TOWN OF CAZENOVIA, NY
GREENHOUSE GAS INVENTORY
BASELINE 2010

APRIL 2013,

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

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ICLEI Local Governments for Sustainability

New York State Climate Smart Communities

Abstract

The Town of Cazenovia has adopted the Climate Smart Communities Pledge as a commitment to greenhouse gas (GHG) emission reduction and climate change mitigation. A GHG emissions inventory is an audit of activities that contribute to the release of emissions. In order to generate emissions results, we incorporated several methods of calculation including the Local Government Operations Protocol (LGOP) and Local Community Operations Protocol (LCOP), developed by ICLEI Local Governments for Sustainability. Data for the municipal facility energy use and vehicle fleet fuel use will be entered into ICLEI's Clean Air Climate Protection (CACP) inventory software. The outputs will be aggregated into metric tons of CO_2 equivalent and summed with direct emissions delineated by sector and scope. Data from the inventory will guide policy decisions and energy improvements, inform sustainability projects, and build public support for broader sustainability initiatives in the Town of Cazenovia.

I. Introduction

A. CLIMATE CHANGE AND GREENHOUSE GASES

Human activities have led to extreme amounts of CO_2 and other greenhouse gases being emitted into the atmosphere. Most of these greenhouse gases come from burning fossil fuels in energy production, as well as other industrial processes.

When greenhouse gases are released into the atmosphere, they form a blanket around the Earth, trapping energy within their boundaries and causing the air to warm. While this process, referred to as the greenhouse effect, is necessary to support life on Earth, the buildup of greenhouse gases negatively changes climate, in turn, having damaging impacts on not only human health, but also the health and vitality of our ecosystem. Understanding climate change, and the role that greenhouse gases play in climate change, is the first step in developing techniques to combat global warming. On a global, national, state, and even local level, changes can be, and need to be, made in order to reduce our emissions. The purpose of this greenhouse gas inventory is to show the Town of Cazenovia what activities release the most greenhouse gases, and finally, ways they can change in order to have a positive impact, not only locally, but globally as well.

B. PURPOSE OF A GREENHOUSE GAS INVENTORY

The increasing amounts of environmental issues that are being discussed around the world today are forcing communities to become more aware of the environmental consequences of their daily activities. Greenhouse gases are being spilled into the atmosphere every day, and the increased carbon footprints of communities are contributing to global warming.

Performing a greenhouse gas assessment for communities shows them where they stand in terms of the total amount of greenhouse gases that they emit, which hopefully will show them that there is room for improvement in reducing their impact. GHG assessments allow communities to see exactly what sections of the community have the largest emission rates and which sections have the least, which allows them to put different priority levels on certain actions and projects.

This is very important because focusing on reducing the highest GHG emitting sectors first will be more effective than focusing on reducing a section of the community that only produces a small amount of GHG emissions. Calculating the amount of greenhouse gas emissions enables communities to set new standards for future generations, thus increasing the environmental quality of that community. Once the GHG assessment is complete, Climate Action Plans can be implemented in order to reduce current and projected emission levels.

C. TOWN PROFILE

The Town of Cazenovia is a small town located in the heart of Central New York, approximately 20 miles southeast of Syracuse. The town encompasses the Village of Cazenovia as well as the hamlet of New Woodstock, located on the southern border of the town. Positioned on the western border of Madison County, Cazenovia occupies a total area of 51.7 square miles, with 49.9 square miles of land and 1.8 square miles of water. Located towards the northwest portion of the town is Cazenovia Lake, roughly 4.5 miles long and 0.5 miles wide, providing a significant scenic, cultural, recreational, and hydrological resource for the Town.

In the 2010 census, it was estimated that Cazenovia was home to 7,086 residents, with 4,251 residents residing outside of the Village. Cazenovia has a relatively low population density of only 130 individuals per square mile, with the majority of the town being made up by rural and farming lands. Agriculture is the predominant land use in the Town, with 54% of land being used for farming. Of the 30,912 acres in the Town outside the Village, 16,828 acres are in parcels that are used in part for agricultural production.

Founded in 1793, the Town of Cazenovia has a very rich history and is strongly committed to preservation of its historic district. There are 27 dedicated historic sites within the town, all of which are registered on the National Register of Historic Places. In addition to historic preservation, Cazenovia's other municipal priorities include: planning and land use policies that protect agricultural land, open space, and Cazenovia Lake, and maintain the community's rural character.

The Town of Cazenovia is becoming increasingly interested with sustainable initiatives, and in 2013 signed on with a team from the Central New York Regional Planning and Development Board and SUNY College of Environmental Science and Forestry to conduct a greenhouse gas inventory and energy audit. Through this initiative, the town hopes to monitor and audit their emissions in order to discover new ways to decrease their ecological carbon footprint as well as incorporate sustainable alternatives into their town planning.

II. Methods

A. SCOPE ANALYSIS

Fuel and energy use data associated with greenhouse gas emissions were collected for community and municipal operations within the Town of Cazenovia. Data were collected for the baseline year 2010 and interim year 2012, and forecasted to year 2020. The baseline year was determined due to available data, assumed representation of normal trends, and correspondence with other inventories. Providing data for three years, two of which cover the recent past, allowed for an analysis of changes over time.

The research team partnered with the Central New York Regional Planning and Development Board, the Town of Cazenovia, and ICLEI Local Governments for Sustainability to conduct this inventory. The preliminary inventory is the first step of the 5-step climate mitigation process as outlined by ICLEI.

In order to avoid double counting, isolate areas of importance, and provide for a more comprehensive inventory we implemented a scope distinction. Emitting activities were allocated to three scopes, outlined as follows:

Scope	Emissions Activity	Town Sector by Scope
1	All direct GHG emissions	Onsite governmental emissions, vehicle fleet emissions, onsite commercial, residential, and industrial emissions
2	All indirect GHG gases related to the consumption of purchased energy	Emissions related to purchased steam, heating, cooling, electricity
3	All other indirect emissions not included in Scope 2	Wastewater and solid waste, employee commute, household waste, commercial waste

Table 1 Emission Scope Distinctions

Within each scope, the emissions data were separated by both sector and source. Sectors were included or excluded in the boundaries of this study based on availability of data and relevance to both emissions totals and scale to which they can be changed. Different sources are associated with different types of GHG emissions and different units of measurement. Different emissions also carry a different global warming potential (GWP) as determined by the Intergovernmental Panel on Climate Change; therefore, all of the emissions were aggregated and converted into metric tons of carbon dioxide equivalent based on a 100-year time horizon.

Of significance for this study were carbon dioxide (1 GWP), methane (21 GWP), and nitrous oxide (310 GWP).

B. CALCULATION TOOLS

Several calculation tools were used to quantify emissions totals. We used both the Local Government Operations Protocol and Community Operations Protocol designed by ICLEI. These protocols provided us with a standardized set of guidelines for quantifying and reporting emissions. Equations developed within the protocol were used to provide consistent and comparable data. We also used the ICLEI developed computer software Clean Air Climate Protection (CACP). The software streamlines the process of converting different sources, units, and varieties of emissions types. For example, CACP takes into consideration not only fuel type, but also model year when calculating the CO_2e of a vehicle fleet. Examples of calculation equations for stationary combustion are below.

Equation 6.2	Calculating CO_2 Emissions From Stationary Combustion (gallons)
Fuel A CO_2 Emissions (metric tons) = Fuel Consumed (gallons) × Emission Factor (kg CO_2/gallon) ÷ 1,000 (kg/metric ton)	
Fuel B CO_2 Emissions (metric tons) = Fuel Consumed (gallons) × Emission Factor (kg CO_2/gallon) ÷ 1,000 (kg/metric ton)	
Total CO_2 Emissions (metric tons) = CO_2 from Fuel A (metric tons) + CO_2 from Fuel B (metric tons) + ... (metric tons)	

Equation 6.7	Converting to CO_2e and Determining Total Emissions
CO_2 Emissions (metric tons CO_2e) = CO_2 Emissions (metric tons) × 1 (GWP)	
CH_4 Emissions (metric tons CO_2e) = CH_4 Emissions (metric tons) × 21 (GWP)	
N_2O Emissions (metric tons CO_2e) = N_2O Emissions (metric tons) × 310 (GWP)	
Total Emissions (metric tons CO_2e) = CO_2 + CH_4 + N_2O (metric tons CO_2e)	

C. GOVERNMENT EMISSIONS

The sectors covered in this study for government related emissions included buildings and facilities, vehicle fleet, streetlights and traffic lights, and water districts (of which there are three). Data for government emissions came from records provided by Cazenovia Town Highway Superintendent. The records indicated fuel and electricity purchases, as well as vehicle inventory and associated fuel use. Purchasing records were obtained for all the aforementioned sectors and costs were also recorded. The vehicle fleet inventory included records of make, model, year, fuel type, mileage and/or hours of operation for each vehicle. These data sets were input into the CACP software in order to retrieve emissions totals, and then were separated by sector, source and scope.

D. COMMUNITY EMISSIONS

Community related emissions were separated by sector to cover residential, commercial and industrial energy use, transportation, water treatment, and waste. The last two sectors are covered under community emissions because they occur outside of the jurisdiction of the town itself, but emissions are associated with in-town activity. Data for energy use had been acquired prior to this study; data sources are briefly outlined here and in appendix 3. Electricity consumption was determined by figures provided by National Grid; although water treatment is categorized as a community activity by this study, the electricity used was purchased by the municipality and covered in government emissions. Fuel use was determined by accessing the American Community Survey for 2010 and the Central New York regional GHG inventory.

Transportation data estimation methods are outlined in Appendix 3. The metrics used were road length within town boundary, vehicular traffic counted as per NYSDOT. CACP used default fuel allocations and not specific vehicle descriptions. The default assumes a fuel use of 83% gasoline, 10% ethanol (adjusted to account for NYS regulations) and 7% diesel.

Emissions associated with community waste recovery were determined using waste tonnage and the community protocol equation SW. 4.1 for methane emissions. It is assumed that the landfill has a standard 75% collection efficiency, an oxidation rate of .10, and a default waste component ratio. Tonnage data was derived from reports for the Town of Cazenovia Transfer Station, which accepts waste directly from community transportation sources. The transfer station then hauls waste to the Madison County Landfill for disposal.

To calculate the amount of emissions associated with wastewater treatment it was first determined that 95% of the town's population was on septic systems and the remaining utilized the faculty of the wastewater treatment plant. Community protocol equation WW. 11 alt. was used to derive the methane emissions associated with septic treatment and equation WW. 7 and WW. 11 were used to calculate the nitrous oxide emissions for the wastewater treatment plant.

The forecast to 2020 was determined using several methods that take into account projected growth and development. We factored in a 2% growth rate in population based on 2000-2010 growth and projected the business as usual municipal data for 2010. The community forecast was calculated using CACP and was based on growth rates for fuels, electricity use, waste generation and vehicle use. These rates were acquired through OCCRA, the 2009 NYS Energy Plan, and the US Energy Information Administration.

Agriculture and marine activities, while significant, are not within the boundaries of this study. Methods of estimation and results for these sectors are recorded in Appendix 1 and 2 as information items.

III. Results

The results of this analysis included Cazenovia's greenhouse gas inventory from government and community perspectives. The timeline covered the baseline year of 2010, the interim inventory year of 2012, and projected forecast year of 2020.

A. GOVERNMENT OPERATIONS EMISSIONS

The inventory showed that the emissions from government operations produced 469 metric tons of carbon dioxide equivalent ($MTCO_2e$) in the baseline year 2010, with a cost of $123,231. The Town of Cazenovia government operations inventory covered four sectors: buildings and facilities, streetlights and traffic signals, vehicle fleet, and water districts. The government vehicle fleet represented the majority of the emissions at 76% of the total. The pie chart (Figure 1) on right illustrates the distribution of emissions from different sectors for 2010. Emitting sources of the town government include electricity, natural gas, gasoline, diesel, ethanol, propane, and fuel oil. Among them, burning of diesel contributes up to 70% of the total Town emissions. By looking at different scopes, direct greenhouse gas emissions (scope 1) represented 433 metric tons of CO_2e, and indirect greenhouse gas emissions (scope 2) represented the remaining 36 metric tons of CO_2e. Data for scope 3 (all other indirect greenhouse gas emissions not included in scope 2) is not available for assessment at this time.

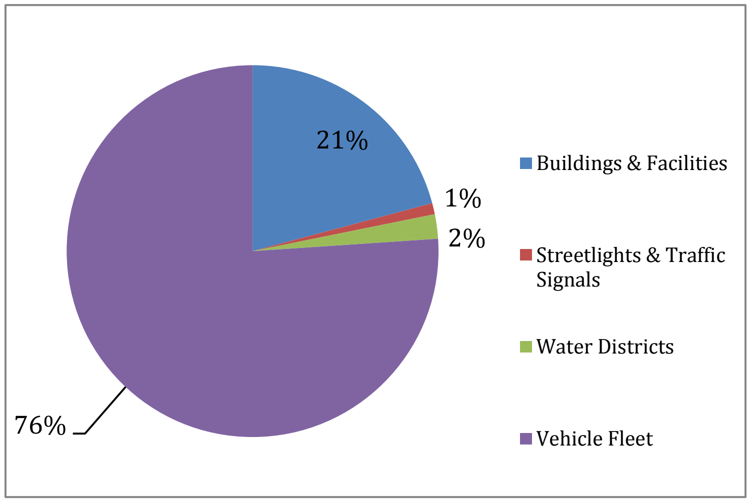

Figure 1 Government Emissions by Sector

In the interim inventory year of 2012, government greenhouse gas emissions decreased to 355 metric tons of CO_2e, while the cost increased to $128,455. During 2012, the town government had the same emitting sectors and sources as the baseline year. The building and facility sector produced more than 30% of total CO_2 emissions. The distribution of emitting sources was similar to the baseline year, with diesel representing the majority of the emissions at about 60% of the total. During 2012, scope 1 sources generated 320 metric tons of CO_2, and scope 2 produced 35 metric tons of the total carbon footprint.

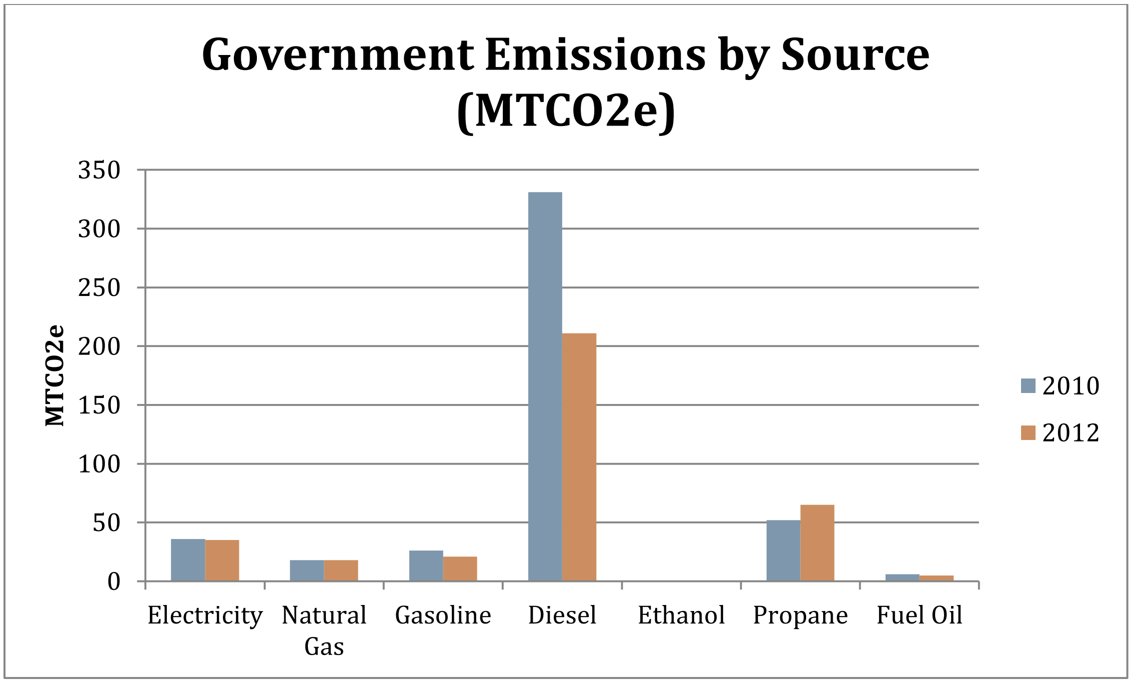

Figure 2 Government Emissions by Source

B. 2020 GOVERNMENT OPERATIONS FORECAST

A projected forecast for 2020 government emissions is based on a single-rate population growth factor. The forecast is estimated based on the 2010 results for the four government emission sectors (buildings and facilities, streetlights and traffic signals, vehicle fleet, and water districts). The projected government greenhouse gas emissions for 2020 is 504 metric tons, which is 14 metric tons of CO_2 less than the baseline year total.

The government emissions population growth rate over the 2000-2010 period was 2%, if this is assumed to continue over the next ten years- and accounting for the decline in emissions from 2010 to 2012 (114 metric tons) then 457 metric tons is the resulting 2020 projection. The graph (Figure 3) below compares government emissions of $MTCO_2e$ in the baseline and forecast years based on emitting sectors.

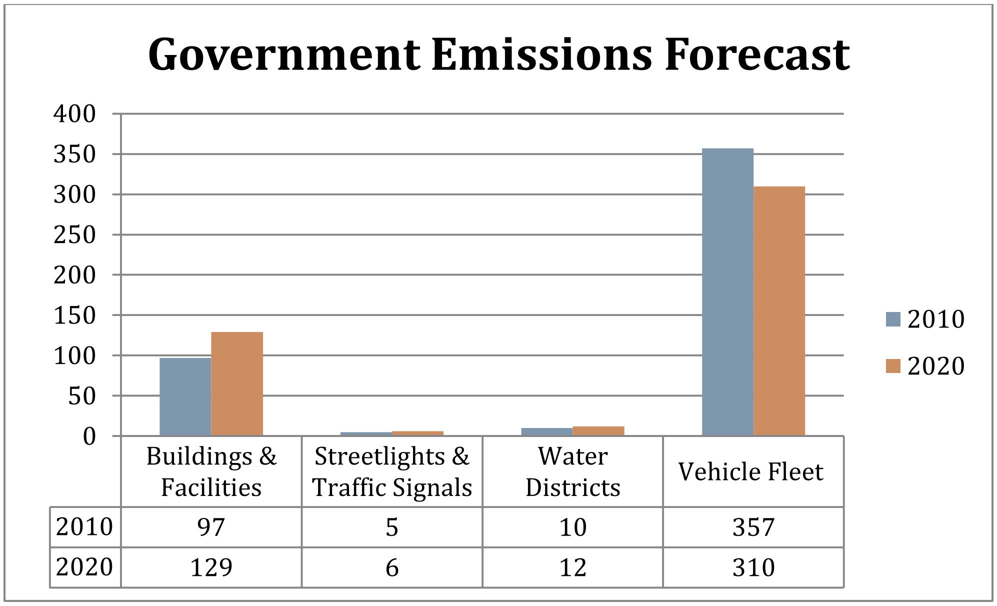

Figure 3 Government Emissions Forecast

C. COMMUNITY EMISSIONS

The result indicated the total amount of community emission for the baseline year was 41,092 metric tons of CO_2e. The Town of Cazenovia's community emissions were measured by sectors as well as sources. Community emission sectors included residential energy use, commercial energy use, industrial energy use, transportation, wastewater treatment and waste. Transportation and residential energy use were the two significant sectors that contribute the most to the town's community inventory, each accounted for 51% and 35%.

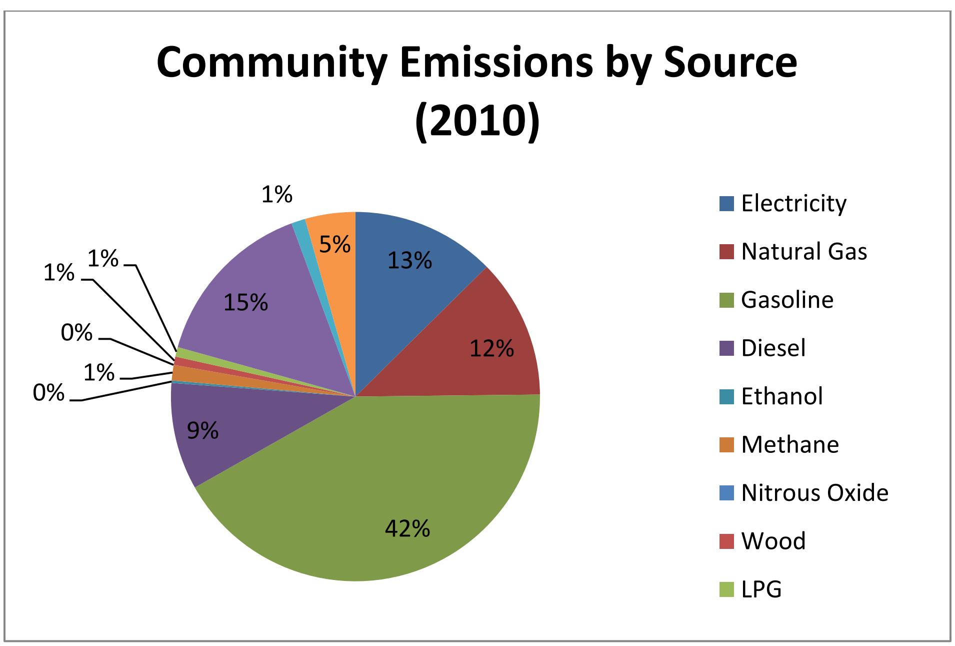

Figure 4 Community Emissions by Source

There was a significant decrease in the total amount of community CO_2e emissions in 2012. The community inventory of 2012 was 35,167 metric tons. There was a 5,925 metric tons CO_2e reduction since the baseline year. Yet transportation and residential energy use were still considered as the primary emission sectors of CO_2e.

Similar to the government emission sources, community emission sources included electricity, natural gas, gasoline, diesel, ethanol, propane, and fuel oil, with addition of methane, nitrous oxide, wood, LPG, and commercial coal. In the baseline year of 2010, burning of gasoline accounted for 42% of the community emissions. Electricity, natural gas, diesel and fuel oil also represented relative large percentage of the community's CO_2 emissions. Nevertheless, the result indicated a noticeable decrease in each emission sources in the interim inventory year of 2012. The graph below (Figure 5) compares community emissions by source in 2010 and 2012. Reduction was observed in the use of electricity, gasoline, diesel, and natural gas. However, gasoline was still the primary concern for greenhouse gas emissions, which produced 44% of the total community emissions.

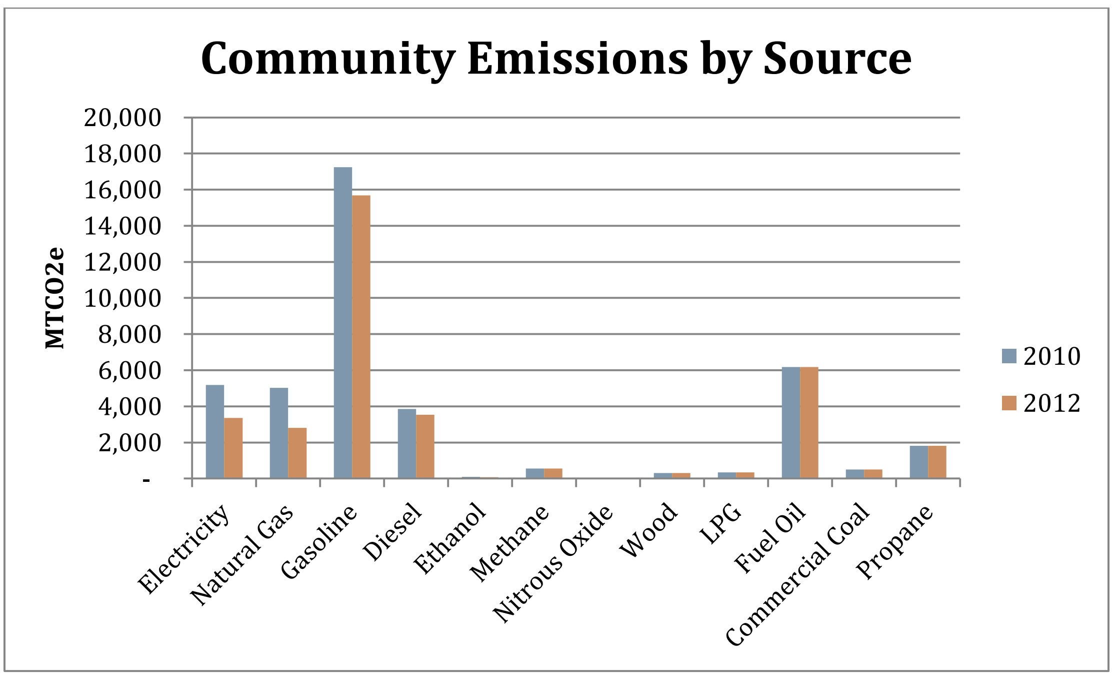

Figure 5 Community Emissions by Source (2010 and 2012)

The result also calculated CO_2e emissions for the information items of the baseline year, including marine emissions and agricultural emissions. The estimated Town of Cazenovia marine emission was 190 metric tons of CO_2e. Agricultural emissions were calculated with the total emissions from agricultural soil (3,739 $MTCO_2$e), enteric fermentation (7,768 $MTCO_2$e), and manure management (1,672 $MTCO_2$e). The total agricultural emissions were 13,179 metric tons of CO_2e during the baseline year.

D. 2020 COMMUNITY FORECAST

Figures 3 and 6 demonstrate the projected 2020 community emissions. The 2020 projection of community emissions is based on five sectors: residential energy use, commercial energy use, industrial energy use, transportation, and wastewater treatment. Cazenovia's community will generate 34,323 metric tons of CO_2e in the projected year. Transportation will still remain to be the top contributor of greenhouse gas inventory. However, it will be decreased by more than 10% compared to the baseline year. The most significantly reduced sector will be commercial energy use, which will be cut by 16.3%. The total decrease over baseline year level will be 16.47%. The graph (Figure 6) summarizes Cazenovia's community emissions forecast by sector.

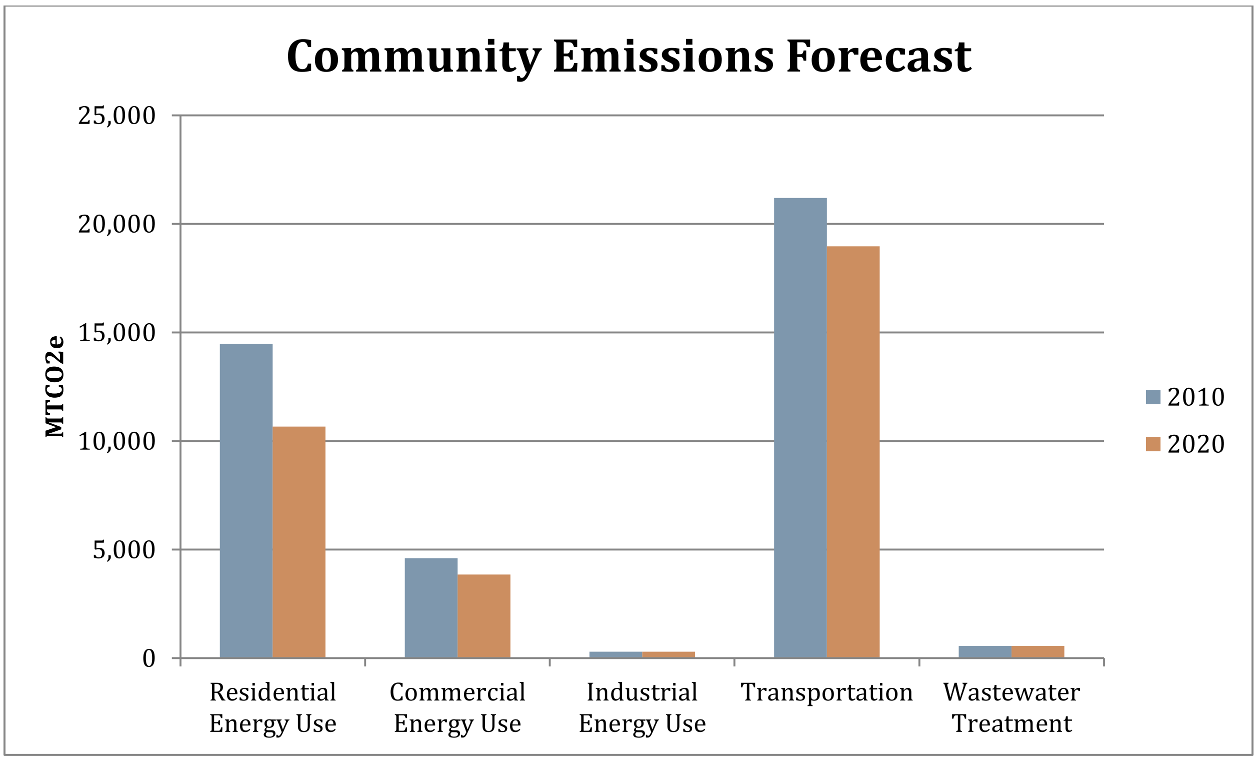

Figure 6 Community Emissions Forecast

III. Discussion

For this study a scope distinction was important because it isolated emissions information into categories that can be addressed with different means and tools. Direct emissions can be linked back to specific fuel types, whereas indirect emissions from the consumption of electricity are more difficult to quantify. Indirect scope 2, and to a greater degree, scope 3 emissions have lower potential to be affected by local policy initiatives. The vast majority of government emissions for Cazenovia was scope 1 emissions, and thus should garner the most attention when mitigation plans are considered.

The greenhouse gas inventory and forecast is the first milestone in mitigation, to be followed by developing a reduction goal and then climate action planning. The reduction goal and climate action plan should take scope differences into account. Sector and source analyses are also important because they will indicate more specifically where emissions are derived from.

The data indicated that the highest emissions came from transportation for both community and government operations. This shows the town that reducing these sources of emissions first would have the largest impact and would be the most effective in reducing total emissions. The Town of Cazenovia turns every vehicle in their fleet over after 7 years of use, but the fleet still represents the most considerable proportion of the emissions. These and other Scope 1 sources are easiest to influence through local planning and policy initiatives. The vehicle fleet did reduce emissions between 2010 and 2012 indicating greater efficiency possibly associated with the vehicle turnover. However, 2012 was a considerably warmer year, and the reductions were seen mostly in diesel emissions, which primarily power snowplows. Further study is required to normalize the data for heating and cooling degree days, and to determine if the vehicle turnover actually improves efficiency or just outsources the emitting potential of those vehicles. It's also important to note that while fuel use decreased, fuel expense increased indicating a need to consider alternative fuel sources, particularly biogenic sources, and reducing unnecessary activity.

The boundaries of this study did not include several considerable sources of emissions. Those include, but are not limited to, agriculture activity, marine activity, employee commute, and municipally generated waste. These sources were left out due to lack of clarity in data and low potential for influence. This does not diminish the need for these sectors to be included in the future.

This study is the first of its kind for the Town of Cazenovia. Several other CNY municipalities have undergone inventories, proving that climate mitigation requires local participation. Local participation will no doubt reflect the character and capacity of the particular municipality and should be in accordance with a comprehensive plan. Moving forward, we also note the importance of institutionalizing data collection in order to broaden the boundaries of the inventory, streamline further studies, and provide more comprehensive sets. Local participation can continue to be aided with efforts from regional support, including the CNY RPDB, Madison County, NYS DEC, and the EPA.

IV. Conclusion

As a Climate Smart Community, the Town of Cazenovia has partnered with state and local agencies to combat climate change and pledge to reduce greenhouse gas emissions. The first milestone for meeting climate mitigation goals, according to ICLEI Local Governments for Sustainability, is to conduct a baseline emissions inventory and forecast. This study was the first attempt to comprehensively quantify these emissions. It will provide a benchmark for planning purposes with the goal of setting an emissions reduction target and developing a Climate Action Plan.

The total Town of Cazenovia emissions footprint for all activity covered in this study was 41,561 $MTCO_2e$, 1.1% of which was from government activity and an additional 13,178 $MTCO_2e$ from agricultural activity. The majority of these emissions came from scope 1 sources that are easiest to influence through planning initiatives. Although a considerable proportion came from the community, which is outside direct governmental control, indicating a need for residential and commercial sector partnership.

Further analysis; however, is required to provide a more thorough inventory including emissions from agricultural animals, marine activity, and government waste. These sectors and emission estimates are noted as information items and not within the boundaries of this study. While seemingly outside the influence of government control, agricultural emissions estimates represent a significant portion of the community emissions and deserve attention. With an established model and methodology for compiling data, and tools for calculating emissions equivalents, Cazenovia can perform its own inventory to capture data sets outside of this study's boundaries, identify sources that can be effectively influenced by local policy, and monitor progress.

The 2020 forecast will be affected by plans to refurbish the Gothic Cottage; in addition, we have included recommendations for other potential areas for improvement. CNY-RPDB and SUNY-ESF intend to continue working with town officials, businesses, and residents. The recommendations will be considered with climate mitigation, community goals and feasibility in mind, and assistance with master plans and community outreach will be encouraged.

V. Recommendations

Following the completion of the greenhouse gas and energy use audit, the second step toward evolving as a Climate Smart Community is the development of a Climate Action Plan. These plans are responsible for determining a strategy and recommendations the town will use to further address climate change and decrease their carbon footprint. As more information is gathered and tracked, the Town will be able to develop more detailed forecasts as well as witness the changes and subsequent decreases in their energy usage as they continue to develop more sustainable mitigation strategies.

Once the data for the Town of Cazenovia was collected and organized, the Greenhouse Gas Inventory team then analyzed the data for gaps and areas the Town could improve in. Following the completion of this analysis, the following improvements are recommended for the Town in order to improve their carbon neutrality and become increasingly sustainable:

A. Energy Efficient Streetlights:

- Replacement of the streetlight bulbs in New Woodstock with high-efficiency LED lighting would increase their lifespan and more importantly decrease their energy usage. In order to combat the higher price for these lighting improvements, New York State has a grant program in place through The New York State Energy Research and Development Authority (NYSERDA). Developed in 2009, their High-Efficiency Public Street Lighting Project promotes the energy-efficiency benefits of improved municipal street lighting.[1] This project also offers support features developed for NYSERDA by ICF Consulting, Inc. and the Lighting Research Center at Rensselaer Polytechnic Institute. Online programs as well as informational packets are available to provide guidance to municipal officials, planners and engineering staff considering street lighting projects in New York State.[1]

B. Gothic Cottage Renovation:

- Historical preservation of the Gothic Cottage is controversial; however, minor improvements can make a lasting improvement on the building's efficiency. Until decisions regarding major renovation projects are decided upon, even small actions can improve the building's efficiency. These minor improvements include the following:

    - Incorporation of LED Lighting or energy efficient bulbs, decreasing the building's energy consumption and improving the lighting lifespan.
    - Energy efficient windows or improvement of weather stripping, caulking, and window coverings—this would dramatically decrease heat loss in the winter and heat gain in the summer.

- Updating the heating system, lowering seasonal heating costs and decreasing the reliance on propane.

- In the case that major renovations to the building are eventually approved, it is recommended that the Gothic Cottage receive new insulated windows, an energy-efficient central heating and cooling system, and complete building insulation. While these improvements are larger in scale than those previously listed, it is estimated that these renovations would be best in consideration of historically preserving the building. Funding and assistance is also available through The New Construction Program administered and operated by the New York State Energy Research and Development Authority (NYSERDA) [2]. A Consolidated Funding Application can be completed online at the NYSERDA website which can provide assistance when incorporating energy-efficiency measures into the design, construction, and operation of new and substantially renovated buildings, which the Gothic Cottage would qualify for [2]. Assistance is also available for efficiency estimates and green building.

C. Carbon Sequestration and Green Infrastructure:

- Carbon sequestration and green infrastructure projects would be extremely beneficial in decreasing carbon output as well as getting the community involved in local sustainability initiatives. It is recommended that the Town of Cazenovia highly consider including tree planting projects and community gardens, as well as green infrastructure such as permeable pavement and green roofs wherever possible. While other infrastructure opportunities do exist, these opportunities may be more feasible in the short term, while still very beneficial for the community.

D. Data Organization:

- Streamlining the data for emissions and waste generation and organizing it for easy access is one of the easiest and most efficient ways to monitor the Town's improvements. It's extremely beneficial to keep updated records of this information and know what the Town is responsible for emitting, in order to monitor improvements and develop future mitigation efforts.

E. Community Involvement & Awareness:

- It is always beneficial to get the community involved in efforts to decrease your carbon footprint. This is generally simple and includes community outreach initiatives, town meetings, public flyers, citizen comment periods, and local articles to ensure that citizens are aware and involved in planning for sustainability! This aids in ensuring that practices and goals come to fruition by having the Town citizens collectively working with the Town Board to decrease emissions and energy consumption.

- As the data shows, the community sector was one of the highest emitters for the Town. Citizen commute data acquired from the Madison County Inventory made up the majority of the Community emissions, so public outreach within the Town that educates the public about this information as well as ways to decrease these emissions such as carpooling systems or public transit initiatives would also be beneficial.

F. Alternative Energy Sources:

- For long term community planning, incorporation of alternative energy sources is highly recommended. Alternative energy sources provide the same amount of energy however decrease your dependence on fossil fuels and increase sustainability! Solar panels, wind turbines, and biofuels are all excellent alternatives to look into.
- Incorporation of these alternative energies is excellent because they are not accounted for within the CACP Software. For example, because Biodiesel is a carbon-neutral fuel, converting the vehicle fleet to this fuel source would be a dramatic decrease in the Town emissions. Carbon-neutral energy sources are not accounted for in Clean Air Climate Planning calculations and therefore create little to no emissions for the Town [3].

G. Tracking Waste Generation:

- Monitoring waste generation is very easy and provides a great representation of how much waste the town buildings are generating. This can be as simple as tracking how much and how often waste is taken to the Transfer Station in an Excel file! This can always be decreased by recycling efforts, reusing items, and substituting reusable items for consumables.

VI. Appendices

APPENDIX 1: ESTIMATION OF THE TOWN OF CAZENOVIA AGRICULTURAL EMISSIONS

According to data published by the United Nations, livestock is responsible for 18% of greenhouse gas emissions on a global scale. Because livestock plays such an important role in greenhouse emissions, it is important to use town agriculture data when completing a GHG inventory to accurately grasp a town's emissions.

To estimate the total metric tons of CO_2e, produced through agricultural emissions for the Town of Cazenovia, data was used from the Madison County Greenhouse Gas Inventory, completed by the Central New York Regional Planning and Development Board. This GHG inventory encompasses all towns within the Madison County boundary, therefore, expressing much higher CO_2e emissions than in Cazenovia itself. Because agricultural information, such as number of livestock and acres utilized for agricultural purposes was not readily available, numbers for agricultural emissions were taken from the Madison County Greenhouse Gas Inventory. The amount of mtCO_2e produced by Madison County was divided by the population of Cazenovia, providing a rough estimate of the GHG emissions produced by livestock, within the Town of Cazenovia.

The total CO_2e emissions produced by agriculture in the Town of Cazenovia are estimated to be 13,178.83 metric tons. This number was produced by adding together three different areas of agricultural emissions: emissions from agricultural soils, emissions from enteric fermentation, and emissions from manure management. The amount of CO_2e produced from agricultural soils was 3,738.86 metric tons. The amount of CO_2e produced from enteric fermentation emissions was 7,768.15 metric tons. Finally, the amount of CO_2e emissions produced by manure management was 1,671.82 metric tons. This data is expressed below in Table # and Graph #.

Because this number is an estimate, it could not be included within the report itself, but simply as an added part of the appendices. It is also important to note that most of the land included within the Town of Cazenovia's boundaries is used as agricultural land, so the number found is probably a lot smaller than the actual amount of mtCO_2e released by agriculture in Cazenovia.

Town of Cazenovia Agricultural Emissions Estimates			
Emissions from Agricultural Soils	Emissions from Enteric Fermentation	Emissions from Manure Management	Total Agricultural Emissions
3,738.86 metric tons of CO_2e	**7,768.15** metric tons of CO_2e	**1,671.82** metric tons of CO_2e	**13,178.83** metric tons of CO_2e

Table 2 Town of Cazenovia Agricultural Emissions Estimates

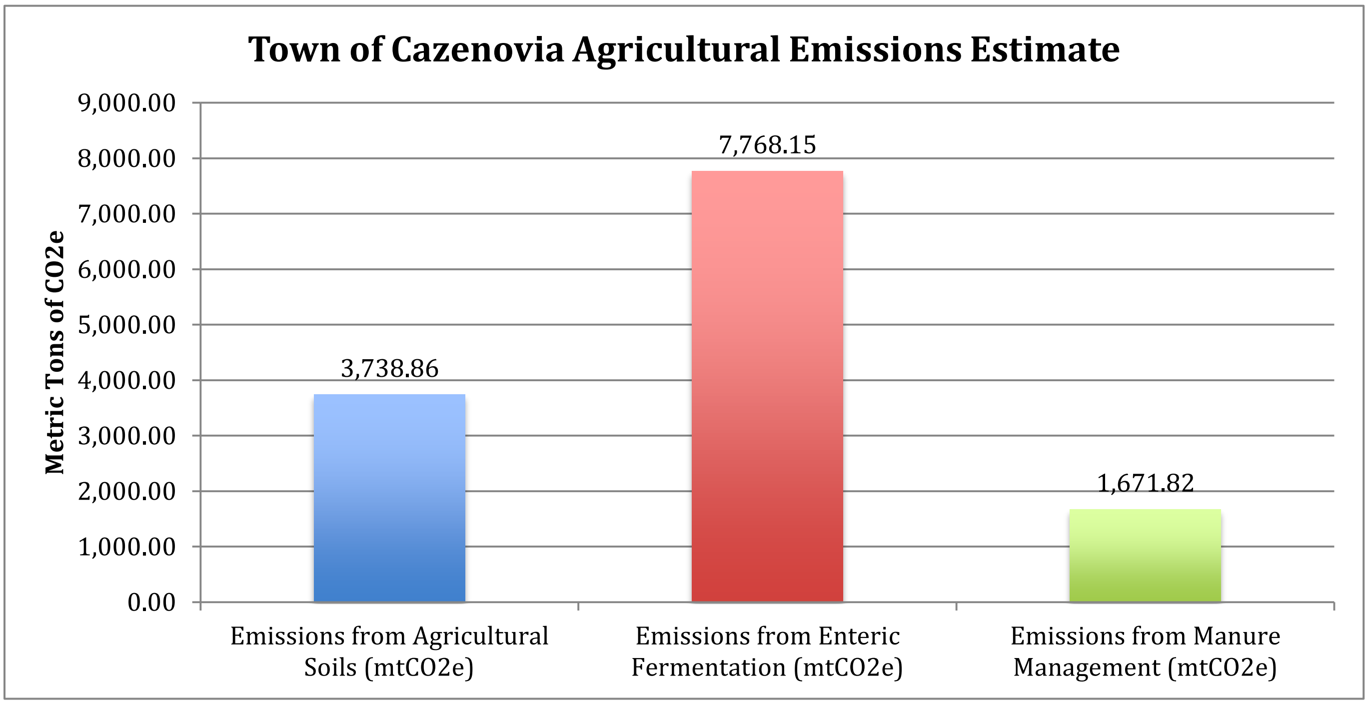

Figure 7 Town of Cazenovia Agricultural Emissions Estimates

APPENDIX 2: ESTIMATION OF THE TOWN OF CAZENOVIA MARINE EMISSIONS

Similar to agricultural emissions, data regarding marine emissions for the Town of Cazenovia was not readily available for examination. Because of this, estimates for marine emissions are not included within the report itself; however, they are included as informational items within the reports appendices.

To estimate the total metric tons of CO_2e produced by marine emissions for the Town of Cazenovia, data was used from the Madison County Greenhouse Gas Inventory, due to the fact that town specific data could not be gathered. Using information published from the 2010 CNY RPDB Greenhouse Gas Inventory, as well as the number of registered boats within Madison County and the fuel they use (2 stroke, 4 stroke, or diesel), the total amount of CO_2e, in metric tons of marine emissions was found for the Town of Cazenovia.

To do this, the number of people residing in Madison County, 73,442 people, was divided into the total amount of Madison County marine emissions, 1,969.08 mtCO_2e. This produced a number representing marine emissions per capita, 0.0268 mtCO_2. Finally, this number was multiplied by the number of people residing within the Town of Cazenovia boundaries, 7,086, to reach a total marine emissions estimate of 189.985 metric tons of CO_2e for the Town of Cazenovia. This information can be seen represented below, in Table #.

Town of Cazenovia Marine Emissions Estimate	
Madison County Marine Emissions	1,969.08 mtCO_2
Madison County Population	73,442 people
Madison County Marine Emissions Per Capita	0.0268 mtCO_2e
Town of Cazenovia Population	7,086 people
Town of Cazenovia Marine Emissions Estimate	**189.985** mtCO_2e

Table 3 Town of Cazenovia Marine Emissions Estimate

APPENDIX 3: INVENTORY ICLEI COMMUNITY PROTOCOL COMPLIANCE

						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**	**Account**	**Inclu**	**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	80,101	53.02 kg CO_2/MMBtu; 1 g CH4/MMBtu; 0.1 g N2O/MMBtu; EPA Mandatory Reporting Rule (MRR)		CA		4,258	
Use of fuel in residential stationary combustion (fuel oil, wood, LPG- MMBtu)	source and activity	119,628	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		6,350	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	14,409	53.02 kg CO_2/MMBtu; 1 g CH4/MMBtu; 0.1 g N2O/MMBtu; EPA Mandatory Reporting Rule (MRR)		CA		766	
Use of commercial stationary combustion (fuel- MMBtu)	source and activity	41,109	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		2,793	
Industrial Stationary combustion sources (nat. gas- MMBtu)	source and activity					NO		
Industrial Stationary combustion sources (fuel- MMBtu)	source and activity					NO		
Electricity								
Power generation	source					NE		
use of electricity by the community (MWh)	activity	22,818	eGrid 2009 subregion factors (EPA)	d data from utility	CA		5,179	Includes residential, commercial and industrial consumption (National Grid 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					NE		
Refrigerant leakage in the community	source					NE		

Table 4 ICLEI Community Protocol Compliance

Transportation and other Mobile Sources								
On-road passenger vehicles								
on-road passenger vehicles operating within the community (VMT)	source	39,703,390	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		21,191	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		
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	emissions data	Non-commercial vessel data is from NYSDEC NONROAD model reporting by county & commercial vessel data is from the 2008 National Emissions Inventory	This data was provided by the DEC in carbon emissions	CA		53,895	The Town of Cazenovia borders Cazenovia Lake but it was not possible to acquire marine fuel use associated with Town residents. This source is included as an information item in the inventory for planning purposes, and is sourced from the CNY (5-county regional GHG inventory municipal allocation)
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					NA		
generation and disposal of solid waste by the community	source and activity	1370.57	Utilized ICLEI Community Protocol waste method SW. 4 to calculate emissions from landfilling outside the Town boundary		CA		353	Town waste is sent to the Cazenovia Transfer Station (either self or contracted delivery), and then hauled to the Madison County Landfill for disposal. The Transfer Station annual reports were used to find the tonnage totals from the Town to input in the protocol calculation.
Water and Wastewater								
Potable Water- Energy Use								
Operation of water delivery facilities in the community	source	kWh= 57,126	This electricity use data came from Town staff; eGrid 2009 emission factors were used		SI	IE	9	The energy use for the Town water districts is included in the commercial sector electricity use stated above; the Town operates 3 main wells for provision of water to approximately 10% of the population, while the remaining 90% have self-supplied water through on-site wells
Use of energy associated with use of potable water by the community	activity					NE		
Use of energy associated with generation of wastewater by the community	activity					NE		
Centralized Wastewater Systems- Process Emissions								
Process emissions from operation of wastewater treatment facilities located in community	source					NA		
process emissions associated with generation of wastewater by community	activity				CA		1	Approximately 5% of Town residents are served by the centralized Cazenoiva wastewater treatment facility.
Use of septic systems in community	source and activity		Followed Community Protocol method WW.11 alt to estimate CH4 emissions from septic		CA		556	Was advised by Town staff that approximately 95% of the Town residents are served by on-site septic systems.
Agriculture								
Domesticated animal production	source		These estimates were derived following a state-wide inventory protocol, which utilized EPA methods among others		CA		7768.151	The Town has dairy cow and horse populations on farms that span the Town boundary. These animal population counts were not identifiable during this analysis (only county-level data from the CNY regional GHG inventory was available), so this municipal estimate is included as an information item.
Manure decomposition and treatment	source				CA		1671.818	Regional inventory estimate for the Town (arrived at through a municipal allocation process)
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		