# Local Government and Community Greenhouse Gas Inventory

## Town of Preble, New York
## December 2012

Town of Preble

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## Acknowledgements

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# Table of Contents

I. Executive Summary ..... 5
II. Introduction ..... 6
A. Town Background ..... 6
B. Climate Change Background ..... 7
C. Climate Change Innovation Program ..... 8
D. ICLEI Partnership ..... 9
III. Methodology ..... 9
A. Greenhouse Gases ..... 9
B. Calculation Tools ..... 10
i. ICLEI Local Government Operations Protocol ..... 10
ii. Additional Resources Utilized ..... 10
C. Reporting by Scope ..... 10
IV. Government Results ..... 11
V. Community Results ..... 14
A. Transportation ..... 16
B. Agriculture ..... 17
C. Carbon Sequestration ..... 17
VI. Emissions Forecast ..... 18
A. Government Operations Forecast ..... 18
B. Community Forecast ..... 19
VII. Conclusion ..... 20
VIII. Appendices ..... 21
Appendix 1. Estimation Method for Agricultural Emissions ..... 21
Appendix 2. Estimation Method for Carbon Sequestration Potential ..... 22
Appendix 3. Estimation Method for Vehicle Miles Traveled ..... 23
Appendix 4. CACP Reports ..... 24

**List of Figures**

Figure 1 Town of Preble ........ 6
Figure 2 Greenhouse Effect ........ 7
Figure 3 ICLEI Five Milestones for Climate Mitigation ........ 9
Figure 4 Government Emissions ........ 12
Figure 5 Government Energy Use ........ 13
Figure 6 Government Emissions by Sector ........ 13
Figure 7 Community Emissions ........ 15
Figure 8 Community Energy Use ........ 16
Figure 9 Community Agricultural Emissions ........ 17
Figure 10 Government Operations Forecast ........ 19
Figure 11 Community Forecast ........ 20
Figure 12 Preble Tree Canopy ........ 22

**List of Tables**

Table 1 Greenhouse Gases ........ 9
Table 2 Emissions by Scope ........ 11
Table 3 Government Emissions by Scope ........ 14
Table 4 Carbon Storage Estimate ........ 18
Table 5 NYS Energy Plan Growth Rates by Sector ........ 19
Table 6 EIA Annual Energy Outlook Electricity Use Projections ........ 20
Table 7 Agricultural Emissions Calculation (SIT) ........ 21
Table 8 Preble Traffic Data ........ 23

# I. Executive Summary

In 2011, Preble Town government operations generated 151 metric tons of carbon dioxide equivalent ($MTCO_2e$). These emissions span three sectors, including: buildings and facilities, streetlights and traffic signals, and vehicle fleet. Community emissions totaled 37,307 $MTCO_2e$ in 2011. This total represents four sectors, namely: residential energy use, commercial energy use, transportation, and waste.

The Town of Preble greenhouse gas (GHG) inventory was conducted in 2012, as part of the Town's participation in the Central New York Climate Change Innovation Program (C2IP). The inventory was conducted on behalf of the Town of Preble with the assistance of a student team from the State University of New York College of Environmental Science and Forestry with additional oversight and technical review by staff at the Central New York Regional Planning and Development Board (CNY RPDB). Data was collected for 2011, which will serve as the Town's baseline year[1] for the analysis.

The Preble community analysis considers agricultural and forestry emissions sectors, which are categorized as **information items**[2] and are described in detail in the report appendices. Despite contributing to the Preble community carbon footprint, agriculture and forestry emissions/sink sources are subject to variation and exist primarily outside of the operational influence of the local government.

The Town will need to continue to monitor and evaluate its performance by conducting additional GHG assessments in the future. A baseline GHG inventory is just that, a baseline, and in order to be truly meaningful it must be measured against future progress. The Town can accomplish this by continuing to identify and track sources of data, evaluate emissions associated with development, and calculate emissions reductions resulting from energy conservation measures. Additionally, emission forecasts can offer a planning tool moving forward, and will enable the Town to target areas for emissions reduction as part of other climate action efforts.

[1] The baseline year is chosen based on several criteria: When choosing a baseline year to provide a benchmark to compare progress going forward, consider whether (1) data for that year are available, (2) the chosen year is representative, and (3) the baseline is coordinated to the extent possible with baseline years used in other inventories. (EPA 2012)

[2] An information item provides useful additional data for a GHG inventory, but often cannot be included in the total emissions roll-up, due to potential double counting, lack of local government influence, biogenic sources, or optional reporting requirements.

# II. Introduction

## A. Town Background

The Town of Preble is located in Cortland County, NY. Hills rise to the east and west of the Town, which resides in a valley. Lakes formed by glacial activity are tucked into the landscape, as is the Preble Swamp, and the start of the west branch of the Tioughnioga River. Mt. Toppin is the highest point of elevation and borders the town of Preble to the west. According to the 2010 census, the population of the town is 1,393, with 687 households. The overall population of the Town has decreased by 208 persons since the 1970 Census. The town has a total area of 27.6 square miles, or 17,670 acres. Preble is comprised primarily of agricultural land and undeveloped forestland, and the SUNY College of Environmental Science and Forestry (SUNY-ESF) owns Heiberg Memorial Forest along the eastern edge of the community. Heiberg is used as an outdoor classroom and experimental station. The public has permission to use the trails and pathways for hiking, skiing and biking. A few light industrial sites are located within Preble  including those currently operated by Suite Kote (an asphalt paving company) and Best Deck, LLC. The Town is also bisected by U.S. Interstate 81 that runs from the Canadian border to Tennessee. Other main traffic corridors are US Route 11 and NYS Route 281.

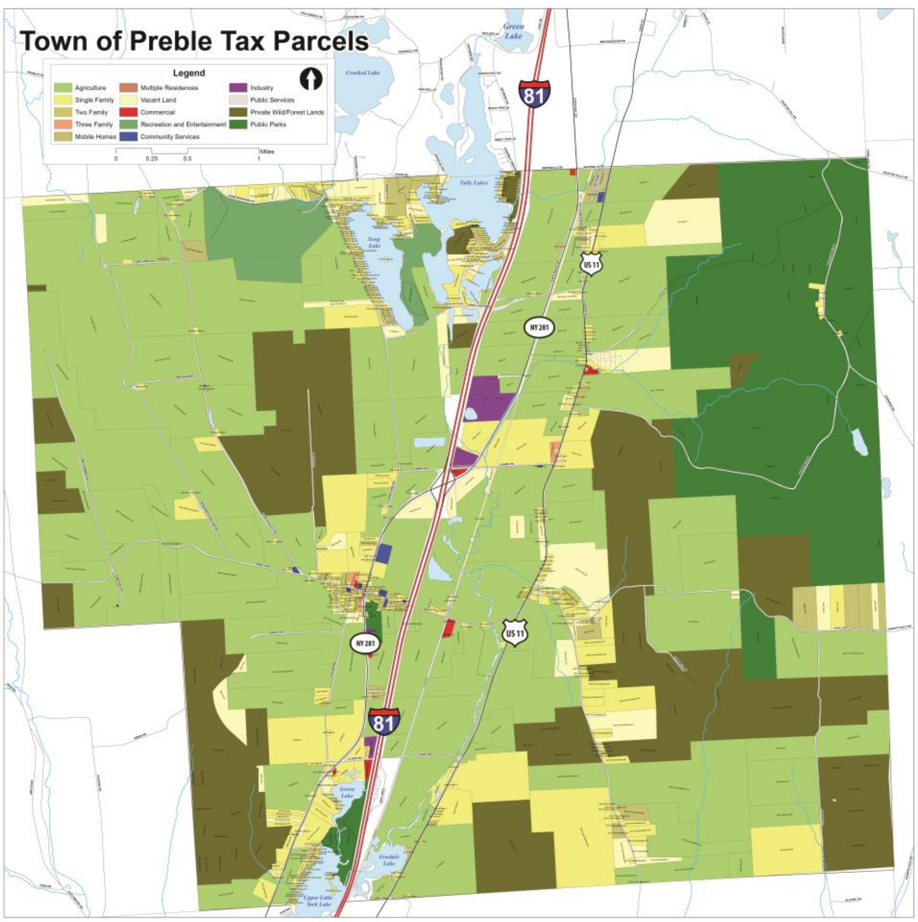


Figure 1 Town of Preble

## B. Climate Change Background

New York State outlined projected climate impacts and vulnerabilities during the 2011 ClimAid assessment.[3] The ClimAid report projects changes to ecosystems, with the increased presence of invasive species and shifts in tree composition, while water quality and quantity may also be impacted due to changes in precipitation. Furthermore, there may be beneficial economic impacts, such as a longer recreation season in the summer, and a longer growing season for the agricultural sector due to rising temperatures. Scientific evidence suggests that the impacts of global climate change will be different in various regions, and will include temperature shifts, sea level rise, and human health risks.

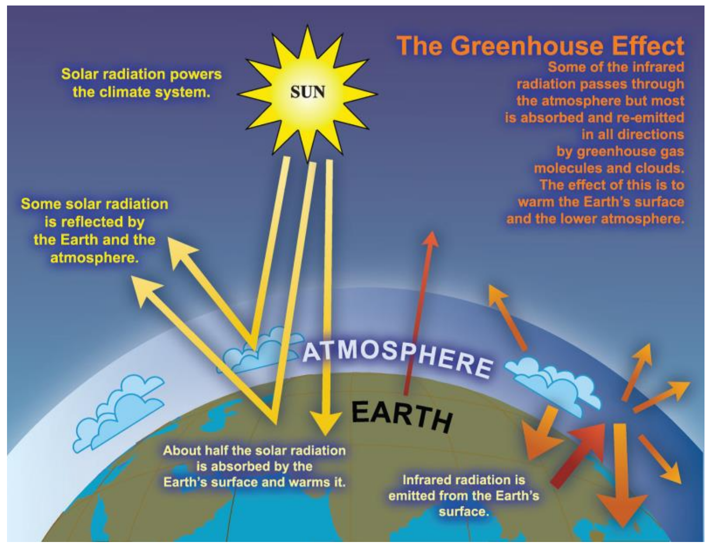


Figure 2 Greenhouse Effect

Climate change is increasingly recognized as a global concern. Scientists have documented changes to the Earth's climate including the rise in global average temperatures, as well as sea levels, during the last century. An international panel of leading climate scientists, the Intergovernmental Panel on Climate Change (IPCC), was formed in 1988 by the World Meteorological Organization and the United Nations Environment Programme to provide objective and up-to-date information regarding the changing climate. In its 2007 Fourth Assessment Report, the IPCC states that there is **a greater than 90 percent chance that rising global average temperatures, observed since 1750, are primarily a result of greenhouse gas (GHG)-emitting human activities.**[4]

The rising trend of human-generated GHG emissions is a global threat. The increased presence of these gases affects the warming of the planet by contributing to the natural greenhouse effect, which warms the atmosphere and makes the earth habitable for humans and other species (see Figure 1).[5] Mitigation of GHGs is occurring in all sectors as a means of reducing the impacts of this warming trend. However, scientific models predict that some effects of climate change are inevitable no matter how much mitigative action is taken now. Therefore, climate mitigation actions must be paired with adaptation measures in order to continue efforts to curb emissions contributions to global warming, while adapting communities so that they are able to withstand climate change impacts and maintain social, economic, and environmental resilience in the face of uncertainty. Climate adaptation can take shape through infrastructure assessments and emergency planning, as well as through educational efforts to raise public awareness about potential climate change impacts. In New York State, regional climate change

[3] NYS. 2011. ClimAid. http://www.nyserda.ny.gov/Publications/Research-and-Development/Environmental/EMEP-Publications/Response-to-Climate-Change-in-New-York.aspx
[4] NYS. 2011. ClimAid. http://www.nyserda.ny.gov/Publications/Research-and-Development/Environmental/EMEP-Publications/Response-to-Climate-Change-in-New-York.aspx
[5] IPCC. 2007. Fourth Assessment Report. http://www.ipcc.ch/publications_and_data/ar4/wg2/en/ch18s18-6.html

impact and vulnerability assessments will likely increase moving forward, but many local governments across the nation are already taking action to lessen climate impacts through GHG reduction measures and climate adaptation planning.

As scientific evidence of climate change grows, the need for climate action and adaptation will also increase. The goal of building community resilience in order to protect the health and livelihood of residents, as well as natural systems, must serve as a motivating factor in the assessment of greenhouse gas contributions and effective sustainability planning.

## C. Climate Change Innovation Program

The Central New York Regional Planning and Development Board (CNY RPDB) was an awardee of the U.S. Environmental Protection Agency's Climate Showcase Communities program in May of 2010. The CNY RPDB utilized the award to launch the Central New York Climate Change Innovation Program ($C_2IP$). The overall goal of the US EPA Climate Showcase Communities grant program is to create replicable models of community action that generate cost-effective and persistent greenhouse gas reductions while improving the environmental, economic, public health, or social conditions in a community.

The Town of Preble was selected by the CNY RPDB, as one of seven municipalities in Central New York**,** to receive technical assistance and financial incentives to conduct a greenhouse gas emissions inventory, complete a climate action plan, and to implement a clean energy demonstration project. The town received a sub-grant of $30,000 through $C_2IP$, which enabled the Town to implement a demonstration project focused on an energy retrofit of the Preble Town Hall Building. The Town Hall building, originally constructed in 1906 as a two-room school house, received improvements that included upgrades to the building envelope, replacement of the building's fuel oil fired forced air heating system with a high efficiency electric heat pump system, and a 9.4 kW solar photovoltaic system.

## D. ICLEI Partnership

The Town of Preble became a member of ICLEI Local Governments for Sustainability to initiate the inventory process, and the completion of the government and community analyses is the first component of ICLEI's Five Milestones for Climate Mitigation (see Figure 3 below).

The five milestones include:

- Milestone One: Conduct a Sustainability Assessment
- Milestone Two: Set Sustainability Goals
- Milestone Three: Develop a Sustainability Plan
- Milestone Four: Implement the Sustainability Plan
- Milestone Five: Monitor/Evaluate Implementation Progress


Figure 3 ICLEI Five Milestones for Climate Mitigation

# III. Methodology

Several forms of guidance and calculation tools were used to conduct Preble's government operations and community analyses.

## A. Greenhouse Gases

The three most prevalent greenhouse gases, and therefore the focus of the Town analysis, are carbon dioxide ($CO_2$), methane ($CH_4$) and nitrous oxide ($N_2O$). The units used to discuss these gases in aggregate is carbon dioxide equivalent ($CO_2e$), which is a conversion based on the equivalent impact of 1 unit of each gas on the atmosphere when compared with 1 unit of $CO_2$ (see Table 1). Emissions totals for each source or sector in both government and community analyses are most commonly presented in metric tons, which can be converted from pounds or gallons, and are then further converted into metric tons of carbon dioxide equivalent using the global warming potential of each gas measured.

| Greenhouse Gas (GHG) | Global Warming Potential (GWP) |
|---|---|
| Carbon Dioxide ($CO_2$) | 1 |
| Methane ($CH_4$) | 21 |
| Nitrous Oxide ($N_2O$) | 310 |

Table 1 Greenhouse Gases

## B. Calculation Tools

### i. ICLEI Local Government Operations Protocol

The Preble GHG inventory utilized several methods of calculation. The Local Government Operations Protocol (LGOP), developed by ICLEI Local Governments for Sustainability, was used to generate the government emissions results. Raw data for the facility energy use and vehicle fleet fuel use was entered into ICLEI's Clean Air Climate Protection (CACP) inventory software tool. Calculations for all emissions sources are outlined in the LGOP, an example for stationary fuel use is shown 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)<br>**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 $CO_2$e and Determining Total Emissions |
|---|---|
| **$CO_2$ Emissions** (metric tons $CO_2$e) = $CO_2$ Emissions (metric tons) × 1 (GWP) | |
| **$CH_4$ Emissions** (metric tons $CO_2$e) = $CH_4$ Emissions (metric tons) × 21 (GWP) | |
| **$N_2O$ Emissions** (metric tons $CO_2$e) = $N_2O$ Emissions (metric tons) × 310 (GWP)<br>**Total Emissions** (metric tons $CO_2$e) = $CO_2$ + $CH_4$ + $N_2O$ (metric tons $CO_2$e) | |

The SUNY-ESF student team was able to initially calculate emissions on their own and then these methods are checked by inputting the activity data for each emissions source into the CACP software (which performs the same calculation with the appropriate emissions factors). Once aggregated into metric tons of $CO_2$e the individual entries for each sector can be summed to emissions totals by source, sector and scope.

### ii. Additional Resources Utilized

In addition to ICLEI guidance, the Environmental Protection Agency (EPA) State Inventory Tool (SIT) was utilized to assess Preble agricultural emissions (see Appendix 1. Estimation Method for Agricultural Emissions for more detail). The SUNY-ESF student team initiated community carbon sequestration estimates utilizing i-TREE software and the National Land Cover Database (NLCD) (see Appendix 2. Estimation Method for Carbon Sequestration Potential for more detail).[6] Lastly, the NYSDOT Traffic Data Viewer tool was utilized, in conjunction with GIS data on Town road lengths, to create the community transportation emissions estimate (see Appendix 3. Estimation Method for Vehicle Miles Traveled).

## C. Reporting by Scope

Emissions can be categorized in terms of the action that causes them. This is done through the scope distinction, which labels the emissions sources within a local government as either scope 1, 2, or 3,

[6] The U.S. Forest Service developed the i-Tree software. There are multiple tools within the program (this analysis utilized VUE), and more information can be found here: http://www.itreetools.org/

distinguishing between what is directly emitted (scope 1) and indirectly emitted (scopes 2 and 3) (see Table 2). Local governments inherently have more control over the emissions in scopes 1 and 2, due to the behavioral and often function-specific nature of scope 3 emissions sources. However, governments and communities are increasingly accounting for all three scopes in their inventory analyses in an effort to conduct more comprehensive carbon footprint assessments.

It is important to use the scope distinction, rather than just an aggregate emissions total, when evaluating the local government GHG footprint because other government inventories (such as Cortland County or New York State) will likely account for the same emissions. If scope distinctions are not made, then there is the potential for double-counting certain sources in these aggregated reporting formats (such as electricity consumed by the Town (scope 2) and the same electricity generated by plants in the state (scope 1)).

| Scope | Emissions Activity | Town Sector by Scope |
|---|---|---|
| **1** | All direct GHG emissions (with the exception of direct CO2 emissions from biogenic sources). | Vehicle Fleet fuel use, Buildings & Facilities fuel oil use |
| **2** | Indirect GHG emissions associated with the consumption of purchased or acquired electricity, steam, heating, or cooling. | Buildings & Facilities electricity use, Streetlights & Traffic Signals electricity use |
| **3** | All other indirect emissions not covered in Scope 2, such as emissions resulting from the extraction and production of purchased materials and fuels, transport-related activities in vehicles not owned or controlled by the reporting entity (e.g., employee commuting and business travel), outsourced activities, waste disposal, etc. | |

Table 2 Emissions by Scope

# IV. Government Results

The Town of Preble government operations inventory covered three sectors: buildings and facilities, streetlights and traffic signals and vehicle fleet. The analysis showed that government operations emissions totaled 151 metric tons of carbon dioxide equivalents ($MTCO_2e$) in 2011.

The Town's vehicle fleet was the largest emitting source, followed by buildings and facilities. Given the small size of Preble municipal operations, the specific buildings and equipment generating these emissions are likely easy to pinpoint. Furthermore, the rural nature of the Town correlates with less demand for some municipal services that normally contribute as municipal emissions sources in this inventory analysis, such as energy used for water delivery (residents have wells) and energy and process emissions from wastewater treatment (residents have septic systems).

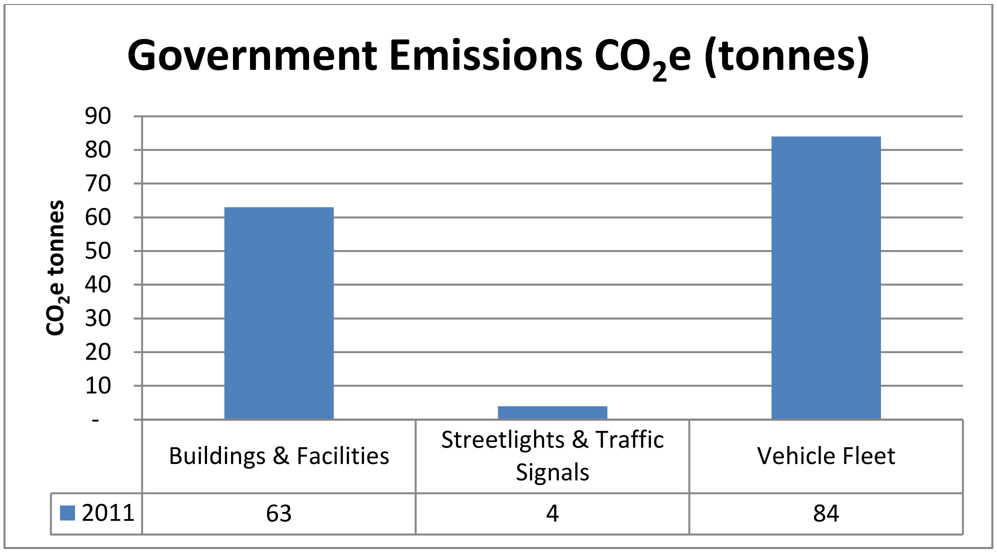


Figure 4 Government Emissions[7]

Specific vehicle fleet data from Town records was used to generate the mobile emissions estimate. The fleet consumed approximately 840 gallons of gasoline, of which 10% is ethanol content[8] (equating to approximately 84 gallons of ethanol and 756 gallons of gasoline), and 8,075 gallons of diesel in 2011. Additionally, Preble government facilities used 34,279 kWh of electricity and an estimated 3,623 gallons of fuel oil for heating in 2011.[9] Streetlights consumed 10,273 kWh of electricity as well.

[7] Emissions and energy use figures were recalculated in November 2013.

[8] New York State, like many states, requires 10% ethanol content in gasoline.

[9] DPW garage information provided by Jeff Griswold, Highway Superintendent; Town Hall information provided by Town Hall c2ip Project Summary Final document, CNY RPDB

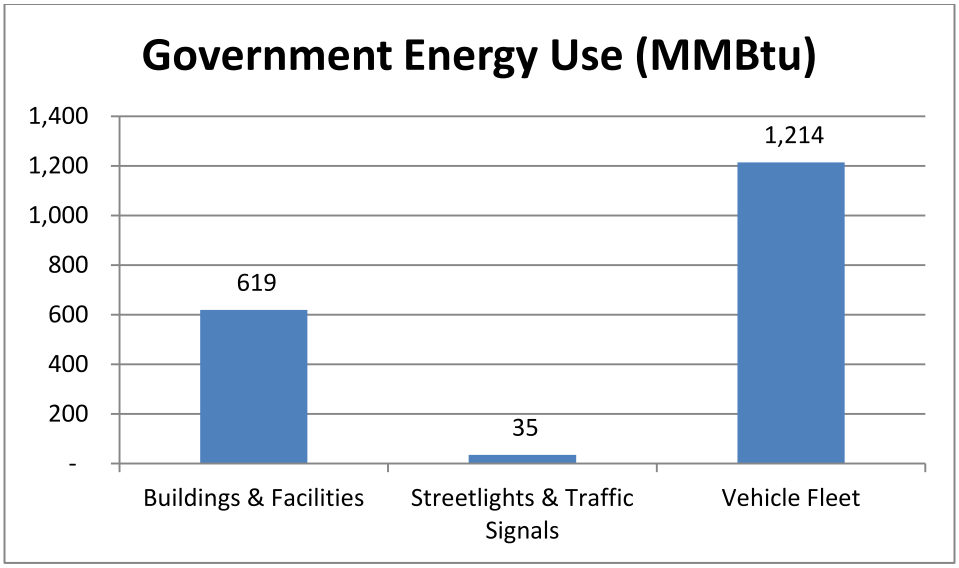


Figure 5 Government Energy Use[10]

In considering the emissions by sector, it must be noted that while Figure 6 indicates a whole (100%) represented by the pie chart, there are likely other sources and emission sectors that could be captured under government operations (product uses and lifecycle emissions are just two examples). However, these three sectors define the boundary of the current analysis, while expanded analyses may be possible in the future.

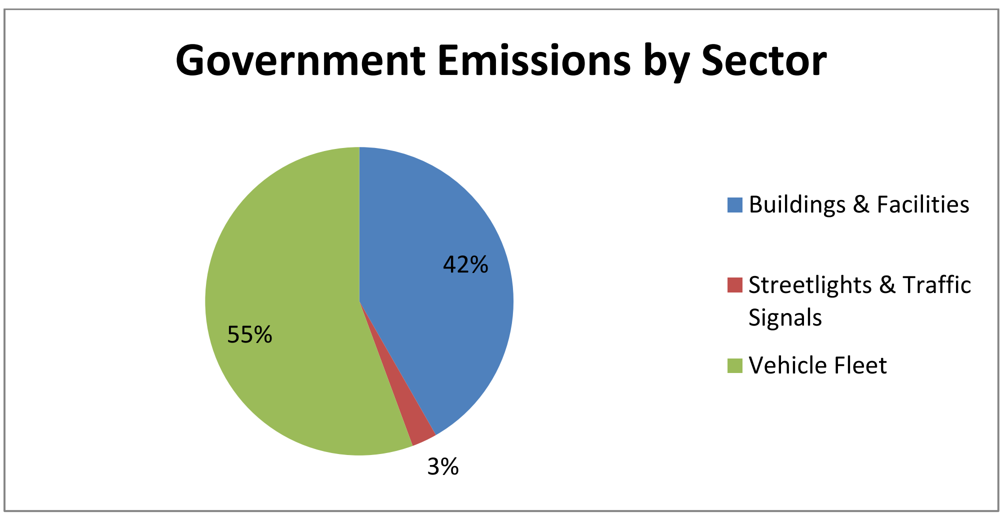


Figure 6 Government Emissions by Sector[11]

[10] Emissions and energy use figures were recalculated in November 2013.
[11] Emissions and energy use figures were recalculated in November 2013.

The Town emission sources can also be allocated by scope. The government operations vehicle fleet comprises a scope 1 source (direct combustion), while the buildings and lighting are both scope 2 energy consumption sources (indirect consumption).

| Scope | Emissions ($MTCO_2e$) | Sectors |
|---|---|---|
| Scope 1 (direct) | 135 | Vehicle Fleet, Buildings & Facilities (fuel oil) |
| Scope 2 (indirect) | 16 | Buildings & Facilities (electricity), Lighting |

Table 3 Government Emissions by Scope

## V. Community Results

The Town of Preble community emissions come from four primary sectors: transportation, residential energy use, commercial energy use, and waste. Additional sources include emissions from agricultural animals (dairy cows) and processes. These sources are categorized as information items due to the level of variability that affects the day-to-day accuracy of these estimates and the potential lack of authority over this sector at the local government scale. As community emissions accounting methods evolve, these sources and analysis methods will need to be re-evaluated.

Community emissions totaled 37,307 $MTCO_2e$ in 2011. The community source with the highest emissions was the transportation sector, at 31,792 $MTCO_2e$, or 85% of total emissions. The emissions are highest in this sector due to the portions of major roadways that travel through the Town of Preble and the associated fuel use of the vehicles using those roadways. While the traffic does not all begin and end in Preble, due to modeling limits it is not possible to assess Town emissions using an origin and destination approach, therefore, this estimate includes through traffic as well (see Section A for more detail). Residential energy use (10%), waste (3%) and commercial energy use (2%) emissions totals follow transportation emissions, respectively, with residential having more emissions than commercial due to residential heating fuel use and the limited commercial development in the Preble community (see Figure 7). The community contracts waste collection with private haulers on an individual household level and residential waste data is not tracked at the county landfill. The community waste sector emissions estimate is allocated from county waste totals based on population.[12]

[12] The Preble community waste estimate was derived from the 2010 CNY RPDB regional GHG inventory, and the municipal allocation of Cortland County scope 3 waste totals (2010 waste data is serving as a proxy for the 2011 baseline of the Preble analysis).

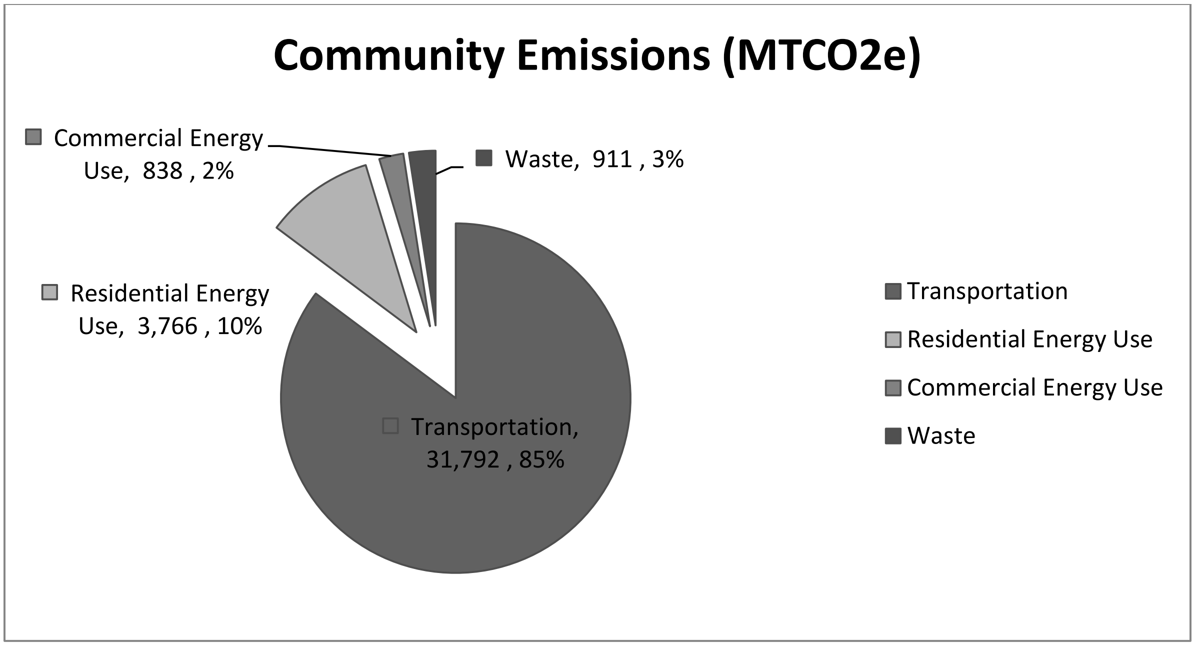


Figure 7 Community Emissions

Energy use in the Preble community correlates with emissions in that the transportation sector consumes the most fuel (gasoline and diesel), followed by residential fuel use (fuel oil, wood and stationary gas) and electricity consumption, as well as commercial electricity and natural gas use. The Preble community also uses approximately 7,000 MMBtu of solar energy.[13] There is no energy use associated with the waste sector, given that this analysis only considers the process emissions from waste decomposition.

[13] This estimate was derived using the Census American Community Survey (ACS) 2010 data on household heating fuels in conjunction with the fuel use estimates generated for Cortland County in the CNY RPDB regional GHG inventory.

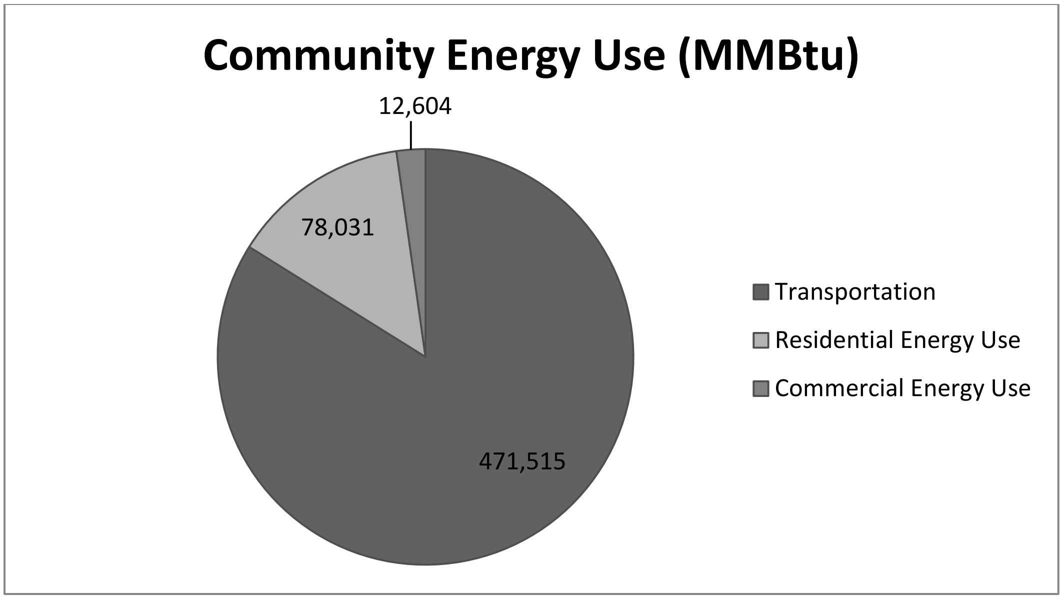


Figure 8 Community Energy Use

## A. Transportation

Community transportation emissions arise from the vehicle traffic associated with the portions of U.S. Interstate-81, U.S. Route 11, and NYS Route 281 that run through Preble. Emissions from community transportation sources total 31,792 $MTCO_2e$. Through default metrics used in CACP, these emissions are attributed primarily to gasoline use (93%), while the remaining emissions result from diesel consumption (7%). However, given the 10% ethanol content in gasoline, this default allocation was adjusted to 83% gasoline, 10% ethanol, and 7% diesel to account for this biogenic[14] source.

Not all of the vehicle trips on these three roads originate or end in the Town of Preble, but it is not possible to determine origin and destination at this scale with existing transportation models; therefore, this total may overestimate the emissions from this sector. The New York State Department of Transportation (NYSDOT) Traffic Data Viewer tool,[15] which was used for this portion of the analysis, offers average annual daily traffic (AADT) counts for the main roads mentioned above only, so the overestimation for origin-destination may compensate for the underestimation of emissions from local traffic (see Appendix 3 for more detail). Additionally, this estimate was derived using alternate vehicle categories and default fuel economies in CACP, due to the lack of information regarding vehicle descriptive data.

This approach is appropriate for estimating Town community transportation emissions, given the circumstances of limited local data. However, as transportation models evolve it will be important to revisit these estimates to be sure that they are representative of changing conditions in the Town, particularly if development or population patterns shift.

[14] Biogenic sources refer to fuels that are derived from biomass, which was recently contained in living organic matter, and the $CO_2$ emissions from biogenic sources must be accounted for separate from $CO_2$ emissions caused by non-biogenic, fossil fuel sources (ICLEI Local Government Operations Protocol).
[15] NYSDOT. 2012. Traffic Data Viewer Tool. http://gis.dot.ny.gov/tdv/

## B. Agriculture

The estimated emissions from agricultural activity in the Preble community totaled 5,925 $MTCO_2e$ for enteric fermentation (methane released during dairy cow digestion processes) and 2,323 $MTCO_2e$ for manure management (methane and nitrous oxide released from animal waste) in 2011 (see Figure 9). These agricultural emissions sources are abundant globally, and a significant contributor to the national carbon footprint (enteric fermentation totals nearly 25% of U.S. emissions resulting from human activities).[16]

The Environmental Protection Agency (EPA) has developed a tool that enables local communities to estimate their emissions in otherwise difficult to measure sectors (such as agriculture), through the use of well-documented default metrics at the state level, and local population estimates. The methods used to estimate agricultural emissions from the Preble community are described further in Appendix 1.

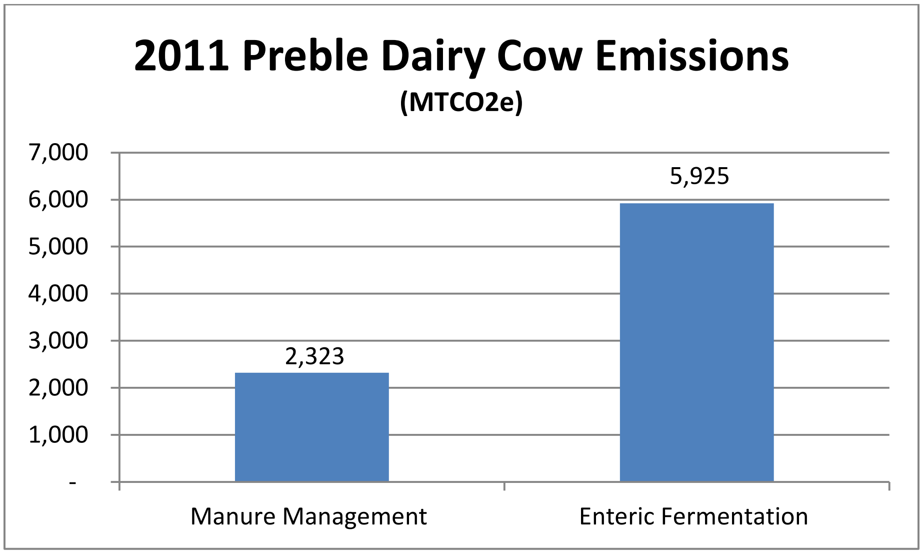


**Figure 9 Community Agricultural Emissions**

## C. Carbon Sequestration

Trees consume and utilize carbon dioxide as part of photosynthesis. This, among the many ecosystem services forests provide, is beneficial in the global effort to reduce carbon emissions. Forests are often referred to as "sinks" due to the fact that they can store carbon. However, carbon storage is a difficult process to measure due to a number of factors.[17] Issues such as shifts in tree species and composition, and development patterns affect the ability of trees to store carbon, as well as the ability to measure carbon sequestration rates and quantities. For instance, when trees are cut down to make way for housing developments, they no longer function as an emissions sink, but rather as a source because some of the carbon that was stored is released after trees are felled (which is also the case when trees

[16] ICLEI. 2012. U.S. Community Protocol for Accounting and Reporting Greenhouse Gas Emissions. Pg.33
[17] Gorte, Ross W. 2009. Carbon Sequestration in Forests. Congressional Research Service. http://www.fas.org/sgp/crs/misc/RL31432.pdf

die or decompose). However, accounting for carbon sequestration potential is becoming more common due to the rise in carbon footprinting analyses and the desire to understand "net" community emissions, taking sinks into account with gross emissions totals. As described above, these emissions must be considered as an information item given the potential for variation and double-counting due to different ownership classifications for much of the land, such as Heiberg Forest, in the Preble community.

The estimation of carbon sequestered in the Preble community was done using i-Tree Software developed by the U.S. Forest Service and data from the National Land Cover Database (NLCD). Land use files were imported into the i-Tree VUE program, which utilizes New York State carbon storage rates to generate an estimated sequestration value. The results of this analysis are outlined in Table 4 and the method is described in more detail in Appendix 2. While the community sequestration total must be considered as an estimate, there is value in assessing land use choices and benefits as they relate to emissions at the community scale. Exercises such as this may provide insight for future land use and climate action decision-making processes.

| Category | Activity Data |
|---|---|
| Land area selected | 7,337.4 hectares or 18,131 acres |
| Area classified as tree canopy | 3,726.9 hectares (51.9% of area) or 9,209 acres |
| Annual carbon sequestration | 11,180.6 metric tons |
| $CO_2$ equivalent annual carbon sequestration | 40,988.2 metric tons |

**Table 4 Carbon Storage Estimate**

## VI. Emissions Forecast

Emission forecasts offer a tool that can be used to target areas for reduction. However, forecasts are limited in their ability to project future outcomes, and it is important to consider all factors affecting the rate at which emissions are generated within a local government or community over time.

### A. Government Operations Forecast

The government operations forecast employs a single rate projection, using the 2010 Census population estimates, and a standard compounding method of (Future Value (FV) =Present Value (PV)$(1+i)^n$). The Town of Preble has seen a population decline of nearly 12% over the last ten years (2000-2010), and this rate is utilized to generate the emissions projection for government operations in 2020, due to the association between population and demand for municipal services. It will be important to consider all other potential factors influencing the growth or decline in government operations emissions, such as increased commercial development, or increased implementation of energy conservation measures. As knowledge of these projects becomes available, they should be built into the emissions forecast.

Using the annualized Town population growth rate, government operations emissions are expected to total 133 $MTCO_2e$ in 2020, with the vehicle fleet continuing to contribute the majority of emissions (see Figure 10).

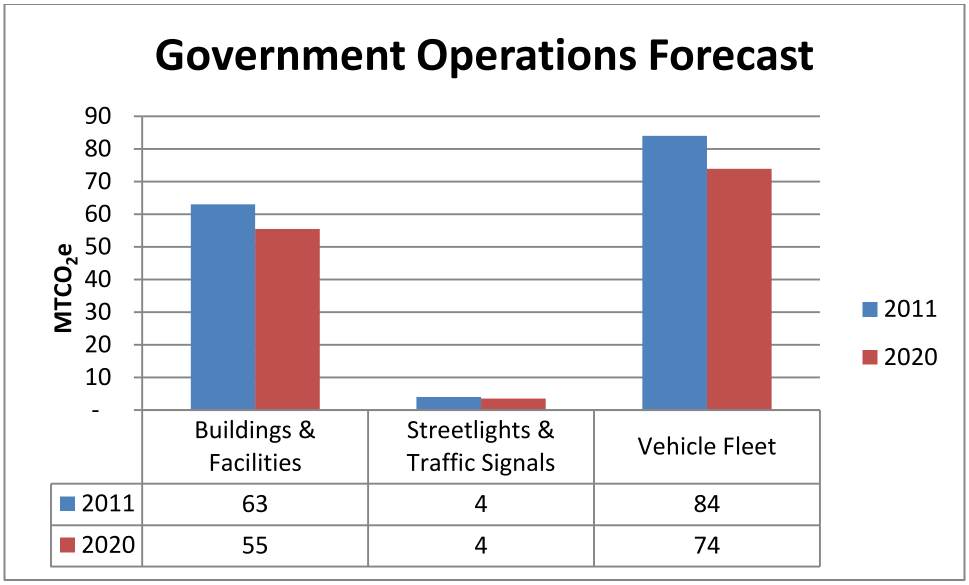


Figure 10 Government Operations Forecast

## B. Community Forecast

The community forecast involves the use of state resources to create a multi-rate projection. The use of several rates leads to a more dynamic forecast, that, when paired with municipal data on development patterns and population trends, can enable a local government to create more effective targets and reduction strategies.

The rates used in the Town analysis include those from the 2009 New York State Energy Plan, the Energy Information Agency's 2011 Annual Energy Outlook, and transportation estimates generated from New York State Department of Transportation traffic count models (see Appendix 3 for more detail).

Community emissions are projected to total 35,527 $MTCO_2e$ in 2020 (see Figure 11). This is a 5% decline over 2010 community emission levels, primarily due to anticipated efficiencies in the transportation and energy use sectors. **Agricultural and waste emissions were not included in this forecast due to a lack of projection data; however, if growth or decline is projected in these sectors within the community over this time frame, further analysis may be required.**

| Growth Rates (2009-2028) | Natural Gas | Distillate | Kerosene | LPG* | Motor Gasoline | Coal |
|---|---|---|---|---|---|---|
| **Residential** | 0.10% | -1.84% | 0.89% | -0.09% | -0.13% | 0.00% |
| **Commercial** | 0.65% | -0.42% | -0.01% | 0.23% | -0.13% | 0.00% |
| **Industrial** | -0.70% | 0.00% | | -0.04% | -0.13% | -0.97% |
| **Transportation** | | 1.46% | | | -0.13% | |

Table 5 NYS Energy Plan Growth Rates by Sector

**Liquefied petroleum gas*

| Regional Consumption (quadrillion Btu) | Residential | Commercial | Industrial |
|---|---|---|---|
| **2012** | 0.44 | 0.57 | 0.26 |
| **2020** | 0.43 | 0.62 | 0.27 |

Table 6 EIA Annual Energy Outlook Electricity Use Projections

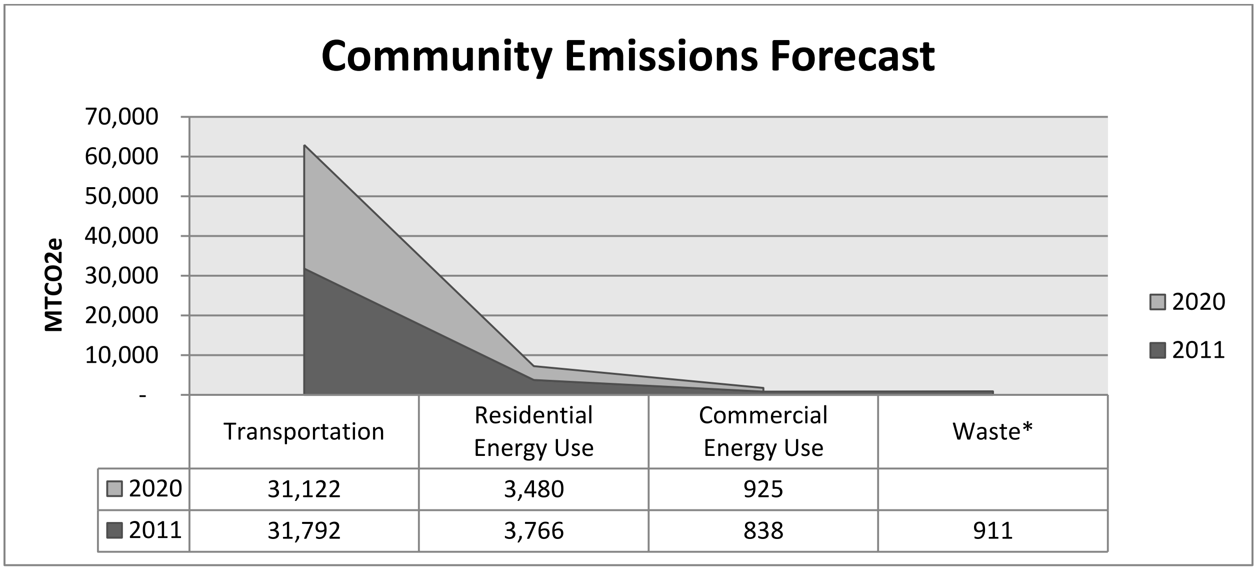


Figure 11 Community Forecast

**Waste emissions are not forecasted at this time due to a lack of projection sources*

## VII. Conclusion

The Town of Preble government operations emitted 151 $MTCO_2e$ in 2011. The greater Preble community footprint totaled 37,307 $MTCO_2e$, with additional estimated emissions from agricultural sources of 8,248 $MTCO_2e$.[18]

The assessment of municipal GHG emissions is an ongoing process. There will always be a need for re-evaluation and adjustment based on changing circumstances such as the implementation of energy conservation measures, adoption of renewable energy technologies, and shifts in development patterns. Therefore, this inventory will require periodic updates to ensure the most accurate estimates for the Town carbon footprint. Additionally, as more information is tracked, the Town may be able to develop more detailed forecasts, which will aid in targeting areas for emissions reduction in the future.

[18] There are strategies to achieve emissions reductions from manure management, such as community digesters that use the waste to generate energy from methane gas, which result in the co-benefits of reducing environmental impact while creating the economic growth from selling excess power generated by the community.

# VIII. Appendices

## Appendix 1. Estimation Method for Agricultural Emissions

The Cortland County Soil and Water Conservation District (SWCD) provided estimates for animal units for Preble based on figures developed throughout the County. Animal units are used as a metric to develop agricultural population estimates. The estimate for the dairy cow population within the Preble community was 3,600 animal units. These estimates are based on the 1 animal unit equivalent of 1,000 pounds, which equates to the total estimated weight of Preble dairy cows at 3,600,000 pounds. This figure was divided by 1,350 pounds per cow, given that the SWCD estimated average Preble dairy cow weight is 1,350 pounds, which totals approximately 2,667 cows in the Preble community. This estimation method was most relevant due to the lack of Town-specific population data from more commonly used sources, such as the USDA's Census of Agriculture and the National Agricultural Statistics Service.

The primary mode of calculation for agricultural emissions was through the EPA's State Inventory Tool (SIT) agriculture module. The module offers default metrics for the state of New York, which were selected for this analysis, while the Town-specific input of dairy cow population scales down the state-wide default estimate.[19] An example of a resulting calculation is shown below for manure management $CH_4$ emissions, which was converted to $MTCO_2e$ in excel (the 1,734 in column 2 (blue cells) is the population estimate for the Town based on the default NYS ratio of 65% dairy cows and below that, the remaining 35% dairy replacement heifers population is estimated at 933 for Preble).

| **MANURE MANAGEMENT (CH4)** | Number of Animals ('000 head) | | Typical Animal Mass (TAM) (kg) | | Volatile Solids (VS) [kg VS/1000 kg animal mass/day] | | Total VS (kg/yr) | | Max Pot. Emissions ($m^3$ $CH_4$/ kg VS) | | Weighted MCF | | Emissions ($m^3$ $CH_4$) | | Emissions (Metric Tons $CH_4$) | | Emissions ($MMTCH_4$) | | Emissions (MMTCE) | | Emissions ($MMTCO_2E$) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Dairy Cows** | 1.7 | x | 680 | x | 10.5 | = | 4,500,206 | x | 0.24 | x | 0.107 | = | 115,919 | = | 77 | = | 0.000 | = | 0.000 | = | 0.002 |
| **Dairy Replacement Heifers** | 0.9 | x | 476 | x | 8.4 | = | 1,365,437 | x | 0.17 | x | 0.012 | = | 2,748 | = | 2 | = | 0.000 | = | 0.000 | = | 0.000 |

Table 7 Agricultural Emissions Calculation (SIT)

[19] EPA. 2012. Ag Module User's Guide. Pg. 7 (Steps to use module: (1) select a state; (2) enter emission factors and activity data for enteric fermentation; (3) enter emission factors and activity data for manure management; (4) enter emission factors and activity data for agricultural soils; (5) review results in respective tabs. If appropriate, steps 2-4 can be circumvented by checking default factors for New York State at the beginning of the module.)

## Appendix 2. Estimation Method for Carbon Sequestration Potential

The i-Tree software package has been developed by the U.S Forest Service. In estimating carbon storage and sequestration, the VUE program is most helpful, and it allows users to:

> *Make use of the freely available National Land Cover Database (NLCD) satellite-based imagery to assess your community's land cover, including tree canopy, and some of the ecosystem services provided by your current urban forest. The effects of planting scenarios on future benefits can also be modeled*[20]

This software was utilized to generate the carbon sequestration estimate for the Preble community inventory analysis. The steps followed, include:

1) Preble area was selected on the NLCD website following the VUE user manual/guidelines
2) This area incorporated land cover, impervious surface and tree canopy layers
3) These files were saved in the location accessed by the VUE program
4) The VUE program was opened and the files were imported for each of the above areas: land cover, impervious surface and tree canopy
5) New York State was selected from the default pollution removal dropdown list
6) The box was checked at the bottom of the interface to manually define the area of interest on the NLCD images
7) The selection of the Town of Preble boundary in VUE's Google map application was done using a larger NLCD file to identify boundary features
8) These features were demarcated on the Google map, which was then transferred to the NLCD clip
9) The remaining NLCD clips were automatically updated to match the manually clipped file
10) Metric units were chosen and the carbon sequestration statistics report was selected for output

The image below is from the VUE program and shows the approximate tree canopy coverage (52% of the area selected) for Preble.

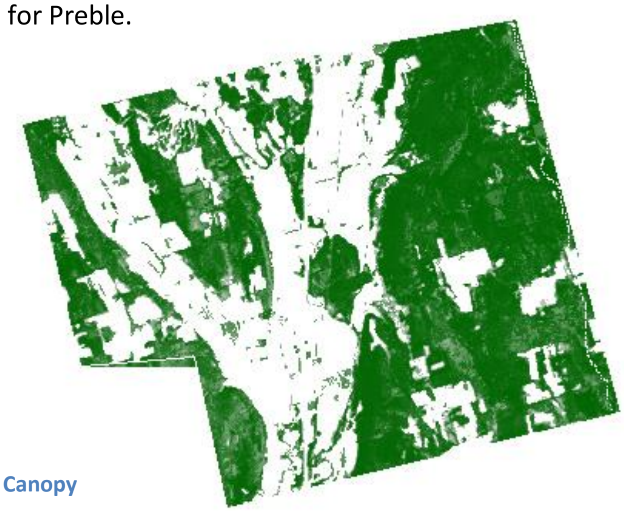

**Figure 12 Preble Tree Canopy**

[20] Binkley, Ellis, Nowak. 2012. i-Tree VUE software. http://www.itreetools.org/vue/index.php

## Appendix 3. Estimation Method for Vehicle Miles Traveled

The New York State Department of Transportation (NYSDOT) Traffic Data Viewer provided data on the Annual Average Daily Traffic (AADT) going through Preble.[21] Internal GIS data was utilized to generate road lengths within the Town boundary, and these lengths were multiplied with the traffic counts to derive estimates for daily vehicle miles travelled (DVMT). These estimates were entered into CACP where the program then uses default fuel allocations (7% diesel and 93% gasoline) and vehicle class data to generate emissions estimates.

These VMT estimates are for main roads only, due to the fact that the NYSDOT tracks traffic counts for main arteries. Therefore, the VMT total does not represent all of the roads in the Town and must be considered as an estimate that requires further refinement. The NYSDOT relies on actual and estimated traffic counts for their model, which may result in slight over or under estimations in the average daily traffic data. Additionally, the counts do not distinguish between origin and destination; therefore, these counts represent all vehicle trips that begin, end, and travel through the Town of Preble.

| BEGINDESC | ENDDESC | TDV_ROUTE | CUR_AADT | LenMiles | Ratio of length in Preble | LengthinPrebleMiles | DVMT for Preble |
|---|---|---|---|---|---|---|---|
| NY281 (OFF) | I-81 NB (ON) | NY281 to I81 NB | 0 | 0.27 | 1.00 | 0.27 | 0 |
| I-81 NB (OFF) | NY281 (ON) | I81 NB to NY281 | 0 | 0.21 | 1.00 | 0.21 | 0 |
| NY281 (OFF) | I-81 (ON) | NY281 to I81 SB | 0 | 0.30 | 1.00 | 0.30 | 0 |
| I-81 SB (OFF) | NY281 (ON) | I81 SB to NY281 | 0 | 0.26 | 1.00 | 0.26 | 0 |
| RR XING | NY SR 11 | PREBLE RD, CR 108E | 375 | 0.54 | 1.00 | 0.54 | 201.835875 |
| SR 281 | RR XING | PREBLE RD, CR 108E | 515 | 0.61 | 1.00 | 0.61 | 313.22506 |
| CR 106 SONG LK XING RD | Cort/Onon Co Line | US11 | 795 | 0.89 | 1.00 | 0.89 | 707.534895 |
| CR 109 LITTLE YORK | CR 108 TO EAST HOMER RD | US11 | 1022 | 3.09 | 0.76 | 2.36 | 2408.901012 |
| CR 108 TO EAST HOMER RD | CR 106 SONG LK XING RD | US11 | 1210 | 2.20 | 1.00 | 2.20 | 2661.87658 |
| ACC RT 81I | Cort/Onon Co Line | NY281 | 1542 | 2.57 | 1.00 | 2.57 | 3962.027136 |
| CR 108B | ACC RT 81I | NY281 | 2607 | 0.89 | 1.00 | 0.89 | 2319.851985 |
| CR 102 PRATT COR | CR 108B | NY281 | 3130 | 3.55 | 0.67 | 2.38 | 7464.99053 |
| JCT RT 281 | Cort/Onon Co Line | I81 | 27182 | 2.25 | 1.00 | 2.25 | 61158.30399 |
| ACC RT 11 | JCT RT 281 | I81 | 27736 | 8.80 | 0.34 | 3.02 | 83672.85536 |
| | | | | | *Miles in Preble* | *18.75* | |
| | | | | | *Days per year* | *365.00* | |
| | | | | | | **TOTAL DVMT** | **164,871** |
| | | | | | | **ANNUAL VMT** | **60,178,061.89** |

**Table 8 Preble Traffic Data**

[21] NYS DOT. 2012. Traffic Data Viewer. http://gis.dot.ny.gov/tdv/ (The model uses 2010 AADT estimates)

# Appendix 4. CACP Reports[22]

11/27/2012 Page 1

## Government Greenhouse Gas Emissions in 2011
## Report by Source

### *Scope 1 + Scope 2*

| | $CO_2$ (tonnes) | $N_2O$ (kg) | $CH_4$ (kg) | Equiv $CO_2$ (tonnes) | Bio $CO_2$ (tonnes) | Energy (MMBtu) | Cost ($) |
|---|---|---|---|---|---|---|---|
| **Buildings and Facilities Sector** | | | | | | | |
| Electricity | 8 | 0 | 0 | 8 | 0 | 117 | 0 |
| Fuel Oil (#1 2 4) | 3 | 0 | 0 | 3 | 0 | 35 | 0 |
| **Subtotal** | 10 | 0 | 1 | 10 | 0 | 152 | 0 |
| **Streetlights & Traffic Signals Sector** | | | | | | | |
| Electricity | 2 | 0 | 0 | 2 | 0 | 35 | 0 |
| **Subtotal** | 2 | 0 | 0 | 2 | 0 | 35 | 0 |
| **Vehicle Fleet Sector** | | | | | | | |
| Diesel | 82 | 0 | 0 | 83 | 0 | 1,115 | 0 |
| Ethanol (E100) | 0 | 0 | 0 | 0 | 0 | 7 | 0 |
| Gasoline | 7 | 0 | 0 | 7 | 0 | 94 | 0 |
| **Subtotal** | 89 | 1 | 1 | 89 | 0 | 1,217 | 0 |
| **Total** | 102 | 1 | 1 | 102 | 0 | 1,404 | 0 |

This report has been generated for Preble, New York using ICLEI's Clean Air and Climate Protection 2009 Software.

[22] The waste emissions estimate was derived through another source and not input into CACP; therefore, the community totals in these images will not show waste. These estimates were updated in November 2013.

# Government Greenhouse Gas Emissions in 2011
# Detailed Report

***Scope 1 + Scope 2***

| | $CO_2$ (tonnes) | $N_2O$ (kg) | $CH_4$ (kg) | Equiv $CO_2$ (tonnes) | Bio $CO_2$ (tonnes) | Energy (MMBtu) | Cost ($) |
|---|---|---|---|---|---|---|---|
| **Buildings and Facilities** | | | | | | | |
| **Preble, New York** | | | | | | | |
| *Aggregate Government Energy Use (Scope 2)* | | | | | | | |
| Electricity | 8 | 0 | 0 | 8 | 0 | 117 | 0 |
| Fuel Oil (#1 2 4) | 3 | 0 | 0 | 3 | 0 | 35 | 0 |
| *Subtotal Aggregate Government E* | 10 | 0 | 1 | 10 | 0 | 152 | 0 |
| **Subtotal Buildings and Facilities** | 10 | 0 | 1 | 10 | 0 | 152 | 0 |
| **Streetlights & Traffic Signals** | | | | | | | |
| **Preble, New York** | | | | | | | |
| *Aggregate Lighting Electric (Scope 2)* | | | | | | | |
| Electricity | 2 | 0 | 0 | 2 | 0 | 35 | 0 |
| *Subtotal Aggregate Lighting Electi* | 2 | 0 | 0 | 2 | 0 | 35 | 0 |
| **Subtotal Streetlights & Traffic Signa** | 2 | 0 | 0 | 2 | 0 | 35 | 0 |
| **Vehicle Fleet** | | | | | | | |
| **Preble, New York** | | | | | | | |
| *Aggregate Government Fleet Fuel Use (Scope 1)* | | | | | | | |
| Diesel | 82 | 0 | 0 | 83 | 0 | 1,115 | 0 |
| Ethanol (E100) | 0 | 0 | 0 | 0 | 0 | 7 | 0 |
| Gasoline | 7 | 0 | 0 | 7 | 0 | 94 | 0 |
| *Subtotal Aggregate Government F* | 89 | 1 | 1 | 89 | 0 | 1,217 | 0 |
| **Subtotal Vehicle Fleet** | 89 | 1 | 1 | 89 | 0 | 1,217 | 0 |
| **Total** | 102 | 1 | 1 | 102 | 0 | 1,404 | 0 |

This report has been generated for Preble, New York using ICLEI's Clean Air and Climate Protection 2009 Software.

# Community Greenhouse Gas Emissions in 2011
## Report by Source

### *Scope 1 + Scope 2*

| | $CO_2$ (tonnes) | $N_2O$ (kg) | $CH_4$ (kg) | Equiv $CO_2$ (tonnes) | Bio $CO_2$ (tonnes) | Energy (MMBtu) |
|---|---|---|---|---|---|---|
| **Residential Sector** | | | | | | |
| Commercial Coal | 112 | 2 | 13 | 112 | 0 | 1,171 |
| Electricity | 1,001 | 14 | 32 | 1,006 | 0 | 15,124 |
| Fuel Oil (#1 2 4) | 1,818 | 18 | 267 | 1,829 | 0 | 24,585 |
| Natural Gas | 9 | 0 | 1 | 9 | 0 | 179 |
| Stationary LPG | 584 | 10 | 101 | 589 | 0 | 9,273 |
| Wood 12 pct moisture | 0 | 116 | 8,753 | 220 | 2,598 | 27,700 |
| **Subtotal** | 3,524 | 160 | 9,167 | 3,766 | 2,598 | 78,031 |
| **Commercial Sector** | | | | | | |
| Electricity | 834 | 11 | 27 | 838 | 0 | 12,604 |
| **Subtotal** | 834 | 11 | 27 | 838 | 0 | 12,604 |
| **Transportation Sector** | | | | | | |
| Diesel | 5,834 | 17 | 17 | 5,840 | 0 | 78,905 |
| Ethanol (E100) | 0 | 403 | 331 | 132 | 2,257 | 32,983 |
| Gasoline | 25,263 | 1,698 | 1,449 | 25,820 | 0 | 359,627 |
| **Subtotal** | 31,097 | 2,118 | 1,797 | 31,792 | 2,257 | 471,515 |
| **Total** | 35,456 | 2,289 | 10,991 | 36,396 | 4,855 | 562,151 |

This report has been generated for Preble, New York using ICLEI's Clean Air and Climate Protection 2009 Software.

11/27/2012 Page 1

# Preble

## Community Greenhouse Gas Emissions
## Time Series Report

***Scope 1 + Scope 2***

| Year | **2011** | **2020** |
|---|---|---|
| **Residential** | | |
| eCO2 (tonnes) | 3,766.1 | 3,479.6 |
| Energy (MMBtu) | 78,031.0 | 74,169.8 |
| **Commercial** | | |
| eCO2 (tonnes) | 838.2 | 924.6 |
| Energy (MMBtu) | 12,604.4 | 13,903.6 |
| **Transportation** | | |
| eCO2 (tonnes) | 31,791.7 | 31,121.8 |
| Energy (MMBtu) | 471,515.5 | 461,482.1 |
| **Total** | | |
| eCO2 (tonnes) | 36,396.0 | 35,526.0 |
| Energy (MMBtu) | 562,150.8 | 549,555.5 |
| Cost ($) | 0.0 | 0.0 |

This report has been generated for Preble, New York using ICLEI's Clean Air and Climate Protection 2009 Software.

11/27/2012 Page 1

# Community Greenhouse Gas Emissions in 2011
# Report by Source

### *Information Items*

| | $CO_2$ (tonnes) | $N_2O$ (kg) | $CH_4$ (kg) | Equiv $CO_2$ (tonnes) | Bio $CO_2$ (tonnes) | Energy (MMBtu) |
|---|---|---|---|---|---|---|
| **Residential Sector** | | | | | | |
| Wood 12 pct moisture | 0 | 0 | 0 | 0 | 2,598 | 27,700 |
| **Subtotal** | 0 | 0 | 0 | 0 | 2,598 | 27,700 |
| **Transportation Sector** | | | | | | |
| Ethanol (E100) | 0 | 0 | 0 | 0 | 2,257 | 32,983 |
| **Subtotal** | 0 | 0 | 0 | 0 | 2,257 | 32,983 |
| **Other Sector** | | | | | | |
| Methane | 0 | 0 | 360,720 | 7,575 | 0 | |
| Nitrous Oxide | 0 | 2,170 | 0 | 673 | 0 | |
| **Subtotal** | 0 | 2,170 | 360,720 | 8,248 | 0 | |
| **Total** | 0 | 2,170 | 360,720 | 8,248 | 4,855 | 60,683 |

This report has been generated for Preble, New York using ICLEI's Clean Air and Climate Protection 2009 Software.