New Mexico Environment Department

P2 Pollution Prevention Internship Program

Summer 2016 Project Summaries

New Mexico Pollution Prevention (P2) Internship Program

The P2 Intern Program is an opportunity for engineering students to work with New Mexico organizations helping to identify, evaluate, and implement projects with positive environmental impacts.

Summer 2016 Interns: Back row - Tyler Vertovec, Jennifer Lew, Jonathan Ungaro, Rachael Miera, Meifeng Lin; Front row - Evan King, James Romero, Craig Gorum, Brandon Lujan, Aaron Bolivar, Sayf Ben Fraj.

During the 12-week program, interns attend a 1-week training seminar then provide technical assistance to their host organization, focusing on the principles of pollution prevention and E3 (Economy, Energy, and Environment) and applying their individual engineering backgrounds.

The program is coordinated by the New Mexico Environment Department (NMED) Pollution Prevention Services. Funding is provided through a U.S. Environmental Protection Agency (EPA) Pollution Prevention grant.

The program began as a pilot in 2014 with 4 students and ended in 2016 with 10. NMED has successfully collaborated with the University of New Mexico School of Engineering for the past three years and will be expanding it's partnerships to additional schools for 2017.

2016 Intern Perspectives:

Most Rewarding Aspect: "Being able to independently structure and pursue my project idea and being provided resources to successfully do so. I set my own goals and achieve them and was encouraged to be creative."

- Evan King

"Water conservation is a large part of being environmentally friendly, and getting the opportunity to apply my skills and help improve the water usage is priceless. In school, you learn all the concepts and knowledge you need to be successful in your field of study, and being in a work environment helps you apply the knowledge and skills you have learned, as well as getting the opportunity to learn more. Project management was also one of the skills I learned this summer… Learning to determine the scope, create a budget, and implement the project while staying in the budget is vital part of the process and will help in my future."

- Rachael Miera

"The most rewarding aspect of the internship was helping reduce SF_6 emissions. We were able to cut the site's emissions by 12%. It is very rewarding being able to help actually reduce greenhouse gas emissions and not just talk about it."

- Tyler Vertovec

"I thoroughly enjoyed my internship experience. It opened my eyes to a new world of environmental compliance and regulations that I had never seen before. Upon delving deeper into the world of waste diversion and hazardous waste management I see how the things I've learned studying Chemical Engineering come into play in the field of environmental services. It gave me quite a lot of inspiration to learn that the managers of the ESD perused fields similar to mine in college. I believe this program gave me some great experience and I had fun. I would recommend any engineering student participate in the program.

- Craig Gorum

For more information about the P2 Internship Program, contact:

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www.env.nm.gov/P2/InternProgram

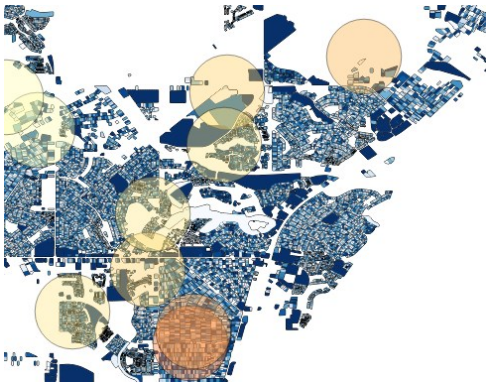
City of Rio Rancho Department of Public Works

Utilities Operations Division - Environmental Programs

Intern: Evan King, Computer Science (Senior)

Facility Description:

The Utility Operations Division is responsible for: water conservation, the domestic well program, the backflow prevention program, the Industrial Pre-treatment program, rebates, water use audits, water, wastewater, and recycled water availability. It operates and maintains the City water, wastewater, and recycled water systems; cross-connection prevention, and maintenance of Federal and State permits for the utility facilities. This is the Division's 3rd year of participation in the P2 Intern Program.



Project Description:

A primary goal of this project was to imagine ways in which the City's separate data sets could be combined and used creatively to empower the City's water conservation specialists. Rio Rancho's data is consistent, well maintained, and diverse. This provides a unique opportunity to conduct interdisciplinary analysis–in this case, with the goal of furthering the City's water conservation efforts.

Traditionally, the City's data exists in silos–engineering, accounts, etc.–without much overlap. In this project, data sets from multiple areas were identified and analyzed for usefulness in water conservation efforts, then merged into a single Geographic Information Systems (GIS) platform - QGIS. Parcel and production well data were used as a foundation to build upon by merging other data sets relevant to water conservation goals. A Standard Operating Procedure was developed for collating these data sets.

The resulting data set provides water conservation specialists with a useful resource for making conservation related decisions, with the hope that they are empowered to substantially reduce water use, water waste, and thus energy use and pollution. Its applications are relatively open ended with multiple uses.

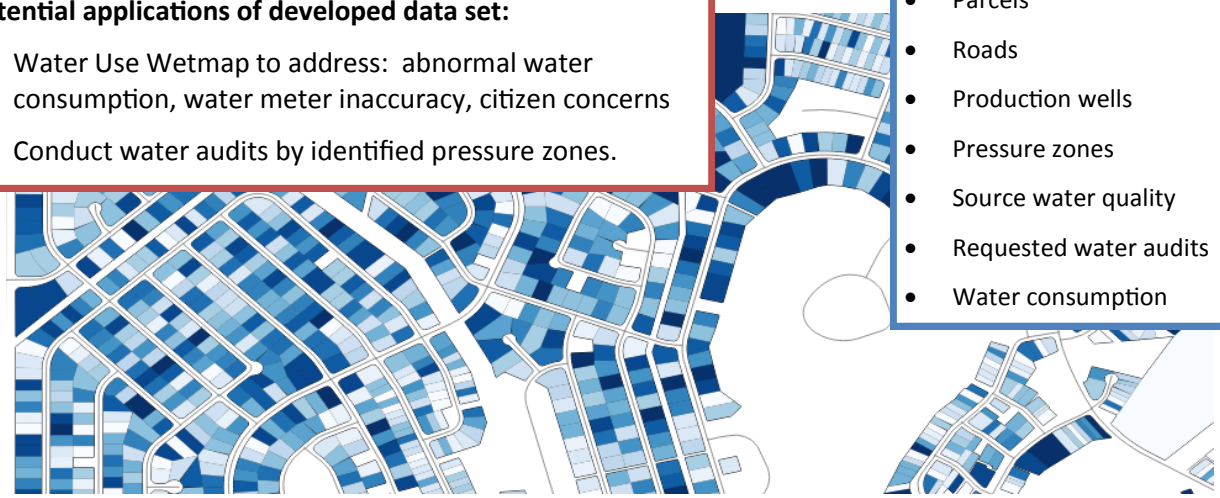
Datasets Relevant to Water Conservation Goals

- Water consumption history
- Parcels
- Roads
- Production wells
- Pressure zones
- Source water quality
- Requested water audits
- Water consumption

Potential applications of developed data set:

⇒ Water Use Wetmap to address: abnormal water consumption, water meter inaccuracy, citizen concerns

⇒ Conduct water audits by identified pressure zones.



Energy Conservation Management Division

Energy, Minerals and Natural Resources Department

Intern: Brandon Lujan, Mechanical Engineering (Senior)

Facility Description:

The Energy Conservation Management Division is housed within the New Mexico state agency of Energy, Minerals and Natural Resources Department. It serves as the state liaison to the U.S. Department of Energy geothermal program and coordinates the New Mexico Geothermal Energy Working Group. ECMD disseminates information on geothermal resources, development, and incentives, and monitors geothermal development activities to promote environmental and economic sustainability for New Mexico and its citizens. The Division recently acquired regulatory responsibility for geothermal activities in New Mexico.

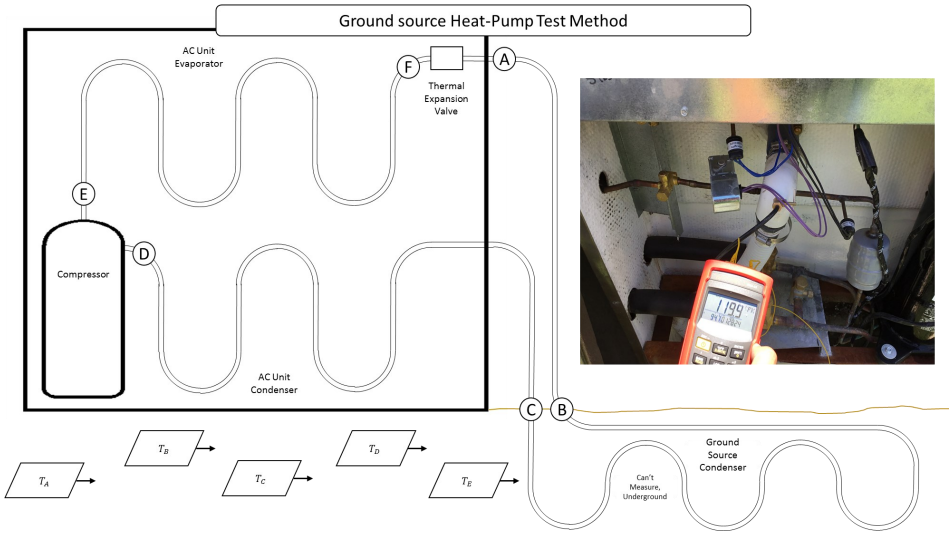
Project Description:

New Mexico has vast geothermal energy resources the can provide a clean, abundant, continuously available renewable energy resource.

The key areas of this project were twofold: the research of failures in high temperature geothermal wells (thermal fatigue) to ensure the current geothermal and ground source technology performs safely and efficiently; and the promotion of geothermal technology and infrastructure around the state.

Project work included:

- Investigating the mechanical, thermal, and chemical properties of geothermal well design and specifying the industry's common practice in preventing failure.
- Promoting geothermal technology and infrastructure that could potentially heat or power a facility in the rural village of Jemez Springs. The village was awarded funding to research the potential of implementing geothermal technology.
- Evaluating the efficiency of a ground source heat-pump system being installed in homes in Las Cruces; determining that under the conditions tested, these systems are a viable alternative to standard air conditioning units or more traditional geothermal ground coupled heat pump units.



New Mexico Environment Department P2 Program

Technical Assistance Provided to Honeywell and UNM Safety and Risk Services

Intern: Meifeng Lin, Chemical Engineering (graduate student)

Facility Description:

The purpose of the New Mexico Environment Department's P2 Program is to provide no-cost technical assistance to businesses and other organizations.

Project Descriptions:

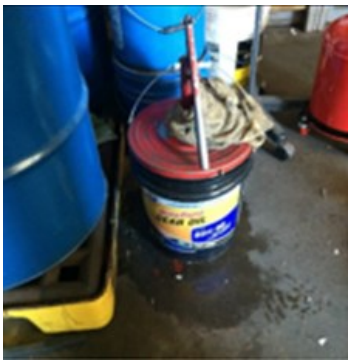
This internship was unique in that Mei worked directly under the NMED P2 program manager and completed technical assistance projects for two different organizations - Honeywell Federal Manufacturing & Technologies and the UNM Safety and Risk Services.

Honeywell - DOE National Security Campus

The purpose of this short project was to reduce working environment hazards and reduce the use of toxic chemicals by substituting a highly flammable and highly toxic chemical used for silicone removal. Two alternatives were identified and tested, but unfortunately did not perform well in the needed activity so ultimately not be used as a substitute.

UNM, Albuquerque Campus, Safely and Risk Services

The project for UNM Safety and Risk Services was to develop a written plan for improvements of hazardous chemical and hazardous waste management. This was accomplished through an assessment of campus facilities that generate hazardous waste and identification of improvement opportunities. The overall goal is to develop best practices and ensure a culture of safety and awareness in order to better comply with local, state, and federal safety and environmental regulations.



After identifying locations at UNM main campus that involve hazardous chemicals which could potentially contaminate the waste water system, site visits to these facilities were conducted to further investigate how hazardous wastes were handled. The sites included: a golf course, an engineering laboratory, art studios, campus utilities & maintenance, and the sports arena.

UNM and the Water Utility Authority have an agreement to select three locations every year for a P2 program certificate. UNM has various wet labs that generate large amount of hazardous wastes, which make them prime location for P2 certification. However, it is also important to take into account the smaller labs that generate smaller amount hazardous wastes and these were the main targets of this project.

A multitude of recommendations were made for improving the hazardous materials and waste management throughout the campus including regular trainings for staff and students, regular inspections, and better chemical inventory. This project is a small part of a much larger effort to successfully address the widespread issues at UNM.

PNM - Reeves Generating Station

Intern: Rachael Miera, Civil Engineering (Senior)

Facility Description:

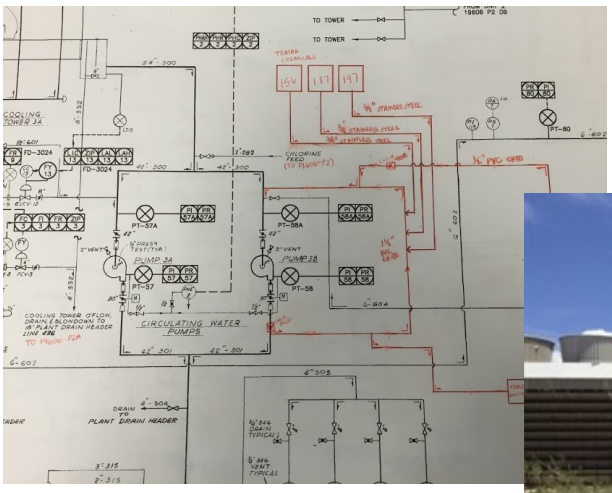
PNM (Public Service Company of New Mexico) is the state's largest electricity provider, serving more than 500,000 New Mexico residential and business customers. The Reeves Generating Station in Albuquerque is a 154-megawatt natural gas plant which provides electricity during peak summer periods, and serves as a central conduit to redirect electricity from coal plants in northwestern New Mexico to communities statewide. Opened in 1958, it has received several important upgrades in the last few years. This is the facility's 2nd year participating in the P2 Intern Program.

Project Descriptions:

The primary project this summer involved updating and automating the chemical feed used to disinfect cooling water in the cooling towers, and to prevent scaling and corrosion. This was a continuation of a P2 intern project completed last summer to replace the chlorine used for disinfectant with a less hazardous salt solution. The goal of this year's project was to reduce the amount of water used throughout the system.

The disinfectant system includes the NALCO 3D TRASAR chemical, which provides chemicals that inhibit scaling and corrosion, and the MIOX system, which produces a mixed oxidant solution that is generated onsite for disinfection. The 3D TRASAR technology provides real-time monitoring and management of chemicals. The upgrade will replace the current blend of a single line chemical feed to a three line chemical feed used for corrosion and scaling prevention, resulting in an increase the water's conductivity. This will allow for more cycles of concentration which leads to fewer blowdowns and the use of less water in the cooling towers.

The volume of blowdown water will decrease from 205 gallons per minute, to about 77 gallons per minute, a 36.6% reduction. This improvement will cost $30,000 to carry out with a payback period of 0.43 years. It would bring in a potential annual savings of $69,300.



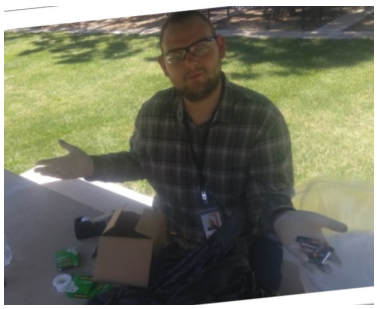
A separate project involved reviewing drawings of the water balance system and making updates to it where needed. This project can be continued to identify additional opportunities for water conservation at the plant.

PNM Resources - Environmental Services Dept.

Intern: Craig Gorum, Chemical Engineering (Senior)

Facility Description:

PNM Resources, Inc. is an investor-owned energy holding company based in Albuquerque, New Mexico. It provides electricity and electric services in New Mexico and Texas through its two utilities, PNM and TNMP. PNM and TNMP have approximately 2,787 megawatts of generation capacity and serve electricity to more than 761,000 homes and businesses in New Mexico and Texas.



Project Descriptions:

PNM Resources Environmental Services Department (ESD) wanted to focus primarily on projects that would improve management of solid and hazardous waste streams. These included:

- Assisting with completions of a mid-year waste audit by working with the internal Team Green's database and comparing 2015 to 2016 waste diversions. The purpose is to assess which facilities are on track to meet their diversion and recycling goals, and which ones the ESD needed to follow up with to determine how to help them get back on track.
- Creating recycling handbooks for each PNMR facility identifying local recycling options (in approximately 30 different cities) that include low-no cost solutions which meet compliance requirements.
- Creating a quick reference guide poster for how to deal with wastes properly. This "common waste streams" poster details proper "cradle to grave" management of about 20 different waste streams that PNMR commonly produces throughout their operations.
- Developing a customized guide for PNM facilities summarizing the Code of Federal Regulations regarding hazardous waste generation, storage, and disposal.
- Creating a waste shipment survey sent to the PNM facilities in order to better understand and track what types of wastes are being disposed of at each location.
- Developing a priority listing for PCB-containing transformers to be removed from service. Higher rankings are given to transformers with locations near schools and waterways.

Raytheon - Albuquerque

Interns: Jennifer Lew & Tyler Vertovec, Chemical Engineering (Seniors)

Facility Description:

Raytheon company utilizes technology and innovation to specialize in defense, civil government, and cybersecurity throughout the world. They have over 61,000 employees worldwide and re headquartered in Massachusetts. The Raytheon Missile Systems - Albuquerque facility participated in the P2 intern program for the first time this year; interns worked within the Environmental, Health, Safety and Sustainability department.

Project Descriptions:

Reducing the emissions of sulfur hexafluoride (SF_6) gas to improve site sustainability.

SF_6 is a potent greenhouse gas found to have a Global Warming Potential of 23,000 times that of CO_2 on a 100-year time horizon. It is commonly used as an insulator for high-voltage switchgear. Scientists at Stanford University estimate the economic impact of the emission of one ton of CO_2 at $220 which equates to $2,530 per pound of SF_6.

Processes and site projects were analyzed to identify sources of SF_6 and formalize monthly metrics. By collaborating with site project leads, it was possible to identify substitute gases, investigate gas reclamation products and re-purification processes, and explore recycling options.

SF_6 Reduction/Monthly Metrics

- 1 project will use SF_6 gas totalizer and report monthly to EHSS Team
- 1 project will report weekly scale weigh-ins to EHSS Team

SF_6 Elimination

- Project substituted Nitrogen for SF_6
- Lab now uses Helium for leak detection

SF_6 Reuse

- Obtained Vacuum Compressor Kit for total reuse of SF_6 in one project

SF_6 Recycling

- Airgas recycling services available

As a result, site emissions of SF_6 were reduced by 11% with a projected annual cost savings for materials of $3,220 and for environmental impact of $85,400.

Creating and categorizing a site-wide chemical inventory based on hazardous waste stream disposal codes.

Raytheon has dynamic products and services that often require new and different chemicals. By completing a chemical inventory, the EHSS team will have a current list of all hazardous wastes sources and their storage locations. An analysis performed on waste stream compositions could lead to reductions in the amount of hazardous waste produced. Further categorization of comingled waste by solid or liquid could lead to reductions of disposal containers.

Reviewing and updating all necessary environmental permits.

This task included helping prepare the NMED Hazardous Waste Report as well as mapping and updating hazardous waste satellite accumulation information. It required mapping and inventorying all site drains, sinks, containments, and sumps for wastewater and stormwater permits. Finally, all process equipment, refrigerants, and venting stack inventories were verified and updated for the air emissions permit.

Rio Rancho Public Schools - Facilities Department

Intern: Jonathan Ungaro, Mechanical Engineering (Senior)

RIO RANCHO PUBLIC SCHOOLS
Igniting Student Potential

Facility Description:

Rio Rancho Public Schools is the third largest district in New Mexico. With 1 preschool, 10 elementary, 4 middle, and 3 high schools. The Facilities Department is responsible for construction, maintenance, grounds, and custodial care of all district facilities. The department is also responsible for facilities long-range master planning and capital improvement projects.

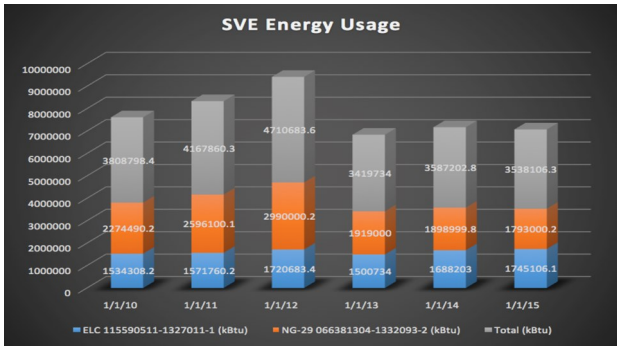
Project Descriptions:

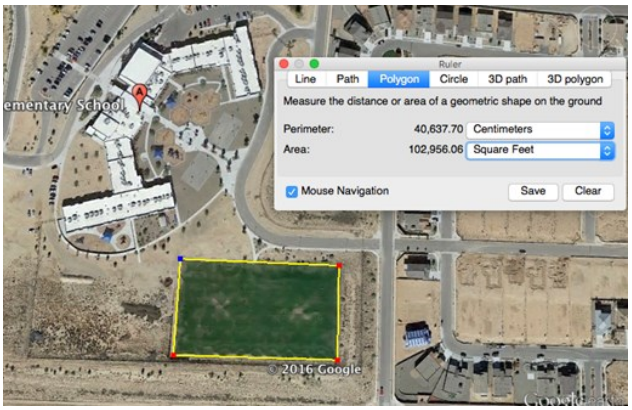
The purpose of this summer's work was to analyze the operation of all facilities district wide and to make recommendations for increases in efficiency. This included: data transfer from School Dude's Utility Direct platform to EPA's Energy Star Portfolio Manager; calculations of greenhouse gas emissions; opportunities for water consumption reduction; and ways to reduce the solid waste flow to the landfill. Several projects and analysis focused on measurements for one particular elementary school, Sandia Vista.

The District is in the process of developing a Sustainability Management Plan (SMP) and this project is part of the first phase of that process. Data analyzed this summer showed that efforts undertaken at Sandia Vista Elementary School from 2010-2015 resulted in a 15.9% reduction in GHG emissions, 25.5% reduction in energy usage per student, and a reduction of 511,000 gallons of water in one year. These success demonstrate the effectiveness of source reduction implementation at one school that can now be implemented at additional schools district wide. The SMP will help to set additional goals and help keep projects on track.

MATLAB software was used to calculate GHG emissions and reductions, primarily from vehicle and bus emissions. Busses already follow a no idle policy which potentially reduces CO2 by 9.4 metric tons at one school per year. Additional reductions of an estimated 48.5 metric tons CO2 can be met by implementing a private vehicle (drop-off/pick-up) no-idle policy at just one school.

Additional recommendations include further study into replacing athletic field turf grass with synthetic turf. Initial calculations show that an offset of 72.5 tons of CO2 would need to be found in order to make the replacement carbon neutral. However, water reduction of 4.5 million gallons per year could be realized for a 100,000 sq. ft. grass field replacement such as the field at Sandia Vista Elementary School.





Roadrunner Food Bank

Interns: James Romero, Mechanical Engineering & Sayf Ben Fraj, Electrical Engineering (Seniors)

Facility Description:

Roadrunner Food Bank (RRFB) of New Mexico began in 1980 and now has three sites, the largest being their 165,000 ft^2 food warehouse and distribution center with 60 full time staff and over 450 volunteers per week. RRFB is the largest food bank in the state and distributes more than 30 million pounds of food every year, helping 70,000 hungry people weekly. This is the facility's 2nd year in the P2 Intern Program.

Project Descriptions:

Projects at RRFB this summer expanded upon project work conducted during last year's P2 Intern program. The primary focus was reducing energy consumption. Areas contributing to the largest electricity consumption are the lighting, HVAC systems, and large walk-in freezer/coolers. Results show completed projects have helped reduce over 250 metric tons a year of greenhouse gas emission and helped lower the electrical consumption by over 340,000 KWh a year. As a result, the organization will be able to put more money in operations that help fight hunger in New Mexico.

For analyzing the facility's electricity consumption patterns, a sophisticated Excel worksheet was developed to calculate on/off peak consumption and peak demand as well as estimating the cost of electricity consumed. These figures can be used to help optimize use of the facility's 377 kW rooftop solar array and identify additional options for conservation. Interns worked closely with PNM energy efficiency program staff to identify and implement several conservation measures.

Low-hanging fruit energy efficiency projects implemented over the summer included installing two free VendingMisers and tune-ups on the HVAC systems through PNM's AC Tune-Up program to render the system 20% more efficient. Replacement of 120 fluorescent fixtures with LED fixtures, for a savings of 8.7kW demand, 22,048 KWh, and 15.5 metric tons CO_2 will be implemented soon. A lighting study of first floor, non-warehouse area was done to determine that some lighting fixtures could be completely removed and others replaced.

GHG reduction calculations were also made using EPA GHG Equivalency Calculator for the facility's solar array installed last year. In one year of use, the reduction is 241 metric tons of CO_2.

Other recommendations

- Optimizing defrosting cycles of walk-in freezer/cooler by shifting to peak solar energy production time and reduce peak electrical grid use.
- Develop an optimized charging schedule for forklifts and train employees on importance of policy.
- Install timers on all charging equipment to reduce phantom load after full charge.

New Mexico Pollution Prevention (P2) Internship Program

For more information about the P2 Internship Program,
to participate as an intern, or to participate as a host organization,
go to the program website at:

https://www.env.nm.gov/P2/InternProgram/index.html

Or Contact:

Jill Turner, P2 Program Manager
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