

*Town of Somers, New York
Greenhouse Gas Emissions Inventory
2009*



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List of Acronyms and Abbreviations

CACP	Clean Air and Climate Protection Software
CH ₄	Methane
CO ₂	Carbon dioxide
CO ₂ e	Carbon dioxide equivalent
eGRID	Emissions and Generation Resource Integrated Database
FE	Fuel Efficiency
GHG	Greenhouse gas
GWP	Global Warming Potential
HFC	Hydrofluorocarbons
ICLEI	International Council for Local Environmental Initiatives
IPCC	Intergovernmental Panel on Climate Change
LGOP	Local Government Operations Protocol
MMBtu	One million British thermal units
MRC	Mercury Vapor Lights
MWh	Megawatt hours
N ₂ O	Nitrous oxide
NYSEG	New York State Electric and Gas
PFC	Perfluorocarbons
SF ₆	Sulfur hexafluoride
T KWh	Total kilowatt hours
TCO ₂ e	Total carbon equivalents
VMT	Vehicle Miles Traveled
WWTP	Wastewater Treatment Plant

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Executive Summary ~

"There is still time to avoid the worst impacts of climate change, if we take strong action now."

~STERN REVIEW: The Economics of Climate Change

Some would argue that the earth's climate is cyclical. That's true. However, *"the current warming trend is of particular significance because most of it is very likely human-induced and proceeding at a rate that is unprecedented in the past 1300 years."* (IPCC Fourth Assessment Report, Summary for Policymakers, p. 9.

NASA (National Aeronautics and Space Administration) has become very involved in climate change, and keeps track of several key indicators such as sea level, carbon dioxide concentration levels, global surface temperature, arctic sea ice, and land ice. None of them are looking favorable. The charts below highlight the sharp rise in carbon dioxide, the most common of the greenhouse gases.



"The chart on the left shows the CO₂ levels in the Earth's atmosphere during the last three glacial cycles, as reconstructed from ice cores. The chart on the right shows CO₂ levels in recent years, corrected for average seasonal cycles." <http://climate.nasa.gov/keyIndicators/#co2>

Evidence of climate change and ecosystem degradation is now ubiquitous. This is attributable to human activities, and poses a tremendous threat to our community, our health, our economy, and our environment. Just as prevalent are the plans and programs rightly evolving to address these very serious issues.

To ensure that resources and funds are used most effectively, whether municipal or federal, the Town of Somers sought to measure the greenhouse gases generated from both government operations and the surrounding community. This will help to provide guidance in the next step of forming a climate action plan.

Total carbon dioxide equivalents TCO_{2e} for the Town of Somers operations are 2,628,082 pounds for the calendar year of 2009. The contribution of each sector is shown graphically below, and explained in greater detail in the sections that follow.

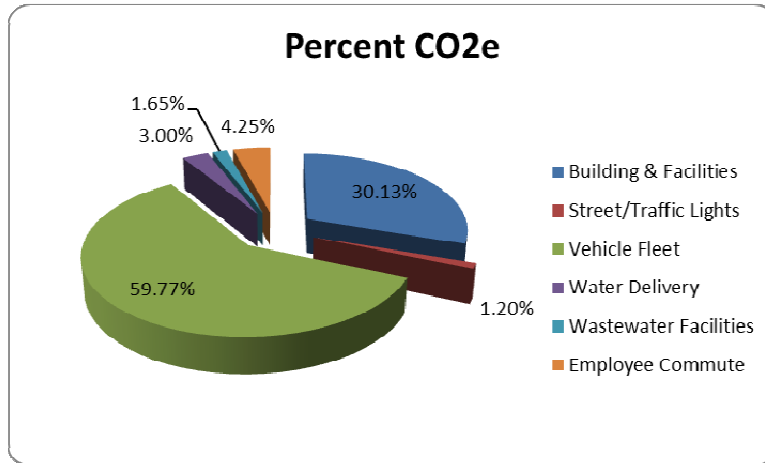


Figure 1 Municipal TCO_{2e} by Percentage

The community inventory, which will be addressed in Part II, reports TCO_{2e} of 456,696,682 lbs. (*Note: municipal emissions are not included in the community assessment.*)

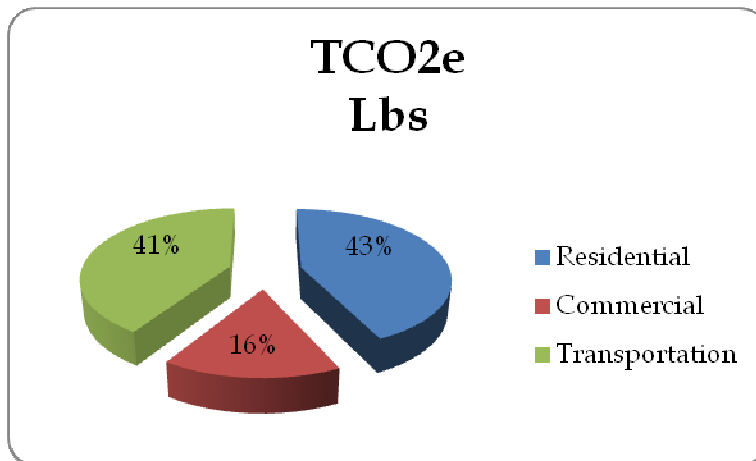


Figure 2 Community TCO_{2e} by Percentage

Town of Somers

Part I ~ Municipal Assessment

Introduction ~

Greenhouse gases have adverse effects on air quality, health, the environment, and climate. In March 2009 the National Association of Insurance Commissioners mandated that effective in 2010 major insurance companies must report on their efforts to prepare for and incorporate strategies to deal with climate change. Major corporations who have implemented programs to reduce emissions have not only improved efficiencies, they have increased their profitability. Strategic and effective plans start with a rigorous assessment of current processes and emission levels.

The Kyoto Protocol¹ is often referenced when citing which gases to measure, what time frame to use, etc. The Protocol was developed as part of the United Nations Framework Convention on Climate Change, and sought to reduce the concentration of dangerous gases significantly. These gases include:

Carbon dioxide	CO ₂	Hydrofluorocarbons	HFCs
Methane	CH ₄	Perfluorocarbons	PFCs
Nitrous oxide	N ₂ O	Sulfur hexafluoride	SF ₆

Although the Kyoto Protocol asks local government leaders to reduce emissions by 7% below 1990 (base year) levels by 2012, most do not have accurate, complete documentation dating back that far. It is more important to choose a base year for which there are complete and accurate records, then strive to reduce emissions as aggressively as economics will allow. Since utility companies generally keep data for two years, the calendar year of 2009 was chosen for this study.

The Town of Somers became a member of ICLEI to join with their neighbors of Westchester County and other governments to learn, share, and develop better cities and communities.

1. http://unfccc.int/kyoto_protocol/items/2830.php

International Council for Local Environmental Initiatives

Founded in 1990 at the United Nations, and now known as ICLEI- Local Governments for Sustainability², this non-profit organization has contributed so much in helping local governments around the globe develop their own operations and the communities they serve.

The organization's programs are performance-based and results-oriented. One such program is their Cities for Climate Protection Campaign; it is based on five milestones.

Milestone 1 ~ Conduct a baseline emissions inventory and forecast.

Milestone 2 ~ Adopt an emissions reduction target for the forecast year.

Milestone 3 ~ Develop a Local Action Plan.

Milestone 4 ~ Implement policies and measures.

Milestone 5 ~ Monitor and verify results.

ICLEI's CACP software was used in calculating the emissions from various sources. This revised software was released in April 2009 to more closely follow the Local Government Operations Protocol (LGOP).

2. <http://www.iclei.org/>

The Local Government Operations Protocol

The Local Government Operations Protocol (LGOP) was used in developing the GHG emissions inventory for the Town of Somers. This Protocol is the most widely accepted measurement for government operations and was developed by

- ✓ California Air Resources Board³
- ✓ California Climate Action Registry⁴
- ✓ ICLEI ~ Local Governments for Sustainability
- ✓ The Climate Action Registry⁵

The LGOP is based on the accounting principles of relevance, completeness, consistency, transparency, and accuracy⁶; and it facilitates the standardized and rigorous inventorying of GHG emissions.⁷

To ensure consistency among the various governments with regards to the documentation used to construct the inventory, the Protocol provides Recommended Approaches and Alternate Approaches. When it was not possible to follow the Recommended Approach in the reporting that follows, the Alternate Approach is noted. Likewise, at times assumptions must be made, and they too are clearly noted.

In all cases activity data is multiplied by an emission factor. Each section below describes the type of activity data that was used; emission factors are specific to each type of fuel. The various emissions are reported as pounds and pounds of carbon equivalents (CO₂e).

Now is a good time to address CO₂e. By way of example, let's look at one MWh of electricity generated in another part of the country. Each MWh generates the following:

CO₂ ~ 1658.14 lbs. CH₄ ~ .02498 lbs. N₂O ~ .02261

But all gases are not equal; CH₄ and N₂O are far more damaging in their capacity to trap heat in our atmosphere, and they have a much longer lifespan than CO₂. This has to be factored into our calculations. Each of the six gases mentioned earlier have a global warming potential (GWP), as shown below:

Gas	GWP
Carbon dioxide	1
Methane	21
Nitrous oxide	310
Hydrofluorocarbon	12 - 11,700
Perfluorocarbon	6,500 - 9,200
Sulfur hexafluoride	23,900

Table 1 GWP Factors

Since carbon dioxide is the most prevalent greenhouse gas, the other five gases are measured in comparison. It provides a final number that is weighted by the volume and heat-trapping ability of each gas.

3. <http://www.arb.ca.gov>

4. <http://www.climateregistry.org>

5. <http://www.climateregistry.org>

6. Local Government Operations Protocol, Pg. 10; <http://www.theclimateregistry.org/resources/protocols>

7. Local Government Operations Protocol, Pg. 3; <http://www.theclimateregistry.org/resources/protocols>

Government reporting is divided into the following sectors:

- Buildings & Facilities *
- Streetlights and Traffic Signals*
- Vehicle Fleet*
- Solid Waste Facilities*
- Water delivery services*
- Port facilities
- Airport facilities
- Transit fleet
- Power generation facilities

However, not all sectors apply to every government operation. Those sectors included in the Town of Somers have been marked with an asterisk.

Additionally, the categorization by Scopes provides transparency in defining direct and indirect emissions.

Scope 1: *All direct greenhouse gas emissions.* An example of this is the City's fleet. These vehicles are used specifically due to government operations.

Scope 2: *Indirect emissions based on the consumption of purchased electricity.*

Scope 3: *Other indirect emissions.* Though the government may not have direct operational control over these sources, they can usually have a strong influence over the activities. This includes services often provided by a local government, but which are sub-contracted instead. It also covers employee commute habits.

Sectors

Buildings & Facilities ~

The total greenhouse gases of 791,878 pounds are comprised of both Scope 1 and Scope 2 emissions. In order to make comparison between the two fuels easier, consumption is being reported in units of energy as opposed to gallons and kilowatt hours.

Scope 1 ~ Fuel oil consumed = 2,639 MMBtu

Scope 2 ~ Electricity consumed = 1,519 MMBtu

Summary of Sources ~

The table shown below lists the various buildings, and when applicable, the departments within each building. This information is important to keep in mind when comparing the results below.

Building	Departments	TCO2e	
Town Hall	Engineering	Finance	114,384*
	Justice Court	Planning	
	Receiver of Taxes	Supervisor's Office	
	Town Clerk	Zoning	
Town Hall Annex	Assessor's Office	Building Department	46,323
Highway	Highway Facility	Garage	141,925
	Salt Shed		
Parks & Recreation	Band Stand/Summer Kitchen	Comfort Station	180,938
	Heat	Pump	
	Recreation Center	Reis House	
	Wayne Van Tassell		
Library			257,906
Police Department			50,403

Table 2 Buildings' Emissions

*Town Hall figure includes electric meters for the cemetery and flag pole.

Figure 3 below provides a good visual regarding the amount of both fuel oil and electricity used in each municipal building.

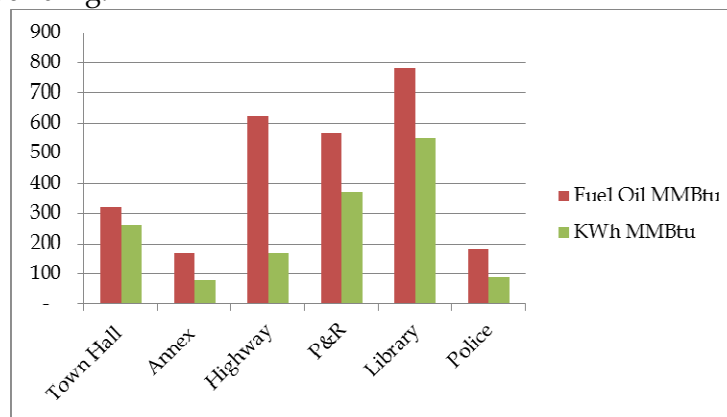


Figure 3 Department Fuel Consumption

Fuel Oil

We'll focus first on the Scope 1 emissions ~ fuel oil combusted in the town's own furnaces for heating. The oil was provided by two different vendors for the calendar year of 2009: Castle Oil Corporation for the first eight months, and Hess Corporation from September through December.

Methodology ~

Since actual meter readings were unavailable, calculations for the Recommended Approach were based on the volume of fuel (activity data) delivered for the year. The number of gallons of fuel was multiplied by the appropriate emission factors for CO₂, CH₄, and N₂O, and then by the corresponding GWP figure to determine total carbon emissions equivalents.

Electricity

Here again, LGOP's Recommended Approach was used, and is calculation based. Known electricity use (activity data) was multiplied by the eGRID subregion default emission factor. Exact electricity consumption will be discussed, but it might be wise to first address the default emission factors used.

Electricity generation is divided into regional power pools, as shown in Figure 4 below. Each power plant in the United States must submit their emissions data to the Environmental Protection Agency, which then compiles the data and develops the eGRID (Emissions & Generation Resource Integrated Database)⁸. The eGRID is a comprehensive assessment of emissions for each Subregion and specifies, among other things, the amount of CO₂, CH₄, and N₂O emitted per MWh generated.



Figure 4

8. www.epa.gov/cleanenergy/powerprofiler.html

The Town of Somers falls under the Subregion of NYCW~ NPCC NYC/Westchester, one of the cleaner subregions in the country. For every one MWh of electricity generated, the following gases and corresponding amounts are emitted in the NYCW Subregion:

Carbon dioxide	815.45 lbs.
Nitrous oxide	.00546 lbs.
Methane	.03602 lbs.

Methodology ~

NYSEG, supplier of the Town’s electricity, provided electronic data files detailing kWhs delivered for all Town-owned meters. This data was reformatted to include the entire calendar for 2009, as required by LGOP. Total kWhs consumed amounted to 608,318. The following table and chart highlight fuel consumption and costs for each department:

Department	KWhs	Cost
Administration	99,856	\$ 9,522
ASWD	71,850	\$ 7,051
Highway	49,833	\$ 5,326
Library	160,508	\$ 21,558
Parks & Recreation	109,355	\$ 12,529
Police	25,519	\$ 2,369
Sewer District	52,892	\$ 6,082
	569,813	\$ 64,437

Table 3 Department kWhs and Costs

We’ll pull the numbers back together again and compare emissions intensity per fuel type based on the square footage of each building. It is interesting to note the variances: in some buildings the emissions generated from fuel oil is far greater than that for electricity; in others it is much closer or even reverse. This type of analysis helps to point out areas of opportunity. (*Note: square footage was not available for every building; where it was accessible, the following analysis was made.*)

Location	CO2e Lbs	Sq Ft	CO ₂ e	CO ₂ e
			Intensity Fuel Oil	Intensity KWh
Annex	46,323	2,000	13.64	9.52
Town Hall	113,953	9,300	5.56	6.69
ASWD	36,691	2,000	10.08	8.27
Highway	110,076	4,000	25.29	2.23
Library	257,906	7,613	16.63	17.24
Reis House	20,106	1,500	N/A	13.40
Wayne Van Tassell	71,083	1,200	51.17	8.07
Recreation Center	51,799	816	36.88	26.60
Police	50,403	1,100	26.85	18.97

Table 4 Facility Fuel Intensity Comparison

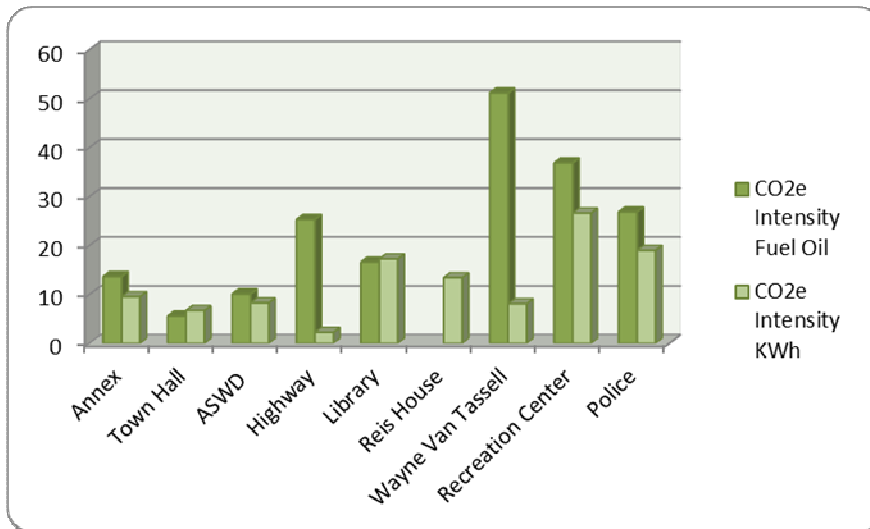


Figure 5 Facility Fuel Intensity Comparisons

Combining the intensity amounts and comparing them to the various buildings provides yet another view to show areas of possible inefficiencies.

Location	CO ₂ e Intensity	
	Per SF	Percent
Annex	23.16	7.80%
Town Hall	12.25	4.13%
ASWD	18.35	6.18%
Highway	27.52	9.27%
Library	33.88	11.41%
Reis House	13.40	4.51%
Wayne Van Tassell	59.24	19.94%
Recreation Center	63.48	21.37%
Police	45.82	15.43%
	297	100%

Table 5 Comparison of Building Fuel Intensity

Streetlights ~

The Streetlight sector includes traffic lights, traffic signals and tree lights which are paid from the Administration budget. As with the Buildings & Facilities calculations, kWh delivery (activity data) for the calendar year 2009 was multiplied by the eGRID factor and then the corresponding GWP to determine total emissions.

	CO ₂ e Lbs	Electricity MMBtu
Admin ~ Tree Lights	1,906	8
Croton Falls Lighting District	7,341	31
Street Lights	21,319	89
Traffic Lights	926	4
	31,492	132

Table 6 Lights Emissions & Energy

The fixtures for both street lighting accounts include:

Mercury vapor lights (MRC) ranging from 100 to 400 watts

High pressure sodium cobra head lights ranging from 50 to 400 watts

Figure 6 depicts the total pounds of emissions per unit of energy consumed. There are grant opportunities available to assist with the replacment or refitting of street lights.

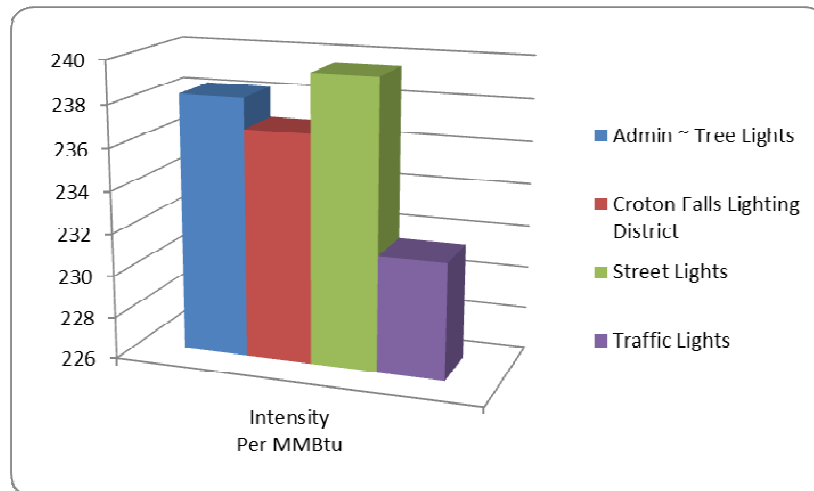


Figure 6 Lights TCO₂e

Vehicle Fleet ~

For the municipal operations of the Town of Somers, Fleet accounts for almost 60% of their greenhouse gas emissions. The following chart illustrates each department's contributions.

Department	CO ₂ e	
	Lbs	Percent
ASWD	14,375	0.92%
Building	18,786	1.20%
Engineering	8,963	0.57%
Highway	1,175,862	74.86%
Parks & Recreation	50,559	3.22%
Police	178,268	11.35%
Pooled Vehicle	9,524	0.61%
Nutrition	<u>114,414</u>	<u>7.28%</u>
	1,570,751	100.00%

Table 7 Fleet TCO₂e by Department

Before delving into the numbers further, a few caveats must be noted:

- ✚ The Highway Department's usage of kerosene was not included because the CACP software does not list it as a fuel. Kerosene (with an emission factor slightly lower than that for diesel) comprises less than 7% of the department's total fuel consumption.
- ✚ Although the Town owns several late model vehicles, these were calculated using 2005 information ~ this is the latest year for which the CACP software provides calculations.
- ✚ Off-road vehicle use was not included. Insufficient data prevented any meaningful calculations. The primary source is backhoe equipment, and the annual estimated usage is 3,516 hours.

Ninety-five percent (1,112,931 pounds CO₂e) of the Highway Department's emissions come from diesel consuming vehicles. Of these, the diesel light trucks (CACP Model years 1996-2004) account for almost 70% of the vehicle miles traveled for the department.

Intensity factors help to point out areas of opportunity. If we look at CO₂e generated per mile driven, as shown graphically in Chart 7 below it appears there may be an opportunity to drastically cut down on emissions in the Nutrition Department. The high intensity factor might be attributed to idling.

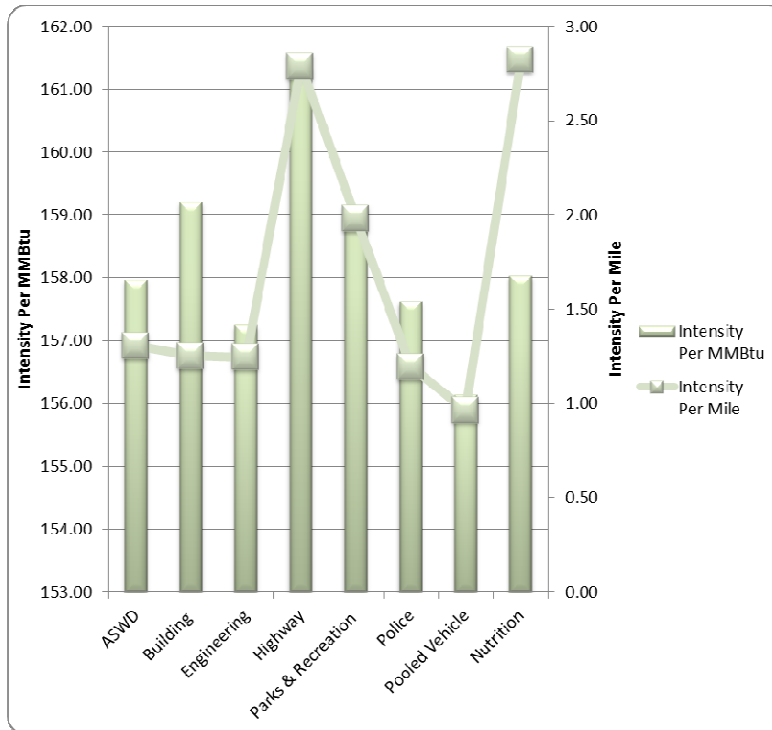


Figure 7 Fleet Emissions Intensity per MMBtu & per Mile

Methodology ~

ICLEI's Mobile Emissions Data Collection Form was used to calculate all Scope 1 emissions for the Town of Somers vehicles. The required information includes:

- ✚ Model Year
- ✚ Number of gallons of fuel consumed
- ✚ Fuel Type
- ✚ Vehicle Miles Traveled

Since fuel consumption was unknown, this estimate was calculated using estimated annual mileage as provided and basic vehicle information. LGOP's Alternate Approach 7.1.1.2.1 was used for the calculation.

$${}^E\text{Distance} / [({}^H\text{City FE} \times \text{City } \%) + ({}^I\text{Highway FE} \times \text{Highway } \%)] = {}^G\text{Estimated Fuel Use}$$

Note: FE = Fuel Efficiency

The EPA uses the defaults of 55% for City and 45% for Highway.

The superscript letters in the above equation correspond to columns in Document 2 of Appendix A.

This data was then transferred to the CACP software Version 2.2.1.b.

Assumptions ~

The following government web site was used to determine individual vehicle fuel efficiencies: <http://www.fueleconomy.gov/feg/findacar.htm>.

Using this site it was necessary to assume certain characteristics or properties about the vehicles. These have been noted in Column J of Document 2, Appendix A.

Water Delivery ~

This sector is comprised of the Amawalk-Shenorock Water District building and three pumps, corresponding to the Town’s three water districts. The primary activity data for Water Delivery is the kWh delivered by NYSEG. Figure 9 outlines the areas of town serviced by the water districts. The total CO₂e for these sources is 78,918 pounds, and is distributed as follows:

ASWD Building (kWhs)	8,608
ASWD Building (Fuel oil)	20,152
Travis Road Pump	16,539
Route 35 & Mahopac Avenue	5,462
Meadow Well House	26,017
Route 118 & Tomahawk Street	2,141

A comparison of the pump efficiencies can be determined by reviewing the pounds of CO₂e per MMBtu of fuel consumption in Figure 8.

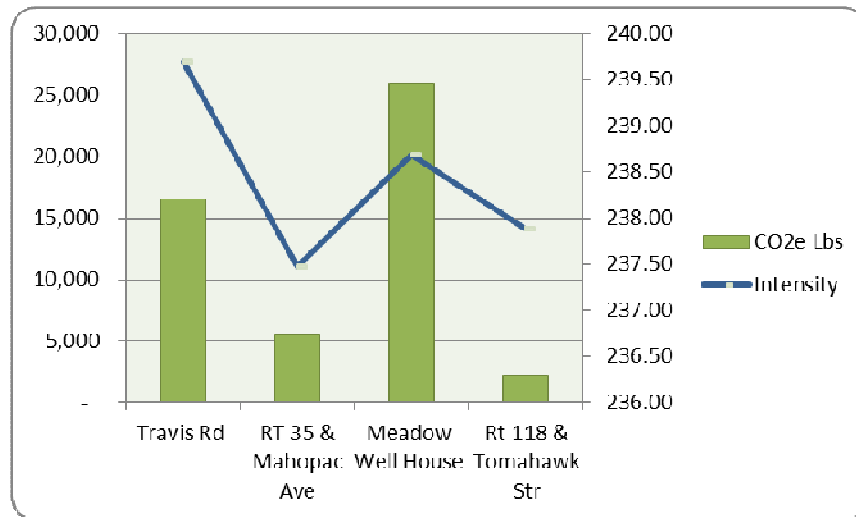
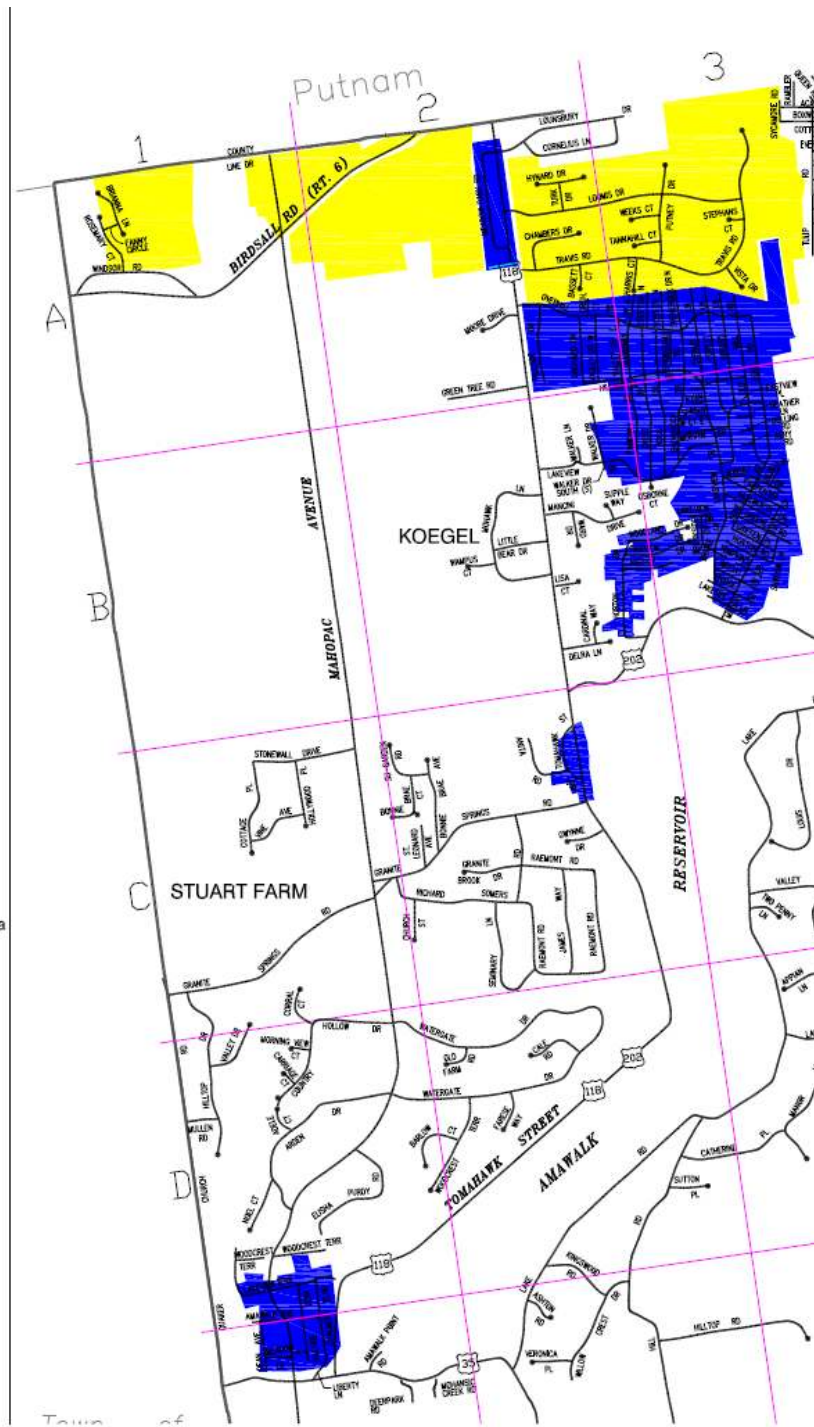


Figure 8 Pump Emissions & Intensities

It may also be helpful to know the output of each pump per MMBtu consumed.

- ASWD Water Operation Area
- ASWD Water & Sewer Operation Area



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Figure 9 Water Districts

Sewer District ~

The Sewer District which the Town of Somers operates consists of two lift stations that service approximately 210 residential customers and retail shopping of approximately 11,000 square feet. The emissions generated from these two pumps equal 43,260 lbs. TCO₂e. Here again, the kWh delivered is the activity data used. Most residents have septic tanks. The emissions per MMBtu are as follows:

Primary lift station ~ 239.42
 Secondary lift station ~ 237.49

Solid Waste ~

Bria Carting, the contractor who provides solid waste pick-up for the Town of Somers supplied Document 1 in Appendix B which outlines the location and service frequencies for each municipal pick-up. The volume of waste generated is as follows:

Location	MSW Lbs	Recycling Lbs
Town Hall	33,280	5,200
Reis Park	75,200	10,400
Van Tassell Park	16,640	10,400
Highway	24,960	5,200
	150,080	31,200

Table 8 Solid Waste Volume

It must be noted however, that MSW from park locations likely includes a large percentage of community-generated waste for eight months of the year.

Methodology ~

According to Mr. Anthony Prestamo, supervisor at Bria Carting, the approximate weight per yard of MSW or cardboard/paper containers is 80 pounds; the approximate weight of a 96 gallon recycling toter is 40 - 50 pounds. Based on this information and conservatively assuming full containers, approximate calculations were made as follows:

$$\begin{aligned}
 & [((\text{Weight} \times \#\text{Yards}) \times \#\text{Pick-ups per Week}) \times 52] = \text{Total Annual Weight MSW} \\
 & (\#\text{Recycling toters} \times 50) \times 52 = \text{Total Annual Recycling Weight}
 \end{aligned}$$

Two different trucks are used by Bria: one for recyclable materials and one for regular solid waste. Bria is able to redeem an additional 10% of recyclables from the “regular” truck. The MSW is sent on to Seneca Meadows landfill where the methane gas is converted to electricity.

These figures roughly translate into 18 tonnes of CO₂e; however this figure is not included in the Town’s total emissions for several reasons:

1. Insufficient data for weight and waste composition.

2. Over 60% of the waste is community generated.
3. In order to calculate methane emissions from the Seneca Meadows Landfill using the recommended First Order of Decay, as recommended by the IPCC, far more detailed information is required about the landfill.
4. The methane is converted to electricity and piped to the grid, with any excess gas flared.

Employee Commute ~

An employee survey was distributed to gain insight into the habits and preferences of staff regarding their commute to work. Seventeen surveys were returned; the tabulated results showing distances traveled and vehicle types are provided below.

Distance From Work	No. of Employees
1 ~ 5 miles	7
6 ~ 10 miles	3
10 ~ 20 miles	2
20+ miles	5

Table 9 Distance Chart

Vehicle Type	% Staff Use
Compact	18%
Mid-size Sedan	41%
SUV	24%
Truck	12%
Unknown	6%

Table 10 Vehicle Usage

Assuming all respondents were full-time staff, total VMT was calculated by multiplying the average distance by the number of employees in each group. This number was then multiplied by 2, and then by 5, finally by 50 weeks, which provided a total VMT of 86,000.

Using ICLEI's CACP Transport Assistant calculator the 86,000 translated into the following emissions:

CO ₂ Lbs	N ₂ O Lbs	CH ₄ Lbs	CO ₂ e Lbs
109,785	6	5	111,783

Table 11 Commute Emissions

Most respondents have chosen their current form of commute out of necessity or lack of other options. There was some interest in walking/biking at times, if the roadways were safer.

Summary ~

The Town leaders have done a remarkable job in keeping the charm and uniqueness of Somers intact. This translates into our needing to report TCO_{2e} in terms of pounds, not metric tons! As the numbers point out, however, there are areas where a more in-depth review could help to reduce not only dangerous emissions, but costs as well. Costs not only of current dollars, but the staggering costs that will come due to lack of action. Costs to health, costs of mitigation, costs of non-compliance relating to carbon constraints, etc.

Furnace efficiencies, building envelopes, retrofitting street lights, and water delivery pump efficiencies, as well as the fleet sector all show areas where improvement can be made. Most municipalities strive for a minimum of a 2% annual reduction. The following chart outlines the results of a 2% reduction rate over the next 10 years. Columns have been included for 3% and 4% annual reductions as well. Reductions are based on the current municipal TCO_{2e} emissions of 2,628,082 pounds.

	2%	3%	4%
2011	2,575,520	2,549,240	2,522,959
2012	2,524,010	2,472,762	2,422,040
2013	2,473,530	2,398,579	2,325,159
2014	2,424,059	2,326,622	2,232,152
2015	2,375,578	2,256,823	2,142,866
2016	2,328,066	2,189,119	2,057,152
2017	2,281,505	2,123,445	1,974,866
2018	2,235,875	2,059,742	1,895,871
2019	2,191,157	1,997,950	1,820,036
2020	2,147,334	1,938,011	1,747,235
2021	2,104,388	1,879,871	1,677,345