

The Environmental Audit of Lycoming College



Fifth Edition: April 2014

By Jocelyn Owens '15, Dacin Kemmerer '14, Emily Vebrosky '14, Samantha Hewitt '14, Lynette Dooley '15, and
Miranda Giraldo '15

Fourth Edition: April 2012

By Zebidiah Buck '12, Alyssa Tomaskovic '13, Laura Walter '13, Ashlynn Beacker '14, Chelsea Brewer '14, and
Samantha Hewitt '14

Third Edition: April 2011

By Megan Schulze '11, Brooke Gessner '12, and Alyssa Tomaskovic '13

Second Edition: April 2010

By Megan Schulze '11 and Nick Lansberry '11

First Edition: December 2009

By Tyler Hutson '10, Dan Cassidy '11, Bethany Herring '11, Emily Hopko '11, and Megan Runyon '10.

Supervisors: Dr. Mel Zimmerman and Dr. Ryan Adams

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Introduction

Colleges nationwide are changing the way their campus' needs are met in order to become more sustainable. As a progressive step forward, a comprehensive environmental audit was conducted at Lycoming College. The original audit was completed by five Lycoming students, Tyler Hutson, Dan Cassidy, Bethany Herring, Emily Hopko, and Megan Runyon, under the direction of Dr. Neil Boyd in 2009. The audit's potential as a living document, in which data can be added on an annual basis, made it possible for Lycoming students Megan Schulze and Nick Lansberry to complete the revised 2010 audit under the direction of Dr. Mel Zimmerman. Megan Schulze, Brooke Gessner, and Alyssa Tomaskovic then updated the audit again during the spring of 2011. The creation of the Lycoming College Sustainability Office in 2011 allowed for further revisions in the spring of 2012 by the Sustainability Coordinator, Co-coordinators, and Environmental Practicum students under the supervision of the office and Dr. Mel Zimmerman.

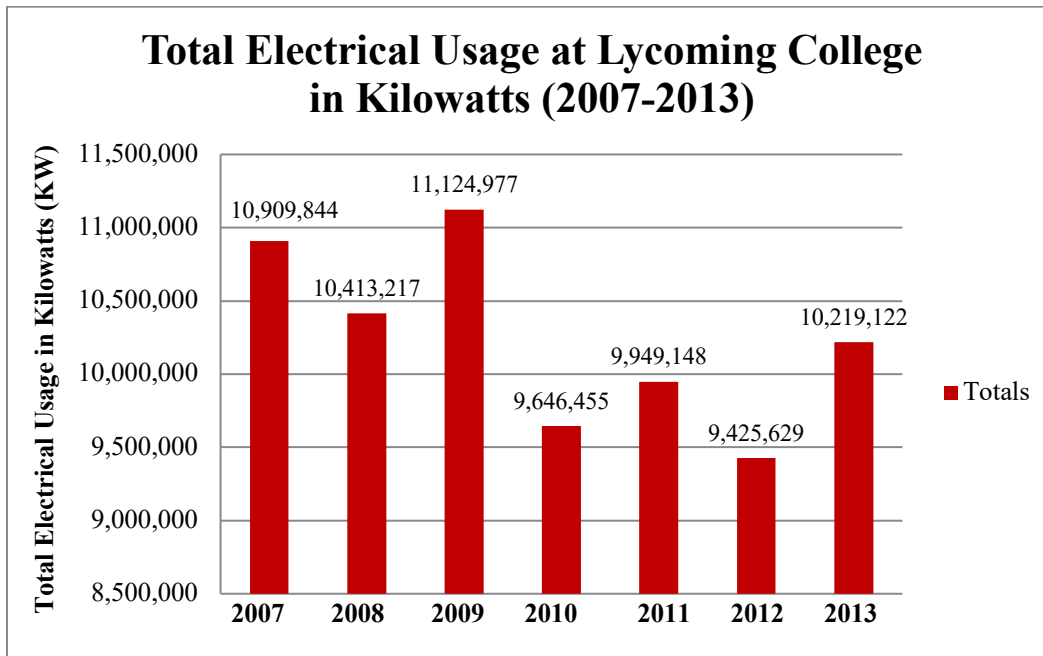
- ✦ The environmental audit incorporates data comparing recent energy use, utility costs, water consumption, solid waste composition, natural gas consumption, and information regarding any recycling and sustainability efforts.
- ✦ **The Lycoming College Environmental Audit provides a baseline from which rolling improvements can be measured. The audit is intended to be a “living document” and will be annually updated as further data is collected.**



Current Electrical Energy Usage:

Lycoming College currently purchases its electricity from PPL Electric Utilities Corporation. A billing analysis has been used to create an energy use profile of the college to document each

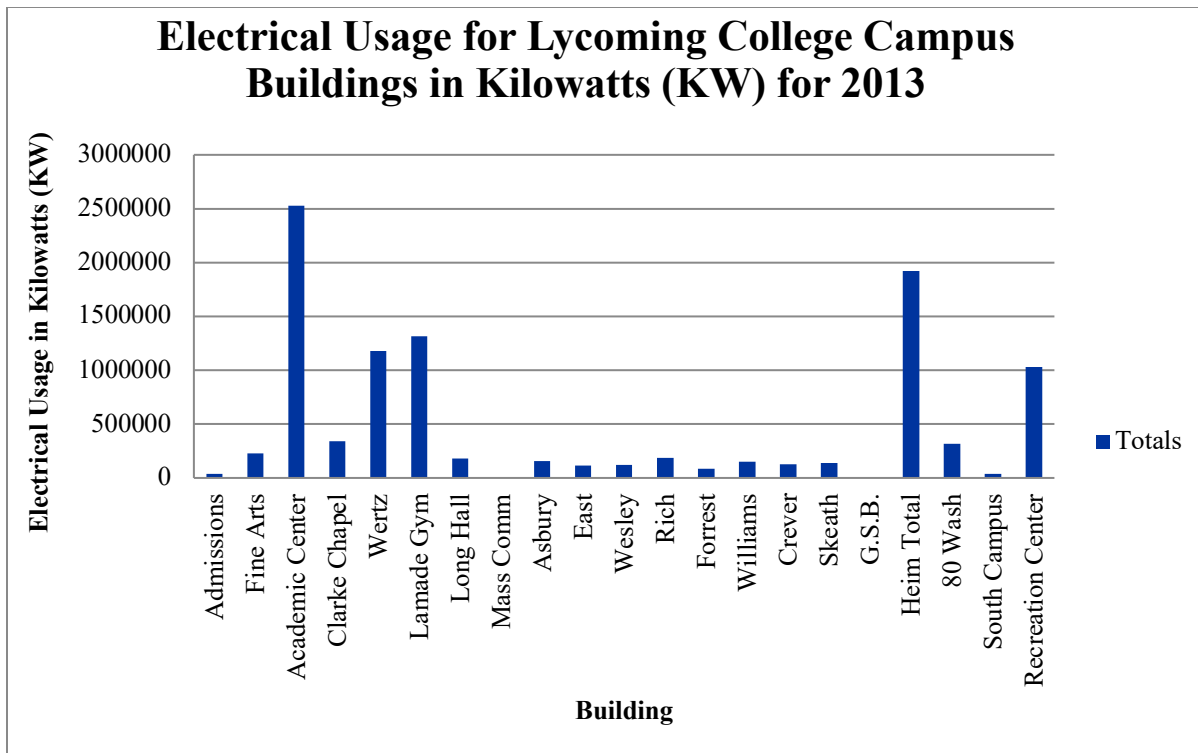
building on campus. The following tables show trends that were observed from the years 2007 to 2013. Using this data, a correlation can be made to determine the highest energy consumers on campus, which can yield information concerning which buildings are the most expensive to maintain. Hopefully, with careful review of this data, efforts can be made across campus to reduce energy consumption in response to rising energy costs.



*Yearly data for future years are not complete and will be available in an updated audit.

The major energy decrease that can be seen from 2007 to 2008 can be accredited to a modification of the previously wasteful sprinkler system in the Heim Building, which is used to cool the compressors. The compressors run on full power, every day, and the new efficient chiller is operating at lower power throughout the day instead of at 100% in order to save energy. In 2009, a major upgrade was done to the compressor in the Heim building, and the library reduced the lighting on the third and fourth floors by using every other light rather than full lighting, particularly on the weekends when there are not many students using the library during daytime hours. The changes made to the compressor and Snowden’s library system can account for the steep decrease in electrical usage that can be seen between the years 2009 and 2010.

The following graph shows a comparison of the total electrical usage of all of Lycoming College’s campus buildings for the year 2013. As can be seen, the Academic Center, Heim, Lamade Gym, Wertz, and the Recreation Center are the highest contributors to electrical consumption. Snowden Library however, is the primary reason why the Academic Center used as much as 2,528,256 KW in 2013.



* Table showing a comparison of total electrical usage for Lycoming College campus buildings for the year 2013.

The Snowden Library is a major contributor to Lycoming’s electrical usage because its lights on all four floors are kept on for sixteen hours every day, throughout the week. In an effort to reduce the library’s electrical output, Buildings and Grounds recently removed half of the lighting tubes on the third and fourth floors, which effectively reduced about one quarter of the lighting in the entire library. Prior to the removal, there were 3,200 tubes in the library and of these, 800 were removed, which was a sustainable action that allowed the library to run at 25 W instead of 50 W. This initiative saved Lycoming College about \$6,000 per year, and with the current energy hike, that is equivalent to approximately \$12,000 per year.

See appendices [1, 5, 9, 10, and 13] for a more complete summary of data, charts, and graphs for electrical energy consumption.

Natural Gas

Lycoming College used to purchase all of its natural gas from UGI Utilities, Inc., a natural gas and electric utility company headquartered in Reading, Pennsylvania. The company is a wholly owned subsidiary of UGI Corporation, which is located in Valley Forge, PA. However, in 2010, Lycoming switched to purchasing natural gas from the Hess Corporation because their prices vary with market costs, making the decision an economic benefit to the college. The school has the ability to consolidate its usage totals from all of the buildings on campus that use natural gas so gas is now purchased in MCFs (1000 cubic feet) rather than CCFs (100 cubic feet), which provides the institution with an overall price. However, all natural gas data included in the Environmental Audit is calculated in, and referred to, as CCFs, not MCFs.

Below is a brief summary of the 2008 – 2009 natural gas totals for Lycoming College as a whole:

2008

Used 568,311 CCFs of gas costing \$727,110.753

2009

Used 391,264.96 CCFs of gas costing \$504,737.42

The decrease of natural gas from 2008 to 2009 can be attributed to the exceptionally cooler temperatures experienced in 2008. Colder weather often results in an increased need for gas to heat buildings on campus, which is why the CCF value and the corresponding bill price may have been higher than the measurement and price listed for 2009. The 2008 chill was felt throughout the northeastern United States in addition to Williamsport, PA, and as much as a 4-6° drop in average temperatures between January and March of that year occurred in that area.

Lycoming College, to compensate for the increased usage of natural gas, reduced the temperatures in the dormitory buildings (East, Wesley, Williams, Forrest, and Asbury) by 10° (68° to 58°) during the 2008 winter break. In a further attempt to reduce gas and energy costs, the current college policy is to reduce the temperature in those dormitories during future winter breaks.

See appendices [4, 8, 9, 12, and 15] for a more complete summary of data, charts, and graphs for natural gas consumption.

Renewable Energy Initiative:

Solar

Lycoming College's involvement in the solar program began after Dr. Mel Zimmerman and Clean Water Institute interns, Megan Schulze '11 and Tracie Curtis '09, attended the Solar Scholars Conference at Dickinson College to learn more about the advantages of solar energy. Attendance at this conference, hosted by the Sustainable Energy Fund, led to a competitive grant process involving institutions that were interested in receiving a grant for a 3.1 kW Photovoltaic (PV) system. After applying for the \$15,000 opportunity amidst competition from thirty-six other colleges and universities, Lycoming was one of twelve institutions to be awarded the grant. On November 12, 2009, a 15-panel Photovoltaic (PV) system was installed on the roof of the Heim building and the electrical output began to be monitored.



According to Eduardo Lorenzo, author of "Solar Electricity: Engineering of Photovoltaic Systems," the method employed uses semi-conductors, usually consisting of silicon, to capture solar rays. The rays captured consist of photons, whose bonds are broken, which allows the

photons to move around freely to create an electrical current that can be transmitted into an electrical system and subsequently, monitored.

The solar photovoltaic system output in 2010 was compared with the energy demands needed to run equipment, not including lights, in three of the Clean Water Institute laboratories. Room 112 houses a refrigerator and two incubators (1.021 kWh), room 105 contains a 150 gallon saltwater tank with a separate emergency circuit (0.972 kWh), and room 120 has two incubators (0.240 kWh). On average, these labs require 1.909 kW per hour, 45.816 kW per day, and 1393.57 kW per month. As of March 5, 2012, the total output of the solar photovoltaic system since its November 12, 2009 installation is 8369.9 kWh, and it is estimated that the PV system offsets the equipment energy demand by approximately 40%.

Power:	2688 W
Daily Yield:	7.19 kWh
Total Yield:	8369.9 kWh

Above: Table showing the power wattage, daily yield, and total yield that is generated by the solar panels. Due to a computer problem with the Sunny WebBox, an update for the Total Yield could not be given for this audit but it is hoped that for the next audit an update will be available.

In the future, Lycoming will be looking into finding more grants and support for other solar power projects such as water pumps for the campus swimming pool and solar recycling compactors. The solar recycling compactors and possibly even solar composting units would be a perfect addition to campus because its small size inhibits the effects of smaller scale projects. These two projects would be ideal to use as sustainability teaching tools for educating students, faculty, and the community.

Side Photo: The 3.1 kW Photovoltaic (PV) System on the roof of the Heim building.



Biodiesel

Biodiesel is manufactured from used cooking and vegetable oils and serves as an efficient form of alternate fuel that can be used in diesel engines. Biodiesel is steadily gaining more popularity in the “Green Revolution” because it reduces carbon dioxide emissions from vehicles by providing cleaner burning power. In addition, biodiesel is a cheaper alternative to the diesel used to fuel today’s vehicles.

The first diesel engine was designed and later built by Rudolf Diesel in 1897, and his model was unique because it was meant to run entirely on peanut oil. Diesel's innovation made his model the first successful biodiesel engine ever built. Lycoming College's own Kyle Ruhl '11 and Chandler Couch '11 led the way to using "green" fuel by building a filtering and purifying system to convert the campus' used cooking oil into effective and useable fuel. Kyle began working with biodiesel to fulfill the needs of his senior project and also to manufacture fuel that he could use for his car. The oil that is recovered from the cafeteria is first added to a large tank, heated up, and filtered to remove any water and excess food particles. Next, the oil is heated to about 350 ° and in previous years, methanol and sodium hydroxide are added to slightly alter the chemical structure of the oil. After this process, excess methanol is recovered for later use and a glycerin byproduct is removed from the crude fuel. Water is then added to the tank to wash the fuel and dissolve the small particles of unused additives. Any excess water is then bubbled out using ordinary air leaving only the final product. The glycerin byproduct can be used as an effective compost contributor, or can be made into a truly "green" soap.

The amount of oil that is used is directly proportionate to the amount of fuel that is made, and a large part of the biodiesel operation is relatively cheap to build and maintain. The biodiesel project has received monetary support in the past including five hundred dollar donation from the college and a one thousand dollar donation from an outside source. The money was used primarily for the maintenance of items such as dry wash filters and screens that are used to remove excess food particles from the oil. Kyle and a few other Lycoming students and staff attended a conference at Dickinson College in the spring of 2010 to learn more about biodiesel and how college campuses can be made more environmentally sustainable.

Emily Vebrosky '14, our Sustainability Coordinator, is now in charge of producing biodiesel that is made from local canola oil that is purchased by dining services from the Susquehanna Mills Co. Farm. Any excess canola oil is then collected and treated with potassium hydroxide, rather than sodium hydroxide due to a problem with the chemical clogging the pipes, to make methoxide through a transesterification process. Any biodiesel that is produced in the shed on Willow St. is then given back to the Susquehanna Mills Co. for use on their farm.

Side Photo: The biodiesel project located on Willow Street.



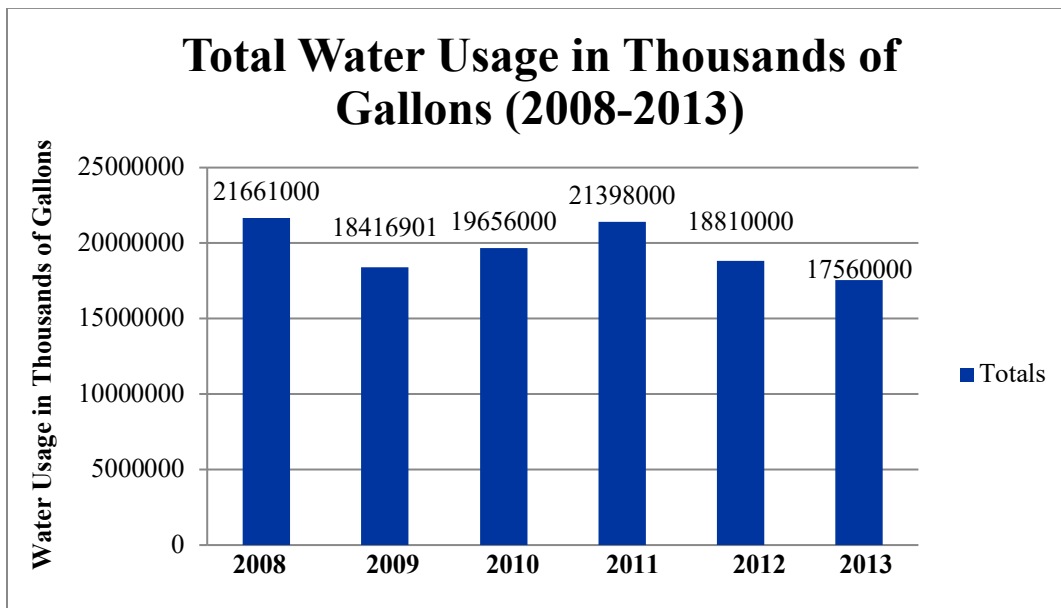
Water

Lycoming College is provided with its water by the Williamsport Water Authority, a facility that extends its services to over 51,000 residents living in Williamsport, South Williamsport, Duboistown, Loyalsock Township, and Armstrong Township. The plant filters water from two,

six hundred and fifty million gallon reservoirs as well as groundwater as needed during periods of drought from a field along the Susquehanna River. The Williamsport Water Authority publishes a yearly update of their drinking water quality, which can be found on their website: www.wmwa-wsa.org/waterquality.htm.

Lycoming College currently has three active wells that are set aside for watering and lawn maintenance. One of the wells is located at the practice field located on South Campus, and the second is located by the graduation steps on the quad. The largest of these wells is located at the stadium, and it is used the most frequently to irrigate the football field, practice fields, and the softball field. The college also has a fourth well that is not currently in use and it is located between Forrest Hall and the Heim building.

Sustainability has been a goal for the college, and in an effort to conserve water, meters have been installed in every building to monitor water consumption, and more efficient showerheads and toilets continue to be installed in every building. The showerheads that have been installed in the dormitories are 2.5 gallons per minute (gpm) and the toilets range from 1.6 to 3.5 gallons per flush (gpf). As the older 3.6 gpf toilets break, they are being replaced with more efficient toilets. In the past, students have removed the Energy Saver showerheads and replaced them with larger and less efficient showerheads, which has resulted in higher water consumption. The energy-saving potential of more efficient showerheads like the 1.5 gpm Earth Massage low-flow showerheads Duke University gave away to its faculty, staff, and students in 2007 is unquestionable. It is estimated that Duke's sustainable initiative saves 7,300 gallons of water annually (Patrick et al. 2008), which is all the more reason why Lycoming's future endeavor to install more low-flow showerheads, toilets, and faucets should be actively pursued.



*Yearly data for 2014 are not complete and will be available in the next updated audit.

A five year problem involving the 190,000 gallon pool in Lamade Gymnasium resulted in a considerable water loss, but Don Cook of Don Cook's Scuba Equipment was able to resolve the issue by diving to the bottom with a spray bottle containing colored dye that helped find the source of the leak. His success led to its repair in 2008, which explains the significant drop in water usage that was encountered in 2009.

In the fall of 2011, the Sustainability Office initiated the “Flip It Off” campaign in an effort to conserve water. As a part of their campaign, the committee encouraged students to turn off lights, appliances, electronics, and faucets when not in use.

See Appendices [2, 3, 6, 7, 11, and 14] for a more complete summary of water usage data, tables and charts.

Sewage

The Williamsport Sanitary Authority (WSA) treats all of Lycoming College’s sewage. The WSA maintains two secondary wastewater treatment plants, the Central Plant and the West Plant. The Central Plant serves residents living in the Williamsport area lying east of Lycoming Creek, eastern Loyalsock Township, South Williamsport, and Armstrong Township. The West Plant on the other hand, serves customers residing in the Williamsport area lying west of Lycoming Creek, portions of Old Lycoming Township, Loyalsock Township, Lycoming Township, and Duboistown. It is estimated that approximately 10.5 million gallons of water per day (mgal/day) passes through the Central Plant and 5.5 mgal/day of water passes through the West Plant. Lycoming College’s sewage goes directly to the Central Plant near Basin Street.

A \$125 million upgrade of both the West Plant and the Central Plant was mandated by the Environmental Protection Agency and the Department of Environmental Protection in an effort to reduce nitrogen and phosphorus discharge levels to the Chesapeake Bay and to also reduce the frequency and severity of combined sewer overflow systems (CSOs). Modifications to the West Plant began in 2000 and were recently completed sometime between 2011 and 2012. The West Plant upgrade was meant primarily to reduce the discharge severity of combined sewer overflows, but nitrogen removal capabilities were also incorporated into construction. The Central Plant however, is still in the process of being upgraded and construction is focused primarily on reducing the nutrients, namely nitrogen and phosphorus, that are discharged to the Chesapeake Bay. However, there is also hope that the upgrades being made to the Central Plant will help to reduce combined sewage overflow events that occur during heavy rains. Combined sewage overflow has detrimental effects to the health of the Chesapeake Bay because storm water that comes into contact with roadways and sidewalks can transfer raw sewage directly into the West Branch of the Susquehanna River. The upgrade of the Central Plant in particular, is a proactive move that reduces nitrogen concentrations in the West Branch as a part of the Chesapeake Bay initiative and has had success in lessening a factor that has had so much of an effect on the bay.

The upgrades to both plants have improved nitrogen and phosphorus discharges, which could help the bay to recover by reducing eutrophication that can lead to “dead zones” with low levels of dissolved oxygen that has been detrimental to many macroinvertebrates, fish, crabs, and other fauna. A brief summary of the nutrient improvements can be seen in the following:

Nitrogen Discharge Improvements as a Result of Combined Plant Upgrades

Combined Nitrogen Discharge 2010-2011	Nitrogen Discharge in 2013 (first nine months)	Permit Level of Nitrogen Discharge
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602,251 lbs	189,443 lbs	230,970 lbs
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* This table shows that as a result of the combined plant upgrades, the nitrogen discharge is now under the mandated permit level.

Phosphorus Discharge Improvements as a Result of Combined Plant Upgrades

Combined Phosphorus Discharge 2010-2011	Phosphorus Discharge in 2013	Permit Level of Phosphorus Discharge
54,017 lbs	28,755 lbs	30,002 lbs

* This table shows that as a result of the combined plant upgrades, the phosphorus discharge is now under the mandated permit level, but could still use improvement.

On March 27, 2013, the Williamsport Sanitary Authority signed a sales and service agreement to acquire and maintain the sanitary collection system that was previously owned by Loyalsock Township. The purpose of the agreement is to direct finances onto purchases and investments that are more important to sanitary treatment by reducing administrative costs and unnecessary operational costs and equipment purchases.

Ultimately, the upgrade of both the West Plant and the Central Plant may lead to a reduction in the rate customers pay for sewage treatment. Over the past five years, in particular, rates imposed to customers have been high in order to fund the construction of the two upgrades. According to John Baker, the authorities' director of finance at the Williamsport Water Authority, "On average, a household using 52,000 gallons a year pays \$808 annually" (Maroney, 2013). Until all nutrients credits are purchased and other costs involving the operation, administration, and construction of the upgrade are handled, budget costs are expected to remain high. According to Doug Kuntz from Buildings and Grounds, the campus is currently paying 1.5 cents per gallon for domestic sewage and water for the years 2013 and 2014.

The Lycoming College Clean Water Institute (CWI) has participated in an educational effort in the city of Williamsport to encourage the public to not dump materials down storm water drains. Storm water that contains materials like trash, grease, grass, and motor oil is not treated like sanitary waste water and many residents are not aware that the harmful chemicals contained in these substances are carried to the Susquehanna River, and eventually to the Chesapeake Bay. In Williamsport, there are 13,000 storm water drains, with one hundred and ten of these located in and around the campus of Lycoming College. In the past, CWI interns were engaged in a storm water stencil project to warn the public to not dump down storm drains and to promote awareness about how harmful chemicals from wastes find their way back to the Chesapeake Bay.

Dining Services:

There is a focus on the food sector of the College in this audit to determine where our food comes from and how much of it is organically and locally grown. Buying from local farmers strengthens the economy of the local community by cutting down the travel time it takes food to arrive to dinner tables.

Lycoming College outsources its food services to Parkhurst Dining, a company whose commitment to sustainability is a leader in the industry. While most of Lycoming's food comes from USFood's distribution center in Altoona PA, Parkhurst also purchases food nationwide, much of which is bought locally and in various other areas of Pennsylvania. According to Leslie Ekstrand, the General Manager of Dining Services, milk is purchased from Schneider Valley Farms distribution center, located on Third Street in Williamsport, PA. Schneider Valley Farms, in turn, purchases its milk from farmers in Pennsylvania and New York. Bread and buns are purchased from the Bimbo Bakery branch in Northumberland, PA, sub rolls are purchased from New Lycoming Bakery in South Williamsport, PA, and bagels are purchased from Georgie's Bagels in Berwick, PA. In season local vegetables are purchased from Pocono Produce in East Stroudsburg, PA and in season apples, peaches, and pears are purchased from Dries Orchard in Sunbury, PA. Canola oil is purchased from Susquehanna Mills Co. in Montoursville, PA. The oil provided by this company is converted to biodiesel in a processing shed located on Willow Street in Williamsport, PA, and later returns to the Susquehanna Mills Co. to be used as fuel on the Susquehanna Mills Co. farm. Pork products are purchased from Clemens Food Group in Hatfield, PA and ground beef is purchased from Milky Way Farms in Troy, PA. In addition, the purchase of farm shares from Walnut Run Farm located in the Nippenose Valley in Lycoming County, PA has been considered. Walnut Run Farm is a local farm specializing in the producing of vegetables like artichokes, cucumbers, onions, beans, beets, carrots, tomatoes, lettuce, squash, and more. Efforts are made to purchase from local sustainable farms whenever possible, and Lycoming College Dining Services currently purchases around 20% of their overall purchases from vendors that are considered local, or are within 125 miles of the college.

Sustainability efforts have also reached Lycoming College's other dining locations like Jack's Corner and Café 1812. Jack's Corner is making an effort to transition from using aluminum foil to waxed paper to wrap food that is taken out by students, but hasn't fully made the switch. In the future, the establishment hopes to eradicate its use of aluminum foil all together. According to Jay Breeding, the Assistant Director of Dining Services, plates that are now used are tree-free and to-go containers are made from corn and are biodegradable. Management is currently working on replacing Styrofoam cups with cups made from more sustainable materials. However, Jack's is required by the company that makes the Freshens smoothies to keep the Styrofoam cups for its smoothies. Café 1812, which is a small establishment that serves Starbucks products to students and faculty, uses earth friendly cups for its drinks. Additionally, Café 1812 and Starbucks participate in the Fair Trade Agreement with coffee bean farmers who will only buy coffee beans from sustainable farms, or farms that are working towards becoming sustainable. The business is actively involved in sustainability by serving organic coffee, and recycling paper products like soup bowls, bakery bags, coffee bags, and plastic products like milk cartons. In an effort to encourage sustainability on campus, the establishment offers a discount on regular coffee if students bring their own reusable cup.

Dining Services has been striving to become environmentally sustainable through its catering practices and efforts are being made to replace plastic ware with chinaware and to suspend the use of plastic utensils. There have even been considerations to buy recyclable utensils and/or "spudware," utensils made from potatoes! For instance, the sustainability sector at the University of Wisconsin-Green Bay has utilized biodegradable dishware that is made of corn, potatoes, and limestone (Patrick et al. 2008). However, plastic utensils are still used occasionally and these goals have not yet been reached.

At the beginning of the spring 2014 semester, dining services introduced the Reusable To-Go Container Program as a way to reduce waste and promote campus sustainability. The program

replaced unsustainable plastic containers with containers that are washable. Prior to the implementation of this program, it is estimated that Lycoming disposed of approximately 1,500 to 1,700 plastic containers weekly and 24,000 containers throughout the semester. Currently, there are six hundred “green” boxes that are being distributed in the cafeteria, all of which that are washable, reusable, and responsible for reducing the waste existing prior to the spring semester. The program, despite being received with mixed feelings, is a convenient and easy system for students, especially if they are on a meal plan. Students using a meal plan can simply ask for a to-go box, use it, bring it back to Wertz to be washed, and receive a “green box ticket” that enables them to obtain another box. Commuter students or visitors who are not using a meal plan must pay \$4.50 for their first box and must return the box to the cafeteria to be washed. According to Leslie Ekstrand, the General Manager of Dining Services, approximately 100 to 125 students ordered take-out prior to the implementation of the Reusable To-Go Container Program and currently, around 110 to 140 students ask for take-out with the “green” boxes. Based on these statistics, Ms. Ekstrand does not believe that the boxes are having any effect on student to-go practices yet, perhaps due to students’ difficulties with handling change.

In February of 2014, dining services entered a partnership with Northern Tier Sustainable Meats, a consortium of local beef organizers brought together by Kim Seeley of Milky Way Farms in Troy, PA. Kim Seeley established Northern Tier Sustainable Meats in 2005, and since its establishment, it has offered customers a local, sustainable, and convenient way to purchase a variety of meats including pork, ham, and beef. Founded in 1962 by Lewis Seeley, Milky Way Farms is currently operated by the 4th generation of the Seeley family to produce beef from grass-fed cattle. In addition to producing beef from livestock that are grass-fed rather than corn-fed, the Seeley family also practices pesticide-free farming, pasteurizes and bottles milk at the farm rather than at a plant, and sustainably produces other dairy products like butter, heavy cream, ice cream, and cheese. By being local, Milky Way Farms reduces packaging and travel costs normally associated with factory processing by selling its products directly through its Milky Way Store, as well as through Penn College of Technology, Bullfrog Brewery, and the Peter Herdic House in Williamsport. The partnership between Dining Services and Northern Tier Sustainable Meats is an environmentally friendly decision that reduces travel costs, saves oil, and gives students meat that is more likely to be higher in nutrients.

In the future, it is a hope that reusable to-go cups can be incorporated into dining services’ sustainability practices alongside the reusable to-go boxes. Currently, the Student Senate is working in partnership with the Sustainability Committee to help launch this new program. The waste that is generated by the current to-go cups is approximately 6,000 to 8,000 cups weekly, which adds up to around 96,000 cups throughout the semester; a staggering amount of waste surmounting the waste produced by the plastic to-go containers. This new program would essentially serve the same purpose as the Reusable To-Go Box Program, in that students would receive a to-go cup at the beginning of the academic year that they would be responsible for bringing to the cafeteria each meal. However, this program differs because students are required to wash their own cups, which has raised concerns from the student body about the possible spread of germs that would result from improper washing and constant use. Nevertheless, the benefits of the program could outweigh its costs. Mount Holyoke College’s “sustainable mug” program has saved them approximately 31,000 gallons of water and 5 tons of paper, a staggering amount of material that was used in the manufacture of the 322,700 paper cups used by the college annually. These statistics, despite being from another establishment is significant, considering that Lycoming College uses around 200,000 to-go cups a year. Therefore, the implementation of this program would reduce campus waste, but may also work to reduce water and paper that may be required for the manufacture of the cups previously used.

Food Waste

Dining Services has been changing its own policies in the last few years in an effort to become more sustainable. The tray-less initiative, which dining services introduced in the 2008-2009 school year, was one a notable change that helped to reduce food waste and water usage. First, trays were not used on Tuesdays and then, an additional tray-less day was added each week until trays were no longer available. The purpose of the tray-less dining hall is to:

- 1) Reduce the amount of food waste produced
- 2) Decrease the amount of water going into and out of the Wertz Student Center
- 3) Reduce the amount of electricity used in running the dishwashers
- 4) Decrease the amount of dish washing chemicals that are purchased and wasted

As a result of this initiative, dining services was able to reduce the amount of food waste that is comparable to that which is produced by eight, fifty gallon trash cans, and water usage by about 360,000 gallons per semester.

All campus wastes are disposed of at the Lycoming County Landfill. Prior to 2014, all food waste was mixed in with other solid wastes from around campus and was measured in tonnage. Because of limited space, there were no dumpsters outside of the Wertz building and each day, food waste was refrigerated in order to reduce odor and insect problems. The waste was then transported to the county landfill for disposal.



Above: Samantha Hewitt, Emily Vebrosky, Lynette Dooley, and Dacin Kemmerer with collections of food that will be donated to the American Rescue Workers.

However, in January of 2014, the Sustainability Committee launched the Food Recovery Network, an organization that assists colleges in collecting food from dining halls and other campus dining facilities to donate to local food banks and soup kitchens. This new initiative was

made possible by the Bill Emerson Good Samaritan Act, which helped to cover any liabilities, and a grant that covered the cost of the containers that were used to transfer food. Collections are made by volunteers and members of the Sustainability Committee Monday through Friday and are delivered each week to the American Rescue Workers. The Food Recovery Network is a new organization that seems to have much promise for lowering food waste from campus and for helping the local community.

Food Waste & Hunger Summit

The weekend of April 5 and 6 at Northwestern University in Evanston, IL marked the first annual Food Waste & Hunger Summit, which was co-hosted by the Campus Kitchens Project and the Food Recovery Network. The conference served to gather student leaders who have worked to reduce food waste in their own communities in an effort to educate and introduce them to new ideas relating to the reduction of food waste and problems concerning food insecurity. Students attending the conference listened to a variety of experts from fields relating to social justice, social enterprise, public health, and non-profit management in order to learn more about how they could work more efficiently with their local communities.

The Campus Kitchens Project (CKP), a co-host of the event, provides community service for students that focuses on hunger relief through the development of models that are used to combat hunger in the students' local communities. In other words, the project aims to build strong leaders out of high school and college students alike, by encouraging them to develop solutions to problems they encounter in their schools and their towns and cities. The Campus Kitchens Project works to help communities help themselves by building leaders who are capable of developing solutions to poverty and food waste. The overall mission of the Campus Kitchens Project is to strengthen bodies by using existing resources to satisfy the hunger and nutritional needs of the community, empower minds by providing leadership opportunities for students and educational benefits for adults, and to build communities by building a network of partnerships among students, schools, and businesses. Currently, fifty-two schools, including Lycoming College, are involved in the Campus Kitchens Project and are actively involved in a food reduction program like the Food Recovery Network at their institution.

In the spring of 2014, three Lycoming students, Emily Vebrosky '14, Lynette Dooley '15, and Julian Jones '16, attended the Food Waste & Hunger Summit conference in Evanston, IL. Throughout the entire semester, the Sustainability Committee has been working alongside LEAF and student volunteers to recover leftover food from the cafeteria every Monday through Friday after lunch and dinner. The food that is recovered is then donated to the American Rescue Workers in Williamsport, PA. As of April 7, 2014, the Sustainability Committee at Lycoming College has recovered 5,000 lbs of food from the cafeteria to be donated. The impact this has on the community is unquestionable, and the college will undoubtedly continue participating in the Food Recovery Network in the future.



Above: Students, Julian Jones '16, Lynette Dooley '15, and Emily Vebrosky '14 at the first annual Food Waste & Hunger Summit held at Northwestern University.

Kitchen Appliances

In an effort to make the campus more sustainable, employees have been urged to turn off their appliances after they are finished using them. This request to Lycoming's workers to "Flip it Off" has been of particular importance because the majority of the appliances on campus are at least thirty years old. However, outdated appliances are gradually being replaced with newer, more energy efficient appliances as they wear out. In 2009, Dining Services made the switch to a more sustainable, electric gas oven. Electric gas ovens contain no pilot light, spark and light on demand, and are better insulated; qualities that all work to reduce cooking time. Many light fixtures have begun using Compact Fluorescent Light (CFL) bulbs with special care being taken to not use CFL bulbs on lights that are used to warm food. Dining services management also tracks the costs of equipment repairs in comparison to the original cost of the equipment to determine whether or not it would be more cost effective to replace that piece of equipment with a more sustainable model. The most energy consuming appliances in the kitchen are the dish washer, bakery oven, and the coolers and freezers. The dish washer generates a high amount of energy because it runs constantly is fueled by steam-generated water pumps. The bakery oven generates a large amount of energy because it is continuously rotating, and the coolers and freezers owe their high energy to the fact that they are continuously running for twenty-four hours throughout the entire week.

Other Initiatives

Parkhurst Dining Services, in addition to purchasing its food from local farmers, working to reduce food waste by participating in the Food Recovery Network, and helping to reduce energy by turning off appliances when not in use, is helping with environmental sustainability in other ways. Parkhurst is working with the school to convert used fryer oil into biodiesel fuel for use by the Susquehanna Mills Co. farm. Cardboard products are currently being recycled, and efforts are being made to find available space to recycle more plastics. During the 2008-2009 school year, dining services replaced individual ketchup bottles on each table with a condiment station containing fast food-style pump dispensers. In addition to this, bleached napkins were replaced with napkins made from post-consumer recyclable materials.

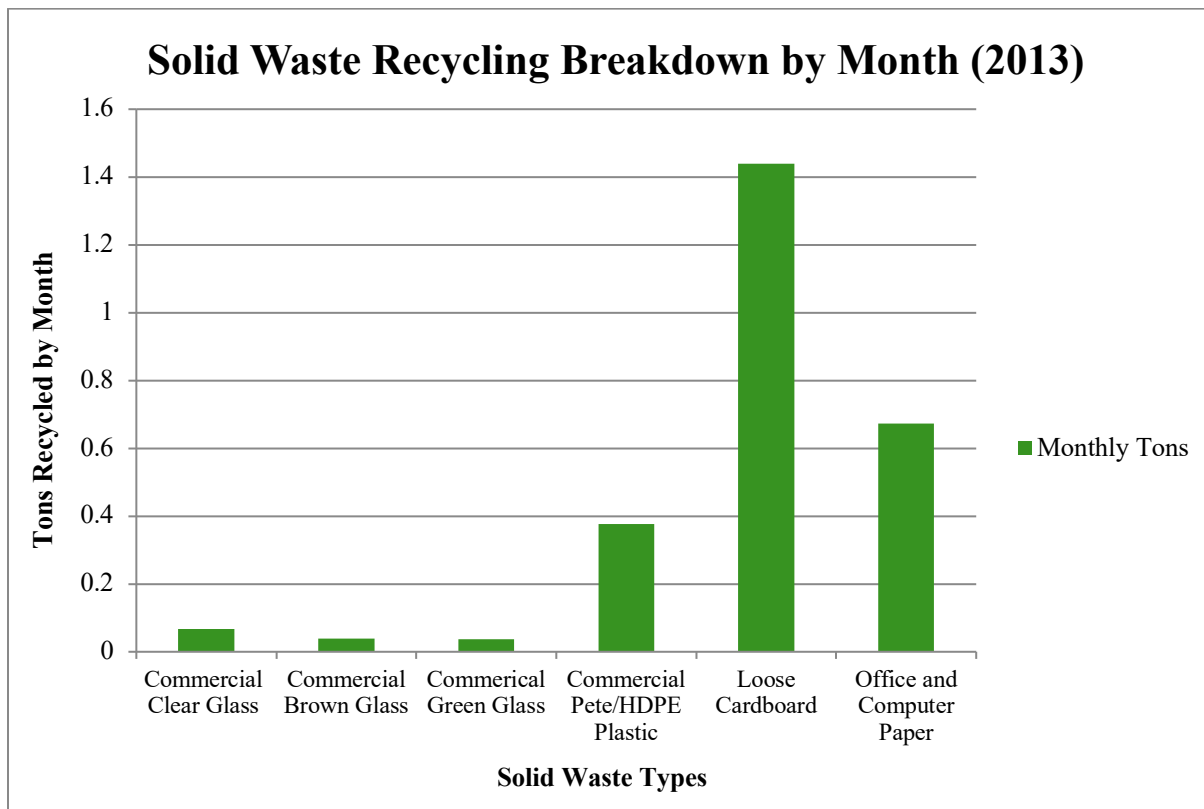
Parkhurst and Lycoming College's Building and Grounds staff are looking into more ways to recycle the large volume of cans and plastic bottles that are generated every week by the college. Currently, the cans and plastic bottles are picked up each day and sent to recycling by the building and grounds crew.

Solid Waste:

All solid waste that is generated at Lycoming College, except that which is recycled, is collected by Fred Hamm Inc., which serves Lock Haven, Jersey Shore, Williamsport, and surrounding areas in Pennsylvania. The collected waste is then disposed of at the Lycoming County Landfill in Montgomery, PA.

The Lycoming Landfill is located just off of Route 15 on property leased from the Federal Bureau of Prisons and is the only municipal landfill in Pennsylvania, serving mostly Lycoming and Union counties; no out-of-state waste is accepted. The landfill receives about 1,100 tons of municipal solid waste per day and is the home to an extensive county-wide recycling program that offers biweekly curbside pick-up and generated approximately \$1,618,544 in revenue from the sale of recycled materials in 2008. The Lycoming County landfill is a Cogeneration plant, which means that they generate electricity and useful heat while simultaneously using power to generate their facility. In fact, they generate enough electricity to power about 1,400 homes and provide hot water to all on-site buildings without having to use fossil fuels. Lycoming College is proud to call the Lycoming County landfill their definitive waste receivers because they are one of the most environmentally-minded landfills in Pennsylvania.

Recycling is collected by the landfill every Monday and Wednesday, and a breakdown of the tonnage of recyclables collected monthly for 2013 can be seen in the following graph:



* Table showing monthly breakdown of recycled solid waste for 2013. Previous years are not included in the audit but may be included in later audits.

As seen in the graph, the most recycled item was loose cardboard at 1.44 tons per month and 17.27 tons per year. The next highest recycled item was office and computer paper at 0.673 tons per month and 8.07 tons per year. Lastly, the third most frequently recycled item was commercial Pete/HDPE plastic at 0.377 tons per month and 4.52 tons per year.

TerraCycle

Natural resources like water, timber, air, and even raw materials used for processing seem inexhaustible at times, but in reality, are diminishing in quality and amount as unsustainable waste practices persist. Waste, if not recycled, is typically disposed of in a landfill where it poses a risk of leaching chemicals into the soil and contaminating groundwater. If the waste is incinerated however, a more serious danger could arise in the form of dioxin, a persistent chemical that has been seen to cause cancer and other health effects. Recycling is practiced on campus regularly, and requires that material be extracted from an item in order to transform it into a new product. Recycling is an effective way to reduce waste and is undoubtedly a better option than disposal in a landfill or incinerator. However, upcycling is a revolutionary technique that reduces even more waste by using every aspect of the item in order to make a new product. Two factors that are central to TerraCycle processing are the material the item is made from and the shape of the item. The program will then use the material and shape of the item in processing to create a product that can be used for a longer time without melting or changing the structure of the item in any way. The TerraCycle Program, by using every part of a recyclable in processing, reduces waste, eliminates the need for raw materials and processing, saves money that would be needed for manufacture, minimizes environmental impact, alleviates the effects of resource depletion and water withdrawal, and reduces the carbon footprint by lowering carbon emissions.

TerraCycle was established by the Sustainability Committee at Lycoming College during the spring semester of 2014 and is slowly growing into an organization that could become a popular way of reducing solid waste on campus. All bins that are used are located in the trash rooms and are made from 100% recycled plastic. The Sustainability Committee and any volunteers who are doing collections record the number and weight of the items present. An accurate record of the weight of the items is critical because the TerraCycle program is based on a point system of \$0.01 per item. The money earned from the TerraCycle point system accumulates quickly and Lycoming College currently donates all of its earnings to Charity: Water, an organization that works to bring clean drinking water to people in as much as twenty-two developing countries, specifically in areas like Sub-Saharan Africa, Central and South America, and South Asia. Charity: Water uses donations to find sustainable solutions for people in rural, impoverished areas through partnerships with local organizations in project areas.

The Sustainability Committee at Lycoming College is participating in four different TerraCycle Brigade Programs: The Solo Cup Brigade, the Personal Care and Beauty Brigade, the Energy Bar Wrapper Brigade by Clif Bar, and the Tom's of Maine Natural Care Brigade. The Solo Cup Brigade collects plastic #6 Solo® cups and upcycles them into items like recycled dog bowls. The college is awarded two TerraCycle points for each unit of waste, which is any shipment over six pounds. The Personal Care and Beauty Brigade collects a variety of personal care items including shampoo, conditioner, hair gel, and hair spray bottles, caps, and triggers, lip balm and chap stick tubes, lipstick containers, powder and eyeliner cases, eyeliner and lip liner pencils, and much more. The Personal Care and Beauty Brigade will upcycle these items into products like tote bags, spiral notebooks, and pencil cases and the college receives two points per unit of waste as long as the shipment is over ten pounds. The Energy Bar Wrapper Brigade by Clif Bar

is a focused collection of Clif Bar and Co. product packaging and any foil-lined energy bar, granola bar, and protein bar wrapper. The wrapper that is collected is upcycled into items like duffel bags, notepads, and clipboards, and the college gains a point per unit of waste as long as the shipment is over a pound. The Tom's of Maine Natural Care Brigade focuses its collection on mouthwash bottles and caps, deodorant containers and caps, toothpaste tubes and toothbrushes, soap packaging, and floss containers. TerraCycle upcycles these personal care items into home décor products like paving stones and patio chairs, and the college receives a point per unit of waste as long as the shipment is at least two pounds.



Side Photo:
A TerraCycle bin used for collection that is
made from 100% recycled plastic.

Climate change, groundwater contamination, and greenhouse gas emissions are becoming of greater concern to environmentalists and individuals with an average or below average interest in the environment, alike. The EPA estimates that increasing the rate of recycling from 30% to 35% is enough to reduce greenhouse gas emissions by ten million metric tons of carbon equivalent (Patrick et al. 2008), suggesting that steps taken by small campuses like Lycoming are enough to make a difference. Every building on campus is equipped with recycling bins on each floor that are able to collect recyclables such as glass, plastic, aluminum, and paper. In addition, bins have been installed in each computer lab specifically for the collection of paper and other recycling bins have been placed in the professors' offices. However, recycling is more extensive in the dormitory buildings because the trash rooms house glass, plastic, aluminum, newspaper, white paper, magazine, and cardboard recycling, as well as general trash cans. It is our hope in the future to install permanent glass, aluminum, and plastic recycling units beside each trash can in every building.

In March of 2012, Lycoming College received nearly 1,600, six gallon blue recycling bins that appeared in every residence hall upon students' return from Spring Break. The receptacles were provided by the ALCOA Foundation's grant to encourage students to enhance their recycling efforts. Any excess bins were placed by the Building and Grounds staff in classrooms, faculty offices, and other common areas.

The ALCOA Foundation grant was discovered as a result of Lycoming College's participation in RecycleMania, an eight week competition between colleges and universities that is meant to reduce waste, increase campus recycling efforts, generate attention towards recycling programs, and encourage students and faculty to pay attention to how much of their waste is actually being recycled and how much is being wasted so their campus can become more sustainable. With the help of Dr. Sue Gaylor, who drafted the proposal to help enable the school to acquire the bins, Lycoming College was one of thirty-two schools that were awarded the grant. Part of the stipulations of receiving the containers however, includes monitoring the impact that the bins

In 2012, Lycoming College collected a total of 14,412 pounds of plastic, glass, cans, cardboard, and paper during a 10-week period, which was still 3,469.4 pounds more than was recycled in 2011. During the 2012 competition year, Lycoming ranked 47th in the nation in terms of the amount of bottles and cans collected, 85th in regards to corrugated cardboard, and 156th in terms of paper collected, out of six hundred and five total institutions. The individual totals for 2012 can be seen in the following:

- Plastic: 1,071.75 lbs
- Glass: 2,465 lbs
- Cans: 1,789 lbs
- Cardboard: 7,496 lbs
- Paper: 1,590.25 lbs

In 2011, Lycoming College recycled a total of 10,942.6 pounds during an eight-week period, and the individual totals obtained for that year can be seen in the following:

- Plastic: 1,450.85 lbs
- Glass: 3,707 lbs
- Cans: 1,256.75 lbs
- Cardboard: 2,900 lbs
- Paper: 1,628 lbs

Increased awareness for recycling through the efforts of the LEAF organization and the Sustainability Committee has helped to promote student interest in recycling and waste reduction. Currently, efforts are being made to re-label the trash rooms to help make sorting recyclable materials easier to understand for both students and members of the Sustainability committee and volunteers who assist in recycling collections. Grants, like the ALCOA Foundation grant received in 2012, has helped to improve sustainability on campus by helping to ensure that recycling can be monitored through the use of small bins issued to each and every student.

The amount of materials recycled in 2012 resulted in a reduction of what was equivalent to eight metric tons of carbon dioxide, which is analogous to keeping four cars off of the road or eliminating the energy consumption of two households during the ten-week period.

In 2007, the first year Lycoming participated in the RecycleMania competition, Lycoming was ranked number one out of the ten Pennsylvania colleges and universities in the category of pounds and cans per person weekly. Lycoming won by recycling more recyclables both per

person and overall than Dickinson College, Bucknell University, Millersville University, and Shippensburg University, among others competing that year. Overall, Lycoming ranked 12th out of 15 Pennsylvania schools in regards to collections of paper, corrugated cardboard, and food service organics. It is a hope that through awareness, both by the Sustainability Committee and the LEAF organization, that Lycoming students can be encouraged to recycle to this magnitude again in the future.

Campus Involvement

Lycoming Environmental Awareness Foundation (LEAF)

In order for change to occur on campus, it is crucial that students, faculty, and administration are all actively involved with sustainability efforts. Lycoming College is an institution that encourages opportunities meant to better its community through campus organizations. The green initiative began on Lycoming College's campus in 1992 with the founding of the Lycoming Environmental Awareness Foundation (LEAF), which is made up of a group of students who strive to create an environmentally friendly campus. The group's purpose is to raise awareness about sustainability issues and ultimately, act on that awareness to promote change.

The majority of LEAF's activities are outdoors, but community service activities are also a priority, with events focusing on stream, park, and highway cleanups. In addition to this, the club donates and participates in the American Cancer Society's annual Relay for Life. LEAF's other trips and activities include, camping, hiking, kayaking, and rafting. The organization also works closely with the Sustainability Office to coordinate RecycleMania, an eight week recycling competition, and Earth Week, a weeklong celebration of Earth Day, both of which occur in the spring. During Earth Week, students can participate in an array of sustainable activities like potting plants and park clean-ups, awareness programs, and can listen to lectures by interesting guest speakers.

LEAF also works with another organization on campus known as the Senate Green Committee. Through this cooperation, both groups aim to create a greener campus. Together, LEAF and the Senate Green Committee stress the importance small changes have in our everyday life and how these changes can collectively improve our carbon footprint. On a campus as small as Lycoming College, these minute changes can have a large and lasting impact on our energy usage.

During the spring 2014 semester, LEAF collaborated with the Sustainability Committee to assist with the Food Recovery Network, an organization that is showing potential as a way of reducing campus food waste while helping those in the community. In addition, LEAF is volunteering in a Canal Clean-Up and is also planning trips to Reptiland and Philadelphia Zoo.



Side Photo:
LEAF's participation in a 2013 clean-up
of Brandon Park in celebration of Earth Day.

Sustainability Committee

The Sustainability Committee is a body of students and faculty members dedicated to the development, implementation, and promotion of environmental sustainability at Lycoming College. The committee works closely with Sustainability Coordinators, Dr. Mel Zimmerman and Dr. Ryan Adams, to develop initiatives that will promote campus environmental sustainability. The Sustainability Committee often reaches out to members of LEAF and other volunteers for assistance with sustainability projects like RecycleMania and Earth Week.

The Clean Water Institute

The Clean Water Institute (CWI) provides services to local watershed and environmental groups by developing and coordinating internships and independent study projects and making them available to Lycoming College students. Watershed projects that are offered to interns through the CWI require that they assist in data collection and analyses of water chemistry. In order to fulfill these requirements, the CWI team carries out any analysis in their water testing laboratory, which provides the groups with technical assistance in the design, collection, and interpretation of water chemistry. In addition, the college's CWI lab assist's interns in their analyses and interpretation of any data they find relating to macroinvertebrates, plankton, and fish. All data that is analyzed in the CWI lab is archived and continuously updated as ongoing projects develop, and results are made available to the public in order to promote awareness relating not only to the environment, but also to the health of watersheds and the Susquehanna River. The CWI, in addition to research, also provides educational and training programs. These programs may include an array of seminars and workshops focusing on a multitude of environmental issues, such as stream restoration, habitat improvement for native wildlife species, and water quality, and these awareness programs are offered to groups such as watershed awareness clubs and local schools.

The CWI is also responsible for the 3.1 kW 15 panel photovoltaic (PV) system that was installed on the Heim Science building on November 12, 2009. The solar power that these panels generate is sent to a power grid in Heim as a source of green energy that can be used throughout the facility. In addition, CWI interns also have an opportunity to study the Eastern Hellbender (*Cryptobranchus alleganiensis*), which is an entirely aquatic salamander that is an important indicator of water pollution that is now only found in drainage areas of the Allegheny, Ohio, and Susquehanna Rivers. Interns working with Dr. Petokas not only have a wonderful opportunity to

do unique research with a species that is unknown to many people, but also have a chance to promote awareness as to how human activities can have a profound impact on surrounding ecosystems and the wildlife inhabiting its streams, forests, and other habitats.

The Lycoming College Fly Fishing Club

The Lycoming College Fly Fishing Club (FLYCO) is campus organization that incorporates the art of fly-fishing with service projects such as stream clean-ups. Members of FLYCO have the chance to learn the basics of the fly fishing technique and take trips to fishing areas along waterways located in the Susquehanna Basin, Pine Creek, and Lycoming Creek watersheds. Last fall, the club participated in steelhead fishing in Erie, Pennsylvania. In addition, members regularly participate in stream clean-ups, which help to keep streams clean for other fishermen, as well as for sensitive fauna such as brook trout, brown trout, caddisflies, mayflies, and stoneflies. The most recent clean-up conducted by the club was the Brandon Park Clean-up, which was done last spring in partnership with LEAF. Also, FLYCO has recently become involved with the Trout Unlimited chapter, which is another way in which it has taken steps to help ensure the health of surrounding watersheds.

Athletics

A number of ideas for future involvement in the campus' sustainability efforts have been proposed by the athletics department, but none of the projects are currently in use. The proposals would be important additions to the college's efforts considering that the athletic department is home to seventeen intercollegiate sports, intramural sports, and multiple facilities that are available to students, faculty, alumni, and even members of the Williamsport community. It is estimated that one out of every four students become involved in an intercollegiate team, and between 475 and 600 students visit the Recreation Center and use its facilities every day. A sustainable project therefore, would prove to be an important addition to the athletics department, especially considering the frequency of its daily visitors.

While the projects that have been proposed take time to be implemented, they can be effectual in the campus' efforts to "Go Green." In 2012, the college participated in its first annual Game Day Challenge, a competition in which recyclables were collected from the stands by volunteers from LEAF, Phi Kappa Psi, and various athletic organizations. In addition, bins were installed around the periphery of the field to encourage fans to recycle their waste. The Game Day Challenge, a competition similar to RecycleMania, was sponsored in part by the Environmental Protection Agency, and helped to promote sustainability by educating the community about proper recycling techniques and waste reduction methods. The competition was similar to the University of Arkansas' sustainability program, "Recycling with the Razorbacks." The sustainability sector of the University of Arkansas would place green recycling boxes at all home games to encourage fans to recycle and as a result, collected more than 36.5 tons of recyclables and reduced the amount of trash by 61.5 tons (Patrick et al. 2008). The amount of trash reduced by the University of Arkansas speaks for itself, and shows just how much waste can be reduced if these practices were employed regularly at Lycoming.

Proposals to eliminate or at least lower the waste that is produced in campus athletic facilities have been proposed by other institutions. For instance, the University of Colorado at Boulder has taken steps to eliminate their waste by creating a zero waste football stadium, which has prevented at least 90% of their waste from going to a landfill. The university eliminated their

waste by replacing all of their trash containers with recycling bins and relying solely on public food containers and beverage cups that are made of recyclable or compostable materials.

Another idea that has been introduced is that of recycling used sports equipment. This proposal suggests that rather than throwing away gently used equipment, the materials could be sent to local clubs and schools for further use. This initiative would not only keep materials out of landfills, but would save money for organizations, and would also help to promote physical health by allowing sport participation to be possible for more of the local community.

Although the implementation of these projects could have a huge impact on campus, there are other issues that could be addressed that would improve our sustainability efforts. For instance, if announcers at athletic events could repeat the announcements made of the locations of recycling bins so that fans knew where to drop their recyclables, signs were posted by the garbage cans as a reminder for fans to recycle, and recycling bins were installed at outdoor games, recycling on campus could rise simply by helping the community to become aware that there is an alternative to throwing their waste away.

The athletic department will be a significant help to the college's overall sustainability project; despite the direction they choose to take with their sustainability efforts. Also, by implementing these projects at one of the campus' largest areas of student, faculty, and community involvement, an increase may be seen in all of the campus-wide sustainability efforts in the very near future.

Purchasing

A future audit will include purchases for Academics and Buildings & Grounds in order to determine how much thought was given into buying recycled or sustainable equipment and supplies from environmentally friendly companies. The Sustainability Committee should be able to provide information as to which of the companies are the most sustainable, and relay this information to people who are interested in making purchases.

E-Waste

E-waste is any form of consumer and business electronic equipment that is near to, or at the end of its useful life, and makes up about 5% of all municipal solid waste worldwide. Despite its small proportion in comparison to other forms of waste, it is much more hazardous, in that it contains compounds like cadmium, lead, mercury, and polychlorinated biphenyls (PCBs) that can damage human health and the environment.

An interview with Dave Heffner, head of the Information Technology Services (ITS) department, has helped to explain how Lycoming College handles its e-waste. Heffner said that the college is on a five-year cycle of computers with many of the newer ones entering the general computer labs and power users about every two or three years. The older computers are removed, and experience "tumble down," or reuse, in the professors' offices or labs. Computers that are out of commission are either sold to campus employees or traded into the manufacturer. An interview with Heffner revealed that IT Services does not strip large devices like hard drives and spam servers for parts and also does not strongly rely on eBay to sell unused electronics. The computers that are not purchased are sent to Computer Parts and Electronics in South Williamsport, and are stripped of parts, sold, and recycled if they are unable to be sold. Upon

removing all hazardous materials and scrap metal from the electronics, Computer Parts and Electronics ships all devices to Staiman's Recycling Corporation in Williamsport, PA. Computer Parts and Electronics will come to the campus to do a pick-up when outdated e-waste fills the ITS hallway to a level of about 224 cubic feet.

Lycoming College is fairly conservative in its five-year e-waste cycle considering that most other institutions operate on a two to three-year cycle, which generates more waste annually. Additionally, the servers or network equipment that are ready to be replaced are either traded into the manufacturer or sold on eBay and their destination is undetermined.

IT services has been actively pursuing other sustainable measures that many people may not have been aware of. In 2012, they started a five to six-year project where they began phasing out bulky, less-efficient equipment for newer, less energy consuming devices. In addition, they started implementing SANs (Storage Area Network devices) that house the faculty F-drive, student H-drive, and e-mail accounts. SANs are large specialized storage equipment that can be logically divided into smaller storage spaces instead of having separate storage in many individual servers. The switch has reduced the cost of electricity to run, heat, and cool the SANs because one large server is more energy efficient than many small servers.

VMware is another innovative idea that has been utilized by IT Services. VMware, which refers to virtual machines, is an efficient idea that made it possible for IT Services to go from forty-seven servers to only ten. VMware makes it possible for IT Services to have fewer computers and instead, use a larger computer to increase utilization, consolidation, and efficiency while simultaneously decreasing heat, cooling, and electricity costs.

Other sustainable measures that IT services encourage include having student lab monitors shut down all computers every night and having faculty members do the same. This energy saving step is similar to the initiative that has been undertaken by the University of Ohio, in which Computer Management Software is used to shut down computers every night when not in use. This initiative saved the university approximately 15,150,000 kWh in energy and 15,000 tons of CO₂, and its similarity to the step taken by IT services may give insight to how much energy is really being saved on campus (Patrick et al. 2008). In another initiative to control waste, a printing curve was calculated in 2000 to project the adequate print balance that should be allotted to all students. This allotment was determined to be six hundred pages and minimal charges were added onto the accounts of those who went over the printing limit during the semester. The limit on printing was implemented because it was noticed that the paper waste in every computer lab was astronomical without a penalty for over-printing set in place. In addition, IT services recycles their toner cartridges after every use, and also recycles their cardboard boxes for shipping purposes when selling old servers on eBay.

Recently, the campus has converted the phone system to voice over IP (VOIP), which is a much more efficient way to offer phone services than the older large PBX equipment. In the future, more equipment will be consolidated into fewer, more efficient units.

Routine e-waste collections are made by Computer Parts and Electronics of South Williamsport, but presently, there is not any permanent e-waste program at Lycoming College. In the future, the college hopes to partner with the Funding Factory, a program that is a branch of Clover Technologies Group. The program is unique in that it provides fundraising to non-profit organizations like K-12 schools, colleges and universities, churches, local charity organizations, sports teams, and clubs and has no charge for participation and shipping for recyclables. The

Funding Factory was established in 1997, and it is estimated from the Sustainability Report that is available on their website that approximately 14,118,678.81 lbs. of e-waste has been recycled through the program and that 58% of this waste consists primarily of inkjet cartridges. Since the Funding Factory's founding, it has helped raise over \$35 million dollars for non-profit organizations, making it one of the most popular fundraising-thru-recycling programs in the country. The program accepts a variety of products including laptops, laser printer cartridges, cell phones, and small electronics like digital cameras, mP3 players and iPods, GPS systems, and headsets. The Funding Factory works like TerraCycle because participants can redeem recycling points they accumulate for cash that they can either convert into a check that they can receive through the mail, or can use the cash they earn to buy a variety of classroom supplies and technology like tablets, laptops, printers, projectors, and more in the Rewards Catalog. In addition to fundraising, the program can also help businesses recycle their ink cartridges, which can serve as an indirect form of fundraising for the business' non-profit organization of choice. The Funding Factory would be a great addition to Lycoming's sustainability program because the program is easy, free, and is compatible with a variety of brands. The program even offers a ten cent minimum for all broken items, and the cash refunded for recyclables like some cell phones may reach up to \$108.00, which can be converted into cash that can be used by a non-profit organization. It is a hope that this program can be permanently implemented at Lycoming College in order to reduce e-waste that is landfilled, earn money for the college, and further spread awareness for sustainability on campus.

Campus Grounds

Lycoming College's Building and Grounds (B&G) staff are essential to making campus more sustainable. In addition to having routine maintenance responsibilities, the B&G staff attends to several projects pertaining to sustainability. One of these projects includes a large generator of waste that needs to be dealt with on a daily basis. Currently, the grass and tree clippings and leaves are being sent to the landfill after being collected, but a future project could involve an evaluation of composting grass clippings and leaf litter in conjunction with a local farmer, or in partnership with an institution like Penn College.

Each spring, the lawns are treated once with fertilizer and herbicides supplied by TruGreen ChemLawn in Lamar, PA. The concentrations of the materials used for application are:

Liquid fertilizer 13-0-7	0.75LBAI/M; (3/4 nitrogen per 1,000 Sq.ft.)
Barricade 4FL	0.375 LBAI/A; (pre-emergent herbicide)
TruPower3	0.3.25 Pint/A; (broadleaf weed control)

In addition, B&G has replaced all but three trucks with golf carts and there are now twelve carts that are used for everyday campus chores. Two of these golf carts and one security vehicle are electrically powered, using \$400 batteries that last for five years, while ten of the golf carts are still gas-powered and use four-stroke engines. The current plan is to replace the gas-powered golf carts with electrically powered golf carts as they wear down. In addition, B&G uses one tractor and three mowers that are all fueled with diesel. The current hope is that the tractors and mowers can be fueled with the biodiesel that is being produced with the help of the new biodiesel project on campus. Also, B&G wants to purchase diesel trucks in the future in order to

possibly create a 50/50 mix of gasoline and biodiesel that would help them use energy more sustainably.

LEED Certification for Future Exploration

The push to become more sustainable is quickly spreading throughout American higher education institutions. Lycoming College needs to improve the ways in which it efficiently uses, and maintains energy in the process of constructing and reconstructing its buildings. Green designs are building plans that have environmental, economic, and social elements that benefit all building stakeholders, including owners, occupants, and the general public. With simple building techniques, operating costs can be lessened, building marketability can be enhanced, worker productivity can be increased, and most importantly, harmful greenhouse gas emissions can be reduced.

Leadership in Energy and Environmental Design (LEED) is a performance oriented system in which credits are earned for satisfying criterion designed to address specific environmental impacts inherent in design construction, operations, and maintenance of buildings. Based on the total credits earned, different levels of green building certification are awarded. The system of LEED certification is designed to be comprehensive in scope, yet simple in operation, and can be seen below:

Points Scale:

Certified: 26-32 points

Silver: 33-38 points

Gold: 39-51 points

Platinum: 52-69 points

LEED addresses the following for new construction: sustainable sites, water efficiency, energy and atmosphere, materials and resources, indoor environmental quality, and innovation in design. In order for a project to become LEED certified for a new construction or renovation plan, it must be registered at the U.S. Green Building Council's website: www.usgbc.org.

As a requirement of the Lycoming College Climate Commitment, any new construction on campus has to meet at least a silver LEED rating. The college could meet this requirement, or a requirement meeting a LEED gold or platinum standard in a variety of ways. For instance, Cape Cod Community College received a gold LEED certification for its use of windows and reflective surfaces to promote natural lighting to illuminate the interior of its buildings during the day. By maximizing the amount of daylight during the day, Cape Cod reduced the amount of energy many other establishments need for electricity (Patrick et al. 2008).

Lycoming College has the potential to improve its environmental sustainability, and with the current economic climate, as well as the 60% increase in the PPL Plug electricity rate, the difficulty posed by rising electric bills is pushing the campus toward making more sustainable choices. With a list of key objectives and solutions, the college could use their LEED certification to promote environmental awareness to current and prospective students as well as a way to receive a tax benefit.

Greenhouse Gas

In the future, Lycoming College's greenhouse gas emissions should be calculated using the Clean Air-Cool Planet: Campus Carbon Calculator. This calculator is the most thorough way to assess a campus's emission output because it analyzes six greenhouse gases specified by the Kyoto Protocol, carbon dioxide, methane, nitrous oxide, hydrofluorocarbons, perfluorinated compounds, and sulfur hexafluoride (CO₂, CH₄, N₂O, HFC, PFC, and SF₆). The extensive spreadsheet that is provided allows emissions to be calculated for years ranging from 1990-2060 when completed in its entirety. When Lycoming College can gather all of the information necessary for this endeavor, an accurate and almost literal carbon footprint will be achieved.

The Lycoming College Climate Commitment

On April 20, 2011, former college president, James E. Douthat, signed the Lycoming College Climate Commitment during a small ceremony held on the steps of Long Hall. The pledge was brought forward by the sustainability committee, which was led at that time by both Dr. Neil Boyd and Dr. Mel Zimmerman, and called for a solid action plan to reduce the college's carbon footprint. This action plan includes but is not limited to the following: the requirement of new construction meeting at least a silver LEED rating, an energy-efficient appliance purchasing policy that requires the purchase of ENERGY STAR certified products, a specified set of environmental guidelines for renovations, continued campus involvement in RecycleMania, and access to public transportation for faculty, staff, and students. Lastly, the commitment requires that the action plan initiated by Douthat's signing and any new reports are publically available to students in order to encourage involvement in the sustainability effort.

Environmental Sustainability Curriculum Offered by Lycoming College:

Lycoming College offers two minors, Environmental Sustainability and Environmental Science, and a major, Sustainable Business Management, in order to educate students about environmental issues so that they are better able to promote conservation and awareness. In addition to these courses, the college offers an Ecology track specifically for biology majors that differs only in the lab time and biological focus that is required for the major.

Environmental Sustainability

The Environmental Sustainability minor educates students about the delicate balance that exists between our climate and the earth's other natural processes and the need of society to satisfy its needs. At Lycoming College, students have a unique opportunity to work with experienced faculty to develop effective solutions. The minor requires the following courses:

BIO 220 – Environmental Biology
ECON 225 – Environmental Economics

And three from the following:

ANTH 232 – Environmental Anthropology
ANTH 310 – Food and Culture

BIO 200 – The 4th and 5th Kingdoms
BUS 313 – Sustainable Business Management
BUS 334 – The Business of Energy
ECON 224 – Urban Problems
PHIL 228 – Philosophy and the Environment
PSCI 338 – Environmental Law and Politics
PSY 221 – Environmental Psychology

Students are encouraged to work outside of the classroom by participating in a practicum or an internship in the field of environmental sustainability. The course the student chooses will often pertain to his or her future career choice and there are several choices for practicum experiences, including:

ANTH 470 – 479 – Anthropology Internship
BIO 400 – Biology Practicum
BIO 401 – Environmental Practicum
BIO 470 – 479 – Biology Internship
BUS 439 – Business Practicum
BUS 470 – 479 – Business Internship
ECON 349 – Management Practicum
ECON 470 – 479 – Economics Internship
PHIL 470 – 479 – Philosophy Internship
PSCI 470 – 479 – Political Science Internship
PSY 470 – 479 – Psychology Internship
SOC 448 – Practicum in Sociology – Anthropology

The Environmental Sustainability minor is supervised by coordinators, Dr. Mel Zimmerman and Dr. Ryan Adams.

Environmental Science

The Environmental Science minor was created for students who wish to further their knowledge concerning conservation and issues that are affecting the environment.

An interdisciplinary minor in Environmental Science consists of two introductory biology courses, one of which must be Environmental Biology (BIO 220), two additional courses numbered 200 or higher, Environmental Economics (ECON 225), and Principles of Geology (ASTR 102).

Biology majors who minor in Environmental Science must complete all requirements of the biology major. In addition to these requirements, they need to complete Environmental Biology (BIO 220), Environmental Practica (BIO 401), Environmental Economics (BIO 225), Principles of Geology (ASTR 112), and one course selected from Economic Geography (ECON 240), Cultural Anthropology (ANTH 229), or an advanced biology course numbered 328 or higher.

In addition to these courses, various symposium presentations act as an outreach mechanism for the college and the community to learn about campus sustainability.

Future Endeavors Include but are Not Limited To:

- # Continued troubleshooting and installation of motion sensors in buildings so that when rooms or hallways are vacant, the lights automatically shut off.
- # Making sure all computers in public computer labs are turned completely off during unoccupied hours.
- # Further expansion of permanent and clearly-labeled recycling stations in every building.
- # Continued replacement of current light fixtures with compact fluorescent (CFL) light bulbs.
- # Use storage tanks in the plumbing systems so recycled water can be used to flush toilets.
- # Installation of low-flow showerheads, toilets, faucets, and energy efficient air dryers in restrooms.
- # LEED checklist usage in buildings with potential certification abilities.
- # Construction of campus garden for flowers and vegetables along with an annual farmer's market on campus.
- # Using food waste, leaves, and grass clippings in a composting project involving a partnership with a local farm or Penn College of Technology.
- # A permanent e-waste program on campus, preferably something like Funding Factory
- # Curriculum integration by adding a sustainability/environmental "distribution" to Lycoming College's degree requirements.
- # Making the transition to single-stream recycling by collecting a variety of different recyclables in only one bin, rather than a bin for each type of material.
- # Providing reusable water bottles to each and every student.
- # The initiation of the Reusable-To-Go Cup Program
- # The establishment of the Swipes for the Homeless program

*Remember that we must all
Reduce, Reuse, and Recycle for a
more sustainable campus!*

Acknowledgements

Dr. Mel Zimmerman, Project Supervisor

Dr. Ryan Adams, Sustainability Coordinator

Dr. Neil Boyd, Past Project Supervisor

Dr. Sue Gaylor and Heather Leonard (Administration and Planning)

Tyler Hutson, Dan Cassidy, Bethany Herring, Emily Hopko, Megan Runyon,
Alyssa Tomaskovic, Chelsea Brewer, Ashlynn Beacker, Laura Walter, and
Zebidiah Buck.

Leslie Ekstrand, General Manager of Dining Services

Jay Breeding, Assistant Director of Dining Services

Doug Kuntz, John Schaffer, and Joe Moyer, Buildings and Grounds staff

Dave Heffner, Bobby Brown, and Julie Adams, IT Services

Beth Bickel, Business Office

Wendy Hastings, Williamsport Water Authority

Appendices

Appendix 1 Raw Electrical Energy Data in kW (2007 – 2013)

Residence Hall Electrical Usage in kW								
<i>Dorms</i>	Asbury	Crever	East	Forrest	Rich	Skeath	Wesley	Williams
2007	196,416	147,348	216,128	129,184	125,728	259,456	180,064	415,451
2008	181,024	159,374	194,304	112,544	107,616	245,824	157,504	171,706
2009	159,173	136,987	140,159	92,918	183,090	167,839	133,101	151,246
2010	118,633	115,955	100,770	83,031	171,385	119,645	100,400	123,084
2011	137,336	131,277	118,886	90,115	176,048	130,873	117,464	127,363
2012	138,687	114,849	111,528	82,442	172,300	126,001	110,665	128,452
2013	156,170	127,891	117,267	85,373	183,563	138,755	123,880	153,204

Academic Building Electrical Usage in kW					
<i>Academic Buildings</i>	Academic Center	Heim (Total)	Communications	Clarke Chapel	Fine Arts
2007	3,101,312	2,139,200	152,832	165,312	31,552
2008	3,102,208	1,669,370	200,192	164,352	29,056
2009	3,146,880	1,888,500	202,741	166,208	294,011
2010	2,704,123	1,584,805	174,092	137,732	273,438
2011	2,785,712	1,685,574	190,085	234,565	306,583
2012	2,365,209	1,586,359	192,535	307,085	289,040
2013	2,528,256	1,923,700	-	342,912	228,102

Other Building Electrical Usage in kW							
<i>Other Buildings</i>	Admissions	General Services	Lamade Gym	Long Hall	Wertz	Honors Hall	Recreation Center
2007	10,304	180,000	1,131,264	196,192	1,124,891	0	1,007,210
2008	9,472	108,000	1,148,511	190,176	1,251,570	51,322	1,159,092
2009	57,043	89,908	1,154,432	175,307	1,133,849	53,183	1,166,679
2010	36,582	50,603	1,040,003	157,433	1,008,193	72,189	1,091,506
2011	36,979	54,790	868,905	161,680	1,145,116	51,074	991,469
2012	32,545	8,679	1,179,279	150,983	1,020,081	39,461	898,432
2013	40,559	6,000	1,315,712	178,095	1,180,933	-	1,031,671

Apartment Electrical Usage in kW						
<i>Apartments</i>	Commons	314-316 E. Fourth St.	601-603 Mulberry	605-607 Mulberry	609 Mulberry	635-635 ½ Mulberry
2009	287,909	10,735	20,265	11,455	5,491	13,448
2010	240,104	12,563	18,082	9,507	3,797	13,249
2011	272,907	6,546	12,159	5,773	6,646	17,631
2012	277,791	-	-	-	6,442	13,091
2013	316,436	-	-	-	-	-

Apartment Electrical Usage in kW							
<i>Apartments</i>	40 Ross St.	60-60 ½ Ross St.	145 Washington Blvd.	73 Ross St.	627 Mulberry St.	71-71 ½ Ross St.	117 Washington Blvd.
2009	21,539	11,443	4,365	7,329	17,322	17,252	3,270
2010	21,769	13,075	4,455	9,507	17,832	15,854	3,059
2011	21,041	11,178	7,177	7,777	17,735	16,579	4,105
2012	19,920	11,181	-	7,970	18,609	12,136	3,877

Appendix 2 Raw Water Usage in Thousands of Gallons (2008-2013)

Residence Hall Water Usage in Thousands of Gallons								
<i>Dorms</i>	Asbury	Crever	East	Forrest	Rich	Skeath	Wesley	Williams
2008	1324000	2004000	1151000	1125000	2154000	1455000	1052000	1798000
2009	1148000	1920000	1047000	849000	1826000	1232000	943000	1194000
2010	1164000	1833000	950000	866000	1872000	1379000	899000	1210000
2011	1173000	1482000	1226000	834000	2011000	1276000	846000	1224000
2012	1117000	1341000	1461000	652000	2132000	1469000	1024000	1208000
2013	981000	1523000	1255000	993000	1588000	1345000	948000	1087000

Academic Building Water Usage in Thousands of Gallons			
<i>Academic Buildings</i>	Academic Center	Heim Building	Communications
2008	1991000	357000	66000

2009	2092000	382000	55000
2010	2344000	336000	60000
2011	4938000	304000	38000
2012	1654000	349000	51000
2013	1625000	372000	68000

Other Building Water Usage in Thousands of Gallons

<i>Other Buildings</i>	Admissions	General Services	Lamade Gym	Long Hall	Wertz	Honors Hall	Stadium	President's House
2008	31000	66000	833000	180000	3948000	11000	602000	-
2009	36000	55000	901000	170000	3534000	11000	645000	-
2010	43000	31000	1029000	190000	3357000	13000	402000	75000
2011	28000	29000	1114000	138000	2865000	10000	297000	88000
2012	38000	5000	1331000	136000	2698000	12000	593000	59000
2013	31000	-	977000	114000	2814000	13000	371000	50000

Apartment Water Usage in Thousands of Gallons

<i>Apartments</i>	Commons	314-316 E. Fourth St.	601-603 Mulberry	609 Mulberry	635-635 ½ Mulberry	Linn Property	40 Ross St.	60-60 ½ Ross St.	145 Washington Blvd.
2008	752000	64000	231000	93000	109000	-	88000	102000	18000
2009	712000	99000	95000	80000	52000	-	68000	84000	19000
2010	872000	70000	99000	13000	47000	236000	62000	61000	20000
2011	691000	77000	66000	78000	74000	218000	70000	55000	26000
2012	746000	15000	-	53000	79000	251000	67000	151000	37000
2013	730000	29000	-	39000	60000	221000	30000	210000	27000

Other Lycoming Owned Rental Properties Water Usage in Thousands of Gallons

<i>Other Lycoming Owned Rental Properties</i>	247 Washington Blvd	151 Washington Blvd	117 Washington Blvd
2010	5,000	34,000	32,000
2011	1,000	33,000	39,000
2012	-	43,000	38,000
2013	-	33,000	26,000

Appendix 3 Water Usage in Thousands of Gallons / Sq. Ft.

Residence Hall Water Usage in Thousands of Gallons / Sq. Ft.

<i>Dorms</i>	Asbury	Crever	East	Forrest	Rich	Skeath	Wesley	Williams
2008	34.479	69.825	30.29	48.76	65.351	31.357	21.065	46.102
2009	29.895	66.898	27.55	36.8	55.4	26.551	18.882	30.615

2010	30.313	63.868	25.00	37.53	56.796	29.720	18.002	31.026
2011	30.547	51.638	32.263	36.148	61.013	27.500	16.940	31.385
2012	29.089	46.725	38.447	28.259	64.684	31.659	20.505	30.974
2013	25.547	53.066	33.026	43.039	48.180	28.987	18.983	27.872

Academic Building Water Usage in Thousands / Sq. Ft.			
<i>Academic Buildings</i>	Academic Center	Heim Building	Communications
2008	10.4	5.564	2.16
2009	10.92	5.953	1.8
2010	12.24	5.24	1.96
2011	25.79	4.74	1.24
2012	8.64	5.44	1.67
2013	8.49	5.80	2.23

Other Building Water Usage in Thousands of Gallons / Sq. Ft.							
<i>Other Buildings</i>	Admissions	General Services	Lamade Gym	Long Hall	Wertz	Honors Hall	Stadium
2008	5.17	3.18	9.52	9.383	80.934	0.57	38.156
2009	6.00	3.29	10.297	8.862	72.447	0.57	40.882
2010	7.17	3.65	11.76	9.91	68.82	0.67	25.48
2011	4.67	3.41	12.73	7.19	58.73	0.52	18.82
2012	6.33	0.59	15.21	7.09	55.31	0.62	37.59
2013	5.17	-	11.17	5.94	57.69	0.67	23.52

Apartment Water Usage in Thousands of Gallons / Sq. Ft.									
<i>Apartments</i>	Commons	314-316 E. Fourth St.	601-603 Mulberry	609 Mulberry	635-635 ½ Mulberry	Linn Property	40 Ross St.	60-60 ½ Ross St.	145 Washington Blvd.
2008	26.953	31.87	96.25	84.55	90.83	-	55.42	42.5	20.0
2009	25.519	49.3	39.58	72.73	43.33	-	42.82	35.0	21.11
2010	31.25	34.86	41.25	11.82	39.17	78.02	39.04	25.42	22.22
2011	24.77	38.35	27.50	70.91	61.67	72.07	44.08	22.92	28.89
2012	26.74	7.47	-	48.18	65.83	82.98	42.19	62.92	41.11
2013	26.16	14.44	-	35.45	50.00	73.06	18.89	87.50	30.00

Appendix 4 Raw Natural Gas Usage in CCFs (2009-2013)

Residence Hall Natural Gas Usage in CCFs							
<i>Dorms</i>	Asbury	Crever	East	Forrest	Skeath	Wesley	Williams
2009	17410	33143	22735	3254	30608	18293	18625
2010	24996	47741	34949	5138	43261	25920	27225
2011	36346	75710	51763	6864	66742	40553	42399
2012	31777	71259	46166	5666	60122	35053	34934
2013	19024	58553	34704	3747	46712	21873	23479

<i>Academic Building</i>	Academic Center	Heim Building	Communications	Fine Arts
2009	123594	68870	3189	-

Academic Building Natural Gas Usage in CCFs				
2011	223437	133037	-	-
2012	140396	171522	8134	32850
2013	120464	115582	5959	26837

<i>Other Buildings</i>	Admissions	General Services	Lamade Gym	Long Hall	Wertz	Honors Hall	President's House	Recreation Center
2009	1227	2981	39844	8329	28284	2401	2390	29303
2010	1114	3209	84689	12452	48487	2247	2403	56460
2011	-	-	106304	18860	69013	-	-	70869
2012	-	-	88633	16324	40879	-	-	59433
2013	973		73109	12314	39710	2963	2050	-

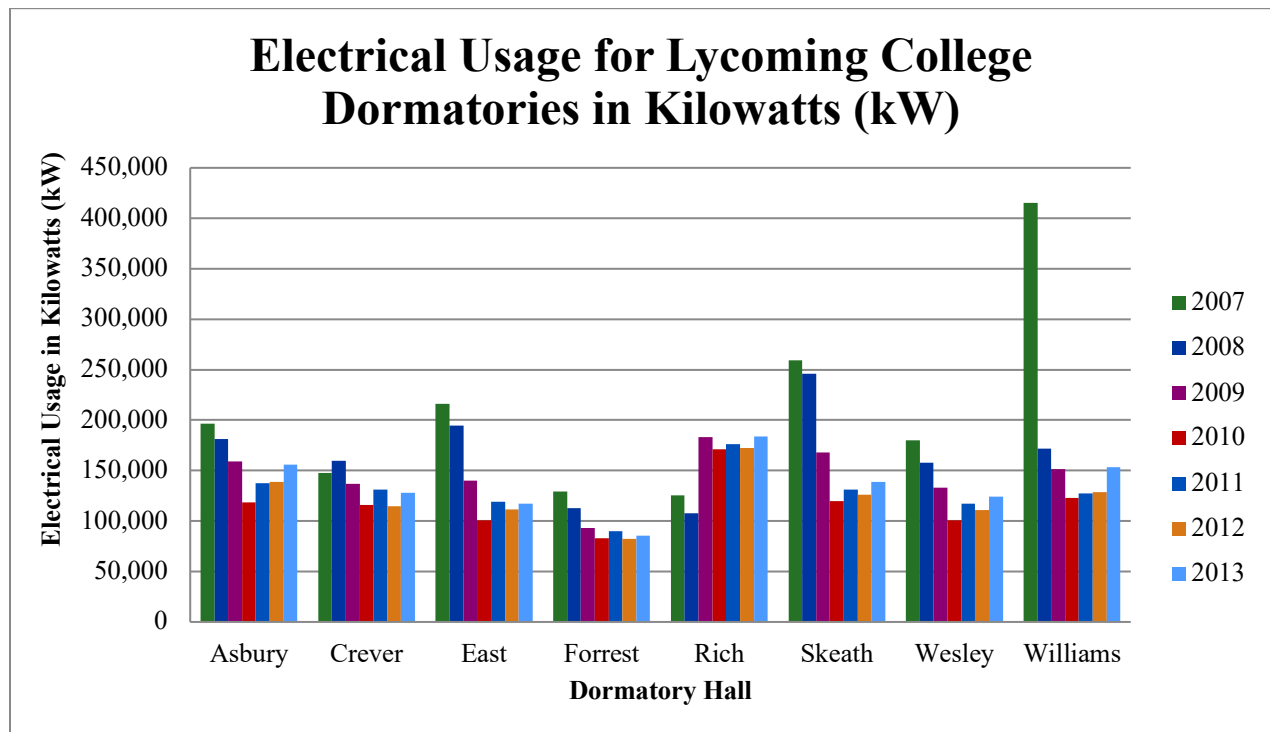
Other Building Natural Gas Usage in CCFs
--

Apartment Natural Gas Usage in CCFs						
<i>Apartments</i>	Commons	314-316 E. Fourth St.	601-603 Mulberry	Linn Property	40 Ross St.	60-60 ½ St.
2009	7147	2687	2855	517	1970	3509
2010	10157	4134	4050	379	3483	4802
2011	15604	3941	3192	-	3928	6690
2012	15128	-	-	-	7188	11441
2013	12249	20	-	415	1661	2074

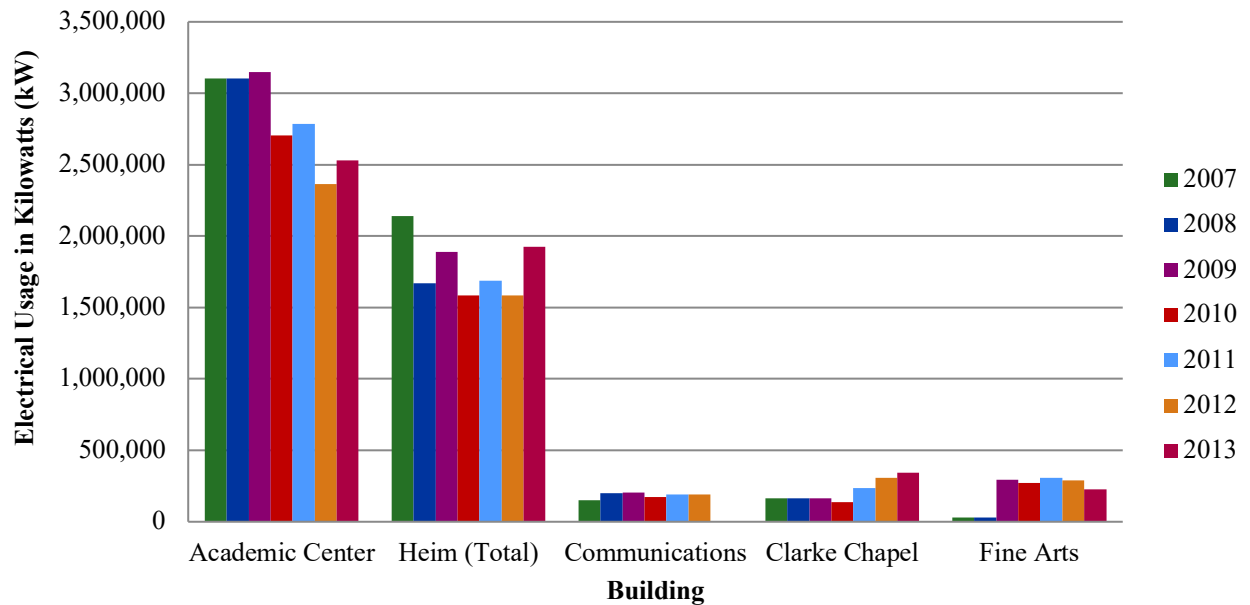
Apartment Natural Gas Usage in CCFs						
<i>Apartments</i>	605-607 Mulberry	44 Ross St.	627 Mulberry	71-71 ½ Ross St.	117 Washington Blvd	73 Ross St.
2009	1611	1182	1138	752	1164	287
2010	2107	-	1732	1294	1580	532
2011	1925	-	2452	1295	2352	896
2012	-	-	4554	2548	2634	1583
2013	-	-	859	475	750	359

Other Properties Natural Gas Usage in CCFs			
<i>Other Properties</i>	1400 Mulberry	235 Washington Blvd	121 E 4th St. (B&G)
2009	7075	-	-
2010	7454	-	-
2011	-	-	-
2012	-	-	-
2013	21585	1	930

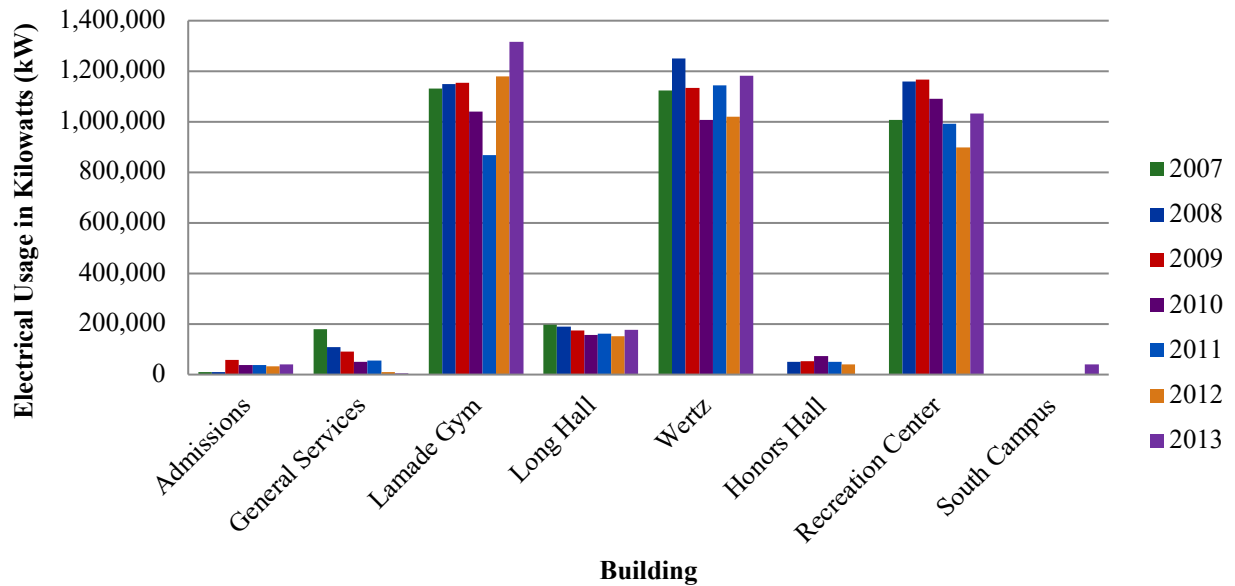
Appendix 5: Raw Electrical Energy Usage



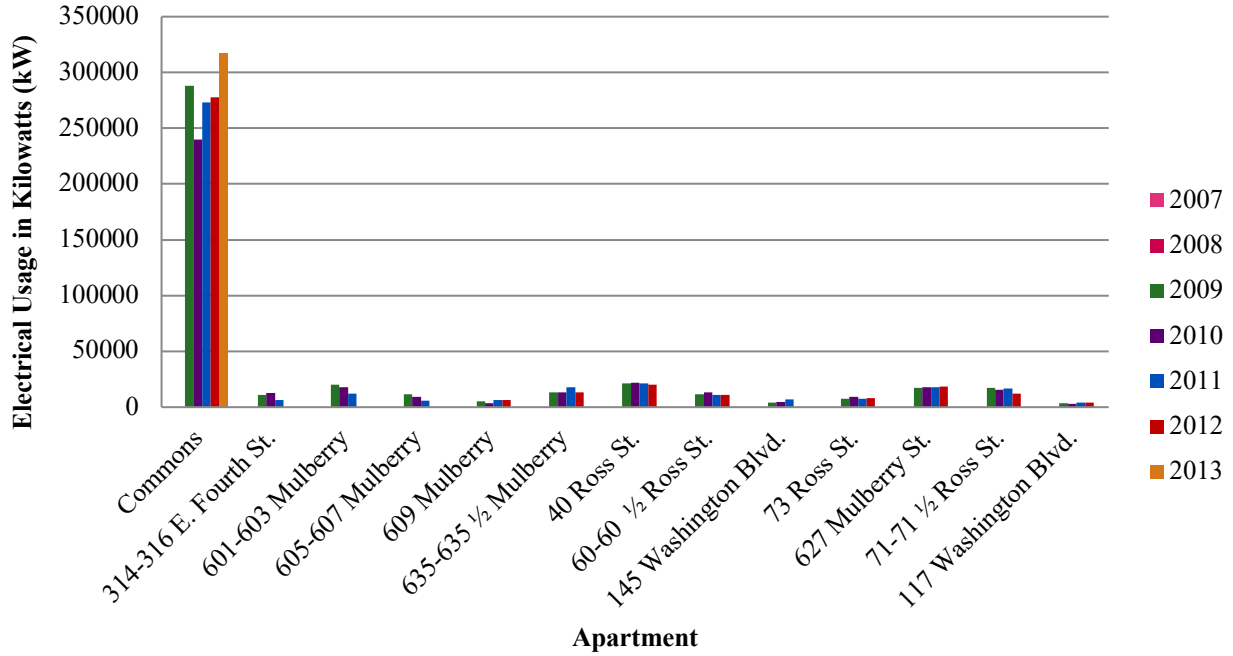
Electrical Usage for Lycoming College Academic Buildings in Kilowatts (kW)



Electrical Usage for Lycoming College's Other Buildings in Kilowatts (kW)

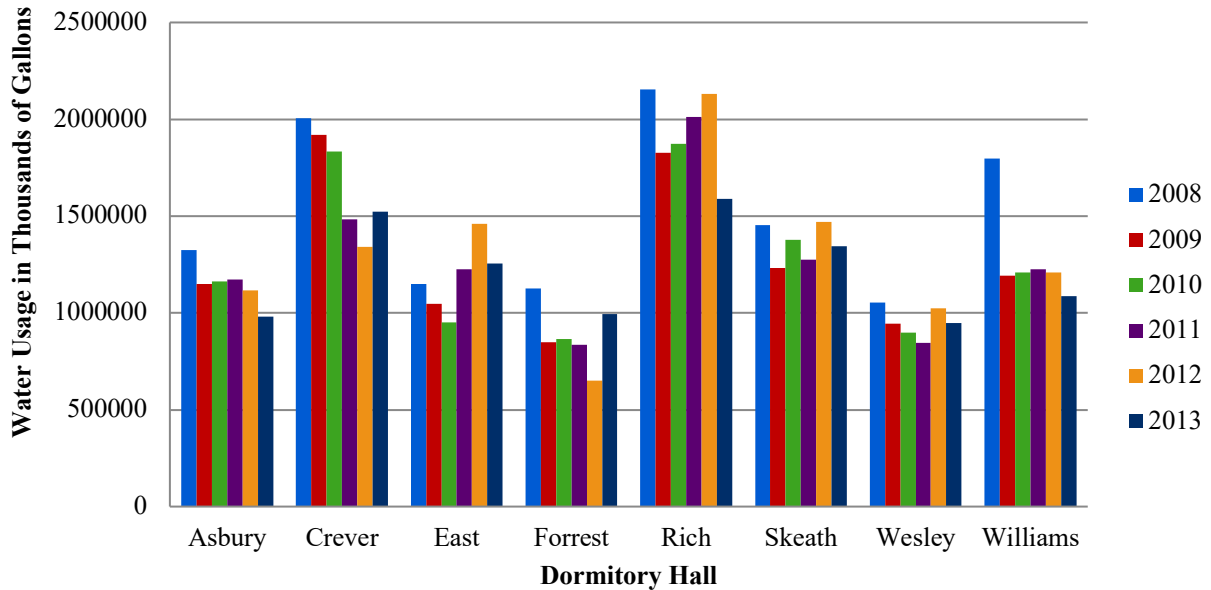


Electrical Usage for Lycoming College Apartments in Kilowatts (kW)

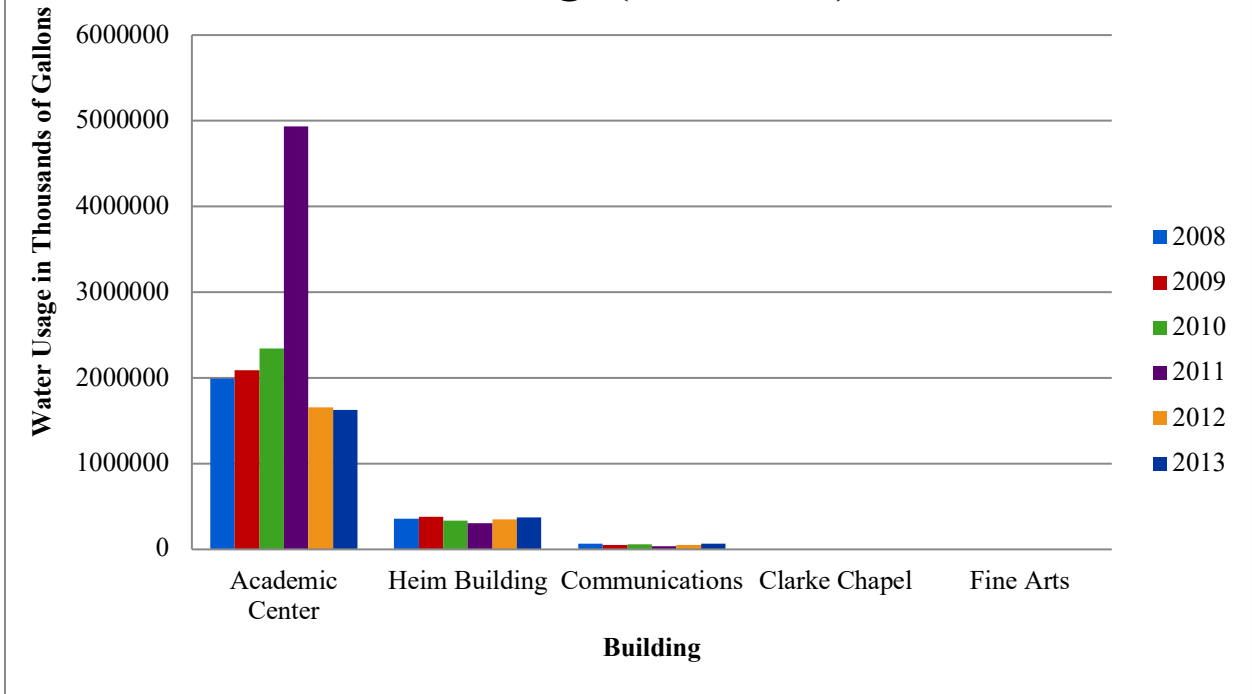


Appendix 6: Raw Water Usage in Thousands of Gallons

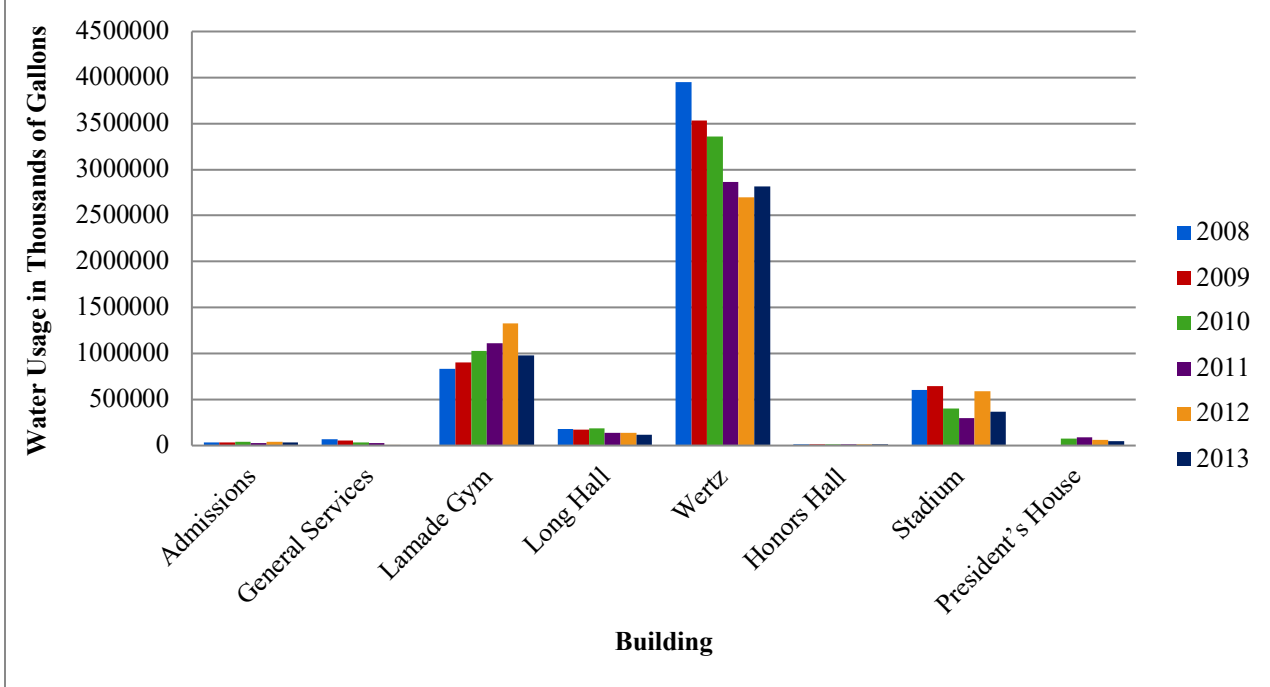
Water Usage in Lycoming College Dormitories (2008-2013)



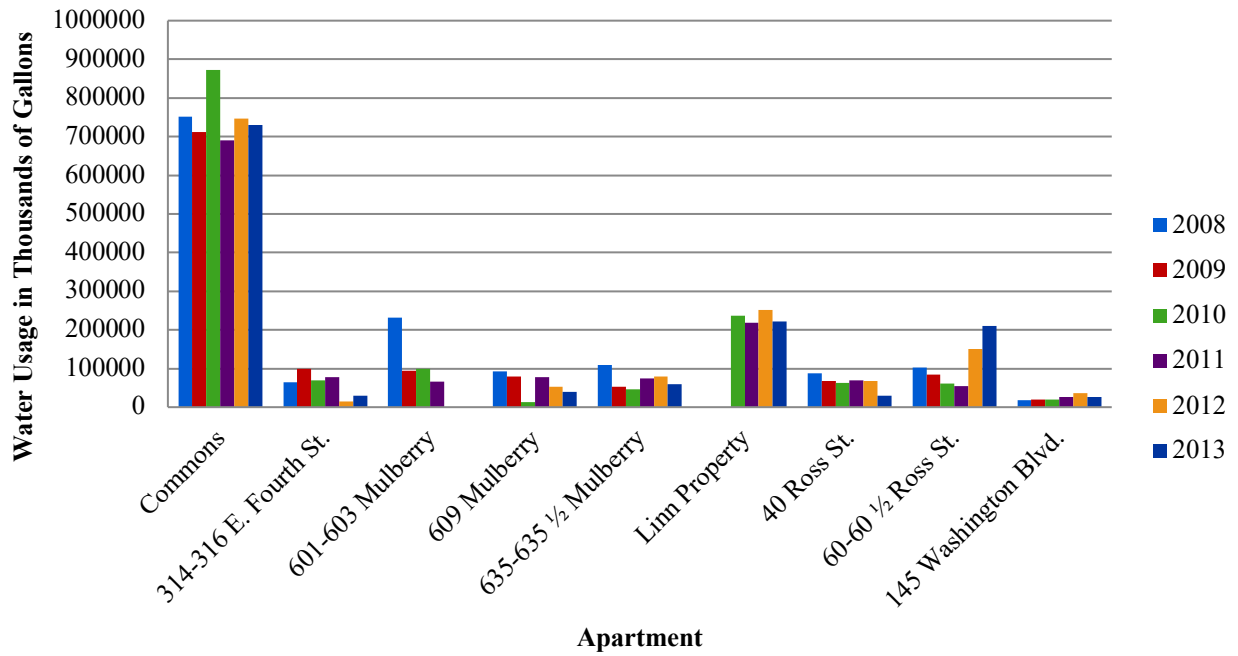
Water Usage in Lycoming College Academic Buildings (2008-2013)



Water Usage in Other Lycoming College Buildings (2008-2013)

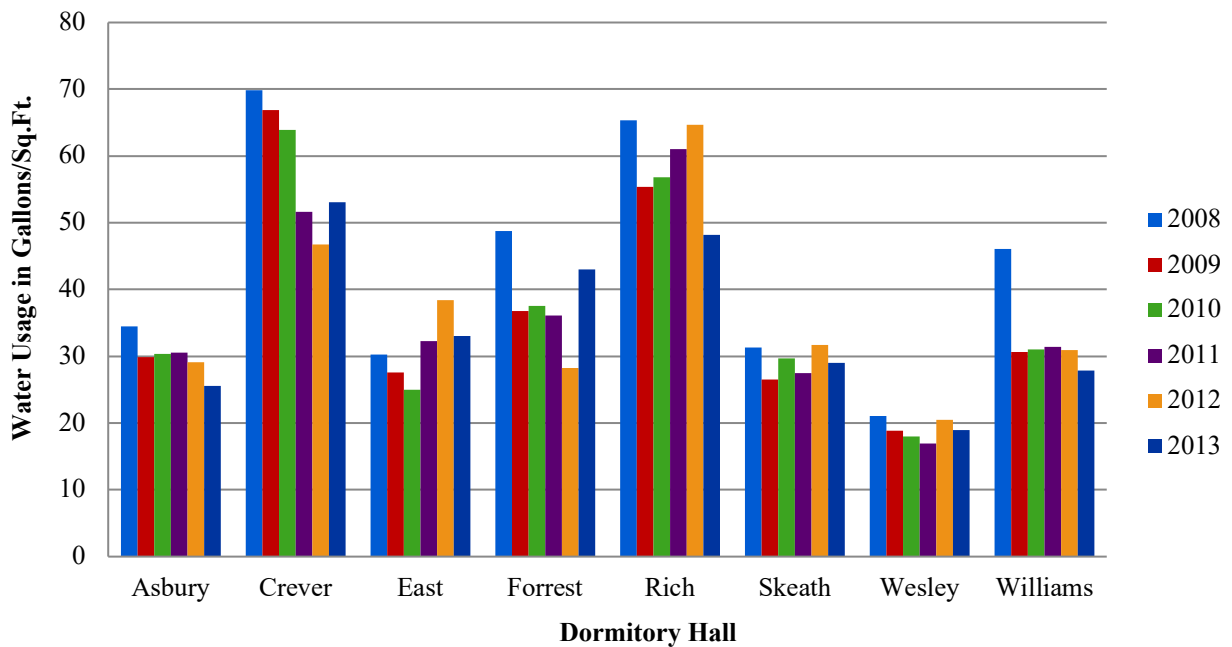


Water Usage in Lycoming College Apartments (2008-2013)

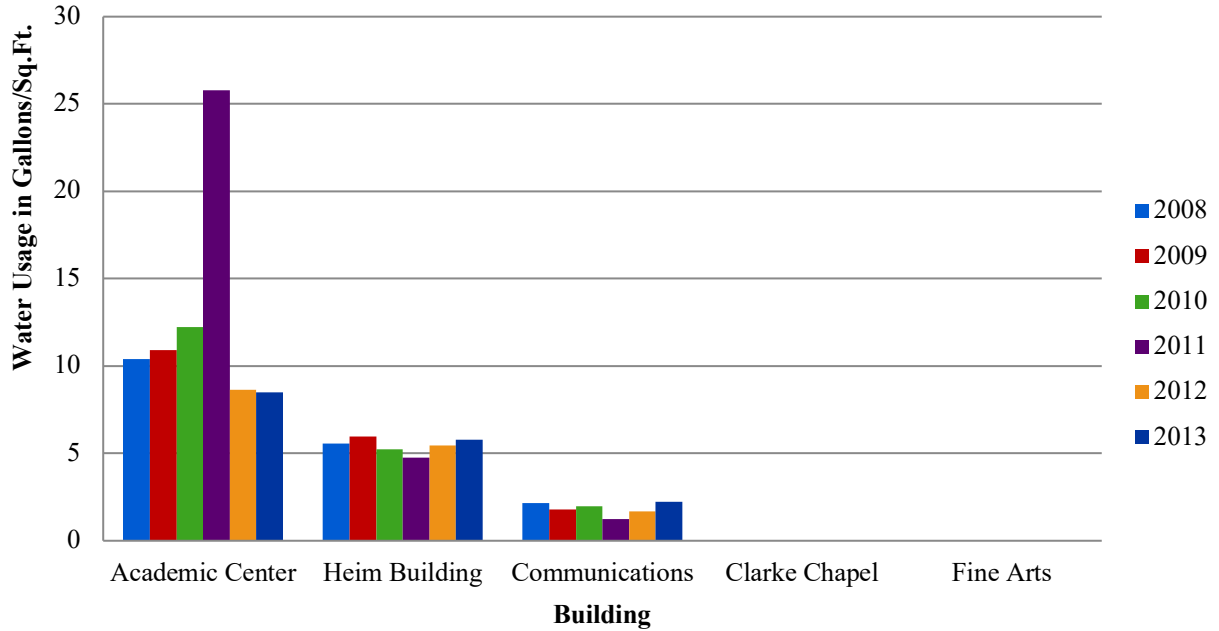


Appendix 7: Water Usage in Thousands of Gallons / Sq. Ft.

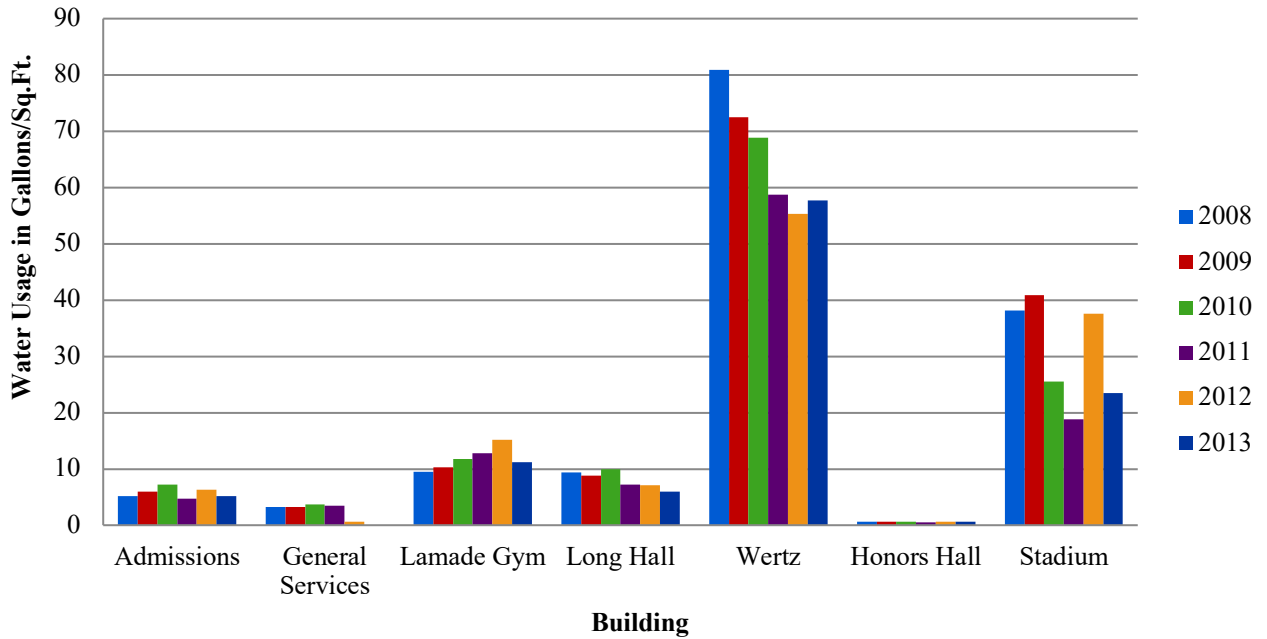
Water Usage in Lycoming College Dormitories (2008-2013)



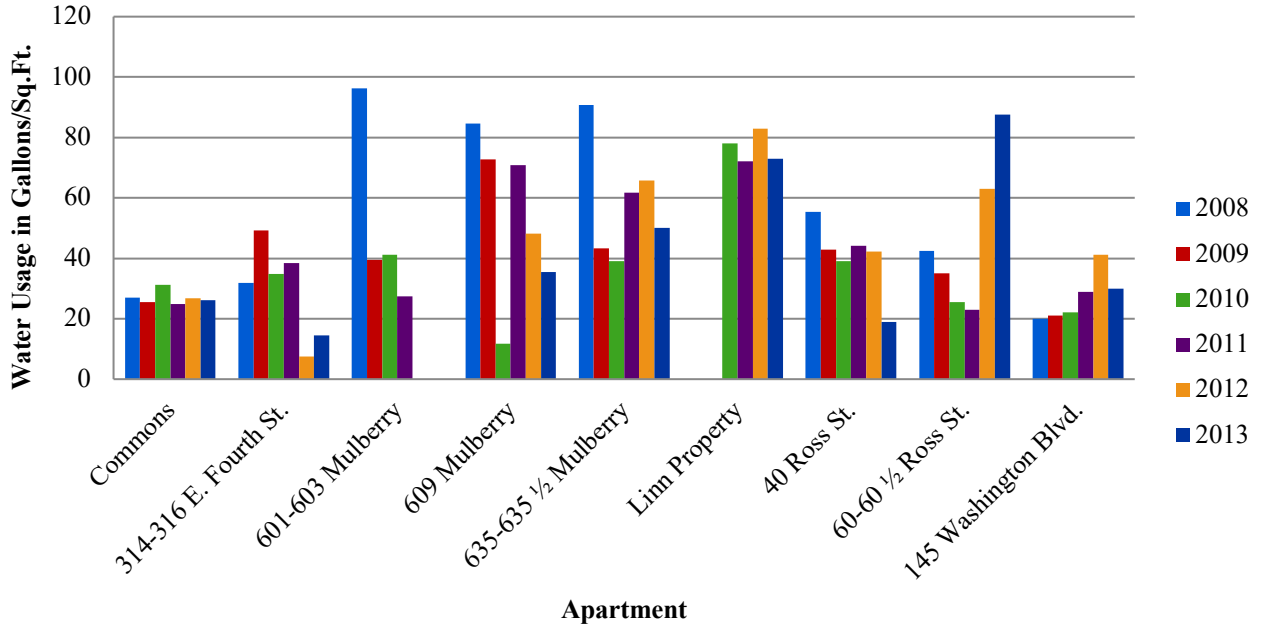
Water Usage in Lycoming College Academic Buildings (2008-2013)



Water Usage in Other Lycoming College Buildings (2008-2013)

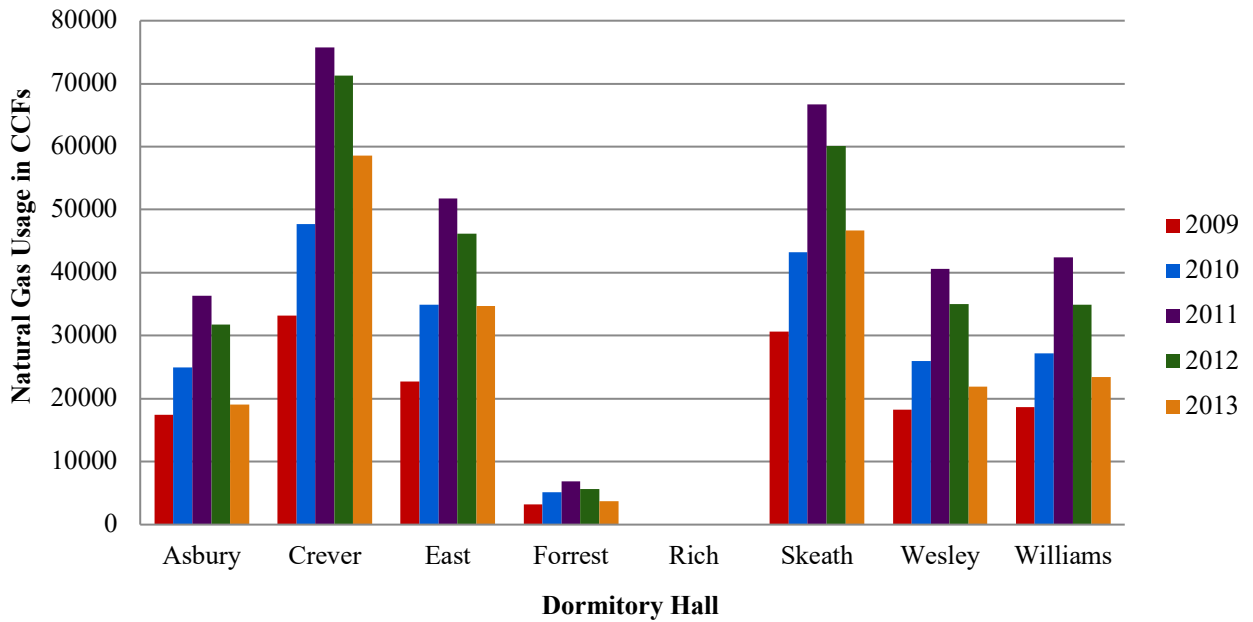


Water Usage in Lycoming College Apartments (2008-2013)

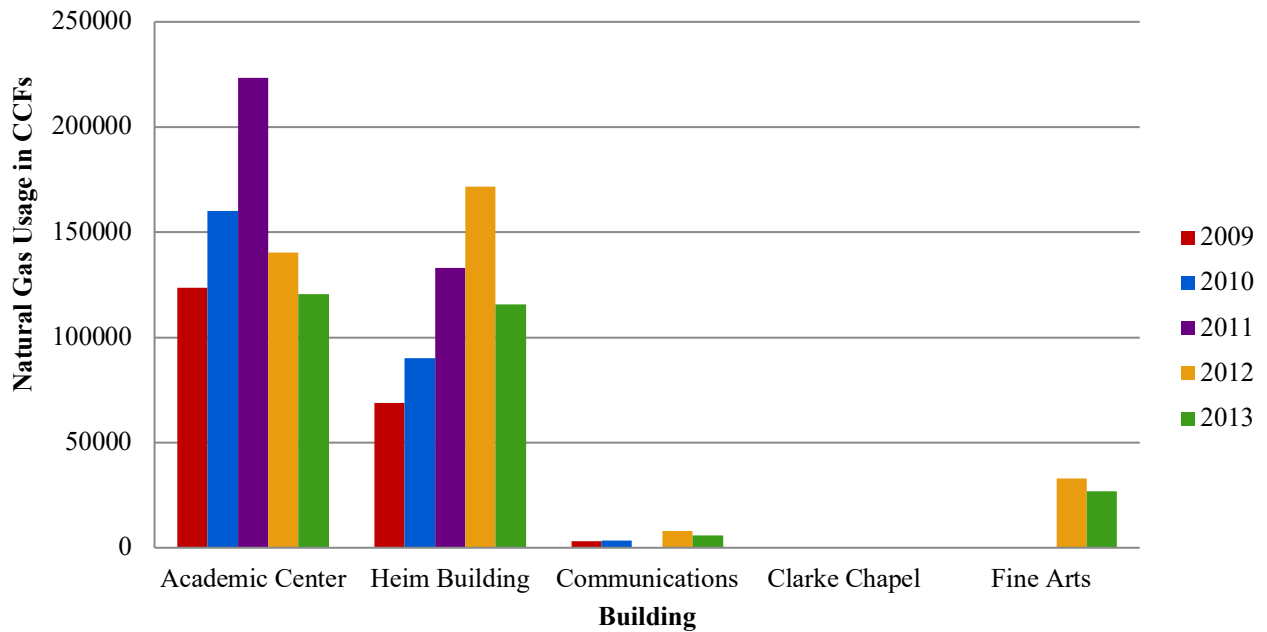


Appendix 8: Natural Gas Usage in CCFs

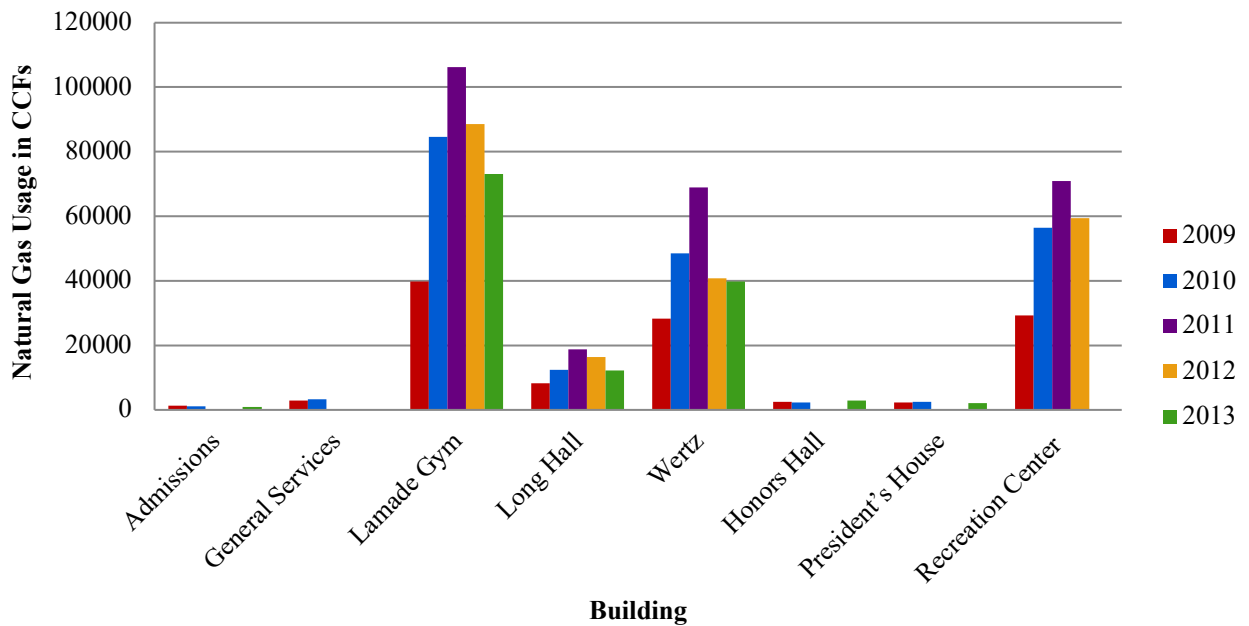
Natural Gas Usage for Lycoming College Dormitories in Hundreds of Cubic Feet (CCFs)



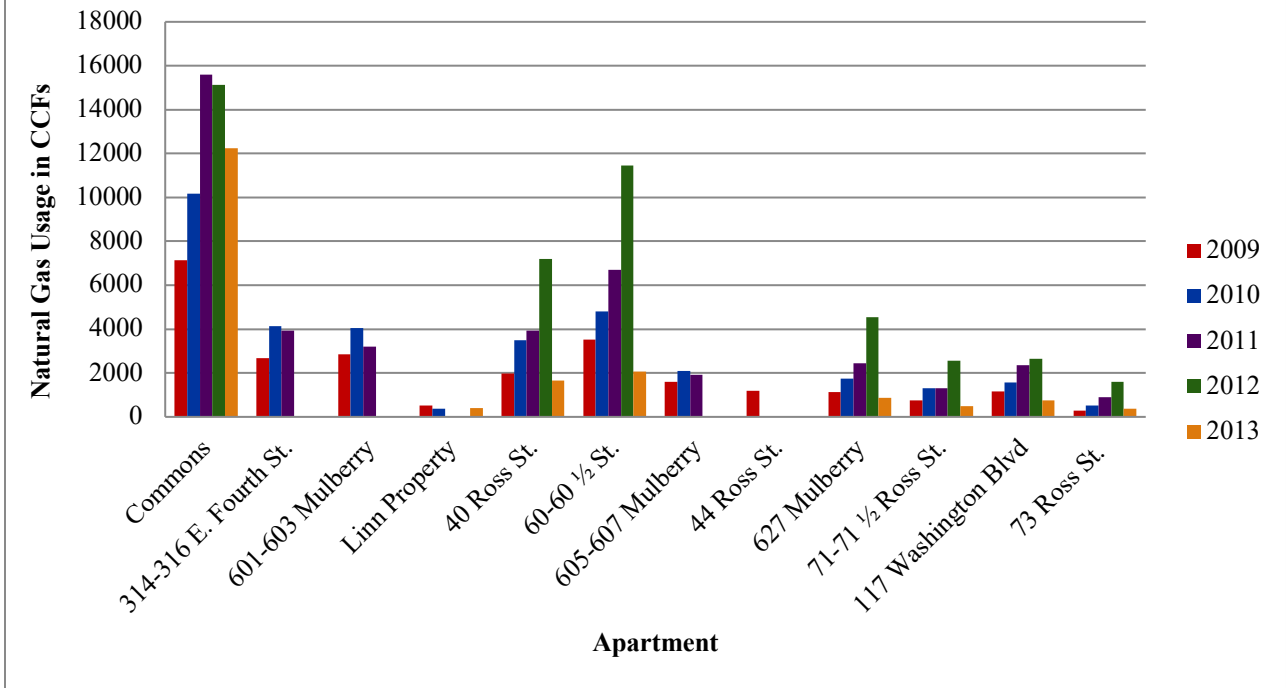
Natural Gas Usage for Lycoming College Academic Buildings in Hundreds of Cubic Feet (CCFs)



Natural Gas Usage for Other Lycoming Buildings in Hundreds of Cubic Feet (CCFs)



Natural Gas Usage for Lycoming College Apartments in Hundreds of Cubic Feet (CCFs)



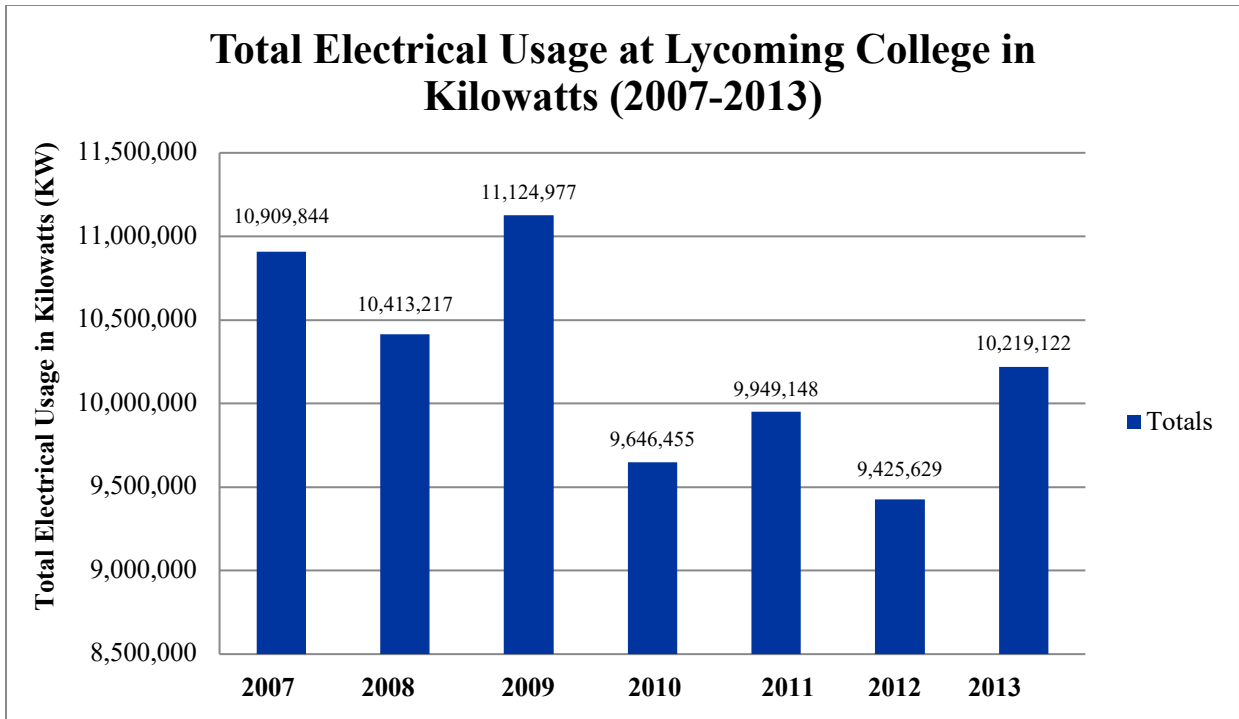
Appendix 9: Total Campus Usages

Year	Electrical Energy in kW
2007	10,909,844 kW
2008	10,413,217 kW
2009	11,124,977 kW
2010	9,646,455 kW
2011	9,949,148 kW
2012	9,425,629 kW
2013	10,219,122 kW

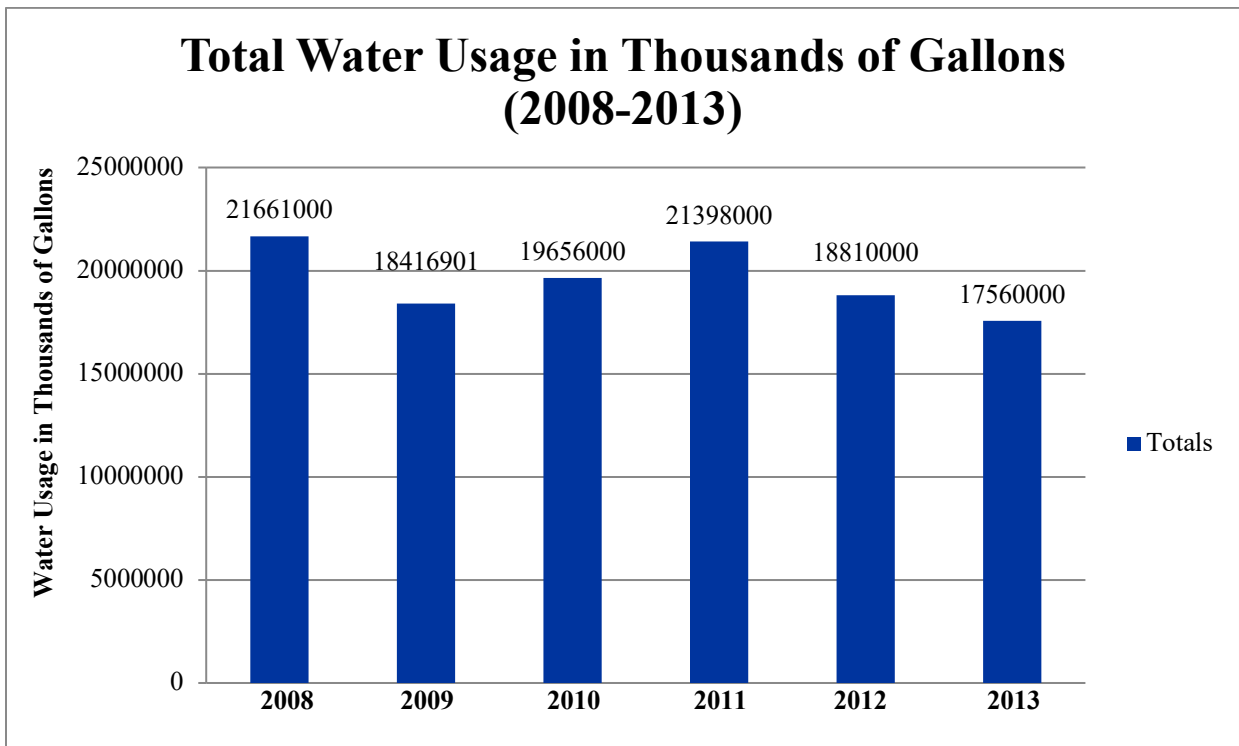
Year	Water Usage in Thousands of Gallons
2008	21,661,000
2009	18,416,901
2010	19,656,000
2011	21,398,000
2012	18,810,000
2013	17,560,000

Year	Energy Usage in CCFs
2009	486,374
2010	715,796
2011	984,192
2012	888,224
2013	649,431

Appendix 10: Electrical Energy Totals in kW

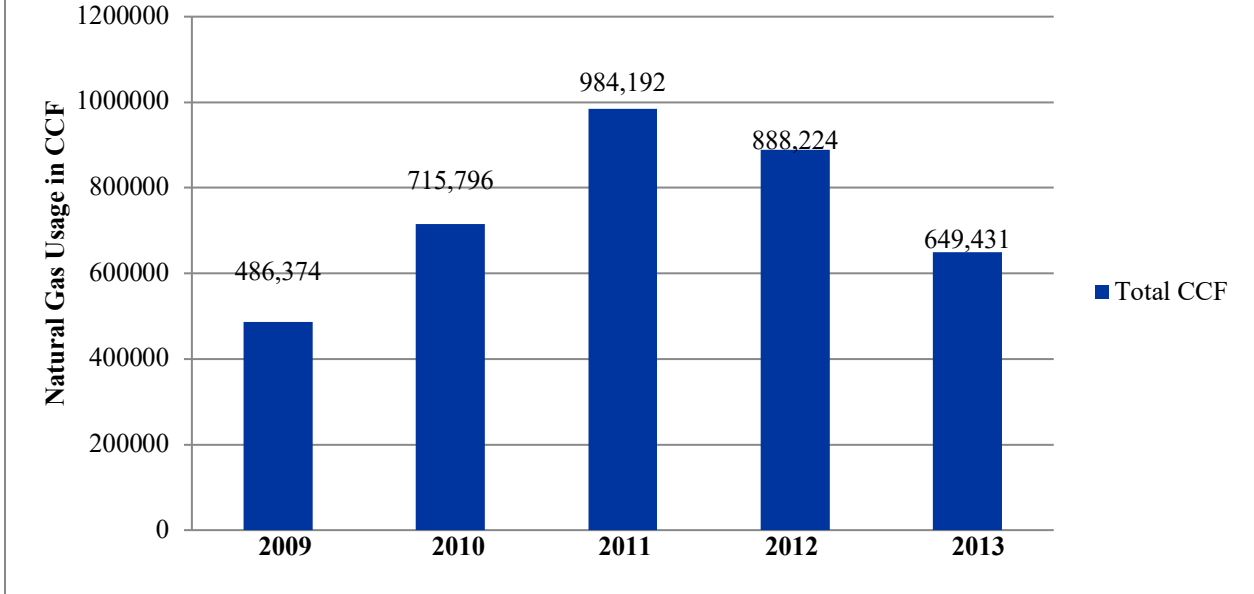


Appendix 11: Water Usage Totals in Thousands of Gallons

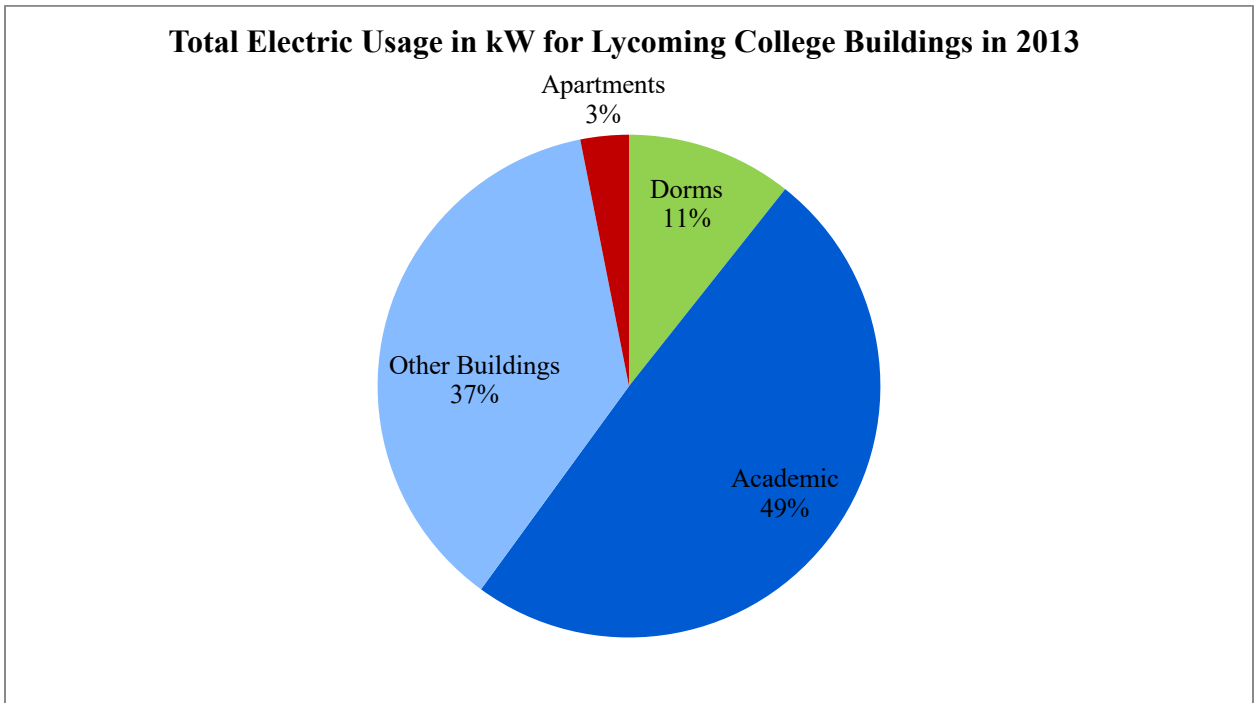


Appendix 12: Natural Gas Totals in CCFs

Total Natural Gas Usage for Lycoming College (2009 - 2013)

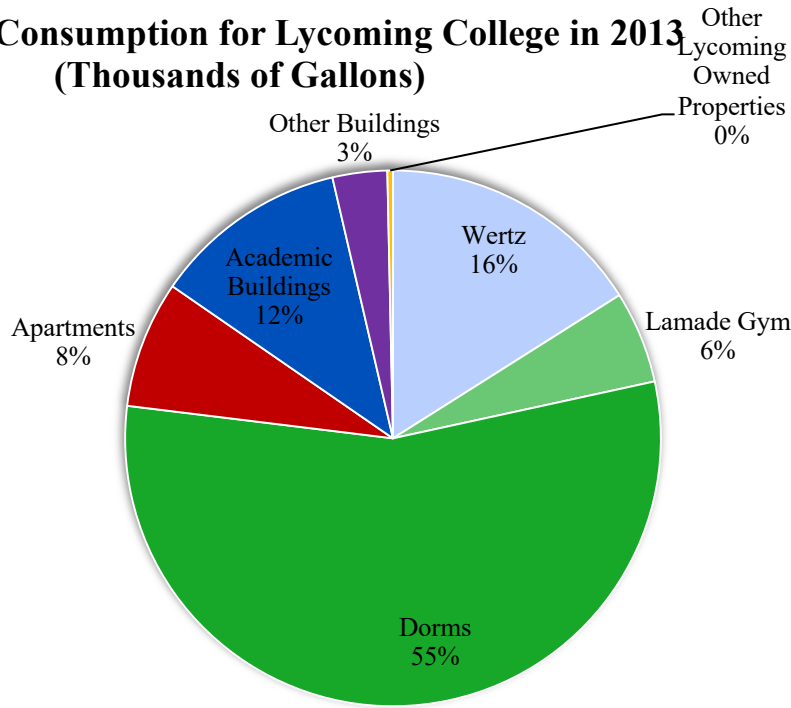


Appendix 13: Electrical Usage Breakdown for Lycoming College Buildings (2013)



Appendix 14: Water Usage Breakdown for Lycoming College Buildings (2013)

**Total Water Consumption for Lycoming College in 2013
(Thousands of Gallons)**



Appendix 15: Natural Gas Usage Breakdown in CCFs for Lycoming College Buildings

Lycoming College Natural Gas Usage (2013)

