

# **Cazenovia Climate Smart Communities: Municipal GHG Inventory 2023**

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## 1.0 Executive Summary

The town of Cazenovia along with the village of Cazenovia has developed a Climate Action Plan (CAP) and is Bronze designated in the Climate Smart Communities (CSC) program for its commitment towards sustainability. The study intends to develop a municipal Greenhouse gas (GHG) inventory for the town of Cazenovia, located in Madison County, New York. The CSC team investigates the municipal GHG inventories and overviews the interdisciplinary programs that stretch across multiple counties, cities & towns. Our team focuses on the climate action steps that are required to be taken under four different pledge elements which include decreasing energy use, shifting to clean/ renewable energy, inventory emissions, and more.

The study is aimed at evaluating the energy use and GHG emissions associated with buildings, facilities, streetlights, vehicle fleets, wastewater, and tank fuels. The main objective of the study is to quantify the GHG emissions associated with the town of Cazenovia by gathering data related to municipal energy and fuel use thereby identifying the areas where energy is being wasted and used inefficiently in supplying facilities and infrastructure in the town of Cazenovia. Another objective of the project is to make suggestions and recommendations to the municipality of Cazenovia for improving energy efficiency, minimizing energy consumption, and therefore reducing GHG emissions; all efforts that will help progress municipal, state, and federal environmental/sustainability goals.

The “Jim” tool developed by the NYSDEC was used as a spreadsheet GHG inventory calculator, helping us identify, quantify, calculate, and analyze energy use and subsequent scope 1 and scope 2 GHG emissions associated with the town of Cazenovia.

Our deliverables include gathering information on municipal energy and fuel use and determining the GHG emissions.

Wastewater treatment, also known as the water pollution control building accounts for the largest amount of GHG emissions in the town of Cazenovia, which produces GHG emissions from denitrification/ nitrification processes. Electricity and propane are the main energy sources associated with the wastewater treatment process and building. Cazenovia’s Vehicle Fleet is the second largest emission source after wastewater treatment, suggesting that transportation is a major source of GHG emissions in the town. Carbon dioxide (CO<sub>2</sub>) emissions are associated with the use of internal combustion vehicles fueled with gasoline and diesel fuel. Compared to Cazenovia’s gasoline consumption, diesel fuel combustion was responsible for the bulk of the vehicle fleets’ GHG emissions (82.7% of the total 191 MTCO<sub>2</sub>e emitted) due to higher amounts of consumption and diesel's higher emission factor. Administrative Facilities account for 16.17% of the town’s GHG emissions, suggesting room for improvement. Concerning administrative facilities, the highest CO<sub>2</sub> emissions are associated with electricity usage. Focusing on tank fuels, Cazenovia has three facilities that use tank fuels: the Highway garage, trooper barracks, and

water pollution control building. All three facilities use propane as their fuel source. Streetlights and traffic lights account for less than 1% of municipalities' electricity usage, emitting only 0.6 MTCO<sub>2</sub>e. Due to our lack of knowledge of Cazenovia's specific energy systems, we are assuming that this lack of energy usage is due to the streetlights and traffic lights already having high-efficiency LED bulbs.

When considering the GHG emissions associated with different sectors in the town of Cazenovia, a few recommendations can be made to improve energy efficiency and reduce emissions, helping contribute towards environmental sustainability goals. As previously mentioned, proposing recommendations is difficult in this case due to our lack of knowledge of Cazenovia's energy systems, building layouts, and operational dynamics; our current knowledge is limited to the energy usage and emissions of different buildings and sectors. Nonetheless, key recommendations include; conducting GHG benchmarking inventories to measure local emissions, transitioning interior lighting in town buildings to LED, participating in Energy Code Enforcement training, installing heat pumps to replace propane usage, and establishing SMART (specific, measurable, achievable, realistic, and timely) climate and sustainability goals.

In conclusion, as a bronze-certified Climate Smart Community, Cazenovia has already taken the first step in the initiative, but to continue and improve its certification, it must develop a plan to improve upon the areas of weakness identified in the GHG inventory report.

## 2.0 Introduction

The purpose of the Climate Smart Communities team is to investigate the municipal GHG inventories (CNY Regional Planning and Development Board) and take into account the interdisciplinary programs that stretch across multiple counties, cities, and towns. These programs cover transportation, planning air and water quality, economic development, and sustainability planning. Aligning their goals with the State and Federal interests, regional officials research further into areas of economic development, environmental management, community development, transportation planning, and energy management that can influence the management of these programs on a State-to-federal scale.

Our group will be focusing on the town of Cazenovia, New York. Cazenovia is currently a Bronze Certified Climate Smart Community which requires one of the climate action steps under four different Pledge Elements. Actions may include decreasing energy use, shifting to clean/renewable energy, inventory emissions, and more.

These programs help support the local government and communities in reducing GHG emissions, building community resilience to mitigate, and adapt to climate change impacts, and promoting a green economy. The CNY RPDP Energy Program is broken down into Planning, Project Development, and Public engagements, within each has its own plans, studies, or challenges. Examples of these objects include looking into project development by evaluating public engagement with Energy Campaigns and Challenge Teams to help promote and educate a green community. Specific programs may include setting goals and planning for climate action through tracking inventory emissions or inspiring and educating green innovation.

Our deliverables will include gathering information on municipal energy and fuel use and determining the GHG emissions. Our reports will include evaluating the energy use and emissions from Building and Facilities, Streetlights, Vehicle fleets, Wastewater, and more.

### 3.0 Methods

Creating a “facility master list” is the first of the NYS DEC “Jim” GHG inventory spreadsheet, this includes inputting the large sources of energy consumption such as street lighting, water treatment plants, police stations, and other large sources of energy consumption.

Secondly, we must list the energy provider accounts and their associated account number, linking them with the master list inputs as they apply. For inputs/consumption sources that are provided with multiple fuel types and energy carriers by the utility such as natural gas and electricity, these are entered separately as they have different emission coefficients. For tank fuels such as propane and fuel oil, we can either create a new row or enter them separately in the new tab to account for them.

Step three of our GHG inventory process involves us adding our electricity and natural gas data to the two separate tabs, “electric data” and “natural gas data”. For this we must have the time period, usage levels, and energy costs; all of which we plan to access via the municipal utility bills and other personalized data they can provide us. Data entered in these tabs will be linked to the facility/input from our master list, and our energy providers account where it will calculate automatically.

Step four of this process includes collecting the tank fuel data (propane and fuel oil) such as the amount purchased and cost, although this can be tricky as tank fuels aren’t metered like utility electricity and natural gas. Due to this, we plan on using 2-4 years of data to help average the usage and assign it to the correct year. From here we can attempt to break the data into rows and link it to the facility master list where it can be calculated automatically.

Step five of the GHG inventory accounting spreadsheet will be collecting and entering the municipality vehicle fleet fuel type, usage, and cost data. The matter in which we go about entering this data will depend on how it is calculated and organized by Cazenovia; however, the suggestion for small communities is to report the fleet fuel data by year rather than by department, or vehicle.

The additional steps included in the NYS DEC “Jim” GHG accounting tool were considered out of the project boundaries as they dealt with accounting for scope 3 emissions and this GHG inventory focused specifically on scope 1 and 2 emissions. Some examples of scope 3 emissions sources not analyzed in this report include municipal employee commutes, refrigerants, landfill methane, and more.

## 4.0 Emission Results by Sector

### 4.1 Building and Facilities

The Buildings and Facilities sector of the town of Cazenovia includes the Town Office, Trooper Barracks, the Water Pollution Control Building (discussed in section 5.4), the Highway Garage, Mt. Pleasant Water District, the New Woodstock Water District, the Wellington Water District, the New Woodstock Water Wheel, and the Town's Lighting. All of these buildings are owned by the town and have various uses. Buildings can produce GHG emissions through heating and cooling, lighting, and fuel usage.

The Water Pollution Control Building and the Highway Garage account for the highest GHG of the town's facilities. These buildings also consume the most propane, with the Water Pollution Control Building consuming 2,279 gallons of propane and the Highway Garage consuming 9,298.8 gallons. Propane could be used for heating and refueling propane vehicles. Vehicles that can run off propane include school buses, forklifts, and police vehicles. Keeping propane usage down is one way that the town of Cazenovia could reduce its GHG emissions. For every 157 gallons of propane used, one metric ton of carbon dioxide is produced.

The water districts supply water and sewer services to the designated communities within the town of Cazenovia. These districts account for 8.9 MTCO<sub>2</sub>e out of the total 307.6 MTCO<sub>2</sub>e for facility greenhouse gas emissions, with the water districts accounting for less than 3% of the town's greenhouse gas emissions. These water districts should not be a cause of concern for the town.

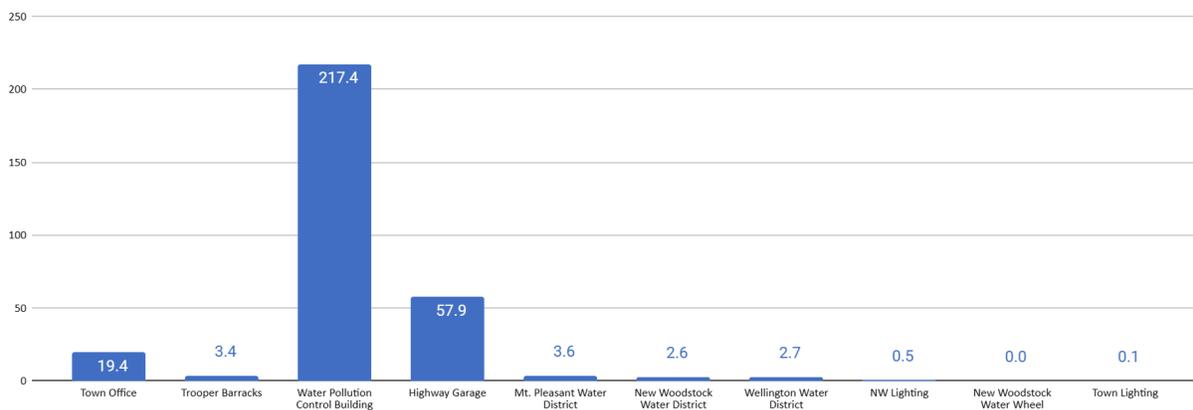


Figure 1: Facility GHG Emissions (MTCO<sub>2</sub>eq) in Town of Cazenovia in 2023

## 4.2 Streetlights

The lighting in the town of Cazenovia is not represented traditionally on the electricity bills the town receives. This is because National Grid uses a multiplier and estimates the amount of energy the streetlights use rather than calculating the exact use of the streetlights. The greenhouse gas emissions created by this sector of the town are relatively low compared to other areas, accounting for less than a metric ton of CO<sub>2</sub>. With the lack of information, and based on the town's already certified bronze climate smart communities ranking, it is safe to assume this is due to already high-efficiency LED bulbs having been previously installed. It is important to note that electricity use for the town's two lighting districts both increased during winter months and decreased during the summer months.

## 4.3 Vehicle Fleet

The Vehicle Fleet in the town of Cazenovia includes delivery trucks, buses operated by public and private transportation authorities, personal vehicles, taxis and rental cars, and company vehicles owned by public and private institutes. These vehicles are used in a variety of applications such as transportation of people or goods, providing services, and supporting daily operations.

Quantitatively, the vehicle fleet accounts for 191.3 MTCO<sub>2</sub>e of GHG emissions, which is the second largest emission source in the town of Cazenovia, after wastewater treatment, suggesting that transportation is a major source of GHG emissions in the town. Carbon dioxide (CO<sub>2</sub>) emissions are associated with the combustion of gasoline and diesel. Gasoline is purchased from WEX Bank whereas diesel is purchased from Buell Fuel. For the year 2023, diesel usage hits 15 540 gallons and gasoline usage hits 3 757 gallons. Diesel usage accounts for 158 MTCO<sub>2</sub>e of GHG emissions and gasoline usage accounts for 33 MTCO<sub>2</sub>e of GHG emissions.

*Table 1: Fuel Usage in Town of Cazenovia in 2023*

Fuel Type	Purchasing Agent	2023 Usage (Gallons)	2023 GHG emissions (MTCO <sub>2</sub> e)	Annual Cost (\$)
Diesel	Buell Fuel	15 540.00	158.00	48 702.81
Gasoline	WEX Bank	3 757.00	33.00	11 053.13
Total		19 297.00	191.00	59 755.94

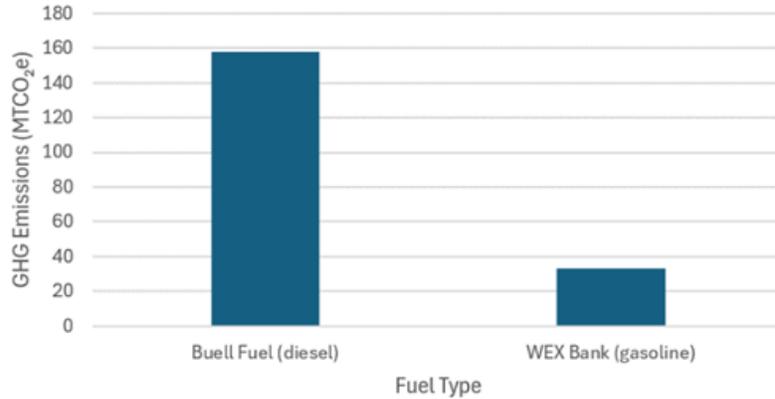


Figure 2: Vehicle Fleet GHG emissions (MTCO<sub>2</sub>eq) in Town of Cazenovia in 2023

Compared to GHG emissions associated with gasoline combustion, GHG emissions associated with diesel combustion are relatively higher in the town of Cazenovia. It may be mainly because of the operation of heavy-duty vehicles which use diesel as their combustion fuel with higher emission levels. Although diesel fuel is more energy- dense than gasoline, it releases more pollutants and GHGs per unit of energy burned. Also, heavy duty vehicles travel higher distances which accounts for higher mileage resulting in higher GHG emissions compared to gasoline vehicles.

#### 4.4 Tank Fuels

Three of Cazenovia's facilities use tank fuels in the form of propane as a power source. The buildings, and their corresponding fuel consumption, are:

- Highway Garage - 9,298.8 gallons
- Trooper Barracks - 368.8 gallons
- Water Pollution Control Building - 2,279 gallons

This equated to 11,946.6 gallons of propane, costing the town \$19,084.68.

## 4.5 Wastewater/ Water Pollution Control Building

For our wastewater audit, our GHG Inventory Tool already had the formula inputted. We took the latest census data for the population as of 2023 and it automatically outputted the emissions. To calculate the annual N<sub>2</sub>O emissions in metric tons, the tool essentially multiplies the total population and the factor for industrial and commercial co-discharge waste into the sewer system then multiplies that by the emission factor for WWTP with nitrification/ denitrification and then converting it from grams to metric ton. After that they multiplied the metric ton/g by the N<sub>2</sub>O global warming potential. The typical modern WWTP are fully aerobic and do not have methane emissions during the process.

The main energy types associated with wastewater included electricity without around 291,852 kWh and propane with 2279 gallons. The Water Pollution Control Building produces 168 MTCO<sub>2</sub>eq GHG from the denitrification/nitrification process required to serve the population of 6,685 people. The total emissions from both Energy Use and the Wastewater Treatment Process was 217.43 gallons. The Water Pollution Control Building is the same as the wastewater treatment building, it will be discussed further in the cumulative analysis.

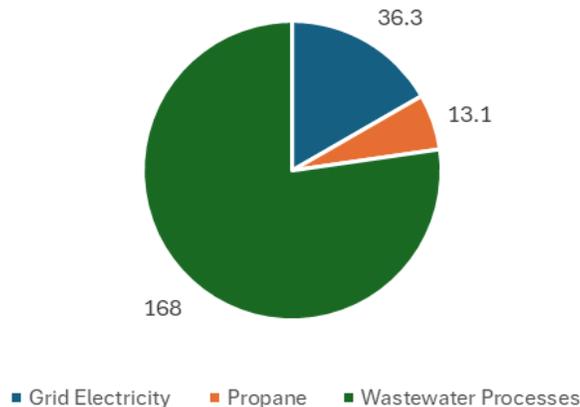


Figure 3: Water Pollution Control Building emissions (MTCO<sub>2</sub>eq) in Town of Cazenovia in 2023

## 5.0 Cumulative Emissions Results & Discussion

The town of Cazenovia has varying levels of GHG emissions, dependent on the corresponding energy source. From our inputs using the jim tool, we found the following emission totals:

### 5.1 Greenhouse Gas Emissions by Sector (Pie Chart)

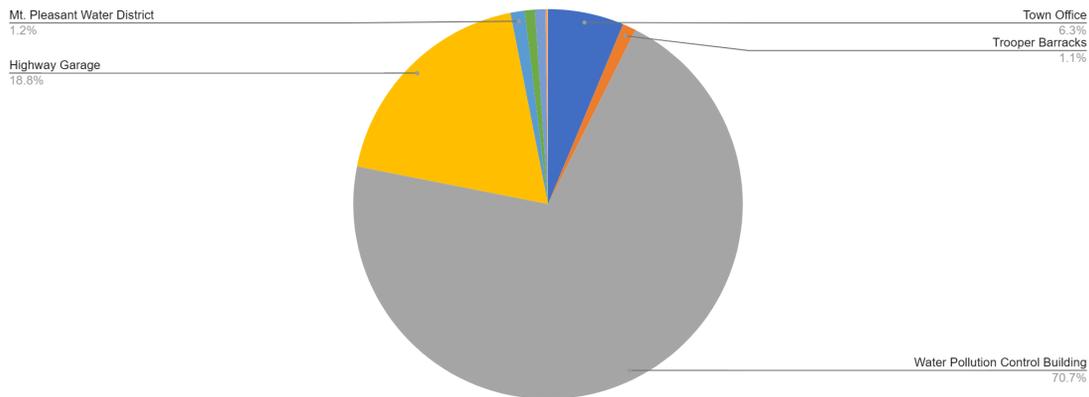


Figure 4: Facility Greenhouse Gas emissions (MTCO<sub>2</sub>eq) in Town of Cazenovia in 2023

This chart visualizes our emissions more comprehensively. The greenhouse gas emissions are primarily contributed from the water pollution control building. This is due to both energy usage, and the wastewater treatment process, with the majority coming from the wastewater treatment process. Additionally, the facility uses propane, which is the highest emitting fuel type a building can use in this study. The second largest sector was the highway garage, which also uses propane as their fuel source. Our recommendations from the town centered around the results from the greenhouse gas emissions by sector. For instance, we believe the town will greatly benefit from heat pumps to replace their propane powered systems.

## 5.2 Greenhouse Gas Emissions by Sector (Bar Graph)

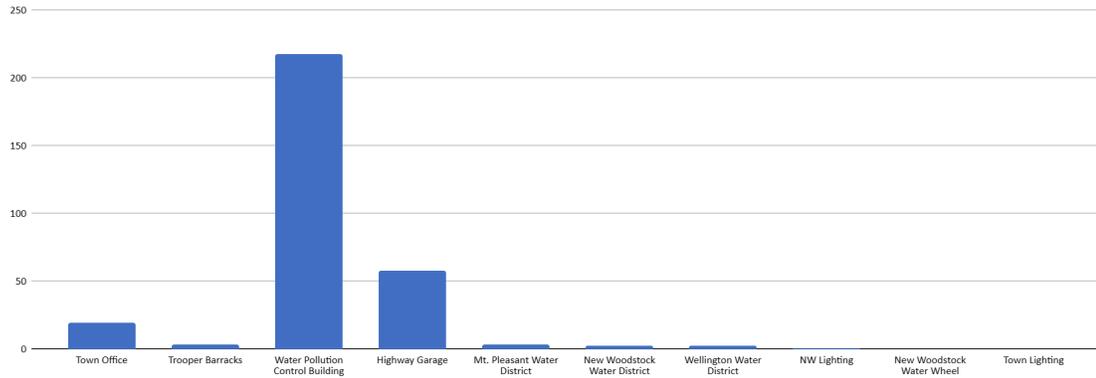


Figure 5: Bar Graph of Facility Greenhouse Gas emissions (MTCO<sub>2</sub>eq) in Town of Cazenovia in 2023

A bar graph is a secondary measure to visualize our results of GHG emissions by sector. This again shows how highly emitting propane is, with the water pollution control building and highway garage having the most emissions.

## 5.3 Greenhouse Gas Emissions by Energy Type

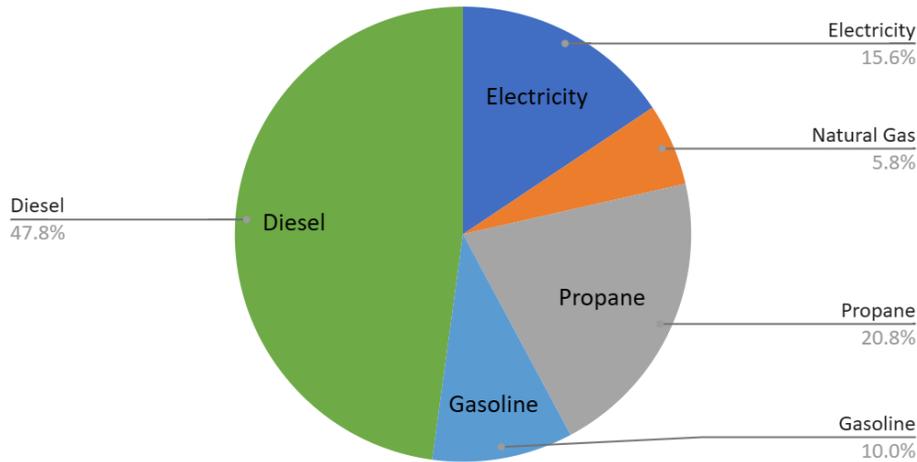


Figure 6: Greenhouse Gas emissions (MTCO<sub>2</sub>eq) by energy type in Town of Cazenovia in 2023

Cazenovia uses the following energy sources: diesel, gasoline, propane, natural gas, and electricity. The pie chart shows the corresponding greenhouse gas emissions for each of these energy sources. This chart heavily influenced our recommendation decisions, as we were able to pinpoint the heaviest sources of emissions.

## 5.4 Energy Cost by Fuel Type

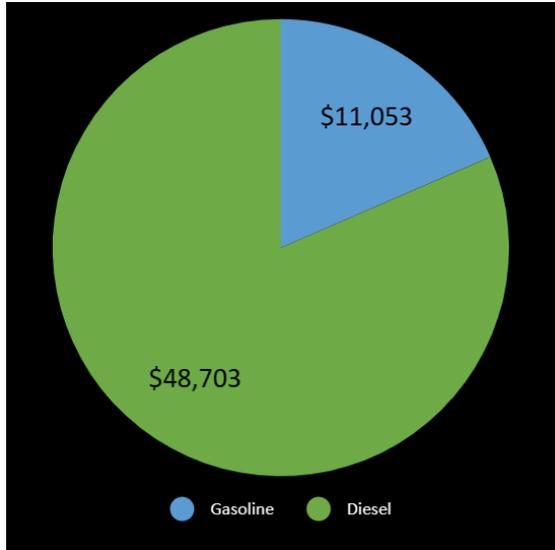


Figure 6: Average Energy Cost (\$) by Fuel in Town of Cazenovia in 2023

The graph above shows the energy costs for the transportation fuels of Cazenovia’s vehicle fleet. Both of these fuels are extremely expensive, costing the town tens of thousands of dollars each year. This influenced our decision to recommend electric vehicles, as it would save them from these expenses.

## 5.5 Emissions by Scope

The town of Cazenovia had much higher scope 1 emissions compared to scope 2.

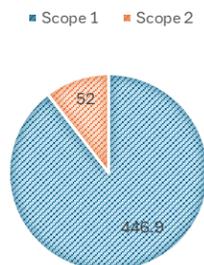


Figure 6: Scope 1 Vs. Scope 2 GHG emissions (MTCO<sub>2</sub>eq) in Town of Cazenovia in 2023

## 6.0 Recommendations

By considering the GHG emissions associated with different sectors in the town of Cazenovia, few recommendations can be made to improve the energy efficiency that will contribute towards environmental sustainability goals.

Conducting GHG benchmarking inventories to measure local emission can be recommended for the town of Cazenovia. A GHG benchmarking inventory is a detailed accounting of GHG emissions from various sources within a defined area (Town of Cazenovia in this particular case). It establishes a baseline for future comparisons and helps track progress towards emission reduction goals. Since this will provide a clear picture of the local contribution to climate change, the local community of the town of Cazenovia can gain valuable insights into their local emissions profile and take informed actions to reduce their environmental impacts. Furthermore, benchmarking inventories enables tracking progress over time and measures the effectiveness of mitigation strategies. This will help in setting realistic goals for reducing emissions.

The lighting in the town building can be improved by transitioning interior lighting to LED. LED lights are known for several advantages over traditional incandescent or fluorescent bulbs in terms of energy efficiency, lifetime, environmental impact, and light quality. LEDs use significantly less energy than traditional bulbs to produce the same amount of light. This may result in reduced GHG gas emissions from power generation and cost savings on electricity bills for the town. LEDs have a much longer lifespan than traditional bulbs, which reduces the frequency of replacements and maintenance costs. LEDs can provide a variety of light color temperatures and dimming options, allowing for better control over the lighting ambiance. Additionally, LEDs do not contain harmful mercury like some fluorescent bulbs.

Participating in Energy Code Enforcement training can be recommended for the town of Cazenovia. Energy Code Enforcement training is a program designed to equip local government officials, particularly inspectors and code enforcement officers, with the knowledge and skills necessary to ensure buildings comply with energy efficiency standards. By participating in this training, the officials gain the expertise to ensure buildings are constructed and renovated in a way that energy use and environmental impacts are minimized, which may contribute to a more sustainable future. At the same time, these programs will enhance public health with improved indoor air quality and occupant comfort. Due to the lower overall energy demand, these will lead to potential cost savings for the community of the town of Cazenovia.

Replacing propane with heat pumps could be a good choice for energy efficiency and environmental reasons. Heat pumps are heating and cooling systems that transfer heat from one place to another, using electricity. In heating mode, heat is extracted from outdoor air and is concentrated indoors. In cooling mode, the process is reversed, extracting heat from indoor air and releasing it outdoors. Heat pumps are more energy efficient than propane furnaces. As existing heat is moved instead of burning fuel to generate heat, heat pumps potentially lead to

lower electricity bills. At the same time, heat pumps provide both heating and cooling (dual functionality), eliminating the need for separate systems. Propane combustion releases GHGs, while heat pumps use electricity, which can be generated from cleaner sources like solar and wind power.

By establishing Renewable Energy Targets for the town of Cazenovia, the town's reliance on renewable energy sources can be improved. This may reduce the reliance on fossil fuels and price fluctuations. Increased reliance on local renewable energy sources enhances the town's energy independence and resilience, thereby ensuring energy security. More importantly, renewable energy sources generate cleaner electricity that reduces the GHG emissions and mitigate climate change impacts. By establishing renewable energy targets and implementing a comprehensive strategy, the town of Cazenovia can take a significant step towards a more sustainable future with cleaner energy and a reduced environmental footprint.

## 7.0 Conclusion

As we've noted previously, Cazenovia is a bronze-certified climate smart community (CSC). As a bronze-certified community, Cazenovia has already taken the first step in the initiative, but to continue and improve its certification, it must develop a plan. Cazenovia has many areas in which the town and its residents can improve upon. These may include conducting GHG benchmarking inventories to measure local emissions, transitioning interior lighting in town buildings to LED, installing LED streetlights, and participating in Energy Code enforcement training, renewable energy target or many of the numerous recommendations we listed above.

By using the Jim GHG Inventory tool we were able to quantify and collect data on the amount of GHG emission in various sectors. By doing so, we were able to identify certain areas such as the tank fuels and vehicle fleet where there are high amounts of emissions and can create a more efficient system to reduce the overall energy consumption of the town.

When small towns such as Cazenovia work to become a Climate Smart Community, they are setting the stage for other communities to follow. Greenhouse gas accounting can appear as a daunting task, and cities may push it aside in their agendas. However, once an example is set to follow, it will seem like a more attainable goal. Consequently, once this standard is in place, it will make it so others feel obligated to achieve this as well.

Cazenovia's initiative to become a climate-smart community directly contributes to New York State's goals under the Climate Leadership and Community Protection Act (CLCPA). The act was passed in 2019 and is one of the most aggressive pieces of climate legislation in the country. Their goals include a clean, electric grid with carbon-free electricity by 2040. To achieve this, there are many renewable energy targets set in place, paired with corresponding energy storage systems. For example, New York plans on having 6,000 megawatts of solar by 2025, with 3,000 megawatts of storage by 2030. Although many of the goals appear to be in the hands of the state, it will ultimately come down to the residents of New York to make any change happen. Programs such as Climate Smart Communities are an excellent way to begin these changes.

## **8.0 Acknowledgement**

Firstly, we wish to convey our appreciation to Dr. Joshua Cousins, our professor, for involving us in this collaborative project. The hands-on experience we got was incredibly enriching and valuable as we could apply the course teachings to practical circumstances.

We would like to thank those at the Central New York Regional Planning and Development Board, particularly Michael Boccuzzi, for leading us through this project and providing support along the way.

Furthermore, we are grateful to the community of the town of Cazenovia for their commitment to conducting a GHG inventory and for entrusting us with this important project. Their dedication to achieving a higher CSC status is commendable, and we feel privileged to assist in this transition.

We also extend our gratitude to Jim Yienger at Climate Action Associates for creating the useful GHG inventory tool.

We would like to express our sincere thanks to all the others who helped us in this auditing process. We are honored to be a part of this project, and we aim to strengthen the decision-making capabilities of the Cazenovia community as it strives to keep improving as a Climate Smart Community.