 2007 E2/P2 intern recommendations

Category	Annual Reductions	Annual Cost Savings
Energy	1,623,566 kWh	$565,275
Waste	5,506 tons	$439,333
Water	25,359,000 gallons	$240,637
Total		**$1,245,245**

Frito-Lay

Curtis Leiker
Biological and Agricultural Engineering
Kansas State University

Topeka, Kansas

Company Background

"The Frito Company" and "The H.W. Lay Company" merged in 1961 to form Frito-Lay. The Topeka plant, a 750-person operation, opened its current location in 1971. The Topeka plant has 11 production lines producing 14 different types of chips for a total of 134 million pounds of product annually.

Project Description

Curtis Leiker's project focused solely on water usage within the facility. A line-by-line breakdown of water usage was created in order to compare actual usage with company standards. Doing this made it easier to see where the greatest potential for water conservation was and to keep track of where the water was being used. Before Leiker arrived, Frito-Lay kept track of how much water they used but did not know how much water went to each part of the plant.

Incentives for Change

Frito-Lay of Topeka has the greatest potential of almost all the 39 company plants in the United States when it comes to potential savings of water. In 1999, the ratio of gallons of water used to pounds of finished product was 2.19 gal/lbs and in 2006, it was down to 1.17 gal/lbs. The ultimate goal set by corporate is to reduce this ratio to 0.81 gal/lbs. If this goal is reached, the Topeka plant will save approximately $200,000 per year.

Projects Reviewed for E2/P2 Potential

Leiker completed a line-by-line breakdown of water usage in order to compare actual usage with company standards. Leiker measured flow rates of the water by sticking rubber tubes over the nozzles and allowing the water to run into a calibrated bucket for one minute. This allowed Leiker to measure the flow in gpm and then compare the number with company standards. The main area of savings occurred in water that was running at a higher gpm than recommended. Leiker also recommended using recycled water in several locations across the plant. After completing measurements on all 11 production lines, Leiker identified nine areas for water usage reductions. These nine areas are discussed below. The potential savings is 13.42 million gallons of water and $67,503 annually.

1. Destoner/Vertical Lift

   Leiker recommended installing an orifice on the freshwater supply to the main bearing on the destoner/vertical lift to reduce the flow rate from 10 gpm to 5 gpm. This will save 2,150,000 gallons of water and $10,815 per year. This recommendation has been implemented.

2. Potato Chip Peeler Orifice

   Leiker recommended installing an orifice on the water supply to the potato peeler to reduce the flow rate from 19 gpm to 10 gpm. This will save 2,070,000 gallons of water and $10,412 per year. This recommendation has been implemented.

3. Potato Chip Flume

Leiker recommended re-piping the flumes in the potato chip line to use recycled water instead of fresh water. This will save 2,870,000 gallons of water and $14,436 per year. Frito-Lay is in the process of implementing this recommendation.

4. Tortilla Chip Orifice

Leiker recommended installing an orifice on the halo in the hopper of the tortilla chip line to reduce water from 15 gpm to 10 gpm. This will save 1,120,000 gallons of water and $5,634 per year. This recommendation has been implemented.

5. Fritos Drain Belt Timer

Leiker recommended reprogramming the drain belt timer on the Fritos line from 50% usage to 25% usage. This will save 1,080,000 gallons of water and $5,432 per year. Frito-Lay is currently investigating the best settings for the timer to get the best quality production. It should be implemented in early 2009.

6. Universal Tortilla Chip Orifice

Leiker recommended that Frito-Lay install an orifice on the cook-to-soak transfer pipe to reduce water flow from 29 gpm to 15 gpm. This would save 1,670,000 gallons of water and $8,400 per year. Frito-Lay has concerns with the plugging of orifices and how that will affect quality if it implements this recommendation.

7. WOW Orifice

Leiker recommended that an orifice be installed on the cook-to-soak transfer pipe to reduce water flow from 19.5 gpm to 15 gpm. This would save 450,000 gallons of water and $2,264 per

reduce the water flow from 19.5 gpm to 15 gpm. This would save 450,000 gallons of water and $2,264 per year. Frito-Lay has concerns with the plugging of orifices and how that will affect quality if it implements this recommendation.

8. WOW Drain Belt Timer

Leiker recommended that Frito-Lay install a timer on the drain belt in the WOW line. The savings on this was unknown. This recommendation has been implemented.

9. Sweep Clean

Leiker also recommended that during cleaning, Frito-Lay sweep clean instead of using high-pressure guns. This would save 2,010,000 gallons of water and $10,110 per year. This recommendation has been implemented.

Frito-Lay has implemented water-saving techniques in five of the nine recommended locations. It is also in the process of implementing two other recommendations. After implementing these changes, Frito-Lay observed a 0.16 gal/lb of finished product reduction in water use, or 21.1 million gallons of water per year. It is also saving $84,000 per year.

Table 9: Summary of 2007 E2/P2 intern recommendations for Frito-Lay; updated winter 2009

Project Description	Annual Estimated Impact	Annual Estimated Cost Savings	Status	Annual Actual Impact	Annual Actual Cost Savings
Production Line Water Reduction	11,410,000 gallons	$56,637	Implemented	21,100,000 gallons	$84,000

Haldex Brake

Lisa Enns
Mechanical Engineering
Kansas State University

Iola, Kansas

Company Background

Haldex Brake is a provider of proprietary and innovative solutions to the vehicle industry. Haldex focuses on products in vehicles that enhance safety, the environment, and vehicle dynamics. The Iola, Kansas, plant is in the commercial vehicle systems division. The plant manufactures air brake components for heavy-duty trucks and employs approximately 230 people.

Project Background

Lisa Enns' main project for the summer focused on water conservation. The Iola plant had already greatly reduced its water use in the last decade, but the chemical finishing department still used approximately 1.8 million gallons per year. Enns had the opportunity to work on several pollution prevention projects, which included researching options for water usage reduction on the assembly lines, upgrading the lighting in common areas, and analyzing some of the plant's heaters for energy savings potential.

Incentives to Change

Haldex Brake desired to reduce water consumption in order to reduce costs associated with purchasing, heating, and disposal of the water. Haldex had an intern the summer of 2006 to help with energy conservation, and water conservation was the next area of reduction Haldex wanted to evaluate.

Projects Reviewed for E2/P2 Potential

1. Conductivity Controls

Each year, Haldex Brake uses approximately 729,720 gallons of water in its overflow rinse tanks. To decrease water usage, Enns recommended Haldex purchase conductivity control systems for all the tanks. Conductivity controls will help maintain consistent water quality throughout the day and will also reduce water flow to the tanks. If Haldex Brake purchases the conductivity controls, it will see a cost savings of $12,000 a year in the purchase, disposal, and treatment of water. It will also see a 489,000 gallon reduction in water usage.

Haldex has installed two conductivity controls on its overflow tanks and is planning on installing a third conductivity control at the beginning of 2009. Each control unit costs $600. Haldex is saving approximately $1,200 and 600,000 gallons of water per year because it installed the conductivity controls.

2. Wastewater Treatment

The current wastewater treatment system at Haldex is almost 20 years old and does not allow for reuse of the 1.56 million gallons of disposed water per year, at a cost of $38,500. Enns considered three main options for reuse of this water: reverse osmosis, ion exchange, and evaporation. When Enns left Haldex, there was still research that had to be conducted to determine if any of the three are a viable option.

Haldex Brake decided not to go ahead with an ion exchange system because the return on investment would be more than 10 years.

3. Common Area Lighting

The 2006 intern recommended a large light system upgrade for Haldex, but there were still areas that had not been updated when Enns arrived. After reviewing the current lighting systems at Haldex, Enns decided to focus her research on common areas that are lit 24 hours a day. These areas included break rooms, bathrooms, hallways, and lobby areas. Enns recommended replacing the current 34 W T8 lamps with 25 W T8 lamps. Enns also recommended replacing the current magnetic ballasts with electronic ballasts. This replacement will account for a savings of $1,469 and 25,000 kWh per year in electricity.

Haldex has implemented the lighting upgrade in all recommended locations. It is saving a larger amount than Enns predicted because it changed out more lamps and saw its energy costs increase from the price used to estimate cost savings. Haldex is saving 260,076 kWh and $21,500 per year.

4. Tank Heaters

Haldex currently uses four, 24-kW heaters to heat its chemical-finishing water tanks for 12 hours a day. Enns' research concluded that the current water heaters were oversized, and Haldex could purchase two,15-kW and two, 10-kW heaters to replace the current heaters. Assuming only two heaters run at the same time, Haldex would see a savings of $3,526 and 59,000 kWh per year in electricity.

Haldex has not rightsized its chemical-finishing heaters. The 2008 intern insulated the tanks and a lower temperature cleaner is going to be implemented. After all this is completed, Haldex plans to rightsize the heaters to the new demand.

Table 10: Summary of 2007 E2/P2 intern recommendations for Haldex Brakes; updated winter 2009

Project Description	Annual Estimated Impact	Annual Estimated Cost Savings	Status	Annual Actual Impact	Annual Actual Cost Savings
Conductivity Controls	489,000 gallons	$12,000	Implemented	600,000 gallons	$1,200
Wastewater Treatment	1,560,000 gallons	$38,500	Not implemented	—-	—-
Lighting Upgrade	25,000 kWh	$1,469	Implemented	260,076 kWh	$21,500
Tank Heaters	59,000 kWh	$3,526	On hold	—-	—-

Hallmark Cards

Rylan Ortiz
Electrical Engineering
Kansas State University

Kansas City, Missouri

Company Background
Hallmark Cards, Inc. is a privately owned company that supplies more than 50% of U.S.-sent greeting cards. Founded in 1910 by J.C. Hall, this company has been in the greeting card business for almost 100 years. Hallmark's main corporate facility has more than 6,500 employees and its surrounding facilities, such as the Liberty distribution center and Lawrence manufacturing center, employ thousands of workers as well.

Project Background
The layout of the intern project focused on Hallmark's goal to become a "zero-free waste company." The time spent during the internship can be summed up into three areas of focus: research for burning waste paper to provide electricity; "pelletization," where by-products from card manufacturing that cannot be recycled are sent to a sister company to be used as an alternative energy source; and an air leak audit.

Incentives to Change
Hallmark has always been in the market for sustainable business practices. Hallmark decided to have its intern research the feasibility for creating a waste-to-energy (WE) program for its company. It wanted to know the economics and logistics for implementing such a program.
Projects Reviewed for E2/P2 Potential

1. Waste to Energy
Rylan Ortiz researched implementing a waste-to-energy project for Hallmark Cards and concluded that a company like Hallmark would have to hire outside its corporation in order to implement a full-scale WE program. Currently the infrastructure is not set up to accommodate this option. The main reason for not recommending this program is due to economic issues.

2. Pelletization
Another more viable option for turning waste into energy is the process of pelletization. Ortiz researched many types of alternative solid fuels that could be pelletized for incineration at a cement facility. Matching items include cellulose, plastic, and textile products. The materials must be non-hazardous and derived from non-reusable materials otherwise going to landfills. For efficiency purposes, the heat value of 5,000 Btu/lb is required and initial customers who can generate > 200 tons/year are preferred. Ortiz looked at various types of waste generated at Hallmark facilities, including baled shrink wrap, foil paper, plastic, waste tissue, paper, toner chips, and polyurethane waste.

As of 2008, Hallmark now has a program in place where it sends 350 tons of foil paper to Lafarge Cement where Lafarge Cement uses it is used as an alternate fuel. Currently, Hallmark breaks even on costs as it pays both transportation fees and Lafarge to take their

waste; but Hallmark saves the same amount of money in landfill costs. It is in the process of negotiating with Lafarge for its fees and believes once this happens, it will start making money off the process. Hallmark is also in the process of finding more materials that it can send to Lafarge.

3. Air Audit

The Lawrence Hallmark facility uses compressed air in its card manufacturing equipment. Ortiz conducted an air audit at the facility to search for leaks and tag the leaks for repair. Ortiz identified $37,200 in savings due to compressed air leaks throughout Hallmark's manufacturing plant in Lawrence.

Hallmark's headquarters fixed all leaks in the building. One production facility also redid its compressed air supply system and placed its pressure-control valves up higher so employees could not adjust them. Hallmark hopes to implement a leak-detection program sometime in the future. Data on savings were not available.

Waste foil paper

Hallmark's headquarters fixed all leaks in the building. One production facility also redid its compressed air supply system and placed its pressure-control valves up higher so employees could not adjust them. Hallmark hopes to implement a leak-detection program sometime in the future. Data on savings were not available.

Table 11: Summary of 2007 E2/P2 intern recommendations for Hallmark Cards; updated winter 2009

Project Description	Annual Estimated Impact	Annual Estimated Cost Savings	Status	Annual Actual Impact	Annual Actual Cost Savings
Waste to Energy	—	—	Not Recommended	—	—
Pelletization	200 tons	—-	Implemented	350 tons waste	Currently none
Air-Leak Audit	—-	$37,200	Implemented	Unknown	Unknown

Philips Lightning Company

Ignacio G. Garita
Electrical Engineering
Kansas State University

Salina, Kansas

Company Background
Philips Lighting Co. is a division of Royal Philips Electronics based in the Netherlands. Philips Lighting, located in Salina, Kan., is considered the largest producer of fluorescent lamps in the world. The Salina plant has five main production lines and employs around 400 people.

Project Background
Philips Lighting produces a variety of fluorescent lamps in its Salina plant. Before Ignacio Garita arrived, the company was recycling large quantities of waste lamps but had no information on the quantity. Philips sends its waste lamps to an outside recycling company instead of processing them in house. Garita's project was to track and record the quantity of waste lamps and recommend a way to recycle them in house.

Incentives to Change
Philips is an environmentally conscientious company and is always on the lookout for ways to increase its efficiency and support the environment. Philips understands that recycling lamp waste has many benefits for the company and the environment. In-house recycling of lamp waste has already been implemented in many other Philips' plants because of its known benefits.

Projects Reviewed for E2/P2 Potential

1. Lamp-Waste Recycling

Garita concluded that every hour, 1,214 lamps are lost to waste in the Salina plant. This amounts more than 10 million lamps a year. All waste lamps are sent to a crusher in house and then transported 300 miles to a recycling company. By recycling this waste in house, Philips can save money on transportation, energy, and parts. The two types of in-house lamp recycling machinery that Garita considered were "crushing -separation" and "end-cut" machinery. Crushing -separation takes all lamp waste, separates the glass from the metal, and crushes the glass so it can be reused. The end-cut method cuts off the ends of a completed lamp and returns the glass to be reused. To decide which type of machinery was most beneficial, Garita studied the lamp waste to determine how much was metal and how much was already broken. By the end of the summer, Garita concluded that the crushing-separation machine would work best. Garita's estimates show that Philips would save $1,471 a day on raw materials, energy, and transportation if it purchased either of the recycling machines. Garita was not able to come up with a final solution for his project but did provide Philips Lighting with two options on how it can recycle in house and save the plant $537,280 a year.

Philips received management approval in August 2008 to order a crushing-separation machine for its broken fluorescent bulbs. The machine will arrive in April 2009 and will allow the company to reuse 100% of their broken and wasted fluorescent bulbs.

Philips received management approval in August 2008 to order a crushing-separation machine for its broken fluorescent bulbs. The machine will arrive in April 2009 and will allow the company to reuse 100% of their broken and wasted fluorescent bulbs.

Table 12: Summary of 2007 E2/P2 intern recommendations for Philips Lighting; updated winter 2009

Project Description	Annual Estimated Impact	Annual Estimated Cost Savings	Status	Annual Actual Impact	Annual Actual Cost Savings
Lamp-Waste, In-House Recycling	1,081,228 kWh and 4088 tons solid waste	$537,280	In progress	—	—

Schwan's Global Supply

Jay Reimer
Biological and Agricultural Engineering
Kansas State University

Salina, Kansas

Company Background

Schwan's Global Supply is one of the world's largest providers of branded frozen food, and their Salina, Kan., plant specializes in frozen pizza.

Project Background

One of the factors affecting a business' reputation is its management of wastewater and air emissions. Many waste streams flow out of Schwan's Salina plant, but focusing on those waste streams with the most significant environmental or financial impact is most important. Reimer's internship involved two different projects: the wastewater treatment plant (WWTP) chemical room audit and the waste control project.

Incentives to Change

Schwan's Global Supply believes focusing on the environmental impact of its operations is not only good for the environment, but also provides the company with a competitive advantage for every additional sustainability program implemented.

Projects Reviewed for E2/P2 Potential

1. Wastewater Treatment Plant Chemical Room Audit

Schwan's sends nearly 5,300 aerosol cans per year to the landfill. If Schwan's enacts a recycling program for aerosol cans, it can receive $90 a year from the recycling company and divert 1,600 pounds of waste from the landfill. Schwan's currently disposes of its batteries through *Safety-Kleen,* but Reimer recommended the company participate in the *Rechargeable Battery Recycling Corporation* program instead.

Schwan's implemented the recommendations to recycle aerosol cans and batteries while the intern was there. It is saving approximately $90 per year, 1,600 lbs of solid waste, and 47 lbs of hazardous waste per year.

2. Waste Control Project

Schwan's throws away an estimated 950 tons of crust each year. Reimer researched two ways to reuse the crust: producing ethanol and producing animal feed. Both of these options

Waste crust

would require purchasing expensive equipment, but it would provide a revenue source of approximately $160,000 per year and eliminate crust waste. Reimer recommended conducting more research before deciding if these are viable options for Schwan's .

Another waste Schwan's produces is 4,700 pounds of solvent per year. *Safety-Kleen* currently works with Schwan's to dispose of this. Reimer recommended that Schwan's join *Safety-Kleen*'s continuous-use program in order to decrease the hazardous waste it generates and allow its old solvent to be reused. Schwan's also uses Styrofoam products in its break rooms; these get deposited in the local landfill. Reimer researched two machines that will turn this Styrofoam into a recyclable material. This will help eliminate 3,500 cubic feet per year of Styrofoam waste.

Schwan's has implemented a waste-crust recycling program. Since its implementation, Schwan's is saving approximately $124,596 and 700 tons of crust waste a year. Schwan's has not implemented Styrofoam recycling at its facility. It is using the Safely-Kleen continuous-use program to decrease its hazardous waste by 4,700 pounds per year.

Table 13: Summary of 2007 E2/P2 intern recommendations for Schwan's Food Company; updated winter 2009

Project Description	Annual Estimated Impact	Annual Estimated Cost Savings	Status	Annual Actual Impact	Annual Actual Cost Savings
Aerosol Container Recycling	0.8 tons solid waste	$90	Implemented	0.8 tons solid waste	$90
Battery Recycling	0.02 tons hazardous waste	—-	Implemented	0.02 tons hazardous waste	—-
Waste Crust	950 tons solid waste	$160,000	Implemented	700 tons solid waste	$124,596
Styrofoam Recycling	3,500 cubic feet	Not calculated	Not implemented	—-	—-
Parts-Washer Solvent	2.4 tons hazardous waste	—-	Implemented	2.4 tons hazardous waste	—-

Schwan's Global Supply

Andrew Sellers
Industrial Engineering
Kansas State University

Salina, Kansas

Company Background

Schwan's is one of the largest providers of branded frozen food in the world, selling products in more than 50 countries. With 22,000 employees worldwide, Schwan's is a leading producer of pizza, egg rolls, and frozen desserts. The Schwan's Global Supply's Salina plant specializes in the production of frozen pizza.

Project Background

The Schwan's Global Supply's Salina plant specializes in production of frozen pizza, where the manufacturing process is energy intensive. Management is persistently making efforts to reduce energy use, which was the focus of the summer internship. Sellers' energy-reduction projects for the summer of 2007 included a plant air-leak audit, hand-washing sink audit, water trough audit, and statistical process control of topping applicators.

Incentives for Change

The plant produces large amounts of waste in many forms, all of which increase energy consumption. Schwan's realizes that reducing waste will improve its environmental standing, while reducing energy costs simultaneously. As energy and water prices have risen recently, Schwan's recognizes the benefit of reducing its utilities usage.

Projects Reviewed for E2/P2 Potential

1. Plant Air Audit

Sellers conducted a facility air audit to ensure the air is being managed to eliminate loss and waste of energy usage. The air audit discovered 46 air leaks amounting to 458,338 kWh and $23,000 in electricity costs per year. Sellers marked each leak with a repair tag so maintenance would be able to easily repair them.

Schwan's has repaired all the air leaks found by Sellers and continues to conduct facility air audits to find new leaks. Currently, it is saving $172,365 and 3,400,000 kWh per year due to fixing the leaks Sellers found and by continuing to do air-leak audits.

2. Hand-Washing Sink Audit

Every hand-washing sink at Schwan's had to provide instant water at 100^{o}F. To do this, all sinks have a spout that is continuously dumping hot water down the drain. In total, the 53 hand-washing sinks cost Schwan's $84,148 per year in energy and water. After much research, Sellers recommended that Schwan's install instantaneous water heaters at each hand-washing sink. This would save 7,500,000 gallons of water and $84,000 per year.

In 2008, Schwan's had another intern who did an audit of the hand-washing sinks. Schwan's has implemented the upgrades recommended by the 2008 intern.

3. Water Trough Audit

Schwan's Salina plant has 15 water troughs. Each trough consists of a metal pipe with several holes along it to disperse water for four peo-

Wasted Water from Hand Wash Sink

ple to wash their hands. However, these troughs are not typically used by four people, so the extra water is wasted. Total wasted water costs Schwan's $49,500 per year. Sellers recommended that Schwan's replace its water troughs with four freestanding sinks. This will save the company $49,500 and 4,400,000 gallons of water per year.

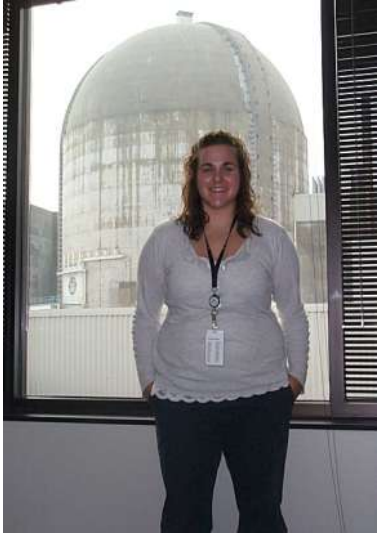
Schwan's has not removed any troughs from its facility.

4. Process Capability Study
Sellers did a study on the accuracy of Schwan's pizza topping applicators to discover sources of waste and quality problems. This study revealed that Schwan's is spending $276,000 a year and wasting 517,000 pounds of food by over-applying toppings due to the inaccuracy of its applicators. Sellers recommended that Schwan's purchase new, more accurate pizza-topping applicators for its manufacturing process.

Schwan's has purchased new applicators to decrease instances of over-applying toppings. It is now saving $386,598 and 517,000 pounds per year due to less product use and energy consumption.

Table 14: Summary of 2007 E2/P2 intern recommendations for Schwan's Global Supply; updated winter 2009

Project Description	Annual Estimated Impact	Annual Estimated Cost Savings	Status	Annual Actual Impact	Annual Actual Cost Savings
Plant Air Audit	458,338 kWh	$23,000	Implemented	3,400,000 kWh	$172,365
Hand-Washing Sink Audit	7,500,000 gallons water	$84,000	Altered for 2008 intern recommendation	—-	—-
Water Trough Audit	4,400,000 gallons water	$49,500	Not implemented	—-	—-
Statistical Process Control	258.5 tons waste	$276,000	Implemented	—-	$386,598



Wolf Creek Nuclear Operating Corporation

Brenna Zimmer
Biochemistry
Emporia State University

Burlington, Kansas

Company Background
Wolf Creek Generating Station (WCGS) near Burlington, Kan., is owned by Westar Energy, Kansas City Power and Light, and Kansas Electric Power Cooperative, Inc., and is operated by Wolf Creek Nuclear Operating Corporation. WCGS is a pressurized water reactor that generates more than 1.2 million kW of electricity, which is enough power for 800,000 homes. The facility employs approximately 940 people.

Project Background
The project at Wolf Creek Generating Station was to reduce or eliminate the amount of solid and hazardous waste produced. The four main areas to be studied were parts-washer solvent, sodium analyzers, paint, and silver reclamation.

Incentives to Change
Wolf Creek Nuclear Operating Corporation is constantly striving to reduce or eliminate its production of solid and hazardous waste. The company is a Kansas generator of hazardous waste and is seeking to become a small quantity generator of hazardous waste. That means it seeks to generate less than 55 lbs of hazardous waste per month. Achieving this goal will allow the company to reduce its regulatory requirements, employee exposure, and disposal fees.

Projects Reviewed for E2/P2 Potential

1. Parts-Washer Solvent
Brenna Zimmer looked into changing WCGS' current type of parts washers to either water-based washers or implementing a continuous-use program. Zimmer recommend a continuous-use program with Safety Kleen, where Safety Kleen will use Wolf Creek's old solvent for its own equipment. If Wolf Creek can contract with Safety Kleen to manage its used solvent in this manner, it would eliminate $320 per year in hazardous waste disposal fees and reduce 2,133 pounds of hazardous waste per year.

Wolf Creek has implemented this recommendation and is saving approximately 3,200 pounds of hazardous waste per year. It is also saving $1,000 per year.

2. Sodium Analyzers
Wolf Creek currently uses a flammable and noxious chemical to measure the quality of its circulating water. This chemical must be disposed as hazardous waste when it is expired. Zimmer found an alternative chemical that completely exhausts itself, thus eliminating the chemical

Parts washer

waste and saving Wolf Creek $270 a year in disposal fees while reducing 57 lbs/year of hazardous waste.

As of 2008, Wolf Creek is in the process of implementing the new solution and will have completed it within the next year.

3. Paint
Zimmer researched the possibility of a paint-thinner recycler, but the high cost of implementation does not make it economically feasible for Wolf Creek.

4. Silver Reclamation
Wolf Creek generates 480 pounds of waste film fixer a year. Zimmer researched a metal-recovery cartridge method that would put the waste film through an ion exchange to recover the silver. This silver can then be sent off for silver recovery, and the non-hazardous waste solution can be disposed of. This will save the company $320 per year in disposal costs and eliminate 480 pounds of hazardous waste per year.
As of 2008, the equipment for this project had been ordered and Wolf Creek was just waiting for delivery to start reclaiming their silver.

5. Ammonium Hydroxide
When Zimmer arrived at Wolf Creek, the facility had 1,500 gallons of 14-year-old ammonium hydroxide sitting in a chemical storage warehouse facility on site. Zimmer researched companies who may have a need for this material and found one that could use it. By researching this waste exchange, Zimmer removed the potential hazardous waste from Wolf Creek and saved $2,333 in disposal fees.

Wolf Creek continues to use this waste exchange any time they have a new waste. As of 2008, it has not been successful in finding a company to take its waste since the intern left, but it will continue to try.

Table 16: Summary of 2007 E2/P2 intern recommendations for Wolf Creek Nuclear Operating Corporation; updated winter 2009

Project Description	Annual Estimated Impact	Annual Estimated Cost Savings	Status	Annual Actual Impact	Annual Actual Cost Savings
Parts-Washer Solvent	1.1 tons hazardous waste	$320	Implemented	1.6 tons hazardous waste	$1,000
Sodium Analyzers	0.03 tons hazardous waste	$270	In progress	—-	—-
Silver Reclamation	0.24 tons hazardous waste	$320	In progress	—-	—-
Ammonium Hydroxide	5.2 tons hazardous waste (1 time only)	$2,333	Implemented	5.2 tons hazardous waste	$2,333

2007 Conclusion

The success of the 2007 E2/P2 Intern Program has resulted in decreased environmental footprints for Kansas industries, thousands in cost savings, and an increased awareness of environmental engineering career opportunities for our graduating engineers.

The table below shows results for the 2007 interns after a follow-up study was conducted in the winter of 2009. As seen below, 57% of the recommended projects have already been implemented at the participating companies and 14% are in process of being implemented.

Table 17: Summary of 2007 E2/P2 intern results as of winter 2009

Category	Annual Reductions	Annual Cost Savings	Project Status
Energy	3,660,076 kWh	$193,865	2 of 4 Implemented; 1 in progress
Waste	1,061 tons	$514,617	8 of 11 Implemented; 2 in progress
Water Conservation	21,700,000 gallons	$85,200	2 of 3 Implemented
Total		**$793,682**	**12 of 21 Implemented; 3 in progress**

What the 2007 interns said about their experience:

"This internship will be very beneficial in both future jobs and relating schoolwork to industry."

"The largest professional contribution I feel I made during the internship was feeling that I was able to bring some new ideas to the table that other people had previously not thought about or had the time to do."

"It's a good feeling to know that I've impacted both the company and environment on a large scale."

2008 Summary

In 2008, the Pollution Prevention Institute found students from Kansas State University, the University of Kansas, and Southwestern College to participate in the third year of the Pollution Prevention Intern Program. These interns recommended projects that would save the participating companies $2,388,377 per year. These projects would also reduce 417 tons of waste, save 187.2 million gallons of water, and reduce 3.2 million kWh per year. The program also had five repeat companies from the 2007 intern program: Frito-Lay, Haldex Brake, Schwan's Global Supply, and Wolf Creek Nuclear Operating Corporation. This is only four companies; we had five companies apply, but only four that received interns .

The 2008 interns were placed in various industries throughout Kansas to focus on a wide range of E2/P2 projects including conducting an air audit to identify and repair air leaks, lighting upgrades, mercury reduction, and water reduction through nozzles and smart practices.

Table 18: Summary of 2008 E2/P2 intern recommendations

Category	Annual Reductions	Annual Cost Savings
Energy	3,209,497 kWh	$303,913
Solid Waste	417 tons	$51,199
Water	187,178,600 gallons	$2,033,288
Total		**$2,388,340**

CertainTeed Corporation

Katie Brennan
Chemical Engineering
Kansas State University

Kansas City, Kansas

Company Background

CertainTeed is a leading North American manufacturer of building materials. The company has approximately 9,000 employees and 70 manufacturing facilities throughout the United States. The Kansas City plant specializes in insulation manufacturing and employs about 500 people.

Project Background

Safety is number one at CertainTeed, so reducing hazardous materials is a top priority. The E2/P2 projects were all based around minimizing hazardous materials found at the plant. In 2006, OSHA lowered the acceptable exposure limit on certain particulates that CertainTeed produces, leading to expensive testing in certain rooms at CertainTeed. This financial incentive encouraged CertainTeed to get its particulate limits well below the regulated quantity.

Incentives to Change

All five CertainTeed insulation plants have in place an environmental management system that conforms to ISO 14001 standards. Maintaining the highest level of environmental management provides the company with a competitive advantage. CertainTeed recognizes that high standards in environmental safety are the only way to succeed in today's market.

Projects Reviewed for E2/P2 Potential

1. Furnace Slag

CertainTeed's furnace slag has Cr^{6+} due to chemical reactions with the furnace. Brennan mixed several solutions with the slag to try to remove the Cr^{6+}. She found that a solution with 10wt% ascorbic acid removed all the Cr^{6+} from the solid and liquid parts of the solution. This project will reduce hazardous waste by 36 tons a year and help keep the exposure limit of Cr^{6+} below required levels. CertainTeed has decided not to implement this recommendation at this time.

2. Electrostatic Precipitator (EP) Dust

Fumes from the furnace go through EPs to clean the air, and particulates that are captured are sent to CertainTeed's pelletizer room. Particulates in the pelletizer room contain Cr^{6+}, so quarterly tests must be conducted and personal protection equipment must be worn. This costs CertainTeed $23,000 per year. Brennan recommended that CertainTeed add ascorbic acid to the particulates that are sent to the pelletizer room to remove the Cr^{6+}. This will save CertainTeed $23,000 a year, reduce its hazardous waste by 365 tons a year, and improve the safety of all its employees. CertainTeed has decided not to implement this recommendation at this time.

Table 19: Summary of 2008 E2/P2 intern recommendations for CertainTeed Corporations; updated winter 2009

Project Description	Annual Estimated Impact	Annual Estimated Cost Savings	Status	Annual Actual Impact	Annual Actual Cost Savings
Slag Treatment	36 tons	Minimal	Not implemented	—	—
EP Dust Treatment	365 tons	$23,000	Not implemented	—	—

Florence Manufacturing Company

Chelsea Renda
Chemical Engineering
Kansas State University

Manhattan, Kansas

The Company

For more than a century, Florence Manufacturing has provided the country with quality mailboxes. Florence Manufacturing is dedicated to improving the quality of its product and reducing its impact on the environment.

Project Background

Renda's main project was to gather information on ISO 14001 certification. For this, she found out what processes Florence had in place by doing a "mock" gap analysis and compared its quality manual to the requirements for ISO 14001. Her second project was to help with the powder-coating chemistry change. Next, Renda worked on consolidating the fabrication coolants. Finally, Renda helped with a scrap-reduction project.

Incentives to Change

As part of Florence Manufacturing's commitment to continual improvement and being environmentally friendly, it decided to pursue ISO 14001 certification. ISO 14001 will help the company focus on what impacts it has on the environment and create methods to reduce those impacts. This certification not only helps the environment but has the potential to save the company money.

Projects Reviewed for E2/P2 Potential

1. ISO 14001 Gap Analysis

The main focus of the internship was ISO 14001 certification. Florence Manufacturing is already ISO 9000 certified. Since the certification process could not be completed in the short time the intern was with the company, Renda's job was to show the company what they physically do in the plant as far as environmental impact .

2. Powder-Coating Chemistry

The second project dealt with the chemicals in the five-stage washing system of powder coating. Modifications to this process would allow for a decrease in temperature in stage one (100 degrees from 130 degrees), and a decrease in temperature in stage three (90 degrees from 130 degrees). This will save an additional $59,000 and reduce the amount of chemicals being introduced into the environment.

3. Consolidation of Fabrication Coolants

The next project involved consolidating the fabrication coolants from two to one. The fabrication department was using Trim HD and Blasocut Universal 2000 coolants. Both have a 7:1 mixing ratio with water, but Blasocut has a lower evaporation rate. Using just the Blasocut coolant, the company would use two fewer drums a year (110 gallons) and save $36.60.

Florence Manufacturing Company has implemented the coolant consolidation. It is saving 110 gallons of coolant and $36 per year.

4. Relighting

Renda researched the possibility of replacing Florence's 54 W T5 and 32 W T8 bulbs with LED bulbs. The LED bulbs only use 14 W. If this is implemented, it will save Florence 236,250 kWh and $1,272 per year.

5. Scrap Reduction

The final project dealt with scrap reduction. The plant sees approximately $1,000,000 worth of scrap a year. Renda's project was to find out what may be causing some of the scrap. Anodized parts accounted for approximately $700,000 of the scrap, so Renda's first job was to figure out which anodized part was causing the most scrap. She also analyzed the fabrication process and recommended procedural changes that led to less scrap.

Table 20: Summary of 2008 E2/P2 intern recommendations for Florence Manufacturing Company; updated winter 2009

Project Description	Annual Estimated Impact	Annual Estimated Cost Savings	Status	Annual Actual Impact	Annual Actual Cost Savings
Powder-Coat Chemistry Change	549 kWh 2,585 gallons of chemical	$143,010	Implemented	1,465,000 kWh	$103,000
Coolant Consolidation	110 gallons waste	$36.60	Implemented	110 gallons	$36
Relighting	236,250 kWh	$1,272	Unknown	—-	—-
Scrap Reduction	0.36 tons waste	$115	Unknown	—-	—-

Frito-Lay

Emily Robbins
Civil Engineering
University of Kansas

Topeka, Kansas

Company Background

Frito-Lay was formed in 1961 after the merging of two chip producers, Fritos Corn and H.W. Lay & Company, to produce the largest snack-selling company in the United States. In 1965, Frito-Lay and Pepsi-Cola merged to become PepsiCo, Inc.

Production at the Topeka site began in 1965; however, the current plant did not come into operation until 1971. Since 1971 there have been six expansions, making the Topeka plant the sixth-largest manufacturing site of Frito-Lay. The Topeka plant has 11 production lines and employees 750 people.

Project Background

In 2007, Frito-Lay Topeka was 85% efficient to the company standard in the area of natural gas consumption compared to production annually. The goal was to reach 95% thermal-efficiency. A thermal efficiency team was formed at the end of 2007 to identify thermal issues and complete projects to increase efficiency. If Frito-Lay Topeka reached 95% efficiency to the standard, it could save approximately $360,000 at the current rate of $7.73 per mmBTU.

Incentives to Change

Rising fuel costs, scarcity of resources, and other environmental issues have made conservation and consumption reduction increasingly important. Since 1999, Frito-Lay has reduced water use by 39%, natural gas by 30%, and electricity by 22%. While these reductions are significant, Frito-Lay would like to continue to improve efficiency and environmental stewardship. Currently, the price Frito-Lay Topeka pays for natural gas is $7.73 per million BTU, but the new Frito-Lay corporate market rate is $12.50 per million BTU. It is in Frito-Lay's best interest to increase thermal efficiency to benefit from cost savings, and it is also the right course to take from an environmental standpoint.

Projects Reviewed for E2/P2 Potential

1. Insulation

Robbins identified that Frito-Lay needed to install insulation on pipes in the boiler room to keep them from losing heat. Since the boiler room is the source of steam throughout the plant, it is especially important for its components to be well insulated. Robbins discovered 94 locations and 350 feet of pipe without insulation. If all the piping is insulated, Frito-Lay will save 703,200 kWh and $39,000 per year.

Robbins discovered that about half the production lines were above the average BTU/lb, while half of the lines were under the average. This allowed Robbins to focus most her time on the production lines that were above the average BTU/lb. After evaluating all production lines, Robbins found 105 locations and 230 feet of pipe without insulation. If all the piping is insulated, Frito-Lay will save $23,000 and 410,200 kWh per year.

Robbins discovered 66 locations and 233 feet of non-insulated piping in other areas of the Frito-Lay plant. If all the piping is insulated, Frito-Lay will save $70,900 and 1,516,275 kWh a year.

Frito-Lay has started to insulate the steam pipes in its plant and will be done by the middle of 2009. All piping locations were not chosen to be fixed due to the large capital cost to install insulation on all exposed piping. Overall, Frito-Lay will spend $47,000 on capital costs and will save $14,000 a year.

5. Hand Dryers

Robbins researched installing two types of hand dryers: Dyson Airblade and Xlerator. After an employee survey, Robbins concluded that Frito-Lay should install the Dyson Airblade hand dryer in each bathroom to replace paper towels. If implemented, Frito-Lay will reduce its solid waste by 9.6 tons per year and save $6,653 per year.

Due to capital restrictions at the end of 2008, Frito-Lay has delayed installing the new hand dryers until 2010.

Table 21: Summary of 2008 E2/P2 intern recommendations for Frito-Lay; updated winter 2009

Project Description	Annual Estimated Impact	Annual Estimated Cost Savings	Status	Annual Actual Impact	Annual Actual Cost Savings
Insulation	2,629,975 kWh	$132,900	In progress	245,622 kWh	$14,000
Hand dryer-Dyson Airblade	9.6 tons waste	$6,300	On hold	—-	—-

Haldex Brake

Dawn Larson
Mechanical Engineering
Kansas State University

Iola, Kansas

Company Background

Haldex Brake in Iola, Kan., is part of the Haldex Corporation headquartered in Stockholm, Sweden. The plant is part of the commercial vehicle systems, which means it produces brake systems for trucks, trailers, and heavy-duty machinery. The Iola plant employs approximately 230 people. Haldex has been ISO 9000 certified since 1995 and ISO 14001 certified since 1998.

Project Background

Dawn Larson was Haldex Brake's third pollution prevention intern. The prior two interns analyzed plant lighting and water conservation. Larson combined both the previous interns' work as well as identified other areas in the plant that needed work.

Projects Reviewed for E2/P2 Potential

1. Hot Air Dryers

Larson noticed that the hot–air dryers in the impregnator line ran 9.5 hours a day when they were only needed for a short time three to six times a day. A timer was installed on the dryers so they only ran for 10 minutes, three to six times a day. Larson estimated this will save Haldex $5,009 and 64,220 kWh a year.

Haldex added the timer while Larson was there and is now saving 70,000 kWh and $5,000 per year. The hot-air dryers now run for only an hour per day.

2. Overflow Rinse Water

Larson noticed that the water into the overflow rinse tank ran all day on the impregnator line. Larson also noticed that the clean water flowed in at the top of the tank, where the overflow is located. This means the clean water did not mix adequately with the dirty water. Larson was able to move the intake water to the bottom of the tank and install a flow meter to restrict water flow. Originally the tank had a flow rate of 5 gpm, but after the flow meter was installed, it reduced the flow to 2 gpm. It was estimated that this will save Haldex 444,600 gallons and $2,502 a year.

Haldex is still using the flow meter and it is saving approximately 450,000 gallons and $2,500 per year.

3. Heater Insulation

Larson noticed that the soap tanks, which are heated to 140F, did not have any lids on them to hold in the heat. During the night, they were also left open so that the heat escaped. Larson realized if Haldex put lids on the tanks the heaters would not have to run as long during the day and would take less time to heat up in the morning. By reducing the time the heaters would have to run by adding the lids, Haldex will save around 12,992 kWh and $1,013 a year.

Haldex has added lids to the tanks and is saving approximately 12,000 to 18,000 kWh and $1,000 per year.

4. Lighting

Larson researched updating the lighting at Haldex in its common areas and grind shop. After conducting a light audit, Larson recommended Haldex change out all the T12 bulbs with T8 bulbs and install electronic ballasts. Once Haldex implements the lighting upgrade, it will save $20,709 and 265,503 kWh per year.

Haldex has upgraded six of the 11 locations recommended by Larson, with the last five locations to be upgraded in the middle of 2009. Haldex is currently saving 150,000 kWh and $12,500 a year due to the completed upgrades.

5. Alternate Energy

Larson looked into several forms of alternate energy, including wind and solar, but did not find a cost-effective solution for Haldex. Larson recommended that Haldex Brake re-look into alternate energy occasionally as technology is always changing.

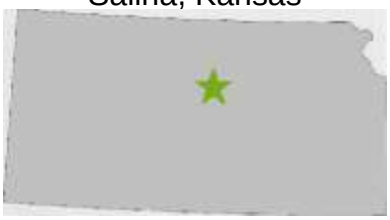
Table 22: Summary of 2008 E2/P2 intern recommendations for Haldex Brake; updated winter 2009

Project Description	Annual Estimated Impact	Annual Estimated Cost Savings	Status	Annual Actual Impact	Annual Actual Cost Savings
Hot Air Dryer	64,220 kWh	$5,009	Implemented	70,000 kWh	$5,000
Overflow Rinse Water	440,000 gallons	$2,502	Implemented	450,000 gallons	$2,500
Heater Insulation	13,000 kWh	$1,013	Implemented	12,000–18,000 kWh	$1,000
Lighting	265,503 kWh	$20,709	Implemented	150,000 kWh	$12,500
Alternative Energy	—-	—-	Not recommended	—-	—-

Schwan's Global Supply

Farai Kwaramba
Southwestern College
Chemistry

Salina, Kansas



Company Background

The Schwan's Global Supply manufactures and delivers frozen foods. Its products include frozen pizza, ice cream, appetizers, frozen vegetables, and fresh seafood. The plant in Salina, Kan., produces mainly Tony's Pizzas. With a total of 22,000 employees worldwide, it is the leading producer of pizza, egg rolls, and frozen desserts.

Project Background

The Schwan's Global Supply realizes the urgency for going green for the sake of the environment and also cost reductions on production. To achieve this demanding mandate, the Schwan's Global Supply has partnered with the Kansas State Pollution Prevention Institute to allow engineering and scientific interns to focus on ways to reduce the plant's water consumption.

Incentives to Change

The Schwan's Global Supply pizza plant in Salina, Kan., is the city's number one user of the county's landfill and city water. The water is mainly used in five major sectors of the manufacturing facility: plant wash stations, facility bathrooms, refrigeration, boiling and cooling, and sanitation. There has been an increase in cost of water usage within the past few years, and wtih huge indications of drastic rises in water costs every November until 2012. In addition, there is a threat of depleting water resources in Kansas.

Projects Reviewed for E2/P2 Potential

1. Plant Sink and Water Trough Audit

Kwaramba counted 67 sinks in the Salina plant. Each of these sinks has bleed-off water flow to keep the water at a constant 100 degrees F. For all sinks, the bleed-off wastes 48.51 gallon/minute. The sinks also operate at 6.96 gallons/minute. Kwaramba recommended that Schwan's re-circulate the bleed-off water back into the system for reuse. He also recommended that flow restrictors be added to all sinks to bring them down to 0.5 gallons/minute flow rate. If all this is implemented Schwan's will save $493,322 and 34,953,000 gallons of water a year.

Schwan's is in the process of upgrading its sink piping so it can re-circulate the bleed-off water back into the system for reuse. Once this is completed, it will save an estimated $214,533 and 15,199,700 gallons of water per year.

2. Sanitation Process Audit

Kwaramba noticed that Schwan's uses water guns and open hoses to clean the plant. Kwaramba recommended that all open hoses install high-pressure nozzles to reduce water flow. Kwaramba also recommended that Schwan's reduce the number of people using water hoses. He recommended that Schwan's use the Hydro squeegees to clean the floors instead of hoses. If all this is implemented, Schwan's will save $335,798 and 64,864,000 gallons of water a year.

Schwan's has decided to install water restrictors on all its power washes. With this one improvement, Schwan's is saving $2,798 and 540,000 gallons of water per year.

3. Bathroom Audit

Kwaramba counted 70 sinks in the bathrooms and measured their average flow rate to be 4.5 gallons/minute. Kwaramba recommended that Schwan's install flow restrictors on the sinks to reduce the flow to 0.5 gallons/minute. Kwaramba also recommended that low-flow toilets be installed. If all these projects are implemented, Schwan's will save 6,430,000 gallons of water and $63,492 per year.

Schwan's is in the process of installing flow restrictors on its sinks to limit the water flow to 0.5 gallons per minute. This will save Schwan's $63,491 and 6,430,000 gallons of water a year.

4. Refrigeration Audit

After conducting a refrigeration audit, Kwaramba recommended that Schwan's minimize bleed-off and leaks from its refrigeration system and also purchase new, indoor water sump tanks. If Schwan's implements all this, it will save 35,897,000 gallons of water and $395,417 a year. Schwan's has not implemented any of the refrigeration audit recommendations as of the winter of 2009.

5. Boiling and Cooling System Audit

Kwaramba completed an Ecolab audit of Schwan's boiling and cooling system during the summer. After the audit, Kwaramba recommended that Schwan's reduce its blow-down by 15%, repair leaks in the tower, and reuse the tower bleed-off. If Schwan's implements all this, it will save 43,243,000 gallons of water and $647,500 a year.

Schwan's decided to implement several of Kwaramba's recommendations. It has repaired the leaks in the condensing towers and is saving $416,354 and 27,806,000 gallons a year. It is also in the process of upgrading its equipment so it can reuse the tower bleed-off and save approximately $49,500 and 3,305,835 gallons a year. Schwan's is also in the process of replacing its current boilers with direct-heat ,hot-water systems. Once this is complete, it will save an average of $251,016 per year. The water savings for the new boilers is not known.

Table 23: Summary of 2008 E2/P2 intern recommendations for Schwan's; updated winter 2009

Project Description	Annual Estimated Impact	Annual Estimated Cost Savings	Status	Annual Actual Impact	Annual Actual Cost Savings
Plant Sink and Water Trough	34,953,000 gallons	$493,322	Implemented	—-	$214,533
Sanitation Process	64,864,000 gallons	$408,940	Partially implemented	—-	$2,798
Bathrooms	6,430,000 gallons	$63,491	Implemented	—-	$63,491
Refrigeration	35,897,000 gallons	$395,417	Not implemented	—-	—-
Boiling and Cooling Systems	43,243,000 gallons	$647,500	Implemented	—-	$716,870

Unilever Foodsolutions

Connor Whitney
Chemical Engineering
Kansas State University

Wichita, Kansas

Company Background
Unilever is a worldwide food solutions company employing 5,400 people in 65 countries. The Wichita, Kan., plant produces a wide variety of spices for various businesses.

Project Background
Unilever Foodsolutions plant in Wichita, Kan., uses very little water in the production of spices but uses a large amount when cleaning the equipment. The equipment cleaners currently run out of hot water, so they have to use more water to effectively clean the equipment. It is estimated they could cut the amount of water used by one-third if they had a proper hot-water supply. Whitney researched the feasibility of installing a new water heater to supply sufficient hot water for cleaning.

Incentives to Change
Unilever currently spends around $33,000 a year to heat water at its plant with several electric point-of-use water heaters. Unilever hopes to reduce its water heating bill and also reduce its CO_2 emissions by installing a more environmentally friendly water-heating system.

Projects Reviewed for E2/P2 Potential

1. Water Heating
   Whitney investigated two options for water heating: solar and point of use. A solar water heater is generally more expensive but requires little maintenance. Point-of-use water heaters are small and inexpensive but require a constant source of energy. Whitney recommended that Unilever install a combination of a gas point-of-use water heater and a solar water heater. If Unilever installs a combination water heater it will save $22,056 and 1,351,600 gallons of water a year. Unilever will also see a 7% decrease in its CO_2 emissions.

Unilever in Wichita no longer operates.

Table 24: Summary of 2008 E2/P2 intern recommendations for Unilever Foodsolutions; updated winter 2009

Project Description	Annual Estimated Impact	Annual Estimated Cost Savings	Status	Annual Actual Impact	Annual Actual Cost Savings
Water Heaters	1,351,600 gallons	$22,056	Facility closed	—	—

Wolf Creek Nuclear Operating Corporation

Craig Ronnebaum
Biological Systems Engineering
Kansas State University

Burlington, Kansas

Company Background
Wolf Creek Generating Station located near Burlington, Kan., is the only nuclear power plant in the state of Kansas. The ownership is split between Westar Energy, Kansas City Power and Light Company, and Kansas Electric Power Cooperative, Inc. The station is operated by Wolf Creek Nuclear Operating Corporation. Wolf Creek produces more than 1.2 million kW of electricity, enough for 800,000 homes. Wolf Creek employs approximately 940 full-time employees.

Project Background
Wolf Creek is trying to reduce its generated waste so it can become a smaller quantity generator in the state of Kansas. In 2008, the intern's focus was on reducing or eliminating solid waste.

Incentives to Change
Wolf Creek is working to reduce its waste. Wolf Creek is seeking to be classified as a small quantity generator of waste. It has been working with pollution prevention interns for the last two years to help reduce the waste generated at its facility. Reducing waste at Wolf Creek does have some cost savings involved, as well as reducing the company's environmental impact.

Projects Reviewed for E2/P2 Potential

1. Reduction of Styrofoam in Cafeteria
Ronnebaum researched several ways Wolf Creek can reduce Styrofoam use in its cafeteria because Styrofoam represents approximately 40% of Wolf Creek's solid waste. The first option, implemented while Ronnebaum was on site, was to have all cafeteria employees ask Wolf Creek employees if they are dining in or dining out. This allows Wolf Creek employees to use a plate if they are dining in instead of a Styrofoam to-go box. The second idea was to place signs in the cafeteria to remind the people in line to use a plate if they are dining in. The last suggestion was for Wolf Creek to use Eco-Clamshells. These are reusable to-go boxes where Wolf Creek employees return them to the cafeteria after they are done eating so the cafeteria can wash and reuse them. If all these actions are implemented, Wolf Creek will see a 40% reduction in its solid waste.

Wolf Creek has implemented the signs reminding people in line to use a plate and it also has the cafeteria employees ask employees if they are dining in or dining out. Wolf Creek has also started to charge employees when they use Styrofoam containers to try to discourage their use. Wolf Creek does not have any information on savings or waste reduction.

2. Hand Dryers
Ronnebaum recommended that Wolf Creek install XLERATOR hand dryers in all its restrooms. If Wolf Creek did this, it would see a savings of approximately 2.8 to 5.6 tons of paper towel waste and a 16% reduction in total solid waste. This would also save $11,025 to $21,784 per year. At this time, Wolf Creek has not implemented the new hand dryers.

3. Plastic Recycling
Ronnebaum recommended that Wolf Creek implement a plastic recycling program. This would only require Wolf Creek to purchase separate bins for plastics, as the recycling program is already in place. If all plastic bottles are recycled, Wolf Creek would see approximately a 6% reduction in solid waste.

Wolf Creek has implemented a plastic bottle recycling program, but the savings are unknown at this time.

4. Recycling Wood Pallets
Ronnebaum did not recommend that Wolf Creek recycle its wood pallets due to the small quantity generated.

5. Recycling Tires
Ronnebaum recommended that Wolf Creek continue to send its used tires to the landfill, because a tire recycling company goes to the landfill and collects all used tires.

Table 26: Summary of 2008 E2/P2 intern recommendations for Wolf Creek; updated winter 2009

Project Description	Annual Estimated Impact	Annual Estimated Cost Savings	Status	Annual Actual Impact	Annual Actual Cost Savings
Reduce Styrofoam	—-	—-	Partially implemented	Unknown	Unknown
Hand Dryers	2.8 to 5.6 tons	$11,025 to $21,784	Not implemented	—-	—-
Recycling Plastics	—-	---	Implemented	Unknown	Unknown
Recycling Wood Pallets	120 pallets	—-	Not recommended	—-	—-
Recycling Tires	—-	—-	Implemented	Unknown	Unknown

2008 Conclusion

Success of the 2008 E2/P2 Intern Program has resulted in decreased environmental footprints for Kansas industries, thousands of dollars in cost savings, and an increased awareness of environmental engineering career opportunities for our graduating engineers. The table below shows results for the 2008 interns after a follow-up study was conducted in the winter of 2009.

As seen below, 63% of the recommended projects have already been implemented at the participating companies.

Table 28: Summary of 2007 E2/P2 intern results; updated winter 2009

Category	Annual Reductions	Annual Cost Savings	Project Status
Energy	1,942,622 kWh	$135,500	4 of 6 Implemented; 1 in progress
Waste	unknown	unknown	3 of 5 Implemented
Water	450,000 plus gallons	$1,000,192	5 of 7 Implemented
Total		**$1,135,692**	**12 of 19 Implemented; 1 in progress**

What the 2008 interns said about their experience:

"I had a wonderful experience and got a glimpse of what it is like working in industry. This was a learning experience and a confidence builder."

"This internship was a wonderful way to be introduced to industry workings. There was support from PPI and the host company for everything I was working on."

"It helped me develop all my skills from problem solving to presenting my findings to others."

Hospitals for a Healthy Environment Summaries 2007-2008

H2E Summary

The Hospitals for a Healthy Environment (H2E) Intern Program uses the same process as the E2/P2 Intern Program, but places interns in hospitals across the region to work on specific toxics and energy conservation projects. Some positions place the intern in the facility all summer; while another intern project, called a Circuit Rider, works with several hospitals on short-term energy or toxics-reduction projects.

In 2007, we had our first H2E interns, one at Via Christi and a circuit rider. In 2008, Via Christi had another intern, and we again had a circuit rider. Projects have focused on issues like mercury identification and elimination, as well as energy conservation and solid-waste reduction.

Table 29: Summary of H2E intern recommendations; updated winter 2009

Category	Estimated Reductions	Estimated Cost Savings
Energy	28,252,249 kWh	$1,311,979
Waste	1,290 tons	$117,668
Water	0	$0
Mercury	7030 grams	none
Total		$1,429,647

Via Christi Regional Medical Center

Intern: Lindy Pope
Major: Electrical Engineering
School: Kansas State University

Wichita, Kansas

Company Background

Via Christi Health System is a non-profit Catholic health organization in Kansas. It has two acute-care campuses, a behavioral health campus, and a rehabilitation center for a total of 1,040 staffed beds. It also has 17 family medicine clinics, two regional medical centers, and 12 senior communities across Kansas. It employs more than 9,000 people. Its main campus, St. Francis, is a level-1 trauma center in Wichita, Kansas.

Incentives to Change

Via Christi recognizes cost and environmental benefits from energy conservation and is motivated to make these changes. Energy consumption at its facility is much higher than expected for a hospital of its size and function. By spending less on energy, it can provide better care for all its patients and help reduce carbon emissions and overall environmental impact.

Projects Reviewed for E2/P2 Potential

1. Delamping and Daylight Timers

After Pope conducted a full light audit, it was determined that delamping and daylight timers were the best options for St. Francis. Twenty-five locations were recommended to be delamped due to high light levels. This will save $1,895 and 37,906 kWh per year. Twenty-one locations near windows were recommended for daylight timers for a savings of $4,358 and 87,162 kWh per year.

Via Christi had another intern in 2008 that helped implement timers and delamping. This intern also helped find more locations to implement both ideas. Via Christi has finished delamping its hospitals. Via Christi also installed timers near windows and in locations not occupied in the evening. After implementing these, Via Christi is saving $31,409 and 436,258 kWh per year.

2. New Lamp Purchases

After a full review of current lamp purchases, 11 new lamp types were recommended for purchase due to longer life or lower power consumption. This will save $81,920 to $97,302 and 1,638,387 to 1,946,004 kWh per year in electricity. The new lamps will also have 69,030 to 82,710 fewer mg of mercury. Via Christi has not yet implemented any new lamp purchases.

3. Occupancy Sensors

Occupancy sensors were evaluated to be placed in several room types across Via Christi. Annual savings amounts to $15,497 to $28,591 per year in electricity. It will also save 310,119 to 571,747 kWh per year. Due to initial capital costs, the sensors have not been installed.

4. Dimming Controls

Dimming controls were evaluated to be placed in 750 patient rooms. They will save $6,716 to $11,191 and 134,291 to 223,818 kWh per year. Due to initial capital costs, the have not been installed

5. Air Audit

The compressed air, medical air, and steam system were all tested for leaks at St. Francis. Twenty leaks were found in the compressed-air system, which cost the hospital approximately $7,863 per year. If these leaks are repaired ,it would save 157,260 kWh per year. Eleven leaks were found in

the medical air system, which cost the hospital approximately $3,009 per year. If these leaks are repaired it would save 60,181 kWh per year. Four leaks were found in the steam system, which cost the hospital approximately $3,999 per year. If these leaks are repaired, it would save 113,000 kWh per year.

Via Christi bought an air-leak detector so it can continue to repair air leaks. It is in the process of covering the whole hospital but does not have any saving calculations.

6. Energy Star Products
Via Christi did not have an Energy Star purchasing program in place when the intern arrived. If Via Christi sets up a program that purchases Energy Star products when practical, it will save approximately $27,090 a year. This will also provide a reduction of approximately 500,000 kWh per year. All new purchases made are now Energy Star products. The savings are not known.

7. Monitor Power-Management Software
Pope recommended that Via Christi look into a monitor power-management system for all its hospital monitors. This software puts all the monitors on the network into sleep mode after a predetermined time. Each monitor at Via Christi will see a savings of $10 to $20 a year, for a total savings of $15,000 to $30,000. It will also provide a reduction of 300,000 to 600,000 kWh per year. Via Christi is still working with its IT department to try and implement the power-management software.

8. Energy Awareness Program
Pope reviewed ways in which an energy awareness program could be initiated at Via Christi. Ideas included ads being placed in the weekly newsletter discussing the latest energy conservation ideas, and fact sheets and posters being placed around the buildings promoting turning off lights and equipment that is left on for long periods while not in use. Once this program is fully implemented, Energy Star estimates it will save the hospitals $30,000 to $76,000 and 600,000 to 1,520,000 kWh a year.

Via Christi has implemented an employee awareness program through information covered in new-employee orientation. It has also established a green team and publishes energy-savings tips in a monthly newsletter. It estimates $30,000 and 600,000 kWh a year in savings.

Table 15: Summary of 2007 H2E intern recommendations for Via Christi Regional Medical Center; updated winter 2009

Project Description	Annual Estimated Impact	Annual Estimated Cost Savings	Status	Annual Actual Impact	Annual Actual Cost Savings
Delamping and Daylight Timers	125,068 kWh	$6,253	Implemented	436,258 kWh	$31,409
New Lamp Purchases	1,638,387—1,946,004 kWh	$81,920 to $97,302	Not implemented	—-	—-
Occupancy Sensors	310,119—571,747 kWh	$15,497 to $28,591	Not implemented	—-	—-
Dimming Controls	134,291—223,818 kWh	$6,716 to $11,191	Not implemented	—-	—-
Air Audit	217,538 kWh	$14,871	Implemented	Unknown	Unknown
Energy Star Products	500,000 kWh	$27,090	Implemented	Unknown	Unknown
Computer Power Mgmt.	300,000—600,000 kWh	$15,000 to $30,000	In progress	—-	—-
Energy Awareness Program	600,000–1,520,000 kWh	$30,000 to $76,000	Implemented	600,000 kWh	$30,000

Via Christi Regional Medical Center

Alicia Warren
Civil Engineering
Kansas State University

Wichita, Kansas

Company Background

Via Christi Health System is a non-profit Catholic health organization based in Wichita, Kansas. It provides more health services than any other healthcare organization in Kansas. It has two acute-care campuses, a behavioral health campus, and a rehabilitation center, for a total of 1040 staffed beds. It employs more than 9,000 people.

Via Christi Regional Medical Center's St. Francis campus has 1,450,000 square feet of space and 850 licensed beds. St. Francis is a level-1 trauma center and is known for its stroke and cardiac care. Via Christi Regional Medical Center's St. Joseph campus has 464,000 square feet of space and has 250 licensed beds. The two other main campuses include Our Lady of Lourdes, a rehabilitation hospital composed of 61,414 square feet; and Good Shepherd, a behavioral health campus, composed of 57,071 square feet.

Project Background

In summer 2007, Via Christi had an intern that identified several energy-saving opportunities. Via Christi invited another intern back in 2008 to find even more energy-saving opportunities and also to help implement some of the recommendations from the previous summer.

Incentives to Change

Via Christi recognizes cost and environmental benefits from energy conservation and is motivated to make these changes. Energy consumption at its facilities is much higher than expected for hospitals of its size and function. This means if all facilities could reduce their consumption to the industry average, a savings of $3,394,160 annually could be realized. By spending less on energy, Via Christi can provide better care for all its patients and help reduce carbon emissions and overall environmental impact.

Projects Reviewed for E2/P2 Potential

1. Timers

After reviewing the 2007 intern's recommendation, Warren also decided to recommend installation of timers in offices that are not occupied during the evening but still have their lights on. Also, with this, Warren recommended security devices so employees cannot access these areas during the evening. When this is implemented, Via Christi will save 443,233 kWh and $28,931 per year.

Timers have been implemented in all locations and will save Via Christi 389,983 kWh and 25,097 per year.

2. Re-Lighting

Warren noticed that the storage center had T12 lamps that needed to be replaced with T8 lamps. Warren also redesigned the lighting in the distribution room to use less lamps but provide more lighting. After doing both these upgrades, Via Christi will save 44,211 kWh and $3,183 per year. Both of these upgrades have been implemented and are saving Via Christi 44,211 kWh and $3,183 per year. Additional delamping activities were implemented at Saint

Francis, Saint Joseph and Our Lady of the Lord for a combined savings of 383,000 kWh and $27,575

.

3. U-Bent Remodel

Warren decided to redesign the lighting in the cafeteria to remove the U-bent lamps. U-bent lamps are more expensive and use more energy than normal T8 or T5 lamps. When this is implemented, Via Christi will save 9,682 kWh and $7,841 per year.

Via Christi implemented this upgrade and is saving 9,682 kWh and $7,841 per year.

4. Steam Traps

After reviewing the 2007 intern recommendations, Warren decided Via Christi should purchase a leak detector. Warren then used the leak detector to find seven failed steam traps. After discovering these, Via Christi brought in a company to repair them. If all steam traps are repaired, Via Christi will save $127,734 and 3,118,692 kWh per year.

Via Christi has repaired all the steam traps and continues to check for failed steam traps with the leak detector. It is currently saving $127,737 and 3,118,692 kWh per year.

5. Energy Center Upgrade

After conducting a full energy center audit, Warren recommended that Via Christi purchase new boilers for its St. Joseph energy center. If new boilers are purchased, Via Christi will save 14,427,906 kWh and $511,241 per year. Warren also recommended that Via Christi install VFDs for the chilled-water pumps. If these are installed, Via Christi will save approximately $30,000 and 732,500 kWh per year.

Financially, Via Christi cannot afford to replace its boilers at this time. It has brought in specialists to see if the boilers can be made more efficient, but no information is available at this time. The VFDs have been purchased but still need to be installed on the chilled-water pumps. This will save Via Christi $30,000 and 732,500 kWh per year.

Via Christi has also implemented an employee energy awareness program. The actual savings are unknown, and EPA estimates were used to calculate savings.

Table 25: Summary of 2008 H2E intern recommendations for Via Christi Regional Medical Center; updated winter 2009

Project Description	Annual Estimated Impact	Annual Estimated Cost Savings	Status	Annual Actual Impact	Annual Actual Cost Savings
Air Audit*	—	—	Implemented	—	—
Timers	443,232 kWh	$28,931	Implemented	389,983 kWh	$25,097
Employee Energy Awareness Program*	—	—	In progress	—	—
Re-Lighting	427,211 kWh	$30,758	Implemented	44,211 kWh	$3,183
U-Bent Remodel	9,682 kWh	$7,841	Implemented	9,682 kWh	$7,841
Steam Traps	3,119 kWh	$127,737	Implemented	3,118,692 kWh	$127,737
Energy Center Upgrade	14,427,906 kWh	$541,241	In progress	732,500 kWh	$30,000

Hospitals for a Healthy Environment (H2E) Circuit Rider

Roger Klein and Rhonda K. Johnson

Project Background

H2E aims to create sustainable healthcare facilities by reducing the quantity of waste, eliminating mercury, and reducing electricity and water consumption. The circuit rider internship is provided by the Pollution Prevention Intern Program and is funded through a grant from the EPA Region 7. A similar program offered through the Iowa Pollution Prevention Institute provides the same services to hospitals in Iowa and Nebraska.

Incentives to Change

Healthcare is the fourth largest source of mercury emissions to the environment. Making hospitals virtually mercury free will help reduce negative environmental impacts from mercury. Healthcare facilities also spend a considerable amount of money on utilities. The EPA reports that each dollar a healthcare facility saves from spending on energy is equivalent to twenty dollars in additional revenue. By reducing costs, healthcare facilities will be able to provide better services to patients and a cleaner environment, and reduce the carbon footprint of the hospital.

Company Background

In 2007, R. Kay Johnston visited seven hospitals across Kansas and Missouri including Ellsworth County Medical Center, Hays Medical Center, Mercy Medical Center, Hospital District #1 of Rice County, Kingman Community Hospital, Liberty Hospital, and Robert J. Dole VA Hospital. Johnston focused on reducing the mercury in these hospitals. She also conducted energy assessments of all the hospitals to help them gage where their energy consumption was in comparison to other hospitals.

In 2008, Roger Klein visited nine hospitals including Via Christi St. Francis, Via Christi St. Joe, Providence Medical Center, St. Lukes Health System, Mercy Health Center, Hays Medical Center, Salina Regional Health Center, and VA Eastern Kansas Health Care System. Most hospitals are not-for-profit institutions ranging in size from 69 beds to 1,500 beds, and provide a variety of services to their patients. Klein provided the following audits or assessments: mercury inventory, solid-waste audit, red bag (infectious) waste audit, and energy conservation opportunities including lighting, appliance upgrade, vending machine misers, and power management systems. After the types of services each hospital wanted were confirmed, a short site visit was set up and Klein performed these services.

Projects Reviewed for E2/P2 Potential

1. Mercury Inventory

Using a spreadsheet tool called Mercury Manager, Klein and Johnston were able to calculate the total mercury found in the hospitals. Resources that identified non-mercury-containing equipment vendors were also provided. Using the Mercury Manager tool, 7,030 grams of mercury in mercury-containing equipment was identified. As of the winter of 2009, 2,773 grams of mercury have been removed.

2. Red Bag (Infectious) Waste Audit

For the first step of the red bag audit, Klein reviewed the red bag policy. This was followed by a visual audit of red bag contents in soiled utility rooms, patient rooms, labs, etc. With disposal rates for red bag waste being so much higher than regular solid waste, it was important for hospitals to determine how much waste can be disposed of for a lesser price.

Items found in red bags that should not have been there were sterile packaging, rubber gloves (no blood), IV bags, cardboard, paper towels, plastic packaging without the biohazard symbol, sticky labels, diapers, gowns, gloves, antibiotics, syringes without needles, plastic wrapping, glass medicine vials, etc. Klein recommended a savings of $48,181 and 135 tons of red bag waste per year. As of the

winter of 2009, 81 tons of red bag waste have been reduced per year. The hospitals are also saving $28,806 per year in disposal fees.

3. Solid-Waste Audit

In order for Klein to perform a solid-waste audit, he had to visit soiled utility rooms, patient rooms, back docks, and general trash cans located in various locations.

Six of the nine hospitals requested a solid-waste audit. Four of the hospitals had a cardboard compactor, while several had recycling programs. Paper recycling was commonly used for confidential paper, but most hospitals did not recycle paper unless it was confidential. Klein recommended a savings of $69,487 and 1,155 tons of waste per year.

4. Vending Machine Misers

Five hospitals requested information about vending machine misers. Vending machines run constantly and use lots of energy through lighting and refrigerating of contents. A vending machine miser regulates how much energy is being used by the vending machine. A single vending machine miser can save between $175- 200 per year. The intern was able to estimate the amount of savings in energy and cost by determining the number of vending machines in the facility, cost of each miser, and payback period (usually less than one year) for each hospital. Klein recommended a savings of $11,586 and 144,500 kWh per year. As of winter of 2009, the hospitals are saving $1,750 and 17,000 kWh per year after implementing vending machine misers.

5. Computer Power Management

Four hospitals requested this service. Energy Star Power Management features place monitors and computers into a low-power "sleep mode" after a period of inactivity. Simply touching the mouse or keyboard "wakes" the computer and monitor in seconds. Activating sleep features saves between $25 and $75 annually, per computer.

Information was gathered regarding the number of computers at each hospital, as well as estimates of how often each computer was used. Then, using the Energy Star Computer Power Management Savings Calculator, cost savings, as well as kWh savings for the hospitals, were determined. Klein recommended a savings of $145,206 and 1,973,728 kWh per year. As of the winter of 2009, one hospital had implemented the computer power management system and is saving $8,603 and 118,324 kWh.

Table 27: Summary of 2007 and 2008 H2E Circuit Rider recommendations; updated winter 2009

Project Description	Annual Estimated Impact	Annual Estimated Cost Savings	Status	Annual Actual Impact	Annual Actual Cost Savings
Mercury Inventory	7,030 grams	None	Partially implemented	2,773 grams	None
Red Bag (Infectious) Waste Audit	135 tons	$48,181	Partially implemented	81 tons	$28,806.48
Solid Waste Audit	1,155 tons	$69,487	Partially implemented	Unknown	Unknown
Vending Machines	144,500 kWh	$11,586	Partially implemented	17,000 kWh	$1,750
Power Management	1,973,728 kWh	$145,206	Partially implemented	118,324 kWh	$8,603

H2E Conclusion

Hospitals in the region and across the nation have realized their potential for environmental and cost-savings industry wide. This H2E intern program is a regional effort implemented in partnership with the Iowa P2 Services program, serving the four states in EPA Region 7.

The data presented in these case studies represent the successes of mainly Kansas hospitals, but a few Missouri facilities as well. The program has helped several hospitals reduce their impact on the environment and operate more efficiently. Our intern's recommendations have been implemented 70% of the time.

Table 29: Summary of H2E intern results
Updated winter 2009

Category	Annual Reductions	Annual Cost Savings	Project Status
Energy	2,734,077 kWh	$293,195	**11 out of 17 implemented, 2 in progress**
Waste	81 tons	$28,806	**2 out of 2 implemented**
Water	---	---	---
Mercury	2,773 grams	---	**1 out of 1 implemented**
Total		$322,001	**14 out of 20 implemented, 2 in progress**

We encourage you to participate in the Kansas State University Pollution Prevention Institute Energy Efficiency/Pollution Prevention Intern Program. This exciting program provides a win-win-win situation for Kansas – the interns gain valuable practical industrial experience, Kansas businesses improve their bottom line by implementing energy efficiency and pollution prevention projects, and the Kansas environment receives fewer hazardous pollutants to its air, water and soil. We thank EPA Region 7 and the Kansas Department of Health and Environmental for their support of the Kansas business community. We welcome your questions and comments and look forward to receiving an application from you.

Application Process
Application forms for students and businesses are available online at http://www.sbeap.org/internships.php. Forms may be submitted electronically, faxed, or mailed.

For Companies
Companies that would like to be considered for participation in future Energy Efficiency/Pollution Prevention intern programs should submit a project proposal by January 31 of each year to participate.

Companies who are committed to implementing cost-effective pollution prevention methodologies and reducing their environmental impact should submit a proposal that identifies a focus project and outlines the desired objectives and deliverables. Business selection criteria is based on the project's relationship to the pollution prevention hierarchy – focusing on source reduction first, then reuse and
recycling, risk reduction potential and environmental impacts.

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

For Students
Graduate and upper-level (juniors and seniors) undergraduate students who wish to be considered for 2010 internship positions should submit an application, along with a resume, cover letter, an informal copy of transcripts and a list of current coursework by January 31, 2010.

The Kansas State Pollution Prevention Institute is offering 11-week internships for during the summer. Applications are requested from students enrolled in environmental science, physical science, agricultural economics, and all engineering disciplines. Selected applicants will be matched to a project based on coursework performance, experience, and technical skills.

Submit proposals and applications to
Kansas State University
Pollution Prevention Institute
Energy Efficiency/Pollution Prevention Program Coordinator
133 Ward Hall
Manhattan, KS 66506-2508
Phone: 785-532-3501
Fax: 785-532-6952
sbeap@ksu.edu

Monarch Internship & New Employees

SUMMER INTERNSHIP

Christopher Frampton will be a senior at Kansas State University. He plans to graduate in the spring of 2008 with a bachelor's degree in Chemical Engineering and a secondary degree in Natural Resources and Environmental Sciences. His eventual hopes are to either attend graduate school for environmental engineering or enter industry and work on its environmental aspects. In the mean time, he enjoys spending any free time outdoors, specifically camping, canoeing, and backpacking. He has taken the past two

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