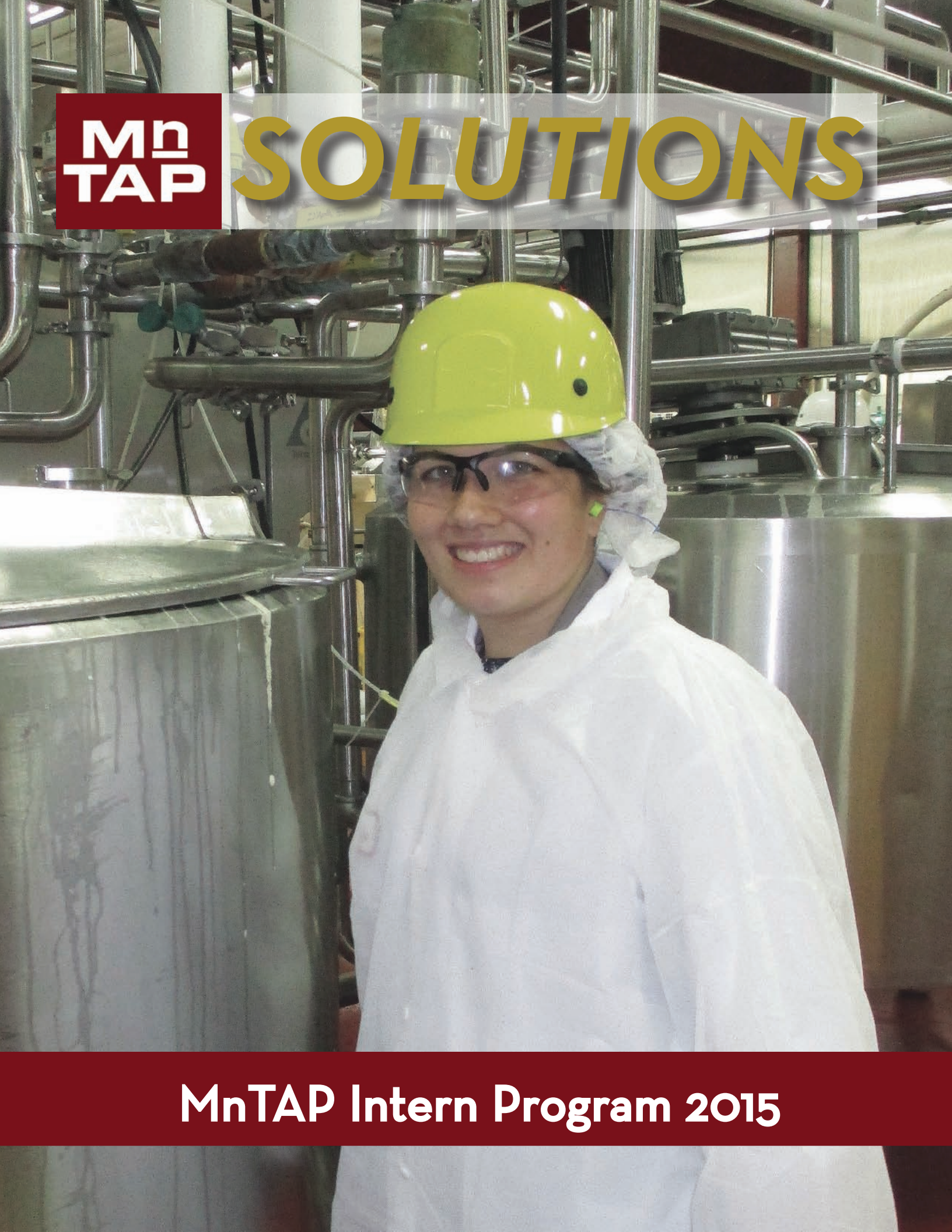




SOLUTIONS



MnTAP Intern Program 2015

MnTAP thanks our generous partners who make this vital work possible. Each of these organizations contributed financially to support at least one intern project for 2015. Their support helps MnTAP increase the number of intern positions available each year and helps maintain our continuing pollution prevention, energy efficiency and water conservation work.

“Minnesota benefits from the MnTAP Intern Program on many levels. In 2015, interns identified opportunities for businesses to improve their operations, leading to increases in production throughput and improved sales/revenue prospects, while students gained experience they can apply in the workforce.”

~ Mark Snyder, Environmental Specialist, Minnesota Pollution Control Agency



“We continue to be impressed with the excellent work performed by MnTAP summer interns in finding water and energy conservation opportunities at metro area businesses and communities.”

~ Brian Davis, Metropolitan Council, Water Supply Planning



“The MnTAP Intern Program has provided a strong platform to explore strategies for business and utility partners to improve energy efficiency at industrial facilities throughout Minnesota to help meet the state’s 1.5% annual energy savings goal. Conducting this work with student interns is helping to instill the value of efficient operations in the next generation of engineers.”

*~ Mary Sue Lobenstein, CIP R&D Program Administrator,
Minnesota Department of Commerce, Division of Energy Resources*

“Xcel Energy values the MnTAP Intern Program and the projects that are identified each year. The program helps us to provide extra resources to our customers who value the high quality projects they get in return.”

~Molly Hiipakka, Xcel Energy Customer Solutions





“The MnTAP intern project allowed us to evaluate different opportunities in preventing waste, saving water, and conserving energy. Working with MnTAP has provided ECO Finishing with the tools to save a minimum of 10% on water costs.”

~ Paul Madden, Technical Director, ECO Finishing





MnTAP staff and the projects they advised:

Laura Babcock, MnTAP Director

Anna Arkin,
Solid Waste Specialist
Park Nicollet Health Services
SW Regional Solid Waste Commission

Karl DeWahl
Sr. Engineer/Team Leader
Sanimax

Matt Domski,
Organic Waste Specialist
Davisco Foods
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Jane Paulson
Senior Engineer
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A.J. Van den Berghe
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Caterpillar Paving Products

Jon Vanyo
Associate Engineer
Lou-Rich

**Mick Jost, Program Coordinator &
Miriam Yee, Associate Engineer**
City of Woodbury
Xcel Energy, Riverside Plant

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Energy 	Waste 
Lean 	Water 

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"Our intern was a great candidate for a future employee. He dove head on into his process improvements with an awesome hands on approach!"

~ Lee Gulbrandson, Manufacturing Engineering Manager, Lou-Rich

Director's Note

It Takes a Village



Laura Babcock
MnTAP Director

This year, MnTAP is celebrating 30 years of assisting Minnesota businesses with water, energy, and waste reduction. To commemorate the occasion, we were privileged to have some VIPs speak at our annual Intern Program Symposium in August. Minnesota Pollution Control Agency (MPCA) Commissioner John Linc Stine urged the interns and the audience to consider a broad array of career options – because you never know how the path you are on will intersect with a future opportunity. We also heard perspectives on the intern program from John Finnegan, Dean of the School of Public Health, Jay Esmay, President of Eco Finishing, and Steve Giddings from the MPCA.

The highlights of the event were the presentations by the thirteen 2015 MnTAP interns on the successful projects they lead. These young professionals are the most recent additions to the legacy of the MnTAP Intern Program and proudly take their place beside 220 former interns.

Long standing programs like this take a village to sustain and grow. I would like to acknowledge the cornerstones of that village here. Without these pillars of support, we would not be able to offer this program that has made such an enormous impact across the state.

- MnTAP staff are dedicated to serving the businesses in Minnesota and provide students and companies the guidance and support needed to ensure success.
- Host companies open their doors to our eager interns, committing internal effort and resources and making deliberate choices to improve their processes and the environment.
- Sponsors and partners provide the financial backing to support this important, ongoing effort and allow us to create new projects every year.
- Student interns step out of their comfort zone and put their best effort forward every day. By applying the concepts learned in classes and through their hard work and resourcefulness, they have developed the *solutions* you will read about in this publication.

“MnTAP provides a triple win opportunity for Minnesota. Their work helps maintain a healthy environment for all residents, improve business performance for companies, and provides work-force experience for students through the Intern Program.”

~John Linc Stine, Commissioner
Minnesota Pollution Control Agency

At MnTAP, our primary focus is on source reduction. The waste, water or energy use improvements we recommend eliminate excesses from the process for as long as the changes are in place. These ongoing savings can open capacity for business growth, new product development and reinvestment. Imagine the potential of implementing some of these solutions in your business.

2015 Intern-Proposed Solutions

Recommendation	Reduction	Cost Savings	Equivalents (annual)
Water conservation	45,196,500 gallons	\$174,403	Water for 1,905 Minneapolis residents
Waste	1,727,665 lb	\$188,384	Weight of approx. 17 Metro Transit light rail cars
Energy	868,875 kWh	\$78,613	Electricity for 91 Minnesota homes
Energy	152,044 therms	\$110,800	CO ₂ emissions from 170 passenger vehicles
Production Gains	---	\$475,930	---
Total Potential Cost Savings	---	\$1,028,130	---

MnTAP Intern Program

A History of Success

For 30 years, MnTAP has been coordinating an intern program that places highly qualified students in facilities for up to three months. MnTAP began offering the program as a way to facilitate implementation of pollution prevention solutions. The goal of the program is to provide benefits to companies and students while building MnTAP's knowledge base and extending our services to businesses around the state.

Interns Have Far-Reaching Impact

The impact of the intern projects has reached far beyond the walls of the host facilities; many of the solutions identified during the projects have been applied to other companies, which magnifies the impact of the program. From Thief River Falls and International Falls in the north to Albert Lea, Preston, and Jackson in the south, MnTAP intern projects have stretched across Minnesota. In fact, MnTAP interns have worked in facilities in 92 distinct communities; over 60% of those communities are in greater Minnesota, while the other 40% are in the Twin Cities metro area.

Companies Reap Rewards

More than 192 companies have participated in the MnTAP program in the past 30 years. Interns have worked with companies as small as 12 employees and as large as 1,000+ employees in industries such as hospitality, healthcare, manufacturing, and food processing. Since 1985, intern recommended solutions have saved Minnesota companies 170 million gallons of water, 29 million kWh, 3 million therms, 100 million pounds of waste, and 10 million dollars annually!

Participating companies have proven to be committed to making changes. Through follow-up over the course of two years, MnTAP encourages and supports intern companies to implement recommendations.

Students See Success

The MnTAP intern program is very popular with students as well. In 2015, 156 students applied to the program to fill the 13 summer internship positions. In total, 220 intern positions have been filled over the past 30 years.

Interns have represented 25 different majors and more than 23 colleges and universities. Chemical engineering and mechanical engineering are the most common majors, and the majority of the interns have been students at the University of Minnesota Twin Cities and the University of Minnesota-Duluth.

The bottom line is, no matter where a company is located or where their intern has studied, MnTAP intern projects result in impactful solutions that save businesses money and reduce waste, water, and energy use.



Summer 2015 interns

Company Testimonials

“Our MnTAP intern was self-motivated, intelligent and provided insight on items that had become status quo, but needed attention. The changes implemented as a result of our partnership with MnTAP will have a positive impact on both operating costs and the environment for years to come.”

~Ben Bertram, PMP, Senior Project Leader, Sanimax

“The benefits of the intern program are two-fold: First, the interns help us save water, energy, etc. Second, we help instruct them on real world conditions, preparing them for industry. It is a win-win situation for both parties.”

*~ Chuck Morrisette, Manager,
Plant Engineering, Lloyd's BBQ*

“We greatly appreciate the hard work Stephen put in assisting during his internship. His contributions will impact the plant operation for years to come in very positive ways.”

~Jeff Shodean, Maintenance Manager, Davisco

“Our intern was extremely motivated and took it upon himself not only to understand the projects he was working on, but also had the initiative to learn the complex operation of a power plant. He uncovered opportunities to improve operations and environmental performance through reduced water usage throughout the plant.”

~Cheryl Erler, Riverside Environmental Analyst, Xcel Energy

“MnTAP's high performing, energetic young professional worked collaboratively with staff and top commercial irrigation water users to improve lawn watering efficiencies and reduce daily draw on the aquifer.”

~ Jim Westerman, Environmental Resource Coordinator – Property/Water Resources, City of Woodbury

“We provided a platform for an intern to apply learned skills to practical applications. He executed the work flawlessly and challenged our assumptions, creating greater value for the client.”

~John Stier, Senior Consultant, Antea Group

*MnTAP thanks the companies that hosted an intern project in 2015.
We recognize student success is directly related to company support!*



Ross Wise
Chemical Engineering
University of Minnesota Twin Cities

Company Background

Antea Group is an international engineering and environmental consulting firm, specializing in full-service solutions in the fields of environment, infrastructure, urban planning and water. Antea Group was contracted by the Brewers Association in 2013 to create sustainability manuals that highlight the best practices for conserving resources during the process of brewing beer. The Brewers Association is a non-profit organization of brewers, for brewers and by brewers, and is made up of more than 2,700 U.S. brewery members and 45,000 members of the American Homebrewers Association. They work to inform breweries of current changes in legislation, provide marketing and networking channels for brewers and breweries, and post articles and guides on the best practices of every aspect of brewing.



“As a MnTAP intern, I have been able to use the skills I developed in the classroom and grow them in the field. Instead of looking at one small part of a process, I have gotten to see and work on a process from start to finish.” ~RW

Project Background

In creating the sustainability manuals for the Brewers Association, Antea Group launched a pilot benchmarking project. The purpose of the project was to collect data from 25 breweries and determine how much water, electricity, natural gas, and carbon dioxide (CO₂) is being used per barrel of beer, and determine how organic solids are handled. The current goal is to expand the nationwide study to 250 breweries of all types and sizes. Antea Group also conducts sustainability roadmapping, which involves an on-site assessment resulting in a three year plan the brewers could follow to slowly upgrade their processes. The savings from lower-cost changes could help support bigger capital improvements further down the road. The goal of this internship was to engage Minnesota craft brewers in the benchmarking project and perform site visits that would identify which projects would have the greatest return.

Incentives To Change

Craft brewing is a booming industry across the country. Ten years ago there were only five breweries in operation in the State of Minnesota, and now there



are over 80 in operation or opening this year. These breweries are expanding production every year. The pilot benchmarking study showed that efficiency increases with production and that a large margin in efficiency exists between brewers of similar size. Adding up the cost of water, electricity, natural gas and CO₂ per barrel can be as high as \$49 or as low as \$16 for brewers producing less than 500 barrels per year. This cost difference is the competitive edge that a new brewery may need to upgrade equipment, or increase capacity to expand their business.



Solutions

Results from Benchmarking

The Brewers Association has divided craft breweries into four size categories, and in consultation with Antea Group, determined a national benchmark for the top 25%, median and bottom 25% in each of the four categories: electric, natural gas, water and CO₂ use. Monthly benchmarking is one way to spot sudden changes in usage that can indicate room for improvement. This project included nine breweries representing three of the four size categories. CO₂ was not included in this comparison, since its use only varies with the type of bottling or canning the brewery does. While water use showed the greatest opportunities for improvement, with only two brewers performing better than the national median, electrical improvements showed the greatest return on investment for achieving a benchmark in the most efficient 25% of the nation.

Better Temperature Control

The process of brewing beer involves high temperatures to create the wort, constant temperatures during the fermentation process and low temperatures to store

the final product. The HVAC demand can be reduced year round by high volume low speed fans that reduce the temperature gradient caused by high ceilings, or by installing curtain walls or strip curtains that divide up production space to create more intentional temperature zones.

Better Maintenance

Proper maintenance is a low cost way to realize savings. Some utilities offer rebates for boiler maintenance and free consultations. Checking steam traps and air intake on the chiller and air conditioning units are two common maintenance items. A checklist to make sure the compressors and condensers are running in their optimal conditions is a good way to ensure success.

Smart Controllers

Smart thermostats or controllers for coolers reduce the power use in walk-in coolers and can extend the life expectancy of the compressor. Savings from an evaporator fan controller can be \$270 per year with a payback less than two years. Installing evaporator fan motors can save \$310 per year. One small brewery found that using the comfort fan recommendation and either the fan controller or the new fan motors would lead to a 7% energy reduction.



Recommendation	Annual Reduction (kWh)	Annual Savings	Status
Install Evaporator Fan Controller	3,060	\$270	Recommended
Manual Control of Comfort Cooling Fan	1,900	\$170	Recommended
New Evaporator Fan Motors	3,500	\$310	Recommended

Caterpillar Paving Products



William Bowman

Environmental Science, Policy & Management,
Corporate Environmental Management
University of Minnesota Twin Cities

“Working with Caterpillar to improve their energy efficiency provided the perfect opportunity to expand my technical knowledge and analytical skills. This experience taught me how to work and communicate effectively with the variety of stakeholders involved in a large-scale manufacturing operation. The connections I’ve made will be invaluable as I transition to a career in environmental management.” ~WB

Project Background

The majority of compressed air is generated by three fixed-speed, 75 hp oil-injected, rotary screw compressors. These compressors are staged across a large pressure band, cycling between a loaded and unloaded state to meet fluctuations on demand. Air is dried and filtered, then fed to a 1,550 gallon receiver prior to being distributed throughout the plant. Use of compressed air begins in the first steps of the fabrication process for each product. The CNC machines that cut and process parts use compressed air for tool changes. Residual slag and oxide build-up is removed manually using hand-held pneumatic tools. Parts are fastened to fixtures to be welded into frames using pneumatic impact wrenches. Prior to assembly, frames are painted. Several pneumatic pumps and mixers are used in the plant’s paint kitchens. Pressure is released through spray guns to deliver paint, while specially treated compressed air supplies clean breathing air to the painters. Numerous pneumatic torque tools are used throughout the assembly processes that follow. In some cases, frames are moved through each step of assembly on an air pallet that releases compressed air

Company Background

Caterpillar Paving Products Inc. (Cat® Paving), a subsidiary of Caterpillar Inc., specializes in the production of road paving machinery. Its main facility in Brooklyn Park is the global headquarters for marketing and engineering efforts that design, build and support the machinery produced by this segment of the company. Machines fabricated and assembled at the facility include 70 different models of asphalt pavers, screeds, compactors and road reclaimers and Cat® Paving is adding an additional line of large asphalt compactors.



to create a near-frictionless surface between the floor and the fixtures.

Incentives To Change

Intensified efforts by Cat® Paving to curb the energy consumption of its expanding manufacturing operations are necessary in order to keep pace with the aggressive sustainability goals established by its parent company. By 2020, the company aims to reduce the energy intensity and GHG emission intensity of its operations by 50% of an established 2006 baseline year. Cat® Paving is currently participating in the Process Efficiency Program offered by Xcel Energy and CenterPoint Energy, which helps companies identify and quantify conservation opportunities and provides rebate incentives on capital investments to improve energy efficiency.

Compressed air is used heavily throughout each production line at the facility and currently accounts for 11% of annual electricity use. Implementation of energy saving opportunities throughout the generation, distribution and use of compressed air will result in significant cost saving and bring the company closer to achieving its energy and GHG emission intensity targets.



Solutions

Integrate a Variable-Speed Drive Compressor into the Primary System and Upgrade Controls

Energy is wasted by the primary compressed air system due to unnecessary start-ups of trim and back-up compressors and excessive time spent unloading. Together, these compressors operate with an average specific power of 36.3 kW/100 CFM and consume approximately 648,300 kWh per year. Replacing one of these fixed-speed compressors with a VSD and upgrading controls to sequence the system is estimated to reduce annual energy use to 444,100 kWh per year. This 204,100 kWh reduction will save the company approximately \$19,100 per year and reduce annual indirect GHG emissions by 96.5 MT CO₂-eq. This project has been pre-approved for a large rebate to partially offset the implementation cost.

Repair All Identified Compressed Air Leaks and Isolate CNC Machines and Robots During Non-Production Hours

As much as 30% of the compressed air generated is currently lost to leaks. Most of this waste can be attributed to the 111 compressed air leaks that were identified and tagged for repair, while some leak flow results from internal losses within CNC machines, robots, and other equipment. By repairing all identified leaks and isolating machines that aren't in use, a minimum annual energy savings of 94,200 kWh is predicted. This equates to an annual cost savings of \$8,800 and a 44.5 MT CO₂-eq emission reduction.

Engineer Alternatives to Air Pallets or Regulate Inlet Pressure to Minimize Artificial Demand During Use

The use of air pallet jacks (particularly on the RM and paver line) consume excessive amounts of compressed air. The back-up compressor is often needed to maintain plant pressure during their use. While it would be ideal to engineer alternatives to air pallets, much of their air use can be eliminated by down-regulating inlet pressure. Further analysis is needed to quantify energy savings accurately.



Recommendation	Annual Reduction (kWh)	Annual Savings	Status
Add VSD and Control Upgrades	204,100	\$19,100	Implementation in progress
Repair Identified Air Leaks and Isolate Equipment During Non-Production Hours	>94,200	\$8,800	Partially implemented
Engineer Alternatives to RM and Paver Air Pallets or Down-Regulate Pressure to Minimize Artificial Demand	Unknown	Unknown	Needs further analysis



Ben Heinle
Earth Sciences
University of Minnesota Twin Cities

"Through my internship, I became very educated in a field that I knew very little about going in. The experience made me more comfortable in communicating with all layers of management and coordinating meetings with people whom I had never met. Also, working at the city gave me insight on government workings which has allowed me to become more appreciative of public works projects."
~BH

Project Background

Water use in the city continues to rise due to increasing population. Data shows per capita water use has a small upward trend over the last 22 years, but the total water pumped has continued to increase steadily due to the rising population. The spring and summer water demand is approximately double because of irrigation and this excess demand strains the city's water supply.

This project focused on conserving water that is used for irrigation at commercial properties. The work involved analyzing city records of commercial-irrigation use, determining the benefits of different irrigation technologies, and facilitating the installation of these technologies on commercial properties. Outreach was conducted with some of the largest commercial water users to facilitate irrigation conservation and make them aware of the benefits of the irrigation technologies.

Organization Background

The City of Woodbury is a southeastern suburb of the Twin Cities that was established in 1967. The City of Woodbury is the most populated city in Washington County and is home to 66,807 residents as of 2014. City hall is home to the city's engineering department. The department is responsible for the maintenance and planning of present and future infrastructure.



Incentives To Change

Woodbury obtains water by pumping an underground layer of water-bearing rock known as an "aquifer." Woodbury and other cities draw their water from the St. Peter-Prairie du Chien-Jordan aquifer which consists of a dolomite unit sandwiched by two sandstone units. Barr Engineering in Minneapolis completed a ground water model of the aquifer from which Woodbury and other cities, pump their water. Results of the latest model suggest that current practices may jeopardize the long term sustainability of the aquifer within the Woodbury area.

Woodbury's main objective is to pump the same amount of water in 2030 as was pumped in 2014. Woodbury pumped approximately 2.5 billion gallons in 2014 and is projected to pump approximately 3.5 billion gallons in 2030. Therefore, the city is aiming to conserve approximately 1 billion gallons annually by 2030 as compared to 2014 pumping data while adding approximately 20,000 new residents.





The city of Woodbury manages the water utilities for the majority of properties. The city's finance department categorizes the properties into three accounts: commercial, home owner association, and residential. If a commercial account has a dedicated irrigation meter, their account is categorized further into irrigation use and domestic use. Commercial account categories include: commercial properties, multi-residential housing properties, and schools. In 2014, 258 commercial irrigation accounts existed. Of the 258 accounts, the top 25 irrigating commercial properties were chosen as targets for this project. These 25 companies represent 10% of the commercial irrigation accounts but represent approximately 30% of the total irrigation use.

Solutions

Replace Clock-based Irrigation Controllers with Evapotranspiration (ET) Controllers

Clock-base controllers are the standard on most properties with an irrigation system. These controllers

are set to water on certain days a week for an arbitrary amount of time. ET controllers utilize local weather data and landscape characteristics to determine if the property needs to be watered. The savings will vary based on weather, but a test site has seen a 49% reduction in water use since July 15th by switching from a clock-based to ET controller while maintaining and improving upon turf health and aesthetics.

Install Pressure Regulators at the Sprinkler Heads or the Master Valve

Irrigation systems are designed to operate at a specific pressure. Over-pressuring can lead to water loss and contribute to poor distribution uniformity of the water.

Pressure-regulated valves and heads are designed to prevent over-pressurized systems and the associated problems. A test site



with a pressure regulator is using 34% less water while maintaining and improving upon turf health and aesthetics.

Of the 25 candidate commercial sites that were contacted, six sites allowed assessments of their irrigation systems. All six sites can benefit from implementing ET controllers and pressure regulating heads/valves. If both upgrades are done, the savings generated from the two pieces of irrigation equipment are compounded and shown combined as such in the annual savings columns below. The cost of the ET controller varies with the number of zones in the irrigation system while the cost of the pressure regulator assumes that the property has a master valve for their irrigation system.

Property	Upgrade*	Annual Reduction (gallons)	Annual Savings	Status
1	ET	360,000	\$1,020	Recommended
	PR	250,000		
2	ET	679,000	\$1,930	Recommended
	PR	471,000		
3	ET	529,000	\$1,500	Recommended
	PR	367,000		
4	ET	1,076,000	\$3,060	Recommended
	PR	747,000		
5	ET	1,056,000	\$3,000	Recommended
	PR	733,000		
6	ET	427,000	\$1,210	Recommended
	PR	296,000		

*ET upgrade = evapotranspiration controller; PR upgrade = pressure regulation of heads and/or valves. **Water savings if one or the other is done; if done together, the compounded water savings would be 66%, which is reflected in the Combined Annual Savings Column.



Stephen Raab
Chemical Engineering
University of Notre Dame

Company Background

Davisco Foods International, Inc. is a dairy processing company headquartered in Le Sueur, Minnesota. Davisco began operations in 1943, when company founder Stanley Davis purchased the St. Peter Creamery in order to make butter. Today, the company produces a wide variety of dairy products, ranging from cheese to whey protein and other food ingredients. In 1969, Davisco began to manufacture cheese for what is today Kraft Heinz Company. Since then, Davisco has expanded, and now maintains facilities in Le Sueur, Minnesota; Jerome, Idaho; and Lake Norden, South Dakota.



“Working with Davisco and MnTAP was a unique experience that allowed me to develop a project from inception to completion. I learned about the workings of a food production plant and then applied that knowledge to assist the company in achieving its financial and environmental goals.” ~ SR

Project Background

At the Davisco-Le Sueur plant, milk is received, pasteurized, and drained of cream to factory specifications. This milk is then sent to production vats and a starter culture is added, causing it to curdle. The resulting cheese curds are then drained of whey, removed from the vats, and packaged into boxes and barrels before being shipped to customers. The whey left over from the cheese making is filtered to remove the valuable products it contains. The remaining water is then purified for reuse in the factory, while the filtered product is sent to be dried. The wet product contacts a stream of hot air that instantly vaporizes any water present. The air, which contains some product, is then vented from the factory. As it leaves the plant, the air is sprayed with water droplets that scrub the remaining product from the air.

at the facility; the company would therefore see lower charges assessed for wastewater treatment. Not only will this give Davisco an economic advantage, it would also align with the company’s commitment to environmental stewardship.

Incentives To Change

In collaboration with the Department of Energy, Davisco has developed an Energy Savings Initiative aimed at reducing energy, water use, and greenhouse-gas emissions by 25% over a five-year period.

In Davisco’s current cheese packaging system, a substantial amount of cheese is lost during packaging. This cheese could be recovered and sold as product and at the same time not contribute to the biochemical oxygen demand





to spill out of the top of the barrel. A higher fill extension would knock this cheese back into the barrel, retaining salable product and preventing BOD.

Recalibrate Automation of Feeder Arm

When a barrel is filled, a mechanical feeder arm brings the next barrel into position. The auger dispensing cheese curds frequently keeps rotating during this transition, spilling cheese trapped in the auger bit. If the feeder arm were reprogrammed to advance only after the auger had begun rotating, this cheese would instead be captured, allowing it to be sold for full price instead of contributing to BOD.

Each day, approximately 184.64 pounds of cheese lands on the floor. If all floor cheese were captured, Davisco could gain over \$34,000 annually in sales as well as additional savings due to reduced BOD loading. Looking only at the recommendations from this internship, Davisco has the potential to gain over \$7,000 in income and realize additional savings from reduced BOD loading.

Adapt Scrubber System to Feed from COW Water

The scrubber system currently uses water purchased from the city. Adapting it to use surplus condensate of whey (COW) water from the water polisher would reduce the amount of water needed to be purchased each day, and it would also lower the volume of water being sent to the pretreatment plant. It is estimated that implementing this change could save the company about \$23,130 per year.

Solutions

Install Metal Catch Pans Beneath Production Towers

At present, much of the floor cheese associated with the block formers is generated upon leaving the tower, when cheese that is not incorporated into the blocks falls to the floor of the facility. Metal pans beneath the towers will catch falling cheese, allowing it to be dumped into tote bins on the floor. The resulting “undergrade” cheese can then be sold for a reduced price. The captured cheese will not contribute to biochemical oxygen demand (BOD), reducing cleaning costs and potential fees.

Place Additional Undergrade Totes Along the Conveyor Belt

Loosely-packaged blocks of cheese spill additional cheese as they are transported from the towers to the sealing apparatus. Placing plastic undergrade totes along this route could capture much of this cheese, allowing it to be sold and neutralizing its BOD contribution.

Adopt Improved Fill Extensions on Fiber Barrels

Barrels of cheese are filled from above by a hopper. As the barrel approaches the end of a filling cycle, cheese tends



Recommendation	Annual Reduction	Annual Savings	Status
Install Metal Catch Pans Beneath Production Towers	7,100 lb	\$3,650	Recommended
Place Undergrade Totes Along Conveyor Belt	270 lb	\$180	Approved
Recalibrate Automation of Feeder Arm	1550 lb	\$2,940	Implemented
Adopt Improved Fill Extensions of Fiber Barrels	130 lb	\$320	Recommended
Adapt Scrubber System to Feed from COW Water	4,625,000 gallons	\$23,130	Recommended

ECO Finishing



Jerico Sanchez Hulstrand
Chemical Engineering
University of Minnesota Twin Cities

Company Background

ECO Finishing is a plating company that has supported electroplating, anodizing, phosphating, and electroless nickel services since 1994. About 100 employees work at the Fridley facility, which contains a certified lab and inspection area. A wide variety of companies make use of these finishes, including the medical, aerospace, military, commercial, and automotive industries. ECO Finishing prides itself on its ability to meet its customer's requirements through quality control while still having a competitive part lead time.



"The MnTAP internship gave me a better understanding of how to approach challenges in industry and allowed me to be in charge of my own project. I really enjoyed seeing concepts from classes in an industrial setting and learning about new processes. It was a great opportunity to use my engineering background to come up with a variety of solutions to increase efficiency at the company." ~JSH

barrels of waste are produced each year from different areas of the plant, which costs \$51,000 to properly eliminate. Water, sewer, and waste disposal charges have been increasing over time, which is a concern as ECO Finishing has been expanding production.

Project Background

Two of the largest ongoing costs at ECO Finishing are water use and wastewater treatment. Most of the water used in the electroplating process originates from rinsing parts in between steps, which is important for high quality plating. This water has to be treated for metals and cyanides before it can be released to the sewer. As a byproduct of the wastewater treatment process, hazardous waste is produced that must be sent out for proper disposal. Industrial waste reduction can occur by reducing contamination at the source and by looking at alternate treatment processes or chemistries, while water use can be reduced at the source or reused in the plant.

Incentives To Change

About 28,000,000 gallons of water are used per year, costing nearly \$200,000 per year. It costs \$120,000 per year to properly dispose of the 840,000 lbs. of electroplating sludge that is produced in the waste treatment process. In addition to this sludge, about 200





Solutions

Install Closed Loop System

After rinsing parts, all water must be treated at the facility before being discharged. Over 60,000 gallons of this water is sent to the sewer per day. If this water were further cleaned, it could be used instead of city water for rinses in the plant. A closed loop system could be installed that uses ultrafiltration and reverse osmosis to recover 70% of the water. This would remove dissolved and suspended solids and make the water clean enough for reuse in the plant. It is estimated that this system could save 15,000,000 gallons of water per year with yearly net savings of \$63,000.

Reclaim RO Rinse Water

Currently, water from the reverse osmosis system is used for final rinses on seven lines. By recording water composition and conductivity, it was determined that most of this water is clean enough to be reused before being sent to waste treatment. One option to reclaim this water is to pipe it to another rinse tank, which would recuperate 2,000,000 gallons of water a year. There is at least one compatible rinse on each line where this water could be reused. Since there is only an initial installation cost for this project, this would result in \$14,000 in water savings each year.

Implement Floating Insulation for Open Tanks

On ten manual plating lines, there is about 950 ft² of open heated tanks which lose heat and evaporate a large amount of water. Additionally, for agitated tanks it can be difficult to keep the temperature high enough. By implementing floating hexagonal insulation on open tanks, heat loss can be reduced by 80% and evaporation by 70%. This will prevent the release of 80,000 therms and 1,000,000 gallons of water to the environment per year when applied to all heated tanks; after accounting for the initial purchase, this will save \$63,000 per year.

Install Drum Evaporator

Besides the sludge from waste treatment, more than 200 barrels of varying types of waste are produced yearly. A drum evaporator will allow the company to reduce the volume of waste picked up, thus decreasing disposal costs and environmental impact. Drums that make good candidates for evaporation have high water contents, no volatile organic compounds (VOCs), and little debris. Using conservative estimates for waste evaporation efficiencies for 32% of these barrels, hazardous waste production will be reduced by 19,000 lbs. per year, reducing yearly disposal costs by \$8,100.



Recommendation	Annual Reduction	Annual Savings	Status
Install Closed Loop Water System	15,000,000 gallons	\$63,000	Recommended
Reclaim RO Rinse Water	2,000,000 gallons	\$14,000	Recommended
Implement Floating Insulation for Open Tanks	1,000,000 gallons 80,000 therms	\$63,000	Implementing
Install Drum Evaporator	19,000 lb hazardous waste	\$8,100	Recommended



Sushruth Venkatesh
Chemical Engineering
University of Minnesota Twin Cities

Company Background

Started in 1895, Firmenich, Inc. is the world's largest privately owned company in the flavors and fragrances business. Firmenich has a strong presence in 64 different countries across the globe, and has 26 manufacturing sites and 56 operational facilities. At its facility in New Ulm, MN (FIRULM), Firmenich makes over 900 different types of spray-dried, dry-blended, paste, and liquid flavors.



“Sushruth brought excellent analytical skills to projects as well as a fresh perspective for new projects. He gained a lot of knowledge about manufacturing and the food industry. It was a win-win situation.”

~ Sandra Mohr, Process Technology Manager, Firmenich

“Lean manufacturing is all about value creation. I don't think there is any greater professional satisfaction than helping create products that many people consume, while doing so more efficiently and by using fewer resources. This internship has given me a chance to apply the most abstract of chemical engineering concepts to a practical setting. I will no doubt use the project management & communication skills I've picked up here in the rest of my professional career.” ~SV



Project Background

Approximately 40% of FIRULM's products are spray-dried products. This makes the spray drying operation a critical component of the company's operation. FIRULM would like to optimize this drying process to improve performance. Furthermore, FIRULM desires to increase capacity to meet increased customer demands.

The clean-in-place (CIP) cycle is a step that immediately follows spray drying. FIRULM's strict adherence to quality control ensures that no contamination occurs across different product batches. The company wishes to reduce (and perhaps even reuse) the water and chemicals used during this step (while maintaining quality levels) to utilize their resources in a responsible manner, keeping in line with sustainability goals.

Incentives To Change

FIRULM practices lean manufacturing principles, and strives to increase productivity and to eliminate the seven wastes associated with manufacturing. Doing this has helped reduce costs and increase profitability. FIRULM counted on a MnTAP intern to bring a fresh pair of eyes to observe the processes at the facility, as well as additional engineering expertise. FIRULM is also on the path of continuous improvement, not only in manufacturing, but also in safety and quality. Finally, FIRULM would like to lead Firmenich's global sustainability efforts by improving resource utilization.



initial water saving estimates of 80,000 gallons per year on one of the dryers, with an accompanied 14 hours of time that could go towards production, resulting in increased annual income of \$9,000.

Increase Feed Solids

The concentration of feed solids in the slurries fed to the spray dryer play a crucial role in the process. Since the primary function of a spray dryer is to evaporate water, reducing the amount of this water leads to a higher production rate. Since there is less water to evaporate, there is a decrease in energy consumption as well. The intern was able to implement a project for increasing the feed content, a move that has the potential to increase production capacity by over 75,000 lbs. per year.

Recover Product Solids

The current CIP process at FIRULM is designed to flush out any solids left in the spray dryers and associated components (screw conveyors) into the drain during washing. The intern suggested recovering this product to reduce total suspended solids (TSS) & biochemical oxygen demand (BOD) costs associated with these discharges. Multiple methods of product recovery were considered. The best option is the use of a pigging device which is expected to prevent over 47,200 lbs. of product a year from going down the drain, and save over \$15,300/year as a result.



Solutions

Add an Operator

One of the spray dryers at FIRULM currently has only one operator to prepare each batch, run the dryer, and run the CIP process. He has to shut down the equipment after every spray drying batch, run cleaning water and chemicals through the spray dryer, take down and manually clean equipment, and then reassemble the equipment. Adding another operator to this dryer would increase throughput. Working alongside the operator, the intern found that a total of 320 hours of production could be gained per year, which translates to a potential production increase of 53,000 lb. and annual income of \$100,000.

Add Sensory Controls

Currently, operators at FIRULM use either a visual inspection or a timer based system to control rinse cycles in the CIP process. To ensure more precision and enable the operators to concentrate on other important things, the intern recommended automation of these processes through the use of turbidity and/or conductivity meters. This way, the operator would be able to tell when to stop a particular rinse, saving precious water and chemicals in the process. Hand held conductivity meter readings provided

Recommendation	Production Gains	Annual Reduction	Annual Savings	Status
Add an Operator	320 hours 53,000 lb	---	\$100,000	Testing
Add Sensory Controls	14 hours	80,000 gallons	\$9,000	Recommended
Increase Feed Solids	>75,000 lb	2,200 therms 28,000 gallons	\$337,500	Testing
Recover Product Solids	---	47,200 lb solids	\$15,300	Recommended

HealthPartners Park Nicollet



Hannah Brady
Environmental Engineering
Northwestern University

Company Background

HealthPartners is an award-winning integrated health care system based in Bloomington, Minnesota, with a team of 22,500 people dedicated to a mission of improving the health of members, patients and the community. The organization cares for more than one million patients with more than 50 primary care clinics, 750 primary care physicians, and six hospitals in Minnesota and Wisconsin.



“This project gave me the opportunity to gain experience and confidence in a business setting using skills learned in the classroom. In addition to developing project management and communication skills, I was able to make a positive impact on the environment and the company.” ~HB

Project Background

This project focused on three clinics in the HealthPartners organization: Park Nicollet clinics in Shakopee, St. Louis Park and Wayzata. HealthPartners has focused many sustainability efforts on hospitals, so this project was developed to increase sustainability efforts in clinics. Many types of waste are produced at Park Nicollet Clinics, including solid waste, regulated medical waste (RMW), RCRA hazardous waste, pharmaceutical waste, universal waste, construction and demolition debris (C&D), recyclables and organics. This project focused on ways to decrease solid waste generated and divert solid waste through recycling.

Incentives To Change

In 2015, HealthPartners received Practice GreenHealth’s System for Change Award, presented to healthcare systems with advanced sustainability programs. They are motivated to continue improving and expanding their current sustainability programs to meet their Sustainability Goals 2020, which were created to “demonstrate green

business practices that are cost effective and improve health.” The goals include reducing waste generated, developing and improving access to the sustainability program, and reducing paper use by 10% over a 2014 baseline.

Additionally, HealthPartners has conducted several waste sorts at clinic facilities that indicated there are opportunities to increase recycling rates. Waste sorts are used to determine the composition of waste – trash, recycling, and organics – generated by a facility during a specific time period. The waste sorts indicated that on average, 21% of the material in the trash was recyclable. Additionally, organics were separated during the waste sorts to gauge the opportunity to introduce organics recycling.





Solutions

Implement Waste Stations & Education

Implementing waste stations will provide equal access to trash and recycling, encouraging recycling and engagement with the disposal process. Placing waste stations in centralized locations with consistent signage, sizing, and coloring, as well as increasing recycling education using a PowerPoint presentation, desk-side cheat sheet, and break room poster, will increase familiarity and decrease confusion about the recycling program. At the Wayzata Clinic location alone, this could divert 9 tons of recyclables from going to landfill annually.

Implement Organics Recycling Program

Similar to a traditional recycling program, implementing an organics recycling program diverts materials like food waste and paper towels from landfill or incineration. Waste sort results showed that, on average, 50% of waste is compostable at clinic locations. By implementing an organics recycling program, 15 tons of organic material could be diverted annually at the Wayzata Clinic location alone.

Default Printers to Duplex

Defaulting printers to print on both sides of a sheet of paper (duplex printing) can theoretically reduce paper use

by up to 50%. A trial at the Shakopee Clinic demonstrated that paper use could be reduced by 17% over 2013/2014 baseline usage. Annually, this would result in half a ton of paper saved at the Shakopee Clinic. Additionally, because only about half of the printers at the clinic were capable of duplexing and included in the trial, paper savings at the clinic could be increased to 27% if all paper was printed on duplex-capable machines.

Install Hand Dryers Whenever Possible

Paper towel waste was a large portion of the organic (compostable) material found in waste sorts. Installing hand dryers in public restrooms reduces paper towel use at the source. Additionally, one study found that paper towels have a global warming potential three times larger than that of high-efficiency hand dryers when considering the entire life cycle of both hand drying methods. High-efficiency hand dryers can only be installed in public restrooms and not in patient care areas due to hygiene concerns. However, if all public restrooms at the St. Louis Park Campus were retrofitted with high-efficiency hand dryers, this would eliminate the use of 3 tons of paper towels annually.



Recommendation	Clinic Location	Annual Reduction (lb)	Annual Savings	Status
Implement Waste Stations and Education	Wayzata	18,000	\$2,500	Piloting
Default Printers to Duplex	Shakopee	1,000	\$1,000	Piloting
Implement Organics Recycling Program	Wayzata	42,000	\$200	Recommended
Install High-Efficiency Hand Dryers	St. Louis Park	14,000	\$15,400	Recommended

Kemps Ice Cream

L



Anne Hunter
Chemical Engineering
University of Minnesota Twin Cities

Company Background

Kemps LLC is a dairy manufacturing company that was founded in 1914 and is known for making high quality dairy products. The ice cream plant, located in Rochester, MN employs 180 people and produces 700,000 gallons of ice cream, frozen yogurt, and frozen novelties per week. The plant brings in ingredients such as sugar and cream from suppliers in the upper Midwest to make their ice cream. Despite increased competition from national brands, Kemps remains a top dairy brand in the Minneapolis-St. Paul metropolitan area, as well as in other areas of the upper Midwest.



"This was my first real-world engineering experience and it was fascinating for me to see how I learned to thrive in an industrial environment. After coming up with my own experiments to collect data and to test my theories throughout the plant, I now have a new appreciation for complex piping systems – and for the ice cream I purchase at the store!" ~AH

Project Background

The purpose of this internship was to study the ice cream making process to determine the main causes of waste in the plant and to make process change recommendations in order to reduce the waste going down the drain. Recommendations were made to improve the company's product yield, which also helps to reduce its impact on the environment. Cost-benefit analyses were also done to determine the impact of each recommended process change.

Incentives To Change

One area of focus at the Kemps ice cream plant is the amount of ice cream mix that goes down the drain as waste. This waste represents a loss for the company on three levels – lost revenue from product that could be sold, labor costs, and increased wastewater treatment fees resulting from dairy product going down the drain.

Over the years, Kemps ice cream plant has experienced high biochemical oxygen demand (BOD) levels in its wastewater, prompting the wastewater treatment facility in the city of Rochester to impose fines in response to the

increased load on the facility. By being able to determine the main causes of this waste, Kemps can explore options to reduce it, thereby increasing product yield and revenue while minimizing wastewater fees and environmental impact.



Solutions

Add a Sugar Pump in the Raw Receiving Area

Liquid sugars such as corn syrup, fructose, and liquid sucrose are unloaded and brought into the receiving



tanks by a pump located on the back of each sugar truck. This pump is about four feet above the ground and pumps sugars through a 20 ft. receiving hose before they reach the 11 ft. vertical sugar receiving lines. Once the truck is empty, sugar remains in the receiving hose that cannot be pumped into the receiving lines. Water cannot be used to rinse the sugar down because it promotes bacterial growth, so the sugar in the hose is washed down and goes to waste. By installing a new sugar pump in the receiving bay, approximately 10 gallons of sugar product will be saved from each sugar shipment by eliminating the need for a receiving hose at the bottom of the unloading process. In the new process, the hose connecting the truck to the pump can be physically lifted, allowing all the sugar load to enter the system piping and eventually make its way into the sugar receiving tanks.

Replace Compressed Air Drains with Zero-Loss Drains

Currently, the plant uses four types of drains to remove moisture from the compressed air system. These include float drains, timed drains, continuously open drains, and a manually opened drain. The float drains are a basic type of zero-loss drain since they use a level sensor to ensure that only water is released from the drains. The other drains all release some amount of compressed air which takes electricity to produce. If this compressed air is not being used to do useful work in the plant and instead leaks

out of an open drain, it represents a loss in the system. Therefore, it is recommended that all drains, except for the two float drains, should be replaced with zero-loss air drains.

Calibrate Flow Meters and Tank Gauges

Of all of the tanks and silos in the ice cream plant, only the two main blend tanks and the three flow meters leading to them are consistently calibrated. The gauges and other flow meters on the raw tanks, pasteurized tanks, and vat pasteurizers are not regularly calibrated, while the flavor tanks do not have any gauges. This creates a problem for the company because the tank inventories taken on a daily basis are based on unreliable information.

Therefore, it is recommended to continue to calibrate tank gauges and flow meters and to set up a schedule for an annual calibration. Though a full economic analysis of the benefits of tank and meter calibration is not possible, the data collected from correctly calibrated equipment is useful to the plant in multiple ways. First, data collected



for loss reports and product reports will be more accurate, allowing company resources to be used more efficiently. Additionally, the plant will be able to use the tank inventory values to double-check the amounts of product brought in by trucks, ensuring the company only pays for the amount of product that is actually received.

Recommendation	Annual Reduction	Annual Savings	Status
Addition of Sugar Pump in the Truck Bay	112,000 lb liquid sugars	\$22,600	Recommended
Replace Air Compressor Drains with Zero-Loss Drains	256,000 kWh	\$24,300	Recommended
Calibrate Tank Gauges and Flow Meters	Unknown	Unknown	Recommended



Ayotunde Olatunbosun
Chemical Engineering
University of Minnesota Duluth

Company Background

Lloyd's Barbeque Company was founded in 1978. In its beginning stages, the company produced strictly pre-cooked barbequed ribs. With increasing popularity, the slowly cooked, vacuum packed product made it to grocery stores around the country. The company broadened its retail base in 1996 by introducing a line of fully cooked shredded pork, chicken, and beef in Lloyd's signature barbeque sauces packed in re-sealable buckets. Lloyds Barbeque Company was acquired by Hormel Foods Corporation in 2005 and continues to make products that customers love.



"This internship gave me exposure to industrial equipment and environmental compliance as well as working within a team. It was eye-opening to learn that every recommendation made might not be economically feasible to implement and that information is not as organized as it is in college level classes." ~AO

Project Background

Lloyd's Barbeque Company processes both shredded meat and barbequed ribs. The process begins with the addition of brine, a flavored preservative and tenderizer, to the raw meat. Depending on the type of meat being processed, brine is either injected into the meat or added through a massager to aid in absorption. At this point, the meat is either hooked onto a rack or bagged and then placed on a rack. The racks are placed in a holding cooler before being cooked in the oven. Cook time, which is dependent on the type of meat, ranges anywhere from 4.5 hours to 18 hours. Once cooked, the product is cooled down in a blast cell to a temperature of 40 degrees Fahrenheit or less. It is then packaged in a film pouch or in a tub to be boxed, palletized, and shipped out to customers. Throughout the meat processing, water is utilized in various processes with the majority of the water consumed on the production floor (i.e. the industrial usage). Lloyd's industrial water usage is 60% of the overall water consumption at the plant and was the main focus of this project.

Incentives To Change

As part of its corporate responsibility policy and goals, Hormel Foods has set targets to minimize its impacts on the world. Lloyd's Barbeque plays an important part in achieving these objectives. Hormel's 2020 goals include: reducing water use by 10%, non-renewable energy use by 10%, and solid waste sent to landfill by 10%. Lloyd's recognizes that by examining its processes, such as the wastewater pre-treatment, lawn irrigation, equipment sanitation, and investigating possible solutions, it can help Hormel Foods achieve its sustainability goals.





Install Temperature Regulator on Wash Tank

Injecting direct steam in the tank is how wash water is currently heated, and with no insulation, energy loss is high. The current energy consumption of the wash tank is about 88,673 therms/year of natural gas. This energy is used in preheating and maintaining the water temperature at 210 degrees Fahrenheit. Based on the determination that the wash tank only needs to be at 140 degrees Fahrenheit, it is recommended that a temperature regulator be installed. This change has been implemented and will reduce energy consumption by 46,450 therms and result in annual savings of \$42,900.

Optimize Hot Water Pump

The pump currently operates at 350 PSI and its total dynamic head is approximately 600 feet. At this setting, the flow rate of the pump is 125 gallons per minute (GPM) and the variable frequency drive operates at 25 horse power. Upon quantifying that turning down pressure to 250 PSI would reduce water and energy consumption to 102 GPM and 15 horse power respectively, it was recommended that this change be made. This change will result in approximately \$11,000 saved annually.

Employee Training on Solid Waste

The plant recognizes it has an opportunity to reduce solid waste lost in production. As product lands on the floor; production yield is affected, water/energy consumption increases (to clean floor), chemical oxygen demand (COD) increases because of increased organic chemicals in the wastewater stream, and rendering charges increases. On the shredded product line in particular, there is an approximate loss of 726 pounds of meat per day. If just 4% of this loss can be prevented, there is a potential of making an additional \$20,000 yearly in income.

Solutions

Fix and Optimize Lawn Irrigation System

Through detailed investigation of the watering system, it was determined that the rain sensor was not working, the runtime for all the zones were set too high, the lawn was watered every day, and there were leaks in the system. Installation of a functioning rain sensor would reduce the water consumption as the sensor would stop a scheduled run if there had been rain early on in the day. Programming the zones to run for a shorter period and every other day would be beneficial, as well as hiring a contractor to fix leaks in the system. Installing a master valve would limit each run to a constant amount of water so this would limit water lost through leaks. Implementing these changes would reduce yearly consumption by 878,200 gallons, saving \$3,000 annually.

Recommendation	Annual Reduction	Annual Income/ Savings	Status
Optimize Lawn Irrigation	878,200 gallons	\$3,000	Implemented
Install Wash Tank Temperature Regulator	46,450 therms	\$42,900	Implemented
Optimize Hot Water Pump	3,930 therms 1,324,800 gallons 25,000 Kwh	\$11,000	Implemented
Employee Training on Solid Waste	6,000 lb	\$20,000	Recommended



Carter Tollefson
Mechanical Engineering,
University of St. Thomas

Company Background

Lou-Rich Inc., is a contract manufacturing and engineering company based in Albert Lea. The company manufactures complete products, weldments, engineering components, and high level assemblies. It provides customers with help in quality assurance, material sourcing, and design of products. Other services include machining, fabricating, finishing, welding, painting, wiring, assembling, testing, and packaging. It provides services to original equipment manufacturers (OEMs) in the agricultural, construction, food service, industrial, medical device and medical equipment markets.



"I really enjoyed this internship because it enabled me to use the skills I have gained through my coursework and apply them to a project that really had a positive impact on the company. I particularly liked learning about lean manufacturing principals because the idea of eliminating sources of waste through continuous improvement is something that can be applied in any industrial setting." ~CT

Project Background

Lou-Rich has been manufacturing freezer assemblies since 1989. Over the years, the types and designs of freezers have changed and many have been removed or added to the line. The production area size has been gradually reduced and its location and work cell layouts have changed many times. It was moved to its current location in 2012 and the work cells were compacted into a smaller area. The goal of this project was to determine and reduce sources of waste in this production line by optimizing product flow and implementing lean manufacturing solutions to ensure the best use of the remaining space for the process.

Incentives To Change

Lou-Rich, Inc. is committed to reducing waste and continuous process improvement through the use of lean manufacturing principles. Current analysis of the freezer line where this project is focused shows that there is an opportunity to reduce many different kinds of waste such as motion, inventory, chemicals, idle time, transportation, and water. The creation of a system that will process materials more efficiently will reduce these wastes. This will save the company money in operator time and associated production costs. It will also reduce the production lead time for freezers and will allow increased production and profit for the company during the year.



Solutions

Purchase New Washer and Place in Freezer Area

The current washer used to clean components in the freezer area is located about 350 feet away from the line. This causes operators to spend a lot of time taking parts to the washer and back. This waste reduction opportunity is estimated to save 280 hours per year or about \$7,700 in operator time. Operators must be paid to run the washer

and load and unload parts; reassigning them to other areas could save about \$2,550 per year. Forklifts must be used to transport parts to and from the washer and then back to the freezer line; this time reduction equates to a savings of \$1,750 per year. The new design of the washer is estimated to save 29,300 gallons of water per year. By combining all of these savings together, new washer implementation would save approximately \$12,200 per year.

Implement Standard Work at Foaming and Coiling Operations

Through lean analysis, it was determined that production processes in the foaming and coiling operations could be accelerated by making simple changes in operating procedures. By implementing standard work in the coiling and foaming processes, it could save operators 420 hours per year where they could be assigned to other work areas. This equates to about \$11,550 per year in operator time. There are also energy savings associated with not having to heat the foam molds which equal \$370 per year.

Remove Current Coil Washer

The current coil washer is believed to be unnecessary to meet customer requirements. During foaming, an air hose is applied to each freezer that blows out any debris that may be in the coil. This, combined with the new washer implementation, is expected to provide the required cleaning. If approved by the customer, this could save \$13,200 per year in chemical, water, and power savings.

Rearrange Layout and Implement Conveyor System

The current layout and equipment are not optimized, and require operators to move excessively in their work cells and they require a lot of operator time handling part containers. The intern suggested that a new layout be implemented to reduce operator movement, and that a conveyor system be implemented to reduce time spent by operators to move parts to and from the work cells. Implementing a conveyor system would clear room on the factory floor and eliminate time handling parts containers. These changes are estimated to save operators



260 hours in handling time per year or \$7,100 per year. Furthermore, these changes will help balance process flow and organize the work place.

Implement Finished Good and Component Supermarket

Due to continuous changes in order sizes by the customer, The intern recommended a finished goods supermarket be installed. The supermarket would implement a pull system that would enable the line to only make parts as the customer needs them. This is different than the push system used that relies on predictions of customer demand which is hard to do with fluctuating order sizes. This would help buffer against the order fluctuations, prevent against excess material handling, and lower the amount of components in work cells.

The current component storage areas are located far away from the welding and soldering areas where all components are combined together. The new supermarket will be located closer to those areas with less movement to and from storage area. This solution can save operators approximately 50 hours per year or \$1,400 in operator time. It will also allow parts to be shipped to customers faster and create a more structured, organized work environment.

Recommendation	Annual Time Savings (hours)	Annual Reduction	Annual Savings	Status
Purchase New Washer	280	29,300 gallons	\$12,300	Proposed
Implement Standard Work	420	4,800 kWh	\$11,900	Implementing
Remove Coil Washer	---	19,200 gallons 7,200 lbs. chemicals 1,300 kWh	\$13,200	Proposed
Lean Layout with Conveyors	260	---	\$7,100	Proposed
Implement Supermarkets	50	---	\$1,400	Proposed



Joseph Carlson
Chemical Engineering
University of Minnesota Twin Cities

Company Background

Sanimax South St. Paul is a rendering facility that is part of a larger global company headquartered in Montreal, Canada, with 18 locations in Canada, the U.S., and Mexico. Sanimax collects and reclaims by-products from the agri-food industry such as meat, used cooking oil and grease, hides and organics, and transforms them into high quality products. The main products that are produced on site are blood meal, feather meal, poultry by-product meal, meat by-product meal, poultry fat, meat fat and yellow grease.



“My MnTAP internship at Sanimax has given me the opportunity to make a difference. Not only was I working toward reducing the environmental impact of the plant through water and energy use, but I also was able to work toward saving the company money on operating costs.” ~JC

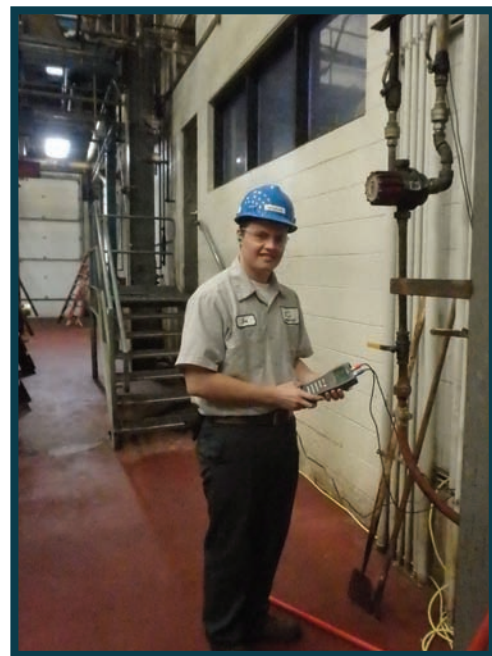
Project Background

The objective of this project was to assess opportunities to reduce water use, wastewater loading, and energy use at the South St. Paul facility. The four main areas that were focused on included noncontact cooling water use, wash water use, process leaks, and process condensate.

Incentives To Change

Sanimax has experienced high operating costs due to freshwater intake and wastewater discharge (volume and strength charges). The freshwater use, sewer discharge, and strength charges are all anticipated to increase significantly next year. By reducing these operating costs, the company will increase profits as well as reduce their environmental impact.

The plant uses about 12,764,000 gallons of noncontact cooling water per year, which represents about one-fourth of the total purchased water annually. In the current operation, cooling water is passed through a jacket to cool the pump seals. This reduces the wear on these seals from excessive heat, increasing the equipment lifetime of this seal and reducing the risk of failure. The first three recommendations reduce non-contact water use in 5 of the 10 applications, while the final two address other waste streams.



Solutions

Install Airfin Coolers on Condensate Pumps

By using a closed loop convective cooling system, a continuous, cooling water flow is no longer needed. The Airfin cooler has been used successfully to cool the pump seal on the poultry cooker condensate pump since 2012.



The installation cost for the Airfin coolers is higher in the red meat plant, due to the added costs of installing additional motor starters. Installing Airfin coolers for the four condensate pumps has been initiated and should reduce water usage by 2,600,000 gallons and \$12,500 per year

Install Radiators on Centrifuge Bearing Cooler

In the current operation, softened water is passed through shell and tube heat exchangers to cool the bearing oil for each of the centrifuges. The water flow rate for both centrifuges is controlled by a ball valve, which is usually set to a flow rate in excess of 5 gpm (sometimes up to 10 gpm). The centrifuge literature suggests that the centrifuge bearing cooler requires a cooling water flow rate of 2 to 4 gpm under normal operating conditions. Installing a forced convection oil cooler for the centrifuges to cool the poultry and red meat centrifuge bearing oil instead of the noncontact cooling water has been initiated and will result in water savings of 3,242,000 gallons and \$13,200 annually.

Optimize Poultry Cooker Cooling Water

Flow rate on the feed end bearing of the poultry cooker was reduced from 1 gpm to 0.2 gpm. At 0.2 gpm, the bearing oil remains in a safe range below the recommended 150 °F maximum temperature. This change has been implemented and has reduced water use by 250,000 gallons and \$1,100 per year.

Install Water Shut-off Valves and Nozzles:

The plant uses steam and water mixing valves throughout the plant to produce high pressure hot water for cleaning floors and equipment at approximately 34 hose locations and over 3,000,000 gallons per year. I recommend that end of the hose shut-off valves and low-flow, high-pressure nozzles are installed on steam hoses at a total cost of less than \$14,000. Avoiding excess use of water and steam will result in reduced freshwater purchase costs, sewer discharge costs, and boiler steam usage equivalent to 1,080,000 gallons of water (\$5,600) and 11,00 therms (\$6,500) per year.

Repair Process Leaks and Compressed Air Leaks

Process leak sources may include leaking seals, pumps, fittings, or other equipment where material or water is lost and may not be recovered. Reducing product leaks can potentially have a large cost savings because revenues are increased, unnecessary sewer and strength charges are avoided that would have been a result of the product entering the wastewater stream, and less water is needed for washing. Compressed air leaks result in a loss of line pressure, requiring air compressors to run more frequently than a system with no compressed air leaks. Fixing identified compressed air leaks will result in savings of 275,000 kWh and \$22,500 annually. Fixing identified process leaks will result in savings of over 570,000 gallons of water, 1,330,000 lbs. of product and \$50,000 annually.

Recommendation	Annual Reduction	Annual Savings	Status
Install Airfin Coolers on Condensate Pumps	2,600,000 gallons	\$12,500	In progress
Install Radiators on Centrifuge Bearing Coolers	3,242,000 gallons	\$13,200	In progress
Optimize Poultry Cooker Cooling Water	250,000 gallons	\$1,100	Implemented
Install Water Shut-off Valves and Nozzles	1,080,000 gallons 11,000 therms	\$12,100	Recommended
Repair Process Leaks	>570,000 gallons water >1,330,000 lb product	>\$50,000	Ongoing
Repair Compressed Air Leaks	>275,000 kWh	>\$22,500	Some repairs completed



Nathan Landwehr

Environmental Science, Policy &
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University of Minnesota Twin Cities

Organization Background

The Southwest Regional Solid Waste Commission (SWRSWC), which consists of Cottonwood, Jackson, Lac qui Parle, Lincoln, Lyon, Murray, Nobles, Pipestone, Redwood, Renville, Rock, and Yellow Medicine Counties, is a 12 county Joint Powers Board whose goal is to foster an integrated approach to solid waste management in the region. The board was created to advance abatement and recycling programs and develop an integrated solid waste management plan for the counties for the next ten years. The focus of the plan is to promote source reduction and recycling.



"This internship gave me the opportunity to tackle real-life challenges in my community. I gained valuable experience in time-management, a strong understanding of solid waste infrastructure, and a chance to use my classroom knowledge to make an impact. Working with great people helped me develop my communication skills and make the internship a fantastic experience overall." ~NL

Project Background

The purpose of this project was to develop a replication model that businesses can use to conduct their own solid waste assessments and to provide direct solid waste assistance to local businesses on behalf of the counties. Nine solid waste assessments were conducted at businesses of varying types and sizes. Reports were drafted for each business detailing recommendations to reduce waste and improve recycling. These reports included cost justification and approximations of the amount of waste that could be diverted from the landfill. In addition, the intern developed the replication model with assistance from county staff and marketed it through local Chambers of Commerce. The project also laid the groundwork for establishing and advertising reuse networking in the area, including via the Minnesota Materials Exchange and a waste-to-feed network.

disposal because it allows the counties to generate revenue from recycled materials. Waste reduction and recycling also reduce the volume of waste that enters the landfill, increasing its lifespan. Local businesses also realize cost savings through reduction, as generating less waste reduces purchasing, handling, and disposal fees.

Incentives To Change

The integrated solid waste management plan was developed to emphasize source reduction and recycling, as both are essential to achieving the reduction and recycling goals outlined in the plan. Solid waste abatement and diversion to recycling has numerous benefits. Recycling can be more cost effective than



Solutions

Approach to Project

Part 1: Assessments

For the first part of the project, the intern conducted nine assessments at small businesses in the three counties. Each assessment took approximately 1-3 hours and involved a visual approximation of waste composition, a facility walkthrough, interviews with staff at all levels of the organization, and follow up questions after the assessment was completed. The intern conducted research and drafted reports containing waste reduction and cost savings recommendations for implementation. These reports included site-specific recommendations as well as general reduction tips. After the reports were submitted to the businesses, the intern followed up to gauge progress on implementation and answer questions.

Part 2: Develop replication model

The second part of the project was to develop a replication model for business owners to use in their own businesses to identify solid waste reduction opportunities. Conducting the solid waste assessments familiarized the intern with the process and gave the perspective necessary to tailor the model to business owners. The model is applicable to any type of small business. Information about the replication model can be found here: www.mntap.umn.edu/industries/waste/tools.html.

Part 3: Networking

The last part of the project involved networking activities. Once the model was developed, it needed to be advertised and promoted to businesses around the region. The intern worked with local Chambers of Commerce to advertise and disseminate the model. The intern also worked to publicize the Minnesota Materials Exchange, a statewide reuse network, and develop a network to facilitate waste-to-feed connections, which allow businesses with food waste to give it to local hog



farmers as opposed to throwing it away. These networks help simplify the waste reduction process by providing more reuse options to business owners.

Summary of Assessments

Nine assessments were conducted during the project. The types of facilities visited included automotive services, restaurant/food service, warehousing, fitness/recreation, manufacturing, pharmaceuticals, and printing/publishing. The most common recommendations made were to establish a waste-to-feed connection, utilize reusable transport packaging, practice rigorous inventory management/purchase monitoring, and prioritize the use of electronic media over paper.

Total savings for the top recommendations are:

- Waste-to-feed: \$500 and 65,300 lb
- Reusable Transport Packaging: \$2,500 and 16,000 lb
- Rigorous Inventory Management: \$1,500 and 3,300 lb
- Prioritizing Use of Electronic Media: \$9,800 and 23,600 lb.

Waste reduction and cost savings potential by sector, as well as the total savings potential

Sector	Annual Reduction (lb)	Annual Savings
Automotive Services	1,600	\$7,900
Restaurant/Food Service	62,200	\$1,700
Warehousing	20,000	\$11,000
Fitness/Recreation	24,000	\$9,900
Manufacturing	10,000	\$5,000
Pharmaceuticals	1,500	\$300
Printing/Publishing	2,900	\$400
TOTAL	122,300	\$36,300



Mitchell Cleveland
Chemical Engineering
University of Minnesota Twin Cities

Company Background

Xcel Energy is an electricity and natural gas provider based in Minneapolis, operating in eight Western and Midwestern states with 3.5 million electricity customers and 2.0 million natural gas customers. The company has two major focuses – enhancing environmental performance and improving operational effectiveness. Xcel enhances environmental performance by reducing emissions through the pursuit of clean energy, energy conservation, and efficiency initiatives. Xcel continues to transition from coal to gas and nuclear, while progressing into renewables like wind, solar, and hydro. Along with cleaner energy, the company is also committed to reducing power usage in the surrounding regions by offering rebates for energy efficiency solutions to households and businesses.



“The MnTAP internship allowed me to gain engineering experience in power generation. From working in a real-world engineering setting I developed communication skills, project management experience, and more self confidence. It is amazing knowing that the recommendations I made resulted in significant water and economic savings.” ~MC

Project Background

The Xcel Riverside generation plant demands high water flow for numerous process and auxiliary systems. Makeup water for most systems is supplied by the onsite well and is first purified by a reverse osmosis system and then a passed through a deionizing system. Process systems targeted for water reduction include reverse osmosis treatment, sampling equipment for deionization, and evaporative cooling. An auxiliary system focus included the condensate recovery from the heating systems. Along with focusing on these main projects, system inspections were also performed to check for any water leaks.



Incentives To Change

Xcel Energy is determined to generate and maintain a clean and sustainable power supply for the surrounding regions. The Xcel Riverside plant strives to reduce water usage to create more environmentally efficient processes. With decreased water usage comes decreased water discharge to the environment, meaning a cleaner operating generation plant. Decreasing water usage also reduces the operational level required by process equipment such as treatment systems and pumps, which means extended life of these units. Reduction in the required operational level also means a decrease in operating costs, which with large water flows results in significant dollar savings.

Solutions

Recover Condensate from Heating Systems

The large generation plant requires significant building heating systems which use steam as the thermal energy source. The steam is condensed and is returned to a single collection tank. Condensate had previously been recycled as makeup water, but is now too low in quality to use for this purpose. It is recommended that this



Recover Water from Sampling System

The deionizing treatment system has a sampling panel which analyzes the conductivity and silica levels to ensure correct operation. The conductivity analyzers do not require any addition of chemicals whereas the silica analyzers do. After sampling, both sets of streams are sent to drain. These sampling systems are constantly analyzing water 8,760 hours a year, so it is recommended that the conductivity analyzer water be recycled back into the reverse osmosis storage tanks. This will result in saving 700,000 gallons of water and \$1,700 annually.

Optimize Air Intake Evaporative Cooling

Water is used to cool the air intake for the combustion turbines. Cooler air increases the density and mass flow rate into the combustion turbine, allowing more efficient combustion. When this water evaporates, the solids in the water are left in the sump of the air intake which requires blowdown to prevent solids accumulation. It is recommended that the blowdown conductivity limit be increased to four times the makeup conductivity to decrease blowdown volume. This will result in saving 650,000 gallons of water and \$1,300 annually.

condensate water be treated with a deionization system so that it can be recycled to the makeup storage tank. The implementation of a treatment system will significantly reduce the water required from the well and discharged to drain. This change will result in saving 3,840,000 gallons of water and \$3,300 annually.

Increase Reverse Osmosis Recovery

Both the first and second pass of the reverse osmosis (RO) system are operating about five percent below their capable recovery limits. For the first RO unit, it is recommended that a control valve be installed on the concentrate stream to drain, allowing control of the system recovery. For the second RO unit, which already has a control valve on the concentrate stream, it is recommended to decrease the set flow rate of the concentrate appropriately to achieve the desired system recovery. Increasing the recovery of the two RO systems will result in saving 1,720,000 gallons of water and \$4,300 annually.



Recommendation	Annual Reduction (gallons)	Annual Savings	Status
Recover Condensate from Heating Systems	3,840,000	\$3,300	In Progress
Increase Recovery of First Reverse Osmosis	920,000	\$2,300	In Progress
Increase Recovery of Second Reverse Osmosis	800,000	\$2,000	Implemented
Recover Water from Sampling System	700,000	\$1,700	In Progress
Optimize Air Intake Evaporative Cooling	650,000	\$1,300	Testing

Join the Intern Program in 2016

For Companies

Do you have a pollution prevention or energy efficiency project that you'd like to tackle, but are pressed for time? Would you like to help a science or engineering student advance their technical skills while providing them with a real-world opportunity to use their classroom knowledge? If so, consider hosting a MnTAP intern.

Your business may be able to address waste reduction and energy efficiency projects sooner and faster with the help of a MnTAP intern. An intern can make suggestions that improve efficiency, save money, reduce waste and material usage, or decrease your regulatory compliance burden. Also, an intern has the time and creativity to research alternative equipment, procedures, chemicals, and raw materials. As with all of MnTAP's projects, proprietary information at your facility is kept confidential during and after the intern project.

Company Benefits:

- A new set of eyes looking at your waste or energy project
- Your intern being mentored and guided by a MnTAP engineer or scientist
- A full report and presentation detailing the intern's work and next steps for your company
- MnTAP managing the recruiting, hiring, and training process

Now is the time to start thinking about developing a project for the summer of 2016. We anticipate supporting up to 15 projects this summer focusing on water conservation, energy efficiency, lean manufacturing, source reduction, and pollution prevention. Applications are being accepted now until February 1, 2016 and will be reviewed upon receipt. Companies will be contacted by MnTAP technical staff within two weeks for additional project development and scoping. We request participating companies to contribute \$3,000 to help support the intern program. These funds are used to offset project costs such as student compensation. Complete an online project proposal or call MnTAP today!

For Students

MnTAP is seeking junior or senior college students to work on water conservation, energy efficiency, lean manufacturing, source reduction, and pollution prevention projects at companies in Minnesota. MnTAP anticipates funding up to 15 projects for the summer of 2016 in locations around the state. The projects are located at different companies and in a variety of industries.

Student Benefits:

- Positively affect a facility's environmental footprint
- Gain hands-on project management experience
- Use your classroom knowledge in a real-world setting
- Earn \$15.00/hr and working 40 hours a week during the summer

"MnTAP was able to provide someone with a fresh perspective and the experience to back it."

~Kyle Pillatzki, SW Counties

Applications are currently being accepted for summer 2016 internships. Interviews will begin in January of 2016 and selection of 2016 interns will continue until March 1 or until all positions are filled. Selected applicants will be matched to a project based on academic background and performance, relative experience, and technical skills. To apply for an internship, complete the online application form and submit it with your cover letter, resume, and unofficial transcript.

The University of Minnesota is an equal opportunity educator and employer.

Company intern proposals and student intern applications are available online now at:

www.mntap.umn.edu/intern

About MnTAP

MnTAP is an outreach program at the University of Minnesota that helps Minnesota businesses develop and implement industry-tailored solutions that prevent pollution at the source, maximize efficient use of resources, reduce energy use, and reduce costs to improve public health and the environment.

MnTAP provides technical assistance tailored to each business. By reducing waste and increasing efficiency, businesses in Minnesota can save on disposal and raw material costs, decrease regulatory compliance burdens, and make working conditions safer for employees.

MnTAP is funded primarily by a pass-through grant from the Minnesota Pollution Control Agency's Resource Management and Assistance Division to the University of Minnesota School of Public Health, Division of Environmental Health Sciences. MnTAP has no regulatory responsibilities or obligations.

“MnTAP and the Intern Program provide great opportunities for business leaders and students to experience how they influence the use of resources and the release of wastes to the environment. These experiences help shape future leaders with the awareness that the environment, public health, and business efficiency are strongly linked.”

~ John R. Finnegan, Jr., Dean, School of Public Health, University of Minnesota



For more information about the intern program or how to participate, please contact MnTAP Intern Administrator Linda Maleitzke at 612.624.4697 or lmaleitz@umn.edu



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