City of Auburn, NY Greenhouse Gas Inventory

Baseline Year 2010

Completed in partnership with the Central New York Regional Planning & Development Board and the SUNY College of Environmental Science & Forestry

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1. Abstract

Greenhouse gas (GHG) emissions have been receiving increased attention due to climate change concerns. Public and private entities around the country are responding by quantifying their emissions in order to improve their sectors' efficiencies and to save money. We have partnered with representatives from the City of Auburn to assist in creating a GHG inventory using - ICLEI Local Governments for Sustainability Local Government Operations Protocol, - U.S. Community Protocol and Clean Air Climate Protection (CACP) Software. Each sector's emissions were categorized into three scopes based on where the emissions occurred. We analyzed data from 2010 to create a baseline using ICLEI methodology in order to utilize the CACP Software and 2012 findings to project 2020 emissions. Our study found that Auburn has multiple sectors that can be improved to lower GHG emissions and the City has several goals and initiatives in order to accomplish this. Our analysis provides the groundwork that will make developing an effective Climate Action Plan (CAP) possible.

2. Introduction

GHGs help to maintain a habitable temperature range on Earth and prevent harmful UV radiation from entering the atmosphere (NOAA, 2010). However, since the Industrial Revolution, humans have significantly increased the rate of GHG emissions into the atmosphere, namely carbon dioxide, nitrous oxide, and methane from the burning of fossil fuels. While GHGs are not inherently detrimental because of their heat regulating ability, many scientists theorize that excessive GHGs contribute to global climate change, as an abnormal amount of heat is being trapped. The general consensus among scientists is that the social, environmental and economic impacts resulting from increased average global temperatures are undesirable. For this reason, policy makers have incentivized the act of documenting and reducing emissions, a process that is completed through a GHG inventory report like the one we have completed for the City of Auburn.

To combat climate change, Local Governments for Sustainability (ICLEI), an international organization whose mission is to help cities around the globe become more sustainable (ICLEI website), created a milestone-based strategy to reduce GHG emissions. To do this, emissions must first be quantified and organized in order to determine the biggest areas of concern. A GHG inventory is the quantification and assessment of GHGs emitted by government and community operations within a defined boundary. The inventory provides a baseline for comparison to later years in order to form a benchmark analysis. It makes a future CAP analysis possible.

Many municipalities are interested in reducing their emissions to improve their City's image and citizens' well-being as well as to save money through reduced energy bills. Auburn, in Cayuga County, New York, adopted a Comprehensive Sustainable Energy and Development Plan in January 2010 intending to make their City more environmentally and economically sustainable over the long term. In order to achieve their vision, the City has made efficiency improvements, such as a cogeneration facility at the City owned and operated Wastewater Treatment Plant, geothermal temperature regulation of City Hall, as well as the police and fire headquarters building, LED and induction streetlight upgrades, and parking garage lighting efficiency upgrades . Several energy intensive operations are located within or just outside the City boundary. Municipal operations include an ice rink, minor-league baseball park, and water filtration plant and pump houses. Private sector industries with intensive energy usage include a steel plant. By facilitating the inventory, Auburn can identify and address sectors with excessive energy use and emissions. This information can then be used in a CAP to establish quantifiable goals and follow through with their comprehensive plan in reducing emissions.

The alternative energy systems that the City has in place have far-reaching effects both on the City's image and their overall emissions. Geothermal wells involve utilizing the thermal energy of the earth itself to regulate the temperature of an area. If these installations are used within a compact environment, heating fuel can be completely removed from the City budget for certain buildings. Landfill gas (LFG) capture systems are an effective method of preventing certain emissions from entering the atmosphere. Auburn's cogeneration facility takes the captured LFG and combusts it, using the heat along with water and a turbine. The electricity generated by the turbine is then used to power the waste water treatment plant within the City boundaries. Given that the efficiency of the LFG capture system is 80%, this is an example of the use of waste products from municipal operations.

Auburn must purchase all other fuels it does not create within its own boundaries. Facilities like the Cogeneration plant and the North Division Street hydropower station (along with the Mill Street Dam hydro station coming back online in May 2014) are examples of power generation utilizing renewable fuel sources, at only the cost of infrastructure. This should be kept in mind when making decisions about implementing further GHG-reducing technologies, many of which are very costly. Cost analyses should be performed prior to installation so that both the taxpayer and policy maker are made aware of the initial costs and probable payback associated with reducing GHGs.

Using ICLEI and CACP software, we quantified Auburn's GHG emissions for 2010 and 2012. The trend between this timeframe was then used to predict emissions in 2020. This study lays the groundwork that makes a CAP possible. The GHG inventory is just another step in Auburn's plan to create a livable, sustainable community. Amenities such as improving walkability and pedestrian safety downtown, a municipal building-wide conservation program, and new zoning rules to facilitate development of buildings that fit the City's cultural, historical, and environmental vision display Auburn's desire to reduce the City's carbon footprint.

3. Objectives

Create a greenhouse gas inventory for the City of Auburn

- Establish a baseline assessment - 2010
- Conduct a follow up assessment - 2012
- Create a future projection based on savings between baseline and follow up – 2020

Collect and organize energy consumption on the following sectors to calculate greenhouse emissions:

- Wastewater treatment
- Lighting
- Waste (Landfill A & B at 311 N. Division St.)
- Buildings and facilities
- Vehicle fleet
- Water filtration and transmission

4. Methodology

GHG emission data was collected for the City of Auburn and formatted to fit ICLEI methodology and standards, which are supported and accepted by international associations of local governments. The years 2010 and 2012 were analyzed with 2010 serving as a baseline measurement and 2012 to monitor the effectiveness of new initiatives launched after 2010. The year 2010 was chosen as a baseline due to several reasons including the availability of sector data and recent census data, the ability to create a 10-year forecast with the 2020 projection year, and the year is recent enough to be relevant. Auburn provided data for the following sectors: buildings and facilities, lighting, the wastewater treatment facility, water transmission and delivery, water purification, vehicle fleet, and landfill waste. The data was broken down into three scopes: (1) direct, (2) indirect, and (3) removed in order to understand how energy is utilized.

Auburn's landfill (waste), wastewater treatment processes, and localized vehicle fleet are considered direct sources of emissions, as the emissions are all produced within City boundaries, placing them in scope 1. Lighting, water purification, water transmission (lower pump) and delivery, buildings and facilities, are considered indirect emissions as their GHGs are produced outside City boundaries and transported to Auburn for use, placing them in scope 2. Scope 3 includes indirect emissions from outside City boundary purchases that are directly financed or encouraged by the City, which includes the upper pump station at Emerson Park for water transmission and distribution and the Soule cemetery maintenance buildings in the Town of Sennett.

By dividing emissions by sector and scope, areas of weakness or concern can be easily and quantifiably addressed with a CAP - a customized blueprint created to develop quantifiable goals and complementary strategies to reduce emissions (ICLEI Local Governments for Sustainability, 2013). Electricity, natural gas, vehicle fuel type and quantity, and alternative forms of energy were provided by City officials in the form of bill tracking and records of purchase. GHG emissions from each sector were then calculated based on methods suggested by ICLEI.

The Nucor Steel Inc. industrial plant is located within the boundaries of the City of Auburn. Due to the limited control the City has over this facility, but given the significant impact of the plant's operations, the process emissions from the plant were included as information items in this report. The energy used by the plant is included in the community industrial energy use sector.

Each yearly energy consumption value for individual identification numbers was inserted into CACP and were organized by sector. This was done for consumers of all GHG emitting fuels such as electricity, natural gas, gasoline and diesel. The program then showed the overall GHG emissions from each sector from both years and served as the basis for Figure 1 and Figure 2 under Results and Analysis.

CACP Software was used to create a 2020 projection for the individual sectors. Each individual source was entered into the software using the meter number or identification number for clear reference. The change in emissions between 2010 and 2012 was factored into the analysis when creating a 2020 projection from the 2010 baseline. This was done by finding the difference of emissions between 2010 and 2012 and subtracting the savings from the projected 2020 emissions.

4.1 Creating a Proxy for 2010

Due to 6 months of missing electrical data, from January 2010 to June 2010, a proxy was created using CACP methods and 2009 data. The 2010 Proxy data was calculated using the methods in the Local Government Operations Protocol handbook (Local Governments for Sustainability, 2010). Specifically, Equation 6.13 of section 6.2.2.2 was used. The proxy year was 2009, so electricity data from "Historical Electric Use -May 2008 - April 2009" was used to develop a 2010 consumption estimate. The majority of energy used in buildings comes from temperature regulation. For this reason, the proxy formula used takes into account the time in 2010 that the furnace and air conditioning units had to be turned on. This is done through the inclusion of HDD (heating degree days) and CDD (cooling degree days), information that was obtained from the National Oceanic and Atmospheric Association (NOAA, http://www.ncdc.noaa.gov/cdo-web) for both 2009 and 2010. HDD are the number of degrees that a day's average temperature is below the level with which a building needs to be heated. CDD are the number of degrees that a day's average temperature is above the level with which a building needs to be cooled. Finally, it was assumed through investigation and feedback, that 100% of the cooling in Auburn is powered by electricity while approximately 0% is used for heating. While this is not entirely correct because geothermal pumps use electricity for heating, it was determined that this consumption was minimal in comparison to other forms of grid-supplied electricity consumption.

To find the costs for the proxy data, ($/kWh) the rates provided in "ECA Bill Amts 7-2010 thru 12-2011.xls" were averaged and then multiplied by the proxy usage result. Once the proxy usage and cost were obtained, they were added to the existing 2010 data (July through December). This was the total 2010 kWh data entered into the ICLEI Master Workbook. Once all the data was collected and calculated using ICLEI methodology, the information was entered into CACP software to generate results and GHG emission projections for the year 2020.

Specialized methodology for each sector is included in the next section.

4.2 Wastewater Treatment

Data was obtained for the wastewater treatment plant through various means. ICLEI's Appendix F (2012) protocol was used to determine nitrous oxide emissions, a series of receipts was collected to determine energy costs, and missing electricity data was substituted using proxy calculations.

4.2.1 Wastewater Treatment Infrastructure

By using the "City of Auburn Electricity Account Billing Groups" document, the types and locations of wastewater infrastructure were identified. A Point of Delivery ID and Meter Number ID corresponded with each individual source. These identification numbers were important, as some invoices referred to the infrastructure with these ID numbers rather than the location or name.

4.2.2 Electricity

The "Electric Supply Usage Report" document from December 2011 – December 2012 was used to determine the kWh total and the total cost for the year. Each source was extracted and totaled, thus the kWh and cost can be identified for each. These totals were summed to enter into CACP.

The "ECA Bill Amts 2010-2011.xls" document was used to determine the electricity data for June 2010 – December 2010. The entries that were split between December 2010 and January 2011 were included. The kWh and cost for each source can be identified, as each individual source was extracted and totaled. The first six months of 2010 data was not available, therefore, a proxy was created using ICLEI LGOP methodology and calculations (p45) (see proxy methodology, above). To determine the total electricity used in 2010, the proxy data was added to the known data.

4.2.3 Natural Gas

A copy of a NYSEG receipt, labeled "WWTP" was given to us at the first meeting with Auburn. This data was the natural gas records for 2011 – 2012. The 2012 therms and costs data was extracted and summed.

A PDF document titled "1-2010 to 2-2011 Natural Gas Usage.pdf Daily Invoicing with Volume" was obtained from Auburn that had the natural gas data for 2010. The original volume was reported in decatherms. An email from Scott McIntyre, dated 03/19/2013, confirmed that the units were decatherms. The total volume, in decatherms, and the costs were summed for 2010. The sum volume for 2010 was then converted from decatherms to therms by multiplying the decatherm sum volume by 10.

4.2.4 Cogeneration Facility

Using the document titled "LGTE_ProductonHistoryfrom201010to20December202012" which was emailed 03/18/2013 via Scott McIntyre, data concerning the cogeneration facility was retrieved. This information was confirmed with the document "Production History from 2010 to December 2012" and a paper handout from the first meeting with Auburn. In this document, the wastewater treatment plant's monthly electricity usage in kWh was found, as well as the amount of energy sent to the grid and the cogeneration facility electricity consumption. The energy used at the cogeneration and wastewater treatment plant was found by subtracting the values from Pole 9 from Pole 1. However, it is important to note that the electricity used at the wastewater treatment plant is provided by renewable energy. The methane capture from the Auburn landfill is sent to the cogeneration facility, turned into electricity, and used to power 100% of the electrical needs of the wastewater treatment plant.

4.2.5 Nitrous Oxide Emissions

A phone interview was conducted in February 2013 with Mark Storrs, Senior Building Maintenance Mechanic of the wastewater treatment facility in Auburn. Using Appendix F titled "Wastewater and Water Emission Activities and Sources" through the CACP ICLEI protocol, the methods were determined by using the decision trees (ICLEI appendix F 2012, p.5-15). Mark Storrs answered a series of questions related to the wastewater treatment facility in Auburn. Chart WW.1 was used to enable us to report emissions from wastewater treatment technologies with the community (ICLEI appendix F 2012, p.11). The information extracted is as follows: Auburn has operational control of its wastewater treatment; they have centralized treatment; they do not use lagoon systems. This data lead us to use Chart WW.4 to report emissions from conventional aerobic wastewater treatment systems (ICLEI appendix F 2012, p.14). The data collected is as follows: process-specific information is available concerning the facility, they do not practice anaerobic digestion, they do not incinerate solids, they do not practice nitrification or denitrification. The results from the decision tree directed the use of Methods WW.8 and WW.12 in the ICLEI Appendix F protocol. Auburn reports that the wastewater treatment plant services the City of Auburn and the towns of Owasco, Flemming, Aurelius, and Sennett. The populations for these towns and the City were obtained by the Auburn spreadsheet via 2010 census and the NYSDEC document: http://www.dec.ny.gov/docs/water_pdf/descdata2004.pdf obtained March 2013. Only 2010 had available and current census data, as the census is done every ten years.

Method WW.8 is used to determine nitrous oxide emission from effluent discharge if only the population is known. The calculations, using the Appendix F, page 55 as a guide to the equation, is as follows:

Step 1: population served = 40,503
F(ind-com) = 1.25 (has significant industry input)

Step 2: Yes, it has significant industrial/commercial inputs; therefore F(ind-com) = 1.25
Step 3: Enter in data (ICLEI Appendix F, p43)

P = population = 40,503
F(ind-com) = 1.25 (has significant industry input)
EF = 3.2
GWP = 310 (GWP value determined by using the ICLEI Appendix GWP) [conversions from mt of N2O into mt of CO2]

Equation: Annual N2O emissions = ((P * F(ind-com)) * EF * 10-6) * GWP
= ((40,503 * 1.25) * 3.2 * 10-6) * 310
= 50.22

= Process Nitrous Oxide Emissions = 50.22

(Created by: Team Auburn, 2013. Template and methods provided by ICLEI Appendix F, 2012)

Method WW.12 is used to determine nitrous oxide emission from effluent discharge if only the population is known. The alternative method (WW.12 (alt)) was used due to the lack of data for the average daily total nitrogen-load. The calculations, using the Appendix F, page 55 as a guide to the equation, is as follows:

Step 1: population served = 40,503
F(ind-com): = 1.25 (has significant industry input)
Step 2: does not employ nit/denit thus 0.0 nitrogen is removed from the wastewater treatment plant
Step 3: enter in data (ICLEI Appendix F, p56)
[aerobic system; stream discharge; does not use nit/denite]

P = population = 40,503
Find-com = 1.25 (has significant industry input)
Total N load = .026 (constant)
N uptake = .05 (aerobic system constant)
BOD5 load = .090 (constant)
EF effluent = .005 (river/stream discharge constant)
44/28 = 1.57
nit/denite = 0.0
GWP = 310 (GWP value determined by using the ICLEI Appendix GWP) [conversions from mt of N2O into mt of CO2]

Equation: Annual N2O emissions = ((P * F(ind-com)) * (Total N load – N uptake * BOD5 load) * EF effluent * 44/28 * (1-(Fplant nit/denite)) * 365.25*10-3) * GWP

= ((40,503 * 1.25) * (.026 - .05 * .090) * .005 * 1.57 * (1 - 0.0) * 365.25 * 10-3) * 310

= Nitrous Oxide Emissions from Effluent Discharge = 967.51

(Created by: Team Auburn, 2013. Template and methods provided by ICLEI Appendix F, 2012)

4.3 Lighting

2012 Data

The only energy consumed by lightning was electricity that was produced off site. Data was taken from the "Electric Supply Usage Report 12/11 - 12/12", which provided the yearly electricity consumption in

KWh for each light by meter number and the price paid for that electricity. This included traffic signals, street lights, park lighting, parking garage lighting and cemetery lighting. The "City of Auburn Electricity Accounts - Billing Groups" was also used to further identify which ambiguous meters belonged with which sector. We then confirmed the sectors for each meter with Scott McIntyre in an email. We organized the data in Microsoft Excel, so it could be copied one meter number at a time into the ICLEI CACP software. ICLEI CACP then provided the approximate GHG emissions in CO_2e, which was put into multiple graphs in order to compare the emissions from each sector.

2010 Proxy Data

Only half of the 2010 electricity data was available in the "ECA Bill Amts 7-2010 thru 12-2011." It provided electricity use and cost data on a monthly basis, which added the step of having to sum up the months; July through December. The remaining proxy data for July-Dec was added to the existing lighting data for 2010.

4.4 Waste

Due to the landfill being within the City boundaries, all of the waste was included in the government operations analysis. The reported emissions from landfill processes (methane resulting from decomposition) were restated from the Environmental Protection Agency's (EPA) Greenhouse Gas Reporting Program (GHGRP) for 2010 and 2011 (used as a proxy for 2012). Auburn identified the sources of waste from government operations including the wastewater treatment sludge, grit, sweeper pile, and City construction & demolition. The government operations waste process emissions solid waste facility energy use was entered into CACP. This is also in accordance with ICLEI's Community Protocol, Appendix E (solid waste), SW.1.

Electricity and natural gas for 2010 and 2012 were calculated by utilizing documents on Auburn's ftp site. For electricity, the first half of 2010 was proxied via 2009 in a process described in the section "Creating a proxy for 2010." The second half of 2010 was compiled from the FTP site, as was 2012. Natural gas usage for 2010 was found via the FTP site, while 2012 was found in the NYSEG billing report for that year.

4.5 Buildings and Facilities

The ICLEI Master workbook can only accommodate 10 buildings. Auburn has more than 10 buildings under its jurisdiction. This was circumnavigated by creating two separate Excel spreadsheets mirrored after the Master Workbook; one was for 2010 and the other for 2012. All of the columns were the same as the ICLEI Master Workbook except for the addition of an “Address” column which was added to help with organization. Both the POD number and Addresses were used to identify buildings, keep consistent data, and make sure that facilities could be matched from document to document. Table 5 is a list of the buildings served along with their addresses and POD numbers. It should be noted that addresses were not found for several buildings. Also, the Falcon Park facility had two electric meters but only one natural gas meter. Since we did not know what electricity meter should be associated with the natural gas meter, a row was created for each electric meter. “Stationary Combustion” was entered in for the Reporting Sub Category since this is the appropriate entry for buildings. The only scope 3 facilities dealt with in the Buildings and Facilities sector was the Soule Cemetery which Christina Selvek, Director of Capital Projects and Grants from the City of Auburn, notified us was outside of the Auburn City boundary but that the City still serviced. The other scope 3 facility was the Upper Pump Station for water transmission and delivery. Electricity was reported in kWh and natural gas was reported in therms. However, the bills of sale reported natural gas in decatherms, so before data from both natural gas documents could be used it had to be converted to therms by multiplying by 10. The type of natural gas used by the City of Auburn is “Pipeline US Weighted Average,” information that was provided by Carolyn Ramsden, Energy Management Program Planner at the CNY Regional Planning and Development Board, Syracuse NY. For all buildings, taxes were included in the bills of sale documents. It should be noted that all numeric entries to the spreadsheets were rounded to the nearest whole number (Decimals were kept however when adding up individual entries. It was only the final answer that was rounded). This was done because all entries in the Buildings tab of the ICLEI CACP master workbook are rounded to the nearest whole number.

4.5.1 Natural Gas

2012 natural gas data (both usage and cost) was taken from “Natural Gas Usage 7-11 to 1-13 Summary.xlsx.” This document listed each building by POD number and address, as well as the name of the facility (this was handwritten on the packet when we received it. We assume that either Christina Selvek or Scott McIntyre did this). Not every facility in the packet fell within the “Buildings and Facilities” sector boundary (Table 5 shows the buildings that were examined). This distinction was made by conversations with members of the group as well as with Carolyn Ramsden, Scott McIntyre, and Christina Selvek. Meters are not charged on the first of every month, so to make sure that the entire year was covered, 13 meter readings were added together. These usually overlapped slightly into 2013. For example, since the 2012 Natural Gas meter reading for Clifford Park did not start until December 29, 2011, data up until December 31, 2012 was included for analysis. This same method for determining the date range for meters was used for both electricity and natural gas data for 2012 and 2010.

2010 natural gas data was obtained using the same process from 2012 except that data was taken from "1-2010 to 2-2011 Natural Gas Usage.pdf" document. It is important to note that natural gas usage for the cogeneration plant was incomplete. No data existed for June through October but since 2012 usage during this time was very low, we made the assumption that 0 therms were used by the facility during this time period. This assumption might lead to some error, but since no further data existed for this year and usage during this time period was low or non-existent in previous years (likely due to the summer season), we believe that this error would be minimal.

4.5.2 Electricity

Electricity data was taken from "Electricity Supply Usage Report 12-2011 thru 12-2012.xlsx." Again, communication between various members of the group was required to decide which meters belonged to each sector. For this document, no building name or address was given so the POD meters were very important. Once these were matched with the POD meters already found, data could be entered into the spreadsheet.

The 2010 electricity data was complete only for July through December. This required data from the other half of the year to be estimated using 2009 data as a Proxy. 2009 data was taken from "City of Auburn Historical Electric Use - May 2008 thru April 2009." This Proxy methodology is described above. The results from the proxy were added to the existing kWh usage provided in "ECA Bill Amts 7-2010 thru 12-2011.xls". Each range was slightly different but ultimately 6 months of the Proxy data and 6 months of the actual data were collected. Two buildings, the Police Report Center (Electric POD #: 1000001607738) and the Logan Street Garage (Electric POD #: 1000011046364) only had actual data for 5 months, so a separate proxy equation was used to include July for these two facilities.

4.6 Vehicle Fleet

All data was entered into CACP software for both 2010 and 2012. To account for the 10% ethanol composition for unleaded gasoline in 2010 and 2012, fuel usage totals for all vehicles using unleaded gasoline were multiplied by .10 (10%). Therefore, 90% of the unleaded gallons were reported as gasoline and 10% was reported as ethanol. This was done to account for the proportion of biogenic emissions (ethanol has biogenic origins from corn) resulting from gasoline use. Departmental equipment, such as tow trailers, was not considered in this report as they do not use fuel directly.

4.6.1 2010 Fuel Usage

The 2010 fuel data was collected from the City of Auburn's Department of Public Works and historic records monthly purchase orders. The following information was extracted: department, vehicle identification number (ID), year, vehicle (if available), product (unleaded or diesel), usage surcharge (fuel consumption), and total cost for each vehicle in each monthly report and entered it in an Excel file. The usage surcharge sum and the total cost sum were then calculated for 2010.

Department, ID, name of vehicle, fuel consumption, and cost were input into the 2010 ICLEI workbook. In order to better estimate emissions, the vehicle type was selected based on information available from the vehicle descriptions reported from the 2010 purchase reports. Most vehicles were categorized as a Highway Vehicle of some kind but there were vehicles categorized as Non-Highway Off Road Vehicle/Equipment (see Table 1).

There were some instances in which vehicle make, model, and year were unavailable from the fuel report. For example, vehicle descriptions were vague and could read something such as "1994 Ford." In such cases, user judgment and resource availability determined the Vehicle Type. When this information was not available on the 2010 purchase reports, we looked at the 2012 purchase report and matched vehicles, if possible, based on the information available. For example, 2010 purchase report featured License Numbers. If the 2010 License Number and ID corresponded with License Number and ID featured in the 2012 purchase report, the 2012 information for that vehicle was used for the 2010 Workbook. For the Police Department, all vehicles with a description featuring the word vehicle year and a description of Chevy/Chevrolet, we assumed the vehicle was an Impala because Impalas are the common vehicles found in the Police Department, thereby listing the Vehicle Type as "Passenger." For all other vehicles without the list information, or vehicle description/names labeled as "tanks," we made the conservative assumption the Vehicle Type "Light Truck/SUV/Pickup," as we felt it would be more appropriate to overestimate rather than underestimate emissions. Vehicle weight, necessary to determine whether the vehicle type was "Heavy Truck" or "Light Truck/SUV/Pickup," was not necessary in these cases. All Fire Department vehicles that reported diesel fuel usage and uncommon vehicle descriptions (e.g., American, Pierce, Schmeal) assumed the Vehicle Type "Heavy Truck" because most diesel vehicles that use diesel fuel are heavy trucks in these departments.

4.6.2 2012 Fuel Usage

2012 fuel use data was collected from a Fuel Transactions sheet provided from the City of Auburn. The 2012 Fuel Transactions sheet was presented in a different format than the 2010 Purchase Report, requiring a different method of data extraction. Fuel Transactions were separated by fuel type (unleaded versus diesel). From the 2012 Fuel Transactions, we extracted information under the following headings: VEH, DEPT, and CUM VEH (see Table 2).

All information was directly entered into the 2012 ICLEI Workbook. Vehicles were separated by department. The number provided under the "DEPT" heading was matched with its corresponding department from the Department Listings Document. For this year, only one value was extracted for each vehicle based on the information provided in the "CUM VEH" column. The entry with the highest CUM VEH value for that vehicle was the value entered into the 2012 ICLEI Workbook. Fuel cost was not available on this sheet.

Once extracted, VEH values were matched with an additional 2012 Vehicle Fleet Inventory provided by Christina Selvek and Scott McIntyre. There were some instances in which no description was available from the fleet inventory sheet provided that matched with the identification number given by the 2012 Fuel Transactions sheet. In such cases, user judgment and resource availability determined the Vehicle Type. For the Police Department, all vehicles with a description featuring the word vehicle year and a description of Chevy/Chevrolet, we assumed the vehicle was an Impala because Impalas are the common vehicles found in the Police Department, thereby listing the Vehicle Type as "Passenger." For all other vehicles without the list information, or vehicle description/names labeled as "tanks," we made the conservative assumption the Vehicle Type "Light Truck/SUV/Pickup," as we felt it would be more appropriate to overestimate rather than underestimate emissions. Vehicle weight, necessary to determine whether the vehicle type was "Heavy Truck" or "Light Truck/SUV/Pickup," was not necessary in these cases. All Fire Department vehicles that reported diesel fuel usage and uncommon vehicle descriptions (e.g., American, Pierce, Schmeal) assumed the Vehicle Type "Heavy Truck" because most diesel vehicles that use diesel fuel are heavy trucks in these departments.

For vehicles featuring uncommon descriptions (e.g., 2012 International Tree Truck, 2009 INTL 7500 Refuse Packer), we searched for an image of the vehicle online on several search engines (mostly Google and Yahoo!). If no information was readily available for these vehicles, we consulted Christina Selvek and Scott McIntyre for additional vehicle information.

Vehicles in a department not provided by the "Department Listing" sheet were given their own department without a qualitative name, based on the number given.

Table 1 Vehicle Type Classification System

Highway Vehicle Types	
Heavy Truck	Trucks with a Gross Vehicle Weight over 8500 lbs. Example: A tractor-trailer truck; or a public transit bus, A three-axle, 10-tire delivery truck
Light Truck/SUV/Pickup	Light Truck/SUV/Pickup: The light truck category includes Sport Utility Vehicles (SUVs), Pickup Trucks, minivans and vans or trucks. Light trucks have a Gross Vehicle Weight up to 8500 lbs. Includes vanpool vans - A vanpool van is a van that can normally accommodate 8 passengers. Typically, these are large light trucks (Gross Vehicle Weight of between 6001 and 8500 lbs., and an Adjusted Loaded Vehicle Weight greater than 5750 lbs.). An example would be a Ford E150 Econoline XL Wagon.
Passenger Car	This category includes compact cars, sub-compact cars, sedans and station wagons
Transit Bus	A transit bus is a 40-foot or longer single body unit or articulated bus operated in urban areas by transit authorities. Gross Vehicle Weight of these vehicles is 40,000 lbs. and greater.
Motorcycle	Note that motorcycles are listed under OFF ROAD Gasoline in CACP 2009

Non-Highway Off Road Vehicle/Equipment Types
Ships and Boats (Residual Fuel Oil, Gasoline or Diesel)
Locomotives (Diesel)
Agricultural Equipment (Gasoline or Diesel)
Construction Equipment (Gasoline or Diesel)
Snowmobiles (Gasoline)
Other Recreational (Gasoline)
Other Small Utility (Gasoline)
Other Large Utility (Gasoline or Diesel)
Aircraft (Jet Fuel or Aviation Gasoline)

(Source: ICLEI Workbook, 2013)

Table 2 2012 Fuel Transaction Headings Description

2012 Fuel Transactions Heading	Description
VEH	Vehicle Identification Number
DEPT	Department Number
CUM VEH	Cumulative Fuel Usage for the vehicle for 2012

(Source: ICLEI Workbook, 2013)

4.7 Water Transmission and Distribution

For water transmission and distribution, data was collected mainly off of Auburn's ftp site. Natural gas data for the Lower Pump Station, the Water Filtration Rapid Sand and Chemical Storage building, and the Water Filtration Slow Sand building was collected from a combination of the “Natural Gas Usage 1-10 to 6-10 Summary”, the “Gas Usage 6-2010 thru 7-2011 - NFR” report, and the “Natural Gas Usage 7-11 to 1-13 Summary”. This data was compiled separately from the electricity data due to a different roster of facilities receiving electricity, but not natural gas.

Data for electricity consumption came from a combination of “Electrical Supply Usage Report 12-2011 thru 12-2012”, “ECA Bill Amts 7-2010 thru 12-2011”, and proxy data from 2009. This proxy data was inserted for the missing months of 2010.

Whenever energy costs were included in the reports, it was directly included in the analysis. However, the cost of electricity and natural gas was missing on multiple occasions. For example, 2010 electricity costs for the months of January through June, which is where we inserted the 2009 proxy, were missing. The total electricity usage for those months was multiplied by the average cost per kWh of July through December. The average cost per kWh to Auburn was approximately $.06. Similarly, the months of July through December of 2010 had missing costs associated with natural gas. The monthly natural gas usage, in therms, was multiplied by the average cost per therm, around $.55, for months where data was available. This gave an estimate of how much energy Auburn was using in the water transmission and distribution sector.

4.8 2020 Emissions Forecast

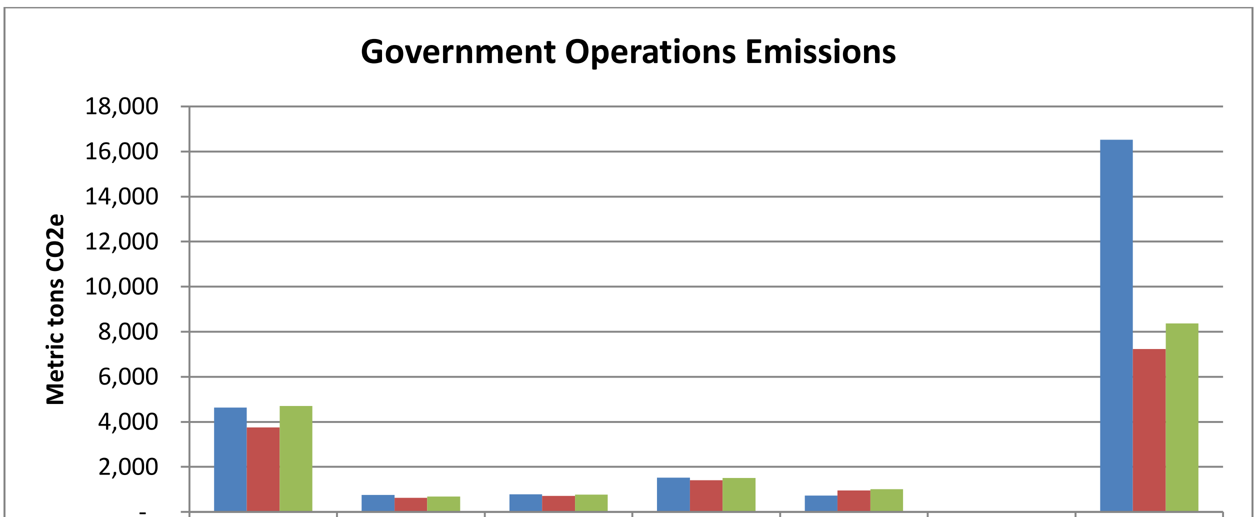
Emissions for 2020 were projected using CACP software after each sector's data was entered for 2010 and 2012. After calculating the CO_2e emissions for all the sectors, emissions were projected by using the following equation:

$$E_{x2020} = E_{x2020} \times (1+r)n$$

where E represents emissions, x represents the sector, n represents the number of years in the future, and r represents the population growth rate calculated from the population change recorded from the 2000 and 2010 census.

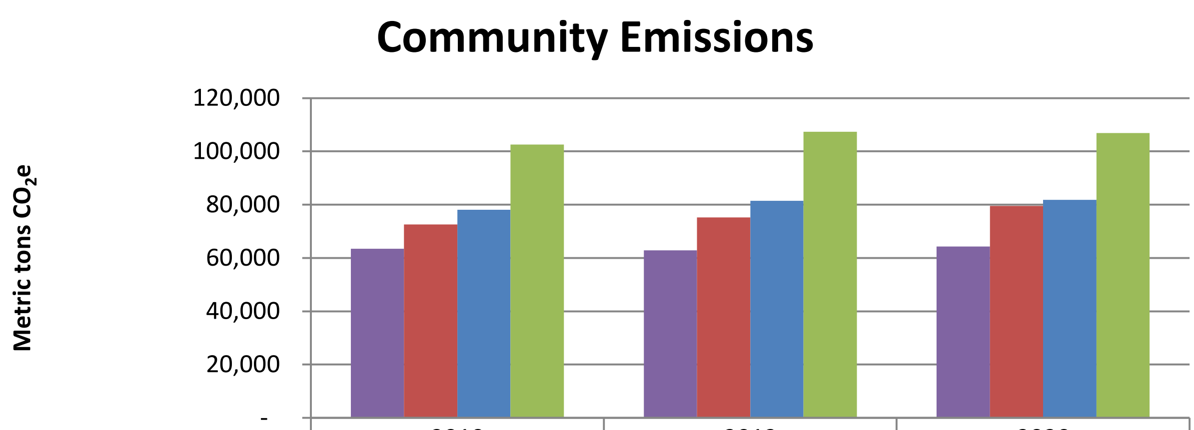
In order to consider the reductions in emissions for each sector in 2012, we subtracted the difference in the emissions between the years 2010 and 2012 from the 2020 emission projection.

5. Results and Analysis



	Buildings & Facilities	Streetlights & Traffic Signals	Water Delivery Facilities	Wastewater Facilities	Vehicle Fleet	Electricity Generation	Waste
2010	4,628	753	784	1,521	727	4	16,521
2012	3,757	627	713	1,408	959	17	7,234
2020	4,705	679	767	1,513	1,009	17	8,371

Figure 1 Government CO2e emissions by sector



	2010	2012	2020
Transportation	63,427	62,851	64,314
Commercial Energy Use	72,554	75,174	79,521
Residential Energy Use	78,122	81,476	81,859
Industrial Energy Use	102,627	107,343	106,837

Figure 2 Community emissions by sector

5.1 Wastewater Treatment Plant

Wastewater treatment plants typically comprise about 35% of a City's energy use (NYSERDA 2008). In both 2010 and 2012 wastewater comprised 8% of the total government energy use. Thus, despite the large numerical difference in energy data between these years due to the cogeneration facility, the relative percentage of energy used within the government emissions remains the same. Within the wastewater treatment sector, electricity and natural gas rates have both decreased between 2010 and 2012 largely due to the cogeneration facility (See Appendix for cogeneration**Error! Reference source not found.**).

The landfill gas to energy (LFGTE) data shows that the energy used by the WWTP (wastewater treatment plant) has increased from 2010 to 2012. However, the cogeneration facility consumption has decreased. The total amount of energy that is sent to the grid has increased from 2010 to 2012. In 2010, the cogeneration facility came online. The methane emissions from the landfill were converted to electricity. The electricity was used to power the cogeneration facility itself, provide 100% of electricity needs at the wastewater treatment plant (not including other wastewater treatment mechanisms and facilities), and energy was also sent back to the grid. The cogeneration facility substantially decreased the electricity purchased for the wastewater treatment sector. It also aided in decreasing the emissions from the waste sector. The electricity, natural gas, and total costs have decreased from 2010 to 2012.

Table 3 kWh and therms consumed by WWTP for 2010 and 2012

	Amount 2010	Cost 2010	Amount 2012	Amount 2010
Electric (kWh)	239,899.7	13,771.91	192,489	10,007.69
Natural Gas (therms)	103,252.00	59,109.49	96,356.60	26,191.82
Total		**72,881.41**		**36,199.51**
Monetary Savings:		**336,681.89**		

Table 4 LFGTE electricity generation and WWTP and co-gen facility electricity consumption

	Totals (kWh)	Note
	3,669,112	WWTP use
2010	8,709,185	sent to grid
	688,174	co-gen facility consumption
	4,174,604	WWTP use
2012	9,571,367	sent to grid
	434,823	co-gen facility consumption

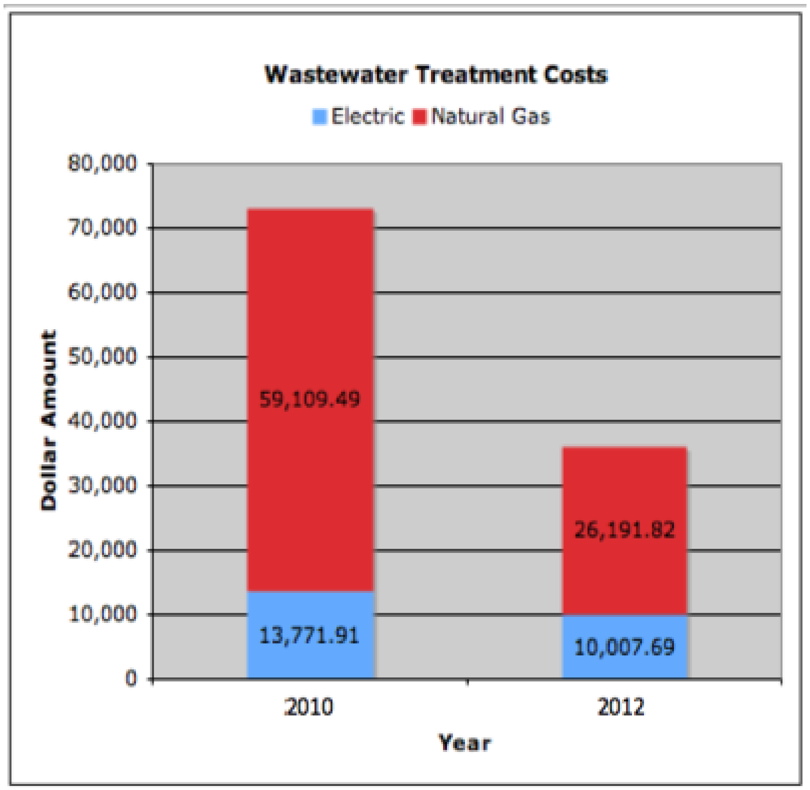


Figure 3 Wastewater Treatment Costs for 2010 and 2012, by fuel type

5.2 Buildings and Facilities

Both natural gas and electricity usage and associated costs decrease for the majority of buildings from 2010 to 2012 (Figure 4, 5, 6, 7). Since this trend is consistent for so many buildings, it is most likely due to temperature shifts. 2012 had over 1,500 fewer heating degree days (HDD) than 2010 (Table 6). However, this number does not include the HDD in December 2012. However, the decreasing trend between these two years was still likely due to climate. Table 8 shows the decrease in emissions and energy use and Table 7 shows the decrease in money spent on energy. Interestingly, emissions and energy use decrease by almost the same percent (Table 7 and Table 8) but money spent on natural gas decreases by a much higher percent than money spent on electricity (Table 7). This is most likely due to the differences between electricity and natural gas rates as well as different changes in the cost of these two energy sources.

Table 5 Building and Facility identification based on address and POD number

Facility Name	Address	NG POD Number**	Electric POD Number**
Mill St Dam*	-	59436238	20017919
Garage (Fire Dept. Storage)	30 Logan St.	14418636	11046364
Fire Station 2	5 Frederick St.	59444422	5387311
Fire Station 3	296 Clark St.	59445452	2402196
DPW	366 W. Genesee Rd.	59416669	387944
Police and Fire HQ	Market St.	59435693	59505982
COGEN	Technology Blvd.	1907005	n/a
Falcon Park (Bathroom and Concessions)	N. Division St.	n/a	3228723
Falcon Park (Bldg. Electric)	N. Division St.	n/a	2802684
Falcon Park	N. Division St.	1400753	n/a
Clifford Park	81 Mary St.	59436030	3255361
Casey Park (Rink)	N. Division St. rink	1098672	1523927
Hoopes Park (Clubhouse)	E. Genesee St.	9013178	8463481
Souel Cemetery	-	n/a	6920573
City Hall (Main Bldg.)	24 South St.	n/a	3936275
City Hall (Gazebo)	25 South St.	n/a	570705
Parking Garage	Lincoln St.	n/a	3204054
State St Mall Band Shelter	State St.	n/a	8445223
Pomeroy Park	Genesee St.	n/a	4862389
Police Dept. Sign	North St.	n/a	7891153
Hoopes Park Fountains	-	n/a	4661377

Police Building Report Center	-	n/a	1607738

* See the “Sources of Error” section below in the Buildings and Facilities methodology

**POD numbers do not include all of the zeros at the beginning of each number

Table 6 Heating and Cooling Degree Days in 2010 and 2012 from NOAA

	2010	2012*	Difference
Heating Degree Days	6610	4944	- 1666
Cooling Degree Days	721	724	+ 3

(Source: http://www.ncdc.noaa.gov/cdo-web/datasets/ANNUAL/stations/COOP:300321/detail)

* At this time, NOAA has not released this information for December of 2012. This means that the number of HDD in 2012 will increase but the number of CDD will be the same (air conditioning units are not used in December).

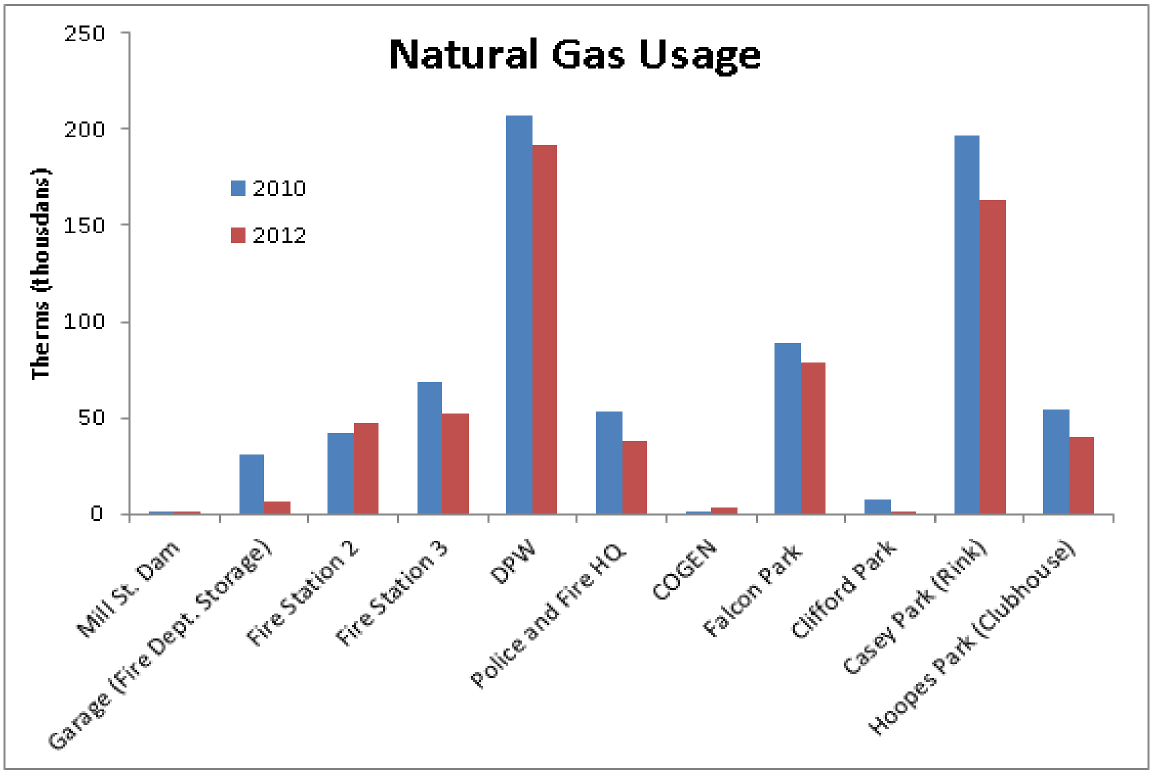


Figure 4 Natural gas use per building

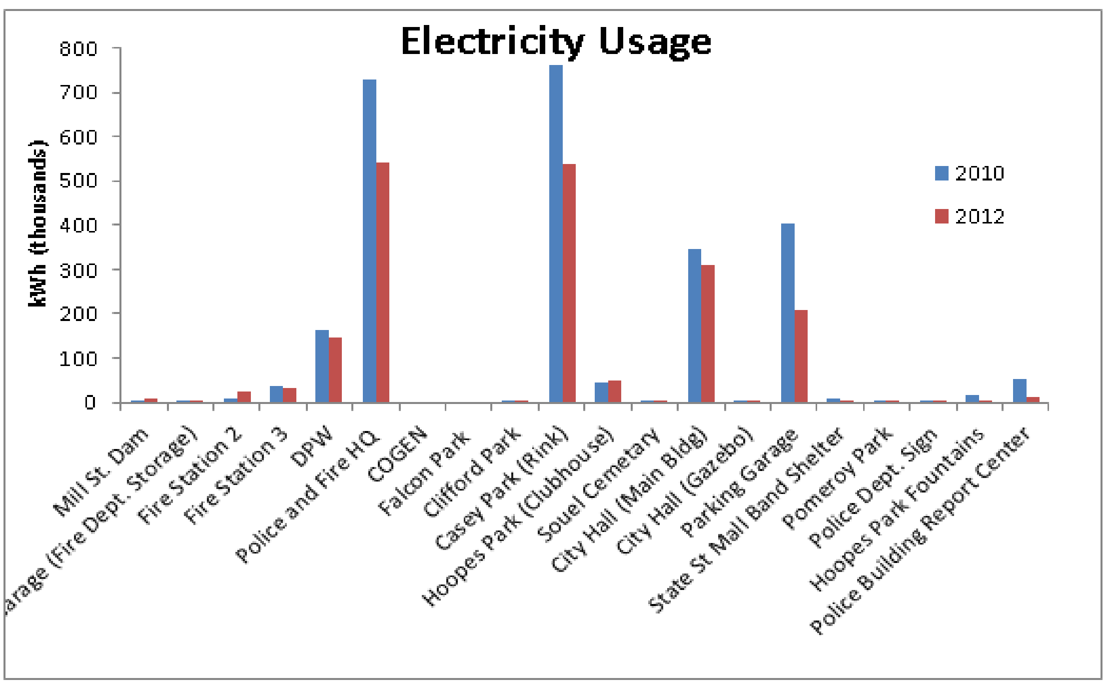


Figure 5 Electricity use by building

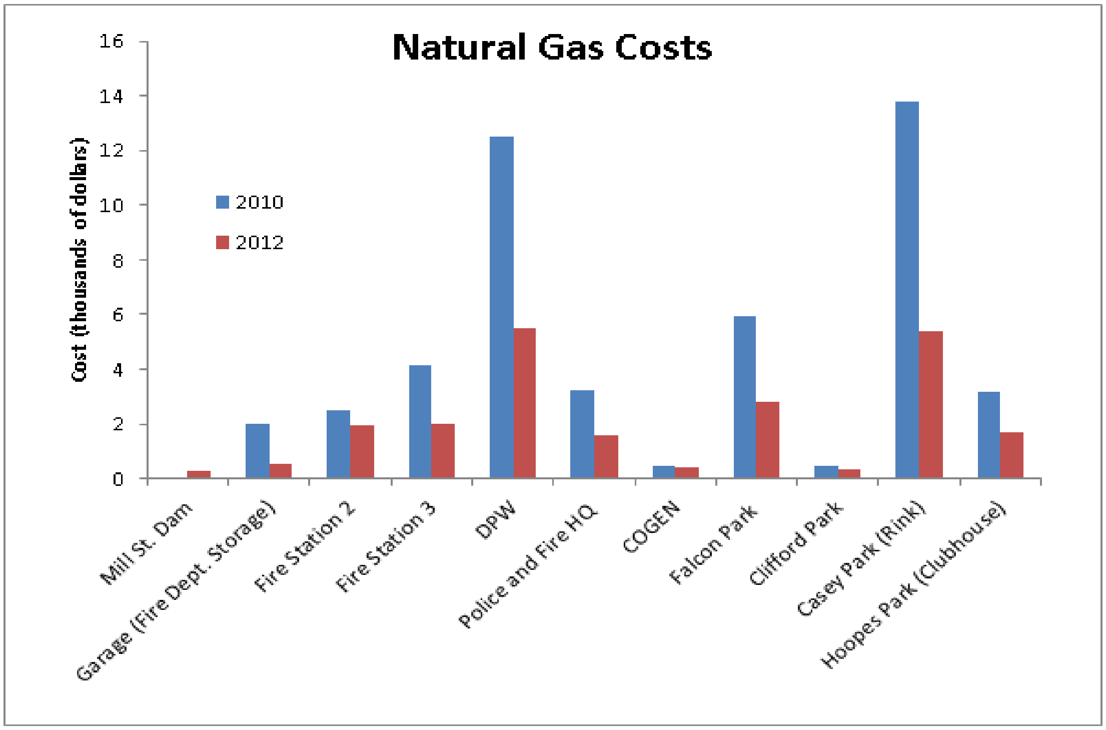


Figure 6 Natural gas costs (not including delivery charges) by building

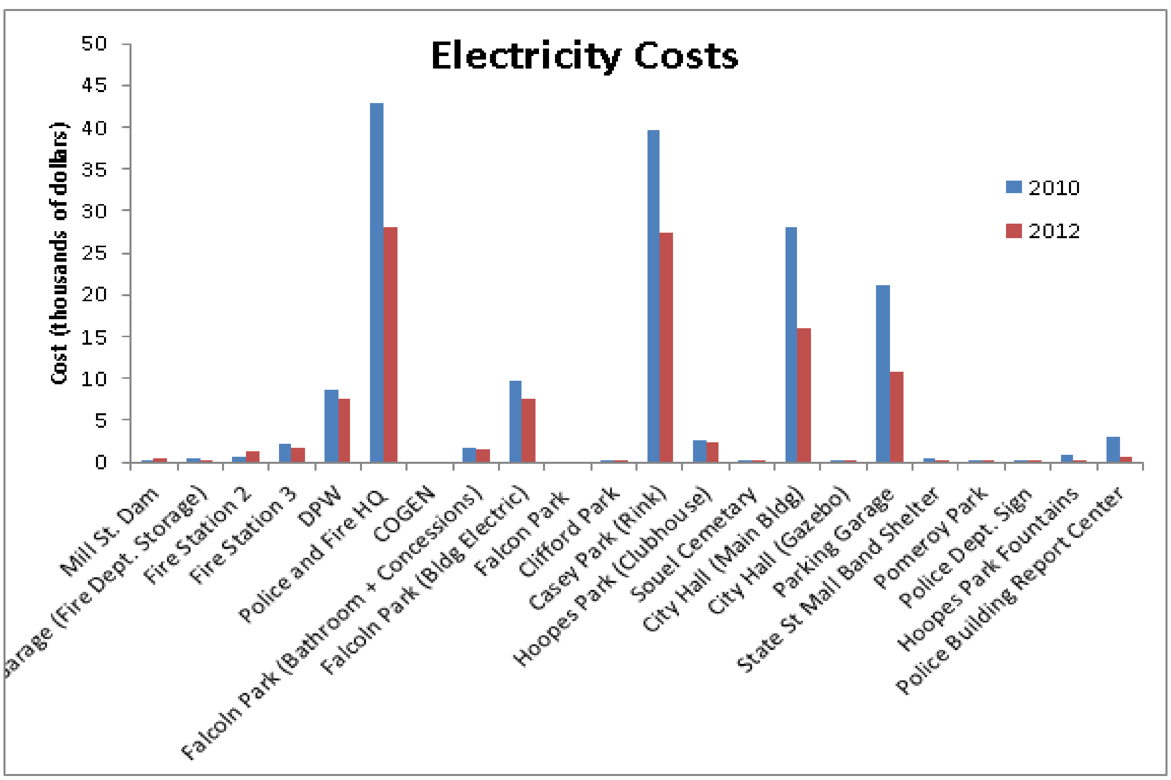


Figure 7 Electricity costs (not including delivery charges) by building

Table 7 Total costs of natural gas and electricity for all of the buildings and facilities under Auburn's jurisdiction.

	2010	2012	Percent Change*
Electricity	$163,010	$106,618	-34.6%
Natural Gas	$48,430	$22,531	-53.5%

* Negative values indicate a decrease in costs.

Table 8 Total emissions and energy use for all buildings and facilities under Auburn's jurisdiction

	2010	2012	Percent Change*
CO_2e (tons)	5,102	4,141	-18.8%
MMBtu	84,668	68,899	-18.6%

* Negative values indicate a decrease in costs.

5.2.1 Source of Error

One probable source of error is the rounding that occurred when entering data into the workbook. Originally, natural gas numbers were entered in as decatherms that is we added to get the yearly totals for each building and rounded it before multiplying it by 10. This means that some of the entries are most likely more than 1 therm inaccurate instead of being less than 1 therm inaccurate. However, we do not anticipate this being a huge source of inaccuracy since some of the rounding would cancel itself out.

If any of these facilities also have lighting connected to them (for example, the electricity meter covers both the energy used by the building itself as well as for outdoor lighting) a small degree of inaccuracy might exist between the sectors. However, all of the emissions are still being counted (thus the total City emissions remain the same). We believe this to be a small source of error on a sector basis, but it should be mentioned nonetheless.

There was some confusion between the Mill Street Dam and Radio Tower Facilities as referenced in the documents. It appears that the Radio Tower natural gas data was counted as part of the Mill Street Dam energy use. This means that the Radio Tower electricity use probably did not get counted, as with the natural gas usage for the Mill Street Dam. However, this likely would not change the total Buildings and Facilities emissions since both of these facilities contributed very little to overall emissions. From here on out, “Mill Street Dam” refers to this inaccurate combination of accounts for the Radio Tower and Mill Street Dam.

Once all natural gas and electricity data was collected for all buildings and facilities for 2010 and 2012, data was entered into the ICLEI computer program.

5.3 Lighting

Auburn’s lighting sector saw a considerable decrease in its electricity consumption from 2010 to 2012. The most likely explanation for this was Auburn’s initiative in replacing its older High Pressure Sodium lights with LED and induction bulbs. The main source of error would be the use of a proxy for the first half of 2010, which can only provide a close approximation. This analysis could probably be strengthened if the hours that the lights were used were tracked in addition to the energy consumption and the price. Another piece of information that could possibly be relevant is whether or not the individual lights are always at their full brightness, especially since LEDs can be dimmed easily. This could help Auburn further lower its energy costs and GHG emissions from the lighting sector.

Table 9 Lighting Electricity Consumption and CO2e Emissions

Year	Electricity Consumption (KWh)	CO2e emissions
2010	3,317,858	753
2012	2,764,247	627

5.4 Waste

Table 10 Solid waste emissions (CO_2e) for the government, and percentage of total government emissions

Year	Solid Waste emissions CO2e (tons)	% of total government emissions
2010	16,521	66%
2012	7,234	49%
2020	8,371	51%

Waste comprised 66% (16,521 metric tons CO2e) of total government emissions in 2010, and decreased to 49% (7,234 metric tons) in 2012. The forecast, calculated using a 2010 baseline, projected 8,371 metric tons of CO2e to be emitted in 2020, 51% of total government emissions (Table 10).

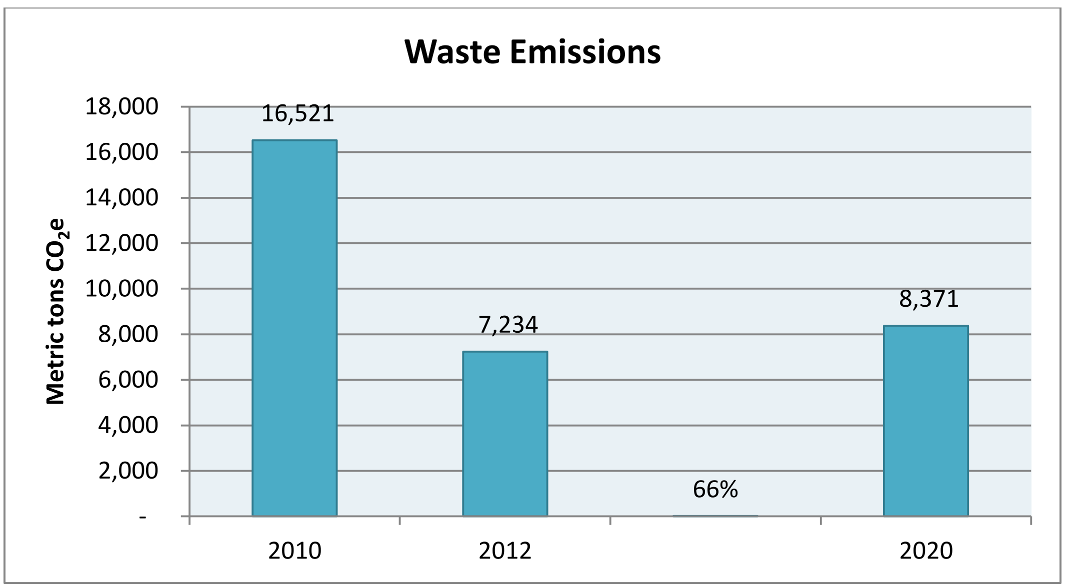


Figure 8 CO_2e emissions from Auburn waste sector for 2010, 2012, and 2020

The 56% decrease in waste emissions between 2010 and 2012 (Figure 8) is most likely a result of the cogeneration facility operations.

5.5 Vehicle Fleet

There was an overall increase in emissions from 2010 to 2012. Government emissions for 2010 were estimated at 727 metric tons of CO_2e and increased 32% to 959 metric tons of CO_2e in 2012. Unleaded fuel usage increased by 41.53% and diesel consumption increased 34.06%. The vehicle fleet accounted for 3% of all government emissions in 2010 and 7% of all emissions in 2012.

The Police Department consumes the most amount of unleaded fuel for both 2010 and 2012 with total usage of 27020.5 gallons and 34228.11 gallons, respectively. The Department of Code Enforcement is the second highest emitter for 2010 and 2012 though its fuel use is less than half of that of the Police Department for 1219.7 gallons and 1410.67 gallons (see Appendix x below), respectively.

Street maintenance uses the most diesel fuel for 2010 and 2012 with consumption at 9711.2 and 12538 gallons, respectively (see Table 18 in Appendix). The Fire Department used the second highest amount of fuel for both years as well with diesel consumption at 6897.3 and 10584.6 gallons, respectively. Diesel use for Water Transmission increased from 2429.5 gallons in 2010 to 8674.9 gallons in 2012 - a 257.07% increase.

5.5.1 Sources of Error

The type of record used to extract each year's information was different - the 2010 fuel data came from the Department of Purchase's Billing Report while 2012 data was collected from a Fuel Transactions sheet. The formats were different and when comparing the information from both years, 2010 appears to be missing some information. For example, some departments, such as Cemeteries, Street Cleaning, and Parks and Recreation Administration, reported no values in 2010. The 2012 Fuel Transactions sheet also reported departments that are not listed on the document provided by the City.

There were many cases in which vehicle information may have been incomplete or mismatched. For example, descriptions for several vehicles reported in the Fire Department by the 2012 Fuel Transactions Sheet were not available from the 2012 Vehicle Inventory provided by the City. As one of the benefits of conducting an inventory, efficiencies in tracking information, such as integrated record keeping methods so that the Fuel Use List and the Vehicle Inventory Sheets are both consistent and easier to read, were identified through this project. Keeping complete, up-to-date records will allow for a more thorough analysis of departmental fuel use and expenditures.

5.6 Water Transmission and Distribution

In both 2010 and 2012, the Upper, Lower, and Grant Ave Pump Stations as well as the Franklin St Reservoir and Water Filtration Plant, accounted for all electricity consumption under the category of Water T&D.

Consumer	Amount (in kWh)	As % of total	Cost	As % of total
Upper Pump Station	643,348	22%	$38,271.59	22%
Grant Ave Pump Station	1,495	0%	$89.68	0%
Lower Pump Station	1,659,682	56%	$93,286.13	54%
Franklin St Reservoir	808	0%	$52.14	0%
Water Filtration Plant	670,064	23%	$41,964.07	24%
2010 Total	2,975,397		$173,663.61	

Table 11 kWh used and the cost by each sector of Water T&D for 2010

The Grant Ave Pump Station and the Franklin St Reservoir use negligible energy when compared to the Water Filtration Plant and the Lower and Upper Pump. The lower pump accounted for the largest amount of energy used at 56% in 2010. As expected, it also had the largest costs associated with its operations (Table 11).

Consumer	Amount (in kWh)	As % of total	Cost	As % of total
Upper Pump Station	567,500	21%	$29,293.21	21%
Grant Ave Pump Station	267	0%	$12.94	0%
Lower Pump Station	1,556,100	56%	$75,700.94	55%
Franklin St Reservoir	856	0%	$44.19	0%
Water Filtration Plant	640,800	23%	$32,182.84	23%
2012 Total	2,765,523		$137,234.12	

Table 12 The kWh consumed and the cost by each sector of Water T&D for 2012

In 2012, the energy consumption for Water T&D mirrors that of 2010. The Lower Pump Station still consumes the majority of energy at 56%. The Water Filtration Plant and Upper Pump Station accounted for 23% and 21%, respectively. The Grant Ave Pump Station and Franklin St Reservoir still did not contribute significantly (Table 12).

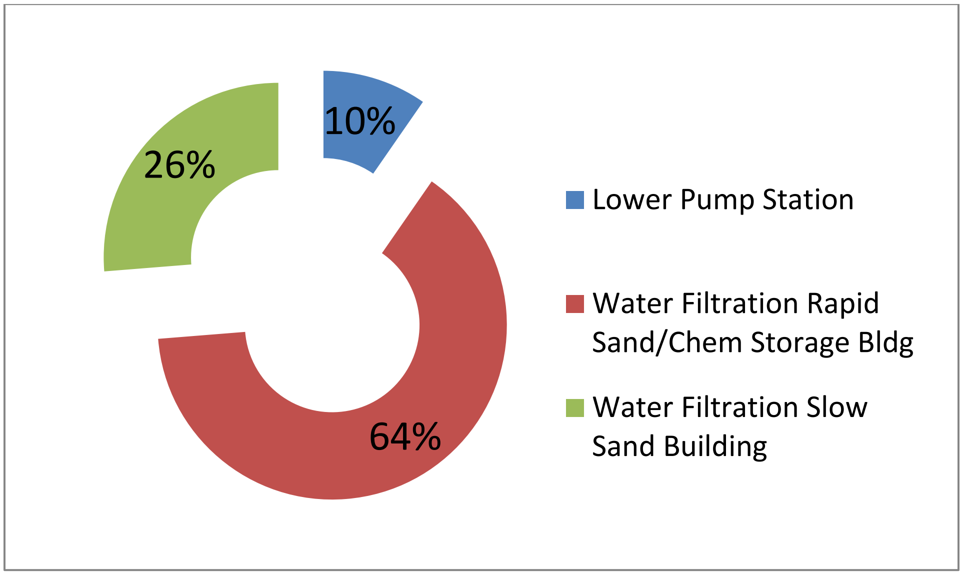


Figure 9 Natural gas consumption for Water Filtration Buildings and Lower Pump Station in 2010

The Water Filtration Rapid Sand and Chemical Storage Building accounted for the majority of natural gas consumption, at 64%. The Lower Pump Station and Water Filtration Slow Sand Building accounted for the other 10% and 26%, respectively (Figure 9).

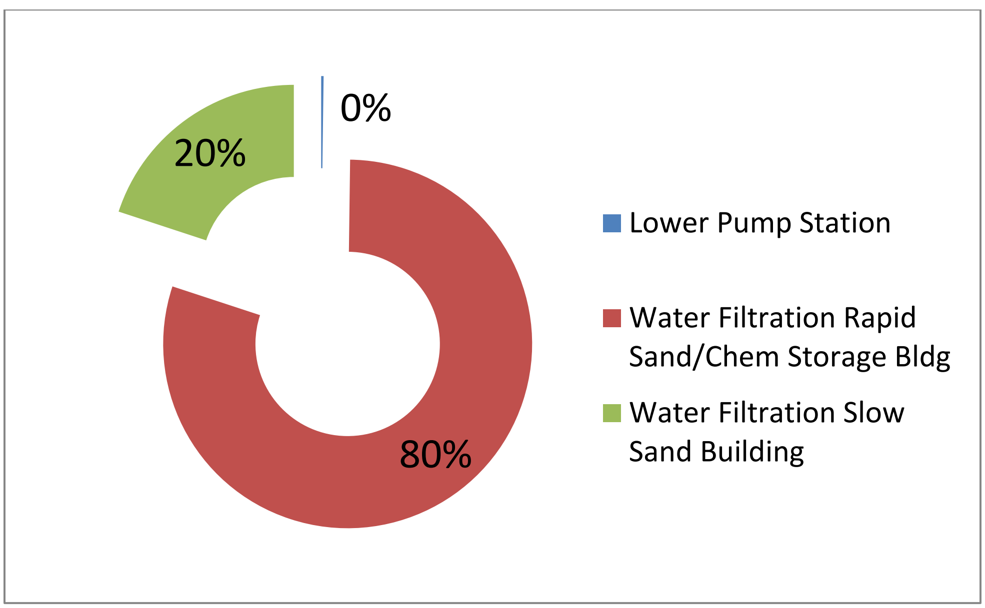


Figure 10 Natural gas consumption for the Water Filtration Buildings and Lower Pump Station in 2012

Consumer	2010	2012	% Change
Lower Pump Station	1,975	33	-98%
Water Filtration Rapid Sand/Chem Storage Bldg.	13,117	12,487	-5%
Water Filtration Slow Sand Building	5,378	3,120	-42%

Table 13 Consumption of natural gas by the appropriate facilities in therms for 2010 and 2012

The Lower Pump Station consumed 98% less natural gas in 2012 when compared to 2010, while the Water Filtration Slow Sand Building cut its consumption by 42%. The Water Filtration Rapid Sand and Chemical Storage Building had the smallest reduction in therms consumed over the two year timespan, only reducing 5% (Table 13). Because of these disproportionate reductions, the Water Filtration Rapid Sand and Chemical Storage Building increased its percentage portion of natural gas consumed, while still reducing the amount of natural gas passing through the facility. The drastic decrease in natural gas use by the Lower Pump Station leaves it with virtually no consumption when compared to the other facilities (Figure 10).

Data related to 2010 costs has a level of error involved due to estimated energy prices per therm and kWh. The kWh consumed for each facility from January to June in 2010 relied on proxy data. There is likely some slight inaccuracy in this data.

5.7 Community Emissions

The main focus of this analysis is on government energy use and emissions because the City of Auburn has control over its operations and processes. The City of Auburn has virtually no control over private, commercial, and industrial emissions. While a GHG Inventory that focuses on government emissions would be useful in helping to achieve the goal of reducing emissions for the City, private emissions also contribute a large portion to the community carbon footprint.

The community analysis utilizes data collected at the state and regional scales for Auburn's commercial, residential, industrial and transportation sectors. A surveying process would enable the City to become more informed about total emissions. The data used in the analysis is directly sourced from utility records and household heating fuel use estimates derived from Central New York regional GHG inventory (baseline 2010) and from NYS Department of Transportation traffic count models. The methodology used to come up with these figures is a pre-determined set of instructions developed by the New York Greenhouse Gas Protocol Working Group in 2012, which was informed by a number of sources such as the IPCC, EPA and ICLEI. More information about the intricacies of this methodology can be obtained from the Central New York Regional Planning Board. The City of Auburn has relatively little control over private emissions as opposed to government emissions and this creates challenges in reducing these sources. For example, Auburn has an unusually large presence of industry which contributes to higher GHG emissions. The primary emitters located within the City boundary are Nucor Steel Incorporated, which emitted 83,481.5 metric tons CO2e (EPA, 2010), and McQuay International, whose energy use is captured in the industrial sector. The steel processing emissions alone contributed twice the amount of GHG emissions as the Auburn government operations in 2010. This is a source of emissions that Auburn cannot reduce since it does not have jurisdiction over the private commercial and industrial sectors. However, community partnerships and joint energy-saving initiatives hold promise for mutually beneficial emissions and operating cost reductions for this entities and the City of Auburn community.

Of note is the fact that the community is projected to contribute nearly triple GHG than that of the government in 2020. However, as a subset of community emissions, government operations are generally always a small proportion of overall community emissions.

Community Sector	$MTCO_2e$	MMBtu
Residential	78,122	1,411,475
Commercial	72,554	1,232,043
Industrial	102,627	1,713,707
Transportation	63,427	940,219

Table 14 Actual GHG emissions and energy consumption for Auburn community (2010)

Community Sector	$MTCO_2e$	MMBtu
Residential	81,476	1,471,937
Commercial	75,174	1,269,279
Industrial	107,343	1,805,049

Transportation	62,851	932009

Table 15 Actual GHG emissions and energy consumption for Auburn community (2012)

Community Sector	Tons of CO_2e	MMBtu
Residential	81,859	1,479,805
Commercial	79,521	1,342,427
Industrial	106,837	1,788,023
Transportation	64,314	956,962

Table 16 Projected GHG emissions and energy consumption for Auburn community (2020)

6. Conclusion

Auburn's decrease in government emissions was likely due to temperature and energy demand fluctuations between 2010 and 2012, as well as the efficiency of operations at the cogeneration facility. Use of technologies such as the LFGTE facility for the mitigation of the government's environmental impact stresses the importance of alternative energy sources and infrastructure. Identifying efficiencies in operations are the basis of the climate action planning process. The GHG inventory of Auburn found that the largest emitting sectors are solid waste, and buildings and facilities, while the cogeneration technology is operating at the desired efficiency, further reductions could be achieved through the use of waste heat for energy needs. While the government energy use and emission analyses were thorough, community emissions analyses have room for improvement, primarily in data accumulation through individual surveys regarding habits and daily operations. The community contributes substantially more emissions than the government, and thus a refined inventory is critical to setting an adequate baseline. Collaboration and partnership will play a large role in reducing the community carbon footprint, as Auburn engages citizens and businesses to collectively reduce emissions and create a climate action plan that increases long-term community resilience.

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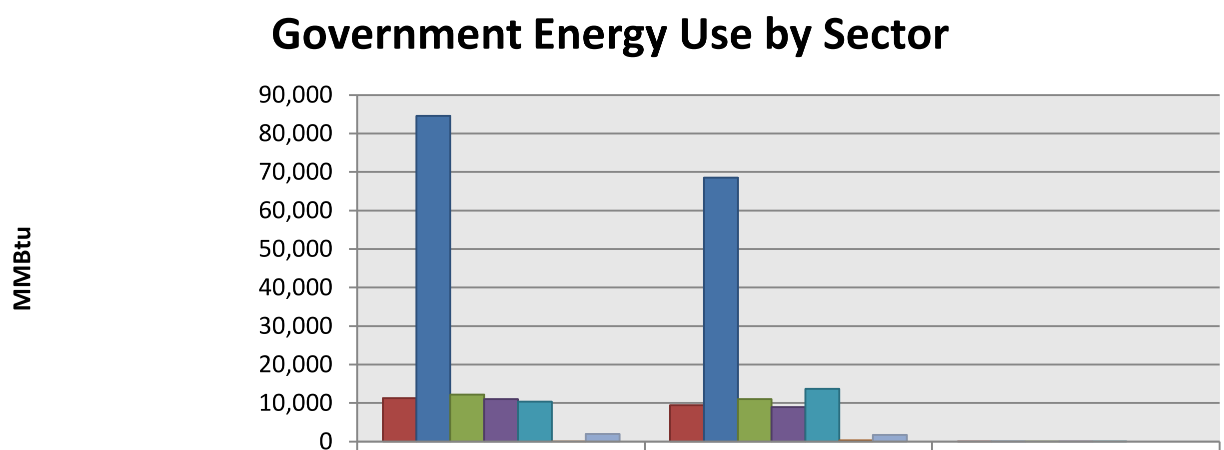
8. Appendix



	2010	2012	% of total 2010
Streetlights & Traffic Signals	11,321	9,432	9%
Buildings & Facilities	84,593	68,572	64%
Water Delivery Facilities	12,202	11,032	9%
Wastewater Facilities	11,074	8,962	8%
Vehicle Fleet	10,361	13,723	8%
Electricity Generation	75	327	0%
Waste	1,962	1,749	1%

Figure 11 Energy Consumption by Sector

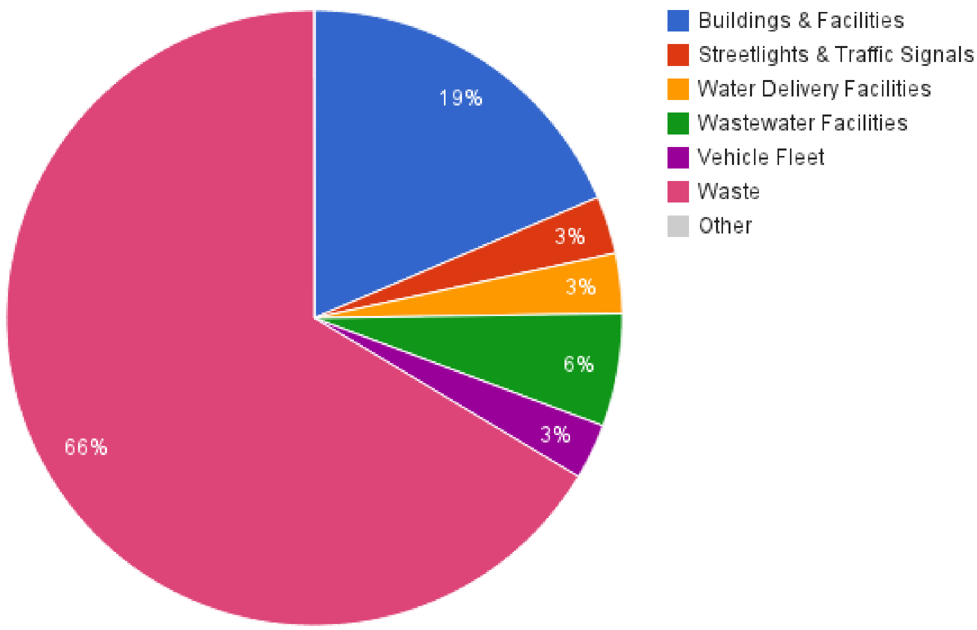


Figure 12 2010 Government Emissions by Sector

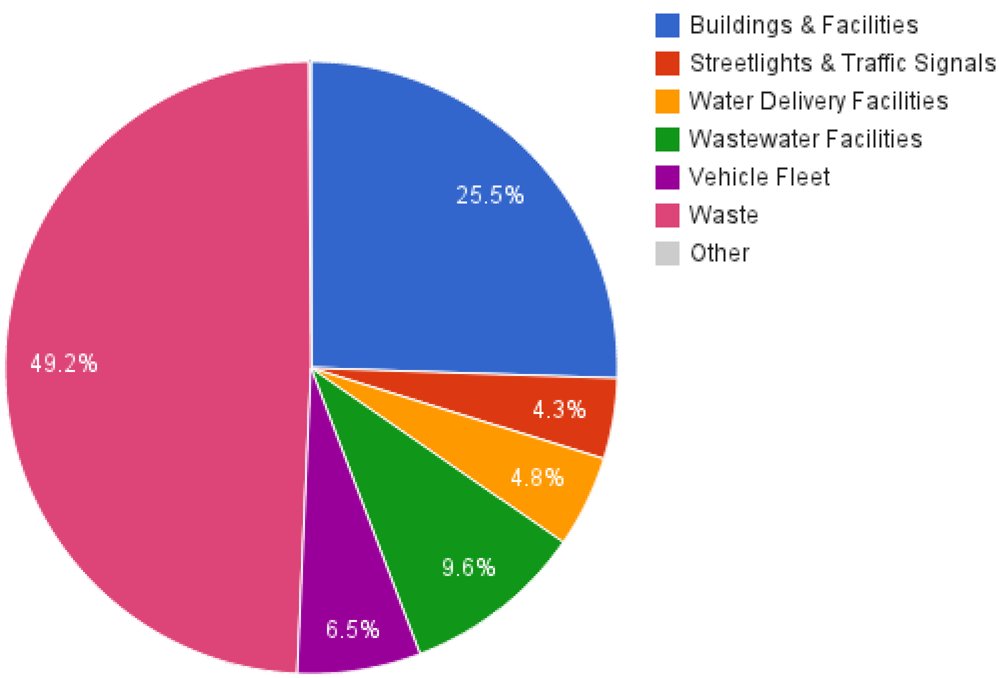


Figure 13 2012 Government Emissions by Sector

Sector	Details	Emissions Sources
Wastewater Treatment Plant	- 3 sewage overflow tanks - 1 grinder pump station - 1 sewage holding tank - 2 pump stations - 1 sewage swirl facility - 1 sewage treatment plant	- Electricity generated from landfill methane conversions due to the co-gen facility - Natural gas
Lighting	- 58 traffic signals - 5 streetlights - 15 park lights - 2 other	- Electricity (NYSEG)
Waste	- 2 Landfills -1 closed -1 accepting waste	-Electricity and Natural gas use (Scope 2) -LFG not captured (Scope 1)
Buildings and Facilities	- See Table 5 for a Complete List of Buildings Examined	- Electricity - Natural gas
Vehicle Fleet	29 Departments -Vehicles in 2010: 131* -86 unleaded -45 diesel -Vehicles in 2012: 141* -112 unleaded -65 diesel *Note: Some vehicles accepted both unleaded and diesel fuel.	Vehicle operations
Water T&D	- 3 pump stations - 1 reservoir - 2 water filtration facilities	- Electricity - Natural Gas

Table 17 Sources of Emissions by Sector

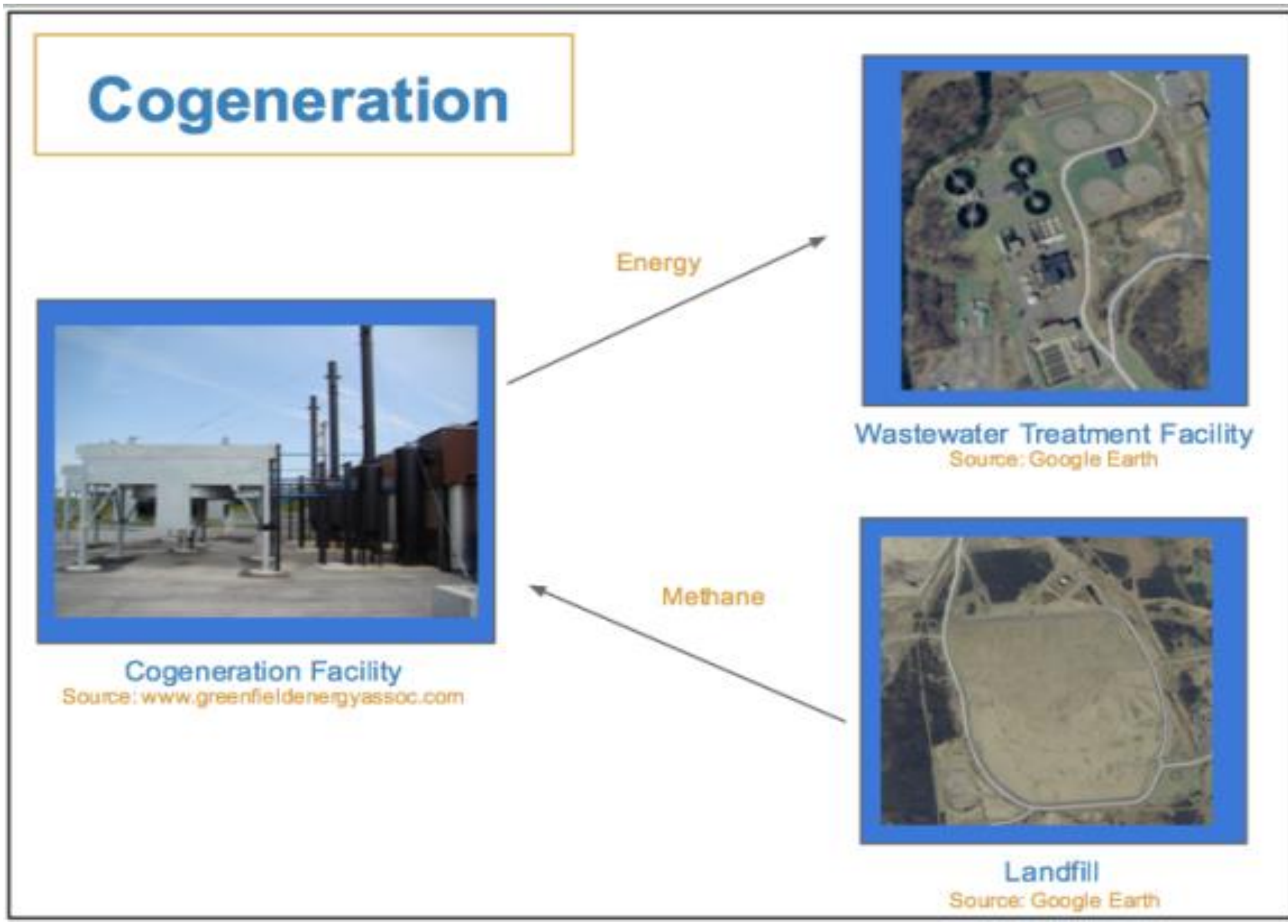


Figure 14 Cogeneration Energy Generation Process

Department	2010 Unleaded	2012 Unleaded	% Change	2010 Diesel	2012 Diesel	% Change
Assessor (a1355)	111.6	321.22	187.83%	0	0	NA
Bldg. (1620)	441.5	1162	163.19%	0	0	NA
C. Garage (1640)	1,626.2	1,092.56	-32.82%	1,322.1	506.3	-61.70%
Police (3120)	27,020.5	34,228.11	26.67%	133.8	142	6.13%
Signals and Alarms (3310)	168.5	52.33	-68.94%	0	159.6	NA
Fire (A3410)	1,683.9	2,810.22	66.89%	6897.3	10,584.6	53.46%
Code Enf (3620)	1,219.7	1,410.67	15.66%	0	0	NA
Street MainT (A5110)	4,155.5	8,277.78	99.20%	9711.2	12,538	29.11%
Municipal Parking (5851)	194.6	0	-100.00%	0	0	NA
Parks MainT (A7110)	2,585.9	3,468.33	34.12%	298.2	1,933.8	548.49%
RSVP (A7611)	214.3	122.78	-42.71%	0	0	NA
Shade Trees (A8560)	0	0	NA	1602.1	761.8	-52.45%
Solid Waste (AL8161)	138.5	393.33	183.99%	1,384.9	17.3	-98.75%
Water Purification (F8330)	1,154.6	1,290.44	11.77%	384.5	24.8	-93.55%
Water Trans (F8340)	2,384.2	3,499.11	46.76%	2,429.5	8,674.9	257.07%
Sanitary Sewers (G8120)	1,250.2	3,793	203.39%	5,842.1	3,737.5	-36.02%
Sewage Treatment (G8130)	1,624.6	0	-100.00%	68	0	-100.00%
Engineering (A1440)	306.6	816.89	166.44%	0	0	NA
Planning (A8020)	110	77.33	-29.70%	0	0	NA
Booker T Washington Ctr	1,278	0	-100.00%	0	0	NA
Casey Park (7143)	0	458.22	-	0	549.5	-
Cemeteries (8810)	0	334.67	-	0	686.6	-
Unknown Department (2225)	0	1,389.89	-	0	0	NA
Unnamed (5410)	0	706	-	0	0	NA
Unnamed (5651)	0	791.44	-	0	0	NA
Unnamed (6410)	0	399.89	-	0	0	NA
Park and Recreation Administration (7020)	0	484.44	-	0	0	NA
Disposal (8162)	0	39.44	-	0	0	NA
Street Cleaning (8170)	0	45.78	-	0	0	NA
Fuel Total	**47,668.9**	**67,465.87**	**41.53%**	**30,073.7**	**40,316.7**	**34.06%**

Number of Vehicles	2010	2012	% Change			
	131	141	7.63%			

Table 18 Vehicle Fleet Fuel Use by Department and Fuel Type for 2010 and 2012

Figure 15 Community Protocol Compliance Table

						IE- Included Elsewhere	SI- Local government significant influence	
Emissions Report Summary Table (2010 baseline year)						NE- Not estimated	CA- community-wide activities	
						NA- not applicable		
Include estimates of emissions associated with the 5 basic emissions generating activities						NO- not occurring		
Emissions Type	**Source or Activity**	**Activity Data**	**Emissions Factor & Source**	**Accounting Method**	**Included (SI, CA**	**Excluded (IE, NA, NO, NE)**	**Emissions (MTCO2e)**	**Notes/Explanations/Comments**
Built Environment								
Use of fuel in residential stationary combustion (nat. gas- MMBtu)	source and activity	1,086,519	53.02 kg CO_2/MMBtu; 1 g CH4/MMBtu; 0.1 g N2O/MMBtu; EPA Mandatory Reporting Rule (MRR)		CA		63,664	Estimate from NYSEG (which is the only utility serving the City of Auburn)
Use of fuel in residential stationary combustion (fuel oil, wood, LPG- MMBtu)	source and activity	39,912	Averaged distillate fuel oil #1, 2,4 EF= 74.5 kg CO_2/MMBtu; LPG= 62.98 kg CO_2/MMBtu; EPA Mandatory Reporting Rule (MRR)		CA		1,557	Derived fuel use from 2010 5-year estimated American Community Survey (ACS) data and regional GHG inventory analysis
Use of fuel in commercial stationary combustion (nat. gas- MMBtu)	source and activity	696,061	53.02 kg CO_2/MMBtu; 1 g CH4/MMBtu; 0.1 g N2O/MMBtu; EPA Mandatory Reporting Rule (MRR)		CA		40,785	
Use of commercial stationary combustion (fuel- MMBtu)	source and activity	151,791	Coal/coke mixed commercial sector= 93.4 kg CO_2/MMBtu; Averaged distillate fuel oil #1, 2,4 EFs= 74.5 kg CO_2/MMBtu; LPG= 62.98 kg CO_2/MMBtu; EPA Mandatory Reporting Rule (MRR)		CA		11,038	
Industrial Stationary combustion sources (nat. gas- MMBtu)	source and activity	843,915	53.02 kg CO_2/MMBtu; 1 g CH4/MMBtu; 0.1 g N2O/MMBtu; EPA Mandatory Reporting Rule (MRR)		CA		49,371	
Industrial Stationary combustion sources (fuel- MMBtu)	source and activity					NE		
Electricity								
Power generation (natural gas use- therms)	source	754				NE	4	Auburn uses a landfill gas to energy co-generation plant to supply their wastewater treatment plant with electricity. In the event that landfill gas is not sufficient to power the generation turbines, natural gas is used; there was a very small quantity used in 2010.
use of electricity by the community (MWh)	activity	450,935	eGrid 2009 subregion factors (EPA)	Collected data from utility providers and input into CACP	CA		112,813	Includes residential, commercial and industrial consumption (NYSEG data)
District Heating/Cooling								
District Heating/Cooling facilities in community	source					NE		
Use of district heating/cooling by community	activity					NE		
Industrial process emissions in the community	source	only emissions data	EPA GHGRP data reported here: ghgdata.epa.gov			NE	54,218	The process emissions from Nucor Steel are included here as information items- and replicate the annual reporting for the EPA's GHGRP; plant stationary combustion emissions are captured in the industrial natural gas use category
Refrigerant leakage in the community	source					NE		

Transportation and other Mobile Sources								
On-road passenger vehicles								
on-road passenger vehicles operating within the community (VMT)	source	118,835,884	CACP (Version 3.0) & EPA MRR emission factors for gasoline and diesel (varies by vehicle class for N2O & CH4): LGOP gasoline EF=8.78 $kgCO_2$/gal; diesel EF= 10.21 $kgCO_2$/gal	Appendix D: TR.1.B Alternative Method for Estimating In-boundary Passenger Vehicle Emissions; Input VMT estimate into CACP community sector tab	CA		69,917	Estimation method used the NYSDOT Traffic Data Viewer Tool, in conjunction with in-house GIS analysis to determine what portion of AADT and road length existed within the city boundary. The emissions estimate includes all vehicle traffic counted in NYSDOT AADT metrics (no vehicle descriptive data was available; CACP utilizes default fuel allocations: 93% gasoline and 7% diesel, which were adjusted to account for the 10% NYS ethanol blend: 83% gasoline, 10% ethanol and 7% diesel); these totals are distributed to alt method vehicle categories in the software, with the assumption that diesel is used by HDV and gasoline is used by LDV and passenger vehicles.
on-road passenger vehicle travel associated with community land uses (VMT)	activity					NE		Data from the Syracuse Metropolitan Transportation Council (our only MPO) travel demand model only covers 1 county in the CNY region, with partial coverage of two other counties; therefore, the model is not able to provide data for all municipalities or on trip origin or destination, or to exclude trans-boundary trips from VMT estimates.
On-road freight vehicles								
on-road freight and service vehicles operating within the community boundary	source					IE		As stated above, these vehicles operate on roads included in the AADT counts and are therefore assumed to be included in this estimation method; the emissions estimate above includes CACP default metrics for heavy duty vehicles, as they travel many of the roads measured within the city boundary
on-road freight and service vehicle travel associated with community land uses	activity					IE		As stated above, these vehicles operate on roads included in the AADT counts and are therefore assumed to be included in this estimation method; the emissions estimate above includes CACP default metrics for heavy duty vehicles, as they travel many of the roads measured within the city boundary
On-road transit vehicles operating within the community boundary	source					IE		As stated above, these vehicles operate on roads included in the AADT counts and are therefore assumed to be included in this estimation method; the emissions estimate above includes CACP default metrics for transit vehicles (in the case of Auburn, CENTRO buses specifically), as they travel many of the roads measured within the city boundary
Transit Rail								
transit rail vehicles operating within the community boundary	source					NE		
use of transit rail travel by community	activity					NE		
Inter-city passenger rail vehicles operating within the community boundary	source					NE		
Freight rail vehicles operating within the community boundary	source					NE		
Marine								
Marine vessels operating within community boundary	source					NE		
use of ferries by community	activity					NE		
Off-road surface vehicles and other mobile equipment operating within community boundary	source					NE		
Use of air travel by the community	activity					NE		

Solid Waste								
Solid Waste								
Operation of solid waste disposal facilities in community	source	emissions data only	Process emissions reported to the EPA GHGRP annually; stationary combustion emissions accounted for in the energy use sector	EPA GHGRP	SI		18,212	The Auburn Municipal Landfill No.2 is in operation and is overseen by the City. The facility accepts all waste from the Auburn community and several surrounding communities.
generation and disposal of solid waste by the community	source and activity				CA			
Water and Wastewater								
Potable Water- Energy Use								
Operation of water delivery facilities in the community	source	kWh=2,975,397; therms= 20,470	CACP 3.0 eGrid 2009 electricity emission factors; and natural gas emission factors= 53.02 kg CO2/MMBtu; 1 g CH4/MMBtu; 0.1 g N2O/MMBtu		SI	IE	864	The energy associated with the operation of water delivery systems and infrastructure, as well as the use of water by the community, is captured in the electricity and natural gas consumption in the Built Environment section above, but the emissions estimate is also included here because it falls under the frame of local government significant influence
Use of energy associated with use of potable water by the community	activity				CA			
Use of energy associated with generation of wastewater by the community	activity	kWh= 239,900; therms=103,252	CACP 3.0 eGrid 2009 electricity emission factors; and natural gas emission factors=53.02 kg CO2/MMBtu; 1 g CH4/MMBtu; 0.1 g N2O/MMBtu		SI	IE	175	The energy used by two treatment facilities to handle wastewater generated by the community is captured in the Built Environment section above; however, the emissions total for this sector is included here as well, given that this is an activity under the frame of local government significant influence
Centralized Wastewater Systems- Process Emissions								
Process emissions from operation of wastewater treatment facilities located in community	source	emissions data only	Method WW.8= EF without nitrification or denitrification= 3.2 g N_2O/person equivalent/year; Method WW.12a= EF for stream/river discharge= 0.005 kg N_2O-N/kg sewage-N discharged	Appendix F: Methods for Conventional Aerobic WWT Systems WW.8 and WW.12a	SI		605	The City of Auburn operates one WWTP that serve the broader community (a total of approximately 40,500 customers); these facilities practice conventional treatment without nitrification or denitrification processes and serve several large commercial and industrial customers
process emissions associated with generation of wastewater by community	activity					NA		The wastewater generated by the community is treated locally and not sent to a regional facility
Use of septic systems in community	source and activity					NE		No data available
Agriculture								
Domesticated animal production	source					NE		Limited agricultural sources in this community
Manure decomposition and treatment	source					NE		
Upstream Impacts of Community-wide Activities								
Upstream impacts of fuels used in stationary applications by community	activity					NE		Not included in scope of analysis due to limited data availability
upstream and transmissions and distribution impacts of purchased electricity used by the community	activity					NE		
upstream impacts of fuels used for transportation in trips associated with the community	activity					NE		
upstream impacts of fuels used by water and wastewater facilities for water used and wastewater generated within the community boundary	activity					NE		
Upstream impacts of select materials (concrete, food, paper, carpets, etc.) used by the whole community (additional community-wide flows of goods & services will create significant double counting issues)	activity					NE		
Independent Consumption-Based Accounting								
Household consumption (e.g., gas & electricity, transportation, and the purchase of all other food, goods and services by all households in the community)	activity					NE		This analysis focused on the sources under local government significant influence, rather than consumption-based accounting
Government consumption (e.g., gas & electricity, transportation, and the purchase of all other food, goods and services by all governments in the community)	activity					NE		
Lifecycle emissions of community businesses (e.g., gas & electricity, transportation, and the purchase of all other food, goods and services by all businesses in the community)	activity					NE		

(Created by: Central New York Regional Planning Board, 2013)