Local Government and Community Greenhouse Gas Inventory

City of Oswego, New York
2012

City of Oswego

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Acknowledgements

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I. Executive Summary

The City of Oswego recognizes the importance of climate action planning to the long-term resilience and sustainability of the community. The City was selected by the Central New York Regional Planning and Development Board (CNY RPDB) to take part in the Climate Change Innovation Program (C_2IP), a regional climate action program funded through the US EPA Climate Showcase Communities program. Conducting a greenhouse gas (GHG) inventory represents the first step in effective climate action planning. The inventory assessed City government operations and broader community emissions in 2010, which will serve as the baseline year[1] for GHG reduction planning moving forward.

In 2010, City government operations generated 5,091 metric tons of carbon dioxide equivalent ($MTCO_2e$). These emissions span seven sectors, including buildings and facilities, streetlights and traffic signals, vehicle fleet, water delivery, wastewater treatment energy use, and wastewater treatment processes. Community emissions totaled 147,926 $MTCO_2e$ in 2010. This total represents five sectors, namely residential, commercial and industrial energy use, transportation, and waste.

The City of Oswego, in accordance with ICLEI's Local Government Operations Protocol and U.S. Community Protocol, assessed emissions through the commonly used framework of operational control for the government analysis and based on local government significant influence over community emissions sources for the community analysis. This framework enables the City to understand the emissions generated through processes and sources it can either directly or indirectly target for reduction through a number of existing channels. Additionally, the framework allows the City to narrow the scope of the inventory analysis to areas where data is available, providing for a replicable process in the future.

The City carbon footprint will expand or contract due to many factors. Energy conservation measures, increased commercial development, reduced vehicle miles travelled, and efficiency upgrades are just a few examples of the interacting variables that affect greenhouse gas emissions levels. Through periodic assessments and forecasts, the City will be able to determine emissions sources and target areas for reduction more efficiently. A baseline GHG inventory is just that, a baseline. In order to be truly meaningful it must be measured against future progress. The City will need to continue to monitor and evaluate its performance by conducting additional GHG assessments in the future. Additionally, emission forecasts can offer a planning tool moving forward, and will enable the City to target areas for emissions reduction as part of other climate action efforts.

[1] The baseline year is chosen based on several criteria: 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)

II. Introduction

A. City of Oswego Background

The City of Oswego is located in Central New York's Oswego County, on the southern shore of Lake Ontario. The city is 35 miles north of Syracuse, between Rochester and Watertown. Oswego contains several miles of shoreline along Lake Ontario and the Oswego River, as well as the deep water Port of Oswego. The name Oswego itself comes from the Native American word "Osh-we-geh" meaning the pouring out place, which accurately depicts Oswego's unique river and lakeside location.

Figure 1 City of Oswego Location

The strategic location of Oswego on the southeastern shore of Lake Ontario provides a connection between the NYS Barge Canal System which links to New York City, to the St. Lawrence Seaway, and to the Great Lakes system. Additionally, the port is well served by both rail and the Interstate Highway System.

i. Port of Oswego

Over recent years, the Port of Oswego has undergone a revival in commerce harking back to the time when the Oswego Harbor was filled with sailing schooners. In 2002, the Port received fewer than a dozen rail cars. Finishing 2011 the Port handled over 750 rail cars, with both grain, aluminum and windmill components equaling close to a thousand percent increase. In 2003, the Port received no aluminum shipments by water, but by the conclusion of 2011, the Port logged eleven port calls by ship for aluminum discharge.

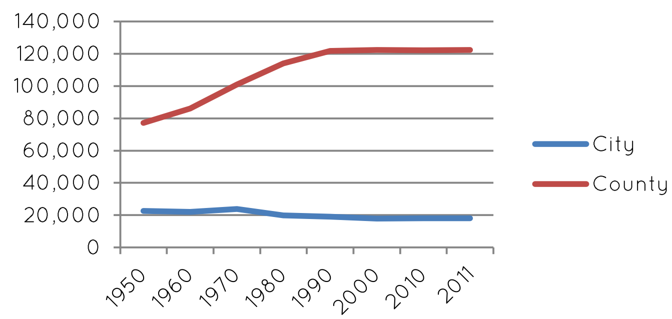
Figure 2 Port of Oswego Regional Transportation System

Since 2004, the Port of Oswego has been a logistic partner with Novelis Oswego Aluminum Plant utilizing the Port of Oswego to meet the escalating demand for aluminum sheet metal for the U.S. auto industry, an outgrowth of rising fuel economy standards.

The Port of Oswego has become a major transportation player in the national renewable energy market. Since 2002 the Port has handled 188 full windmill units and 243 components, including tower sections, blades and nacelles. The Port's position on the eastern United States as a top tier green energy transportation center is well known in the industry. These projects have utilized ship, rail and truck movement to installation points. The Port of Oswego is unique in as it offers an intermodal deep water port with a location that is central to the best windmill placement sites.

ii. Population Overview

The City of Oswego has experienced a decrease in population since a peak population in 1970, although there has been a small gain since 2000 (1.1%). This decline in population is in line with an overall trend in small cities throughout the northeast. Cities of all sizes in the northeast have been losing population to the towns and suburbs just beyond their borders. Oswego County has experienced a steady increase in population over the same time period, a 58.4% increase since 1950. These numbers have an impact on overall GHG emissions in terms of municipal service demand within the City, and increased vehicle travel as population densities have declined. In the city of Oswego population densities have declined by approximately 24% since 1970. While the overall population density of Oswego County has increased, the total percentage of the population living within the cities of Oswego and Fulton declined from 47% in 1950 to 25% in 2010, meaning that more residents in Oswego County are living in areas where they need to drive further to get to basic services.



	Year	1950	1960	1970	1980	1990	2000	2010	2011
Population	City	22,647	22,155	23,844	19,793	19,195	17,954	18,142	18,158
	Per Sq.Mile	2,980	2,915	3,137	2,604	2,526	2,362	2,387	2,389
	County	77,181	86,118	100,897	113,901	121,785	122,377	122,112	122,228
	Per Sq.Mile	81.1	90.5	106.0	119.7	128.0	128.6	128.3	128.4

Figure 3 Total Population City of Oswego vs. Oswego County (1950-2011)

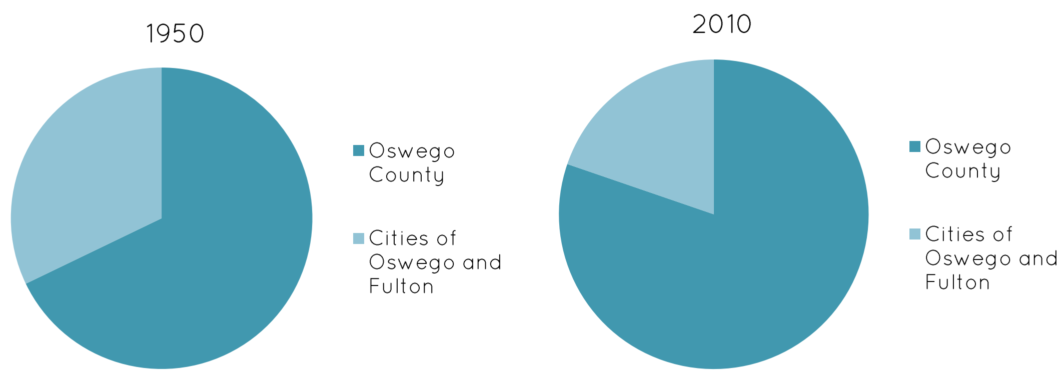


Figure 4 Percentage of Oswego County Population for Cities of Oswego and Fulton 1950 and 2010

The Central New York Regional Planning and Development Board conducted an analysis of regional population density, combined with jobs per acre, to determine areas in the Central New York region where increased transit service might be viable (a minimum threshold of 10-25 persons and jobs per acre is considered appropriate for enhanced service). These areas were then further analyzed to identify potential service nodes that could become transit nodes. The core of the City of Syracuse exhibited the highest densities in the region, as did the NYS Route 104 Corridor in Oswego (Figure 4). This corridor connects the SUNY Oswego campus, Downtown Oswego, and the 104 East Shopping district.

The City's Vision 2020 Comprehensive Plan identifies the importance of the Route 104 corridor for the future growth and development of the city. Oswego is currently pursuing a study of the Route 104 corridor that would identify design strategies for implementing a complete streets strategy that would improve pedestrian and bicycle mobility, as well as enhance the transit service currently operated by Centro. Combined with an updated wayfinding program, the City of Oswego could become a model for small cities regarding how to incorporate alternative transportation mobility.

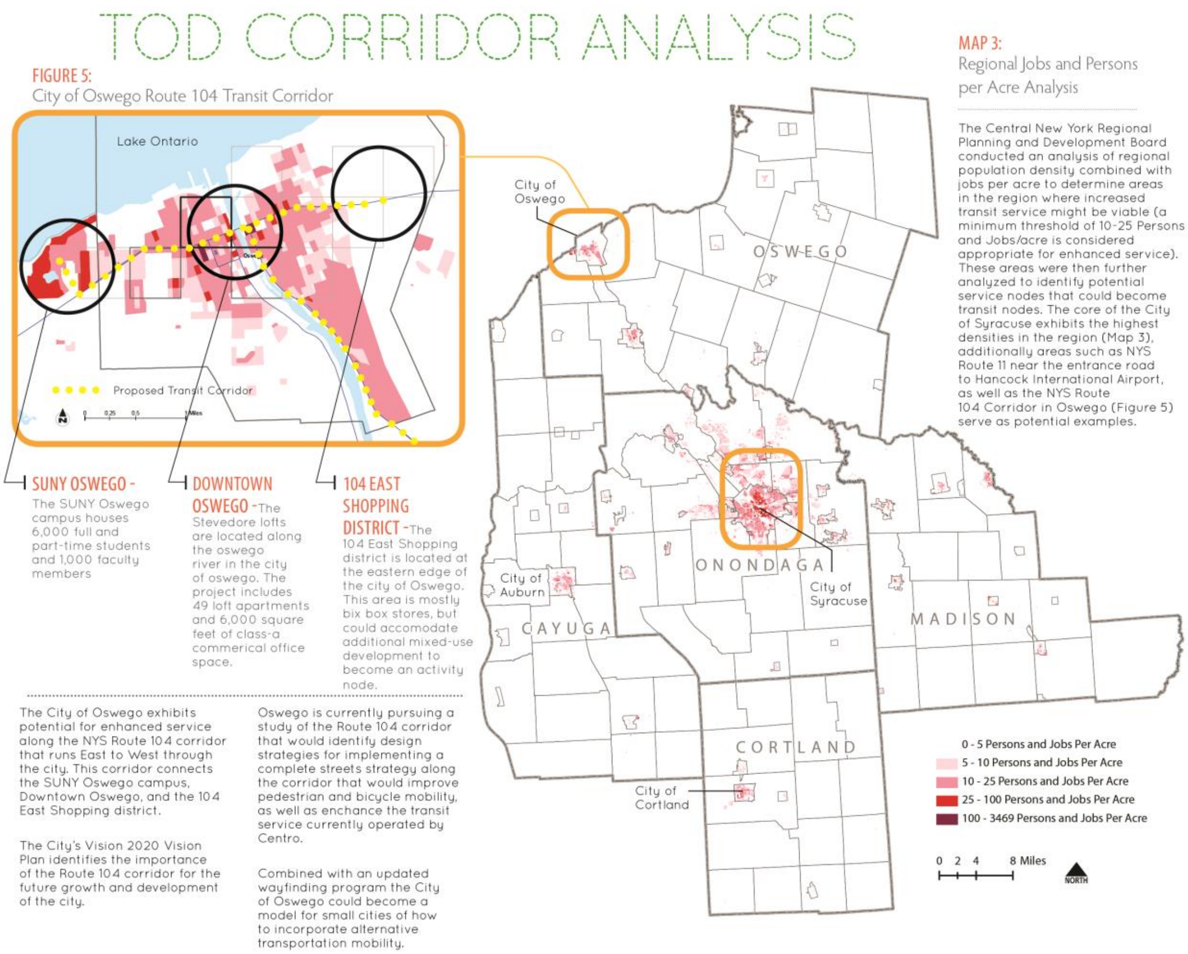


Figure 5 – CNY Regional Transit Oriented Development Analysis (SOURCE: CNY RPDB)

B. Climate Change Background

New York State has outlined projected climate impacts and vulnerabilities in its 2011 ClimAid assessment.[2] The 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.

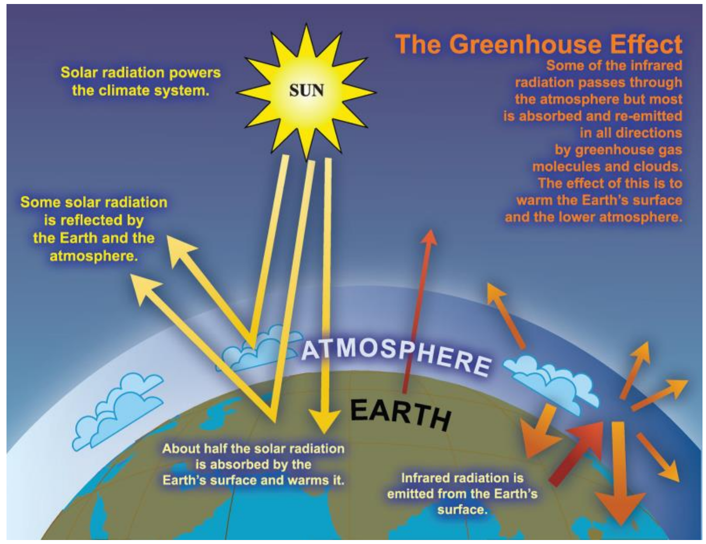


Figure 5 Greenhouse Effect

Global average temperatures and sea levels have been increasing for the last century and have been accompanied by other changes in the Earth's climate. As these trends continue, climate change is increasingly recognized as a major global concern. 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.[3]

The rising trend of human-generated GHG emissions is a global concern. 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 5 Greenhouse Effect).[4] 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.

In New York State, regional climate change 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.

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[2] NYS. 2011. ClimAid. http://www.nyserda.ny.gov/Publications/Research-and-Development/Environmental/EMEP-Publications/Response-to-Climate-Change-in-New-York.aspx

[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] IPCC. 2007. Fourth Assessment Report. http://www.ipcc.ch/publications_and_data/ar4/wg2/en/ch18s18-6.html

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. The CNY RPDB will be utilizing the award to administer 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 City of Oswego was selected by CNY RPDB, one of seven communities that were grant recipients**,** to receive technical assistance and financial incentives to complete carbon foot-printing and sustainability planning processes. The goals of the C_2IP program include:

- improve energy performance in local government operations
- remove barriers for greenhouse gas management and the reduction of vehicle miles traveled through the development of effective local government programs, policies, and outreach in the areas of land use, transportation, and community master planning

The C_2IP includes a grant of up to $30,000 to enable the City to complete feasibility studies for clean energy projects, to implement demonstration projects to retrofit municipal facilities, or upgrade municipal vehicle fleets and make them more energy efficient.[5]

i. City of Oswego C_2IP Demonstration Project

The City of Oswego recently installed a 55 kW solar PV system at the Crisafulli Municipal Ice Rink facility. Funding for the project was made possible through the Federal ARRA program with assistance from the CNY RPDB C_2IP program. The city is seeking to complement the solar PV system with the purchase of an electric ice cleaner at the Crisafulli facility to replace the current diesel powered ice cleaner. The city was already pursuing the replacement of the current diesel powered ice cleaner. The new machine will dramatically impact the emissions inside the facility by providing an emission-free piece of equipment to clean the ice, and help the City take full advantage of their recent solar PV installation by utilizing energy produced on site to power the ice cleaner.

[5] Central New York Regional Planning and Development Board. Climate Change Innovation Program. 2011. http://www.cnyrpdb.org/programs/energy.asp (excerpts from CNY RPDB website)

CNYRPDB staff worked with the city to explore options for replacement of the City's current ice cleaning machine. Factors taken into consideration include rink size, hours of operation, number of resurfacings, and types of use. Given these factors, it was determined that a full size machine would be the most logical investment to complete the desired workload. CNY RPDB staff contacted the Zamboni company in California for an estimate on their all electric ice cleaner. The machine suggested by the company is a Zamboni 552, with a quoted price of $127,600. Electric Ice Resurfacer's (ERV's) consume around 20,000 kilowatt hours per year with a demand of about 8 kilowatts. Battery charging is as easy as plugging in a cord. Battery maintenance requires about one hour per month of labor.

City of Oswego DPW staff estimated average weekly diesel use for the current machine to be approximately 12 gallons per week. With 20 weeks of operation that totals 240 gallons of fuel. At a conservative estimate of $3.20 a gallon (the City purchases fuel under the NYS OGS fuel purchase contract) the City is estimated to be spending at least $768 a year on fuel. Utilization of an electric ice cleaner will eliminate the need to purchase the fuel providing an immediate return on this investment. Additional savings are anticipated by reducing the need to provide air exchanges to keep emissions down in the ice rink during operation. Incoming air greatly increases the heating and cooling loads of the building and the ice making equipment. A 10%-15% reduction in heating and cooling loads has been realized in other replacement projects taking into account adjustments for the need for fresh air. Based on the C&S analysis of the facility, a 10% reduction in the Chiller load, and a 10% reduction in the boiler load would provide an annual savings of approximately $2,307 as reflected in the chart below. As the chart indicates, the annualized costs are significantly lower for the electric model. With a useful life of approximately 20 years, this purchase will have an emissions reduction benefit and it is also a solid financial investment.

Table 1 Annualized Costs Electric vs. Diesel Ice Cleaning Machines

Electric Purchase

	Electric Zamboni Purchase	$125,000
	Delivery	$3,600
	CNYRPDB Contribution	($30,000)
	Total Purchase Costs	**$98,600**
(20 yrs.)	Ice Cleaner Operating Expense (Fuel)	($15,360)
(20 yrs.)	Maintenance	$20,000
	Total Annualized Costs	**$5,930**
	Annual Facility Operating Savings	$2,307
	Annual Sponsorship	$2,000
	Total Annual Costs	**$1,623**

Diesel Purchase

	Diesel Zamboni Purchase	$80,000
	Delivery	$3,600
	Total Purchase Costs	**$83,600**
(20 yrs.)	Ice Cleaner Operating Expense (Fuel)	$15,360
(20 yrs.)	Maintenance	$20,000
	Total Annualized Costs	**$5,948**
	Annual Sponsorship	$2,000
	Total Annual Costs	**$3,948**

Poor air quality at skating rinks is directly attributable to internal combustion ice resurfacing vehicles (ICRV) emissions settling in the rink and contained within the surrounding boards. Of primary concern are the carbon monoxide (CO) and nitrous dioxide (N02) emissions. Typical skating rink health complaints can range from headaches and dizziness, to symptoms requiring hospitalization.

D. ICLEI Partnership

The City of Oswego has been a member of ICLEI Local Governments for Sustainability throughout 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 6 ICLEI Five Milestones for Climate Mitigation).

The five milestones include:

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

Figure 6 ICLEI Five Milestones for Climate Mitigation

III. Methodology

Several forms of guidance and calculation tools were used to conduct the Oswego government operations and community analyses. The appendices to this report describe the methods, data and assumptions used in more detail, and provide supporting documentation for compliance with national standards.

A. Greenhouse Gases

The three most prevalent greenhouse gases, and therefore the focus of the City 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 2 Greenhouse Gases). 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 (see Table 3 Government and Community Sectors for the list of sectors covered in both analyses).

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

Table 2 Greenhouse Gases[6]

Government Operations Sectors	Community Sectors
Buildings & Facilities	Residential Energy Use
Vehicle Fleet	Commercial Energy Use
Streetlights & Traffic Signals	Industrial Energy Use
Wastewater Facilities	Transportation
Water Delivery	Waste

Table 3 Government and Community Sectors

B. Calculation Tools

i. ICLEI Local Government Operations Protocol

The Oswego 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. Activity data for the facility energy use and vehicle fleet fuel use was entered into ICLEI's municipal inventory tool, Clean Air Climate Protection (CACP) software. Calculations for all emissions sources are outlined in the LGOP, an example for stationary fuel use is shown below[7]:

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

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

6 IPCC. 1995. Second Assessment Report. http://www.ipcc.ch/pdf/climate-changes-1995/ipcc-2nd-assessment/2nd-assessment-en.pdf

7 ICLEI 2010. Local Government Operations Protocol. Pg. 42-43

The activity data for each emissions source was entered into the CACP software, which performs the calculation with the appropriate default emissions factors. Once aggregated into metric tons of CO_2e the individual entries for each sector can be summed to emissions totals by source, sector and scope.

ii. ICLEI Community Protocol

The City of Oswego community analysis utilized the new community protocol released by ICLEI in 2012. While the key sectors in this protocol are not dissimilar from those recommended for CACP input prior to the development of the protocol, there is now a required reporting and disclosure method for compliance (see Appendix 2. ICLEI U.S. Community Protocol Compliance Reporting). The sectors required through the community protocol are: electricity use, residential and commercial fuel use, on-road vehicle travel, wastewater treatment and water distribution energy use, and solid waste generation.[8]

iii. Additional Resources

The government operations analysis utilized the wastewater treatment methodology outlined in the ICLEI U.S. Community Protocol, Appendix F (see Appendix 3. Estimation Method for Wastewater Treatment Process Emissions). In general, the community analysis utilized methods outlined in the Community Protocol as well as ICLEI's Clean Air Climate Protection (CACP) software.

Other resources used in this inventory included the New York State Department of Transportation (NYSDOT) Traffic Data Viewer tool, in conjunction with CNY RPDB GIS data to generate transportation emissions estimates (see Appendix 4. Estimation Method for Vehicle Miles Traveled).

There are many other tools and resources available for use in assessing sectors not included in this analysis, which are covered in the guidance documents referenced here. The ability of the inventory to cover each emissions source in the City of Oswego is not possible at this time. For example, emissions resulting from product uses and lifecycle emissions from energy generation are embedded in the City's carbon footprint, but are not included due to data limitations and the scope of this analysis. Resources exist to aid in building these components into the analysis and should be considered for future inventories.

C. Reporting by Scope

Emissions can be categorized in terms of government control over 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, distinguishing between what is directly emitted (scope 1) and indirectly emitted (scopes 2 and 3) (see Table 4 Emissions by Scope). 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.

[8] ICLEI. 2012. U.S. Community Protocol for Accounting and Reporting Greenhouse Gas Emissions. Pg. 21-22

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 Oswego 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 (such as electricity consumed by the City (scope 2) and the same electricity generated by plants in the state (scope 1)).

Scope	Emissions Activity	Government Sector by Scope
1	All direct GHG emissions (with the exception of direct CO2 emissions from biogenic sources).	Vehicle Fleet, Wastewater Treatment processes, Buildings & Facilities (fuel use), Water Delivery (fuel use)
2	Indirect GHG emissions associated with the consumption of purchased or acquired electricity, steam, heating, or cooling.	Buildings & Facilities (electricity), Water Delivery (electricity), Lighting, Wastewater Facilities
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 4 Emissions by Scope[9]

D. Normalization Factors

It is important to assess emissions in the context of changing conditions that affect sources such as electricity consumption or heating fuel use. A primary indicator of these patterns are heating and cooling degree days, which often correlate with a rise or fall in energy consumption (and therefore a rise or fall in associated emissions).[10] In addition to other factors, such as changes in fuels used for heating and cooling, as well as energy conservation measures, HDDs and CDDs serve as explanatory variables affecting both municipal and community GHG emission patterns (Appendix 1. Oswego Climate Data).

[9] ICLEI. 2010. Local Government Operations Protocol (LGOP). Pg. 31

[10] HDD/CDD definition: "A mean daily temperature (average of the daily maximum and minimum temperatures) of 65°F is the base for both heating and cooling degree day computations. Heating degree days are summations of negative differences between the mean daily temperature and the 65°F base; cooling degree days are summations of positive differences from the same base. For example, cooling degree days for a station with daily mean temperatures during a seven-day period of 67,65,70,74,78,65 and 68, are 2,0,5,9,13,0,and 3, for a total for the week of 32 cooling degree days" (source: NOAA National Weather Service: http://www.cpc.ncep.noaa.gov/products/analysis_monitoring/cdus/degree_days/ddayexp.shtml)

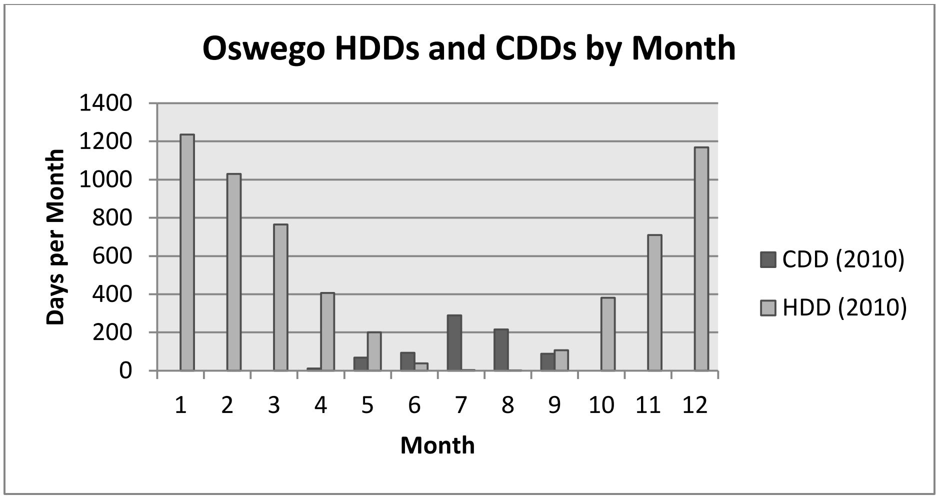


Figure 7 Oswego HDDs and CDDs by Month

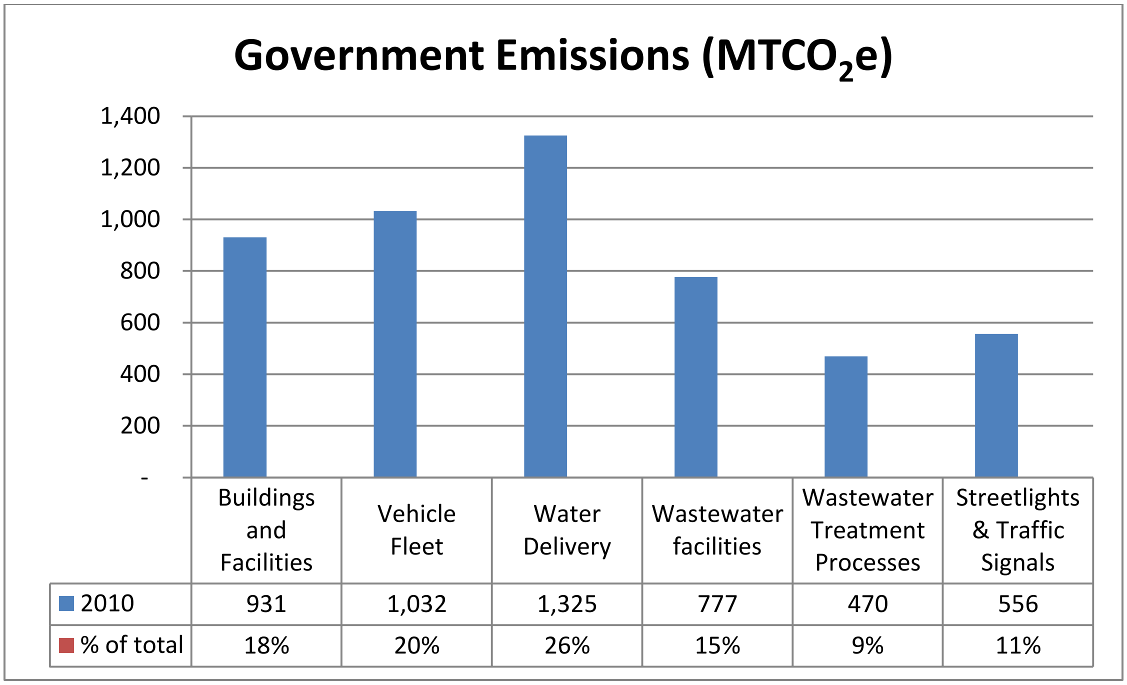
IV. Government Results

The emissions analyzed in the Oswego government operations inventory can be aggregated in several ways, as discussed above in the methodology section. Often, an across the board aggregation does not effectively illustrate a carbon footprint; therefore, the City of Oswego emissions will be presented below in three formats: by sector, scope and source, in order to more usefully display emissions from government operations.

A. Emissions by Sector

The City's emissions span the sectors discussed above: buildings and facilities, vehicle fleet, wastewater treatment processes and facilities, street and traffic lights, and water delivery. The highest emitting sector is water delivery at 1,325 metric tons of carbon dioxide equivalent ($MTCO_2e$) and 26% of total emissions in 2010. Following as the second highest emitting sector for government operations is the vehicle fleet with 1,032 $MTCO_2e$, which comprised 20% of total emissions in 2010 (see Figure 8 Government Emissions by Sector).

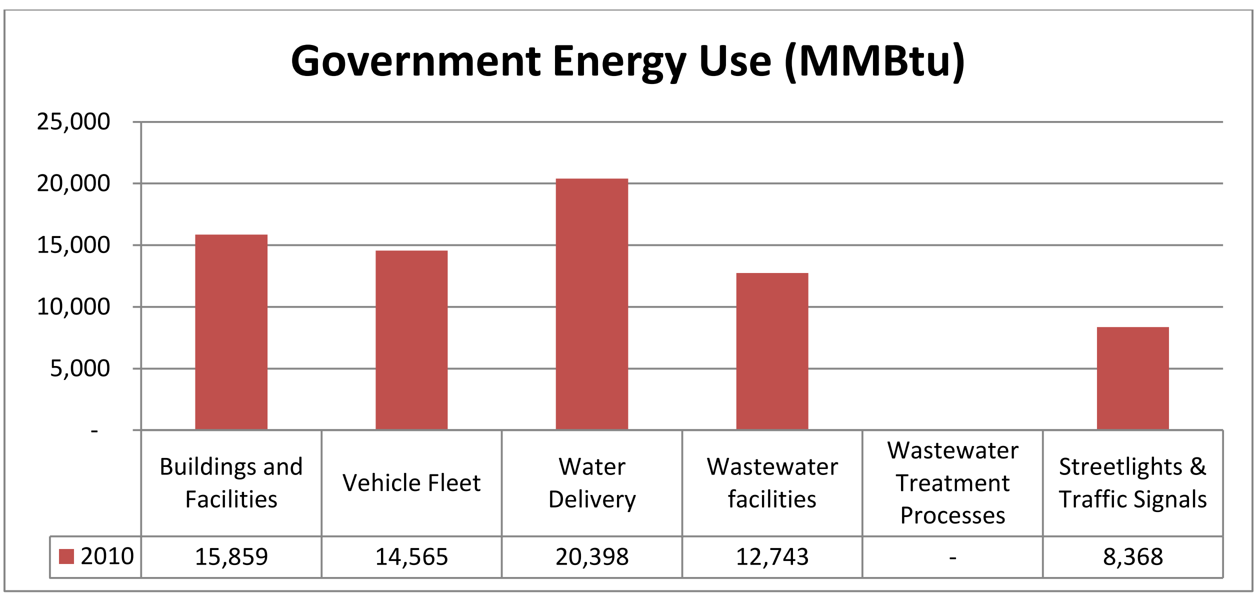
The buildings and facilities sector includes all facilities, except those used in water delivery services and the two City wastewater facilities. This distinction ensures that there is not double-counting of the energy use in all facilities, and that the emissions within each sector can be tracked as transparently as possible.



	Buildings and Facilities	Vehicle Fleet	Water Delivery	Wastewater facilities	Wastewater Treatment Processes	Streetlights & Traffic Signals
2010	931	1,032	1,325	777	470	556
% of total	18%	20%	26%	15%	9%	11%

Figure 8 Government Emissions by Sector

Government operations energy use is also highest in the water delivery sector, followed by the buildings and facilities sector (Figure 9 Government Energy Use). Wastewater processes report no energy use due to the fact that these are the process and fugitive emissions sectors, and the wastewater treatment plant facilities are accounted for separately.



	Buildings and Facilities	Vehicle Fleet	Water Delivery	Wastewater facilities	Wastewater Treatment Processes	Streetlights & Traffic Signals
2010	15,859	14,565	20,398	12,743	-	8,368

Figure 9 Government Energy Use

B. Emissions by Scope

As discussed in the methodology section of this report, it is important to consider local government emissions in terms of operational control, which is done through the scope distinction. Table 5 Government Emissions by Scope, outlines emissions by scope for Oswego. The City did not include optional scope 3 sources in this analysis, which will be an area for ongoing improvement moving forward. Additionally, it will be important to consider sources of energy generation (scope 1) within the City boundary, and any changes in government operational influence over these sources, in the future. Currently, Niagara Mohawk and Oswego Harbor Power generate electricity within the city boundary, but the city has no operational control or influence over these facilities.

The emissions by scope will enable a local government to determine areas of emissions-generating activity occurring within its operational boundary. The scope distinction will also show the sources of consumption leading to emissions for government operations.

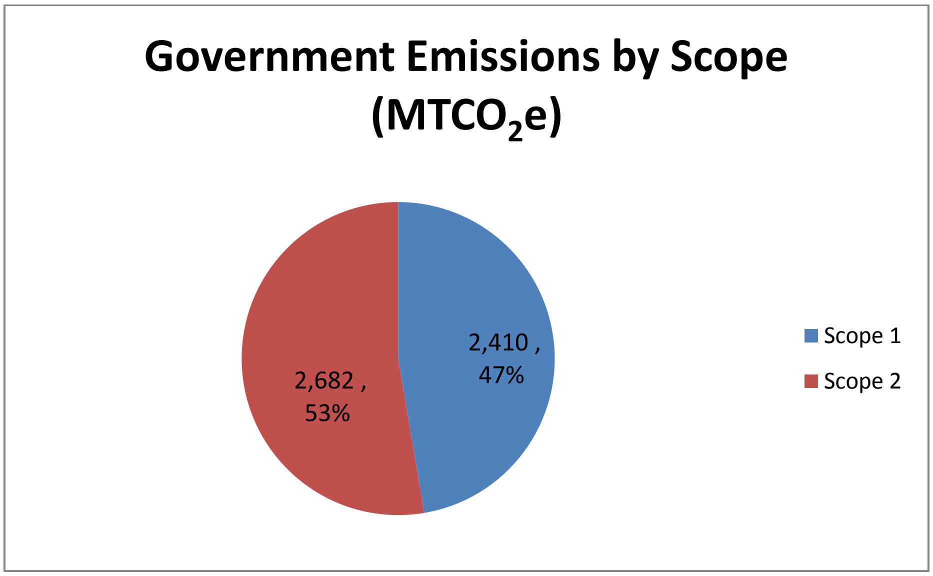


Figure 10 Government Emissions by Scope

Scope	Emissions ($MTCO_2e$)	Sectors
Scope 1 (direct)	2,410	Vehicle Fleet, Wastewater Treatment processes, Buildings & Facilities (fuel use), Water Delivery (fuel use)
Scope 2 (indirect)	2,682	Buildings & Facilities (electricity), Water Delivery (electricity), Lighting, Wastewater Facilities

Table 5 Government Emissions by Scope

C. Emissions by Source

The largest source of emissions for the City of Oswego is electricity use at 2,682 MTCO2e, and 53% of total government operations emissions. In terms of electricity generation, and in addition to the Niagara Mohawk steam station and Oswego Harbor Power facilities discussed above, the City owns a hydropower plant located on High Dam at the edge of the city boundary, and Erie Boulevard Hydropower LP owns the Varick hydro station, which is also located in the city. The combined annual generation capacity of these stations is approximately 20 megawatts.[11] The electricity generated at these plants is contracted to National Grid and does not directly power the city's operations, but it is important to note that these generation sources affect the power supply mix. The increased use of renewable energy by the City would decrease the carbon footprint of the buildings and facilities sector, and reduce the emissions associated with electricity. Under the framework of local government operational control and significant influence, the city-owned hydropower station is an in-boundary source for this inventory analysis; however, hydropower electricity generation is considered a renewable source and does not have a quantifiable carbon footprint within the scope of this analysis (aside from electricity used in pumping or conveyance processes related to High Dam, which is included in the water delivery sector analysis).

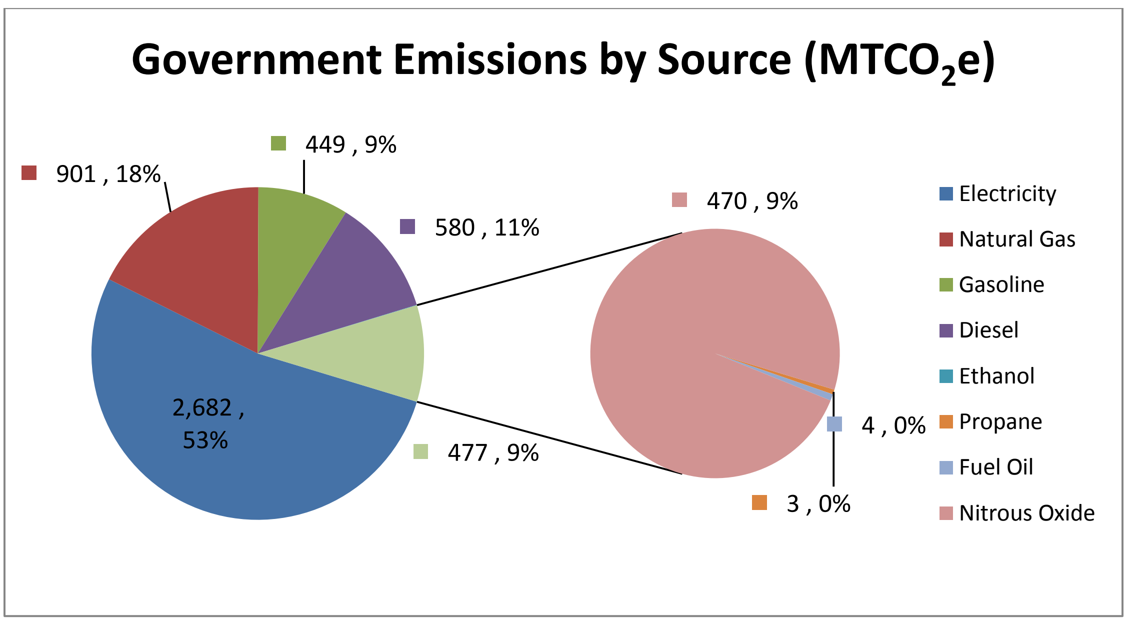


Figure 11 Government Emissions by Source

V. Community Results

The sectors assessed in the Oswego community analysis include residential, commercial and industrial energy use, transportation, and waste. These sources utilized data from a number of community sources and reports; for instance, the waste data was sourced from the Oswego County Waste to Energy Facility

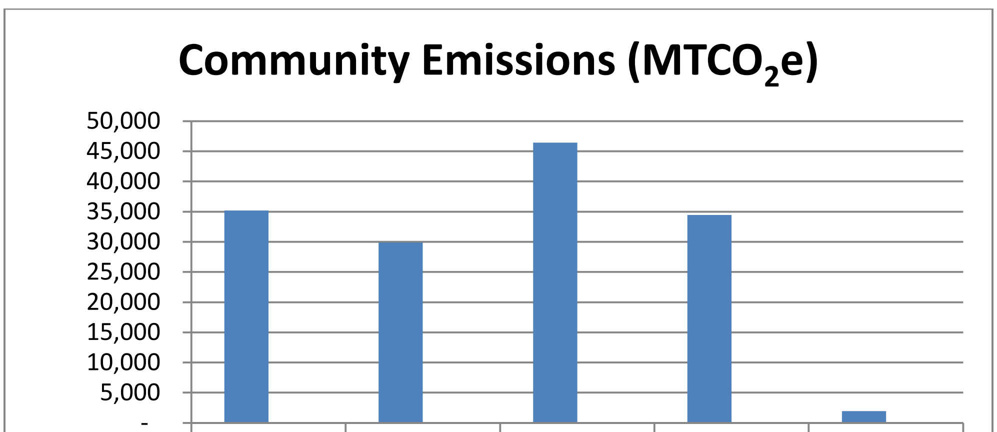
[11] Energy Information Agency (EIA). 2012. Form 923 and Form 860 Site reports for Varick and High Dam Hydro Stations.

and the energy use data came from the National Grid sources used for the regional greenhouse gas inventory for five counties.

As previously noted, the inventory analysis was conducted using the framework of local government significant influence, where assessed sources make up those that the City of Oswego can impact through mitigation efforts. All community sectors are comprised of community-wide emissions-generating activities, whether this is considered in terms of energy use, waste disposal, or vehicle miles travelled. Therefore, these are areas that can be impacted by local government mitigation efforts, but to a lesser extent than government operations emissions sources. The community analysis component of Oswego's inventory may contribute to the ability of the government to work with community partners to achieve mutual GHG reduction goals.

A. Emissions by Sector

Oswego community emissions totaled 147,926 metric tons of carbon dioxide equivalent ($MTCO_2e$) in 2010. The industrial energy use sector generated the highest emissions for the Oswego community, at 46,434 $MTCO_2e$ in 2010, or 31% of total emissions. The residential energy use sector followed at 35,172 $MTCO_2e$, or 24% of total community emissions in 2010, and the transportation, commercial energy use and waste sectors comprised 23%, 20% and 1%, respectively, of the remaining emissions (see Figure 12 Community Emissions by Sector).



	Residential Energy	Commercial Energy	Industrial Energy	Transportat ion	Waste
2010	35,172	29,904	46,434	34,463	1,953
% of total	24%	20%	31%	23%	1%

Figure 12 Community Emissions by Sector

Community energy use was highest in the industrial sector of the 2010 community inventory (823,702 MMBtu). This was followed by the energy used in the residential and commercial sectors, respectively (see Figure 13 Community Energy Use). Waste is sent to the Oswego Waste to Energy Facility located just outside the City, where it is combusted and used to send power back to the grid. Waste is not a sector that contributes energy use to the footprint of the City's operations.

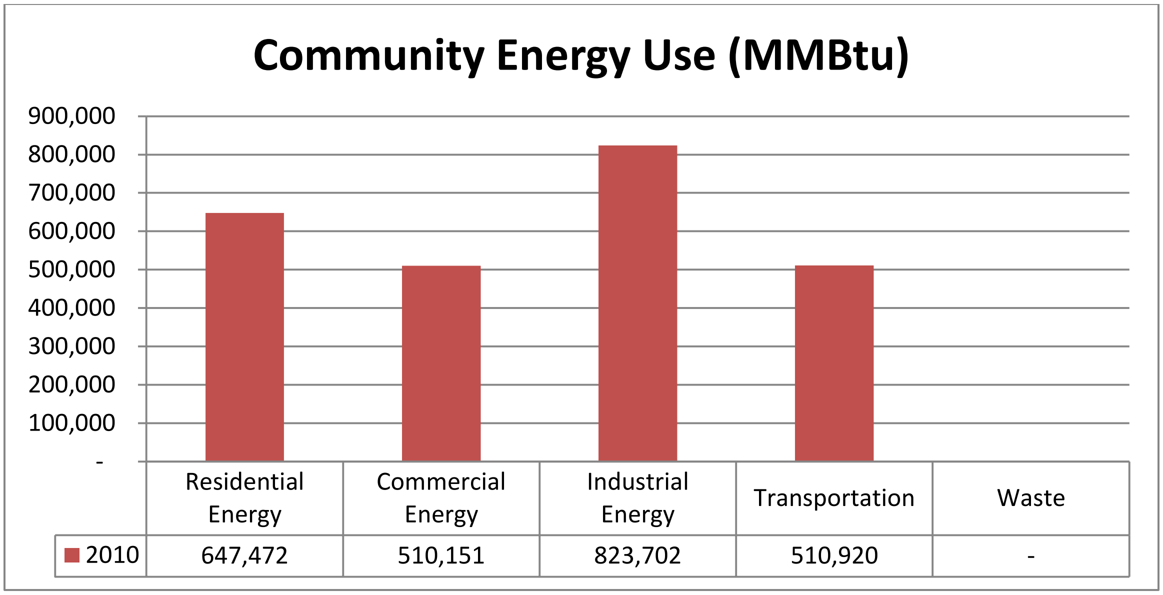


Figure 13 Community Energy Use

B. Emissions by Source

Considering emissions by source, the largest contributor is the natural gas used in the three energy use sectors, which comprises 75,302 MTCO2e or 51% of total emissions in 2010. Gasoline use by vehicles traveling through the community follows at 28,042 MTCO2e, which is 19% of total emissions. Various heating fuels were also small sources of emissions, namely fuel oil (5%), stationary LPG (1.6%), and wood (0.2%). Ethanol fuel is blended with gasoline and serves primarily as a biogenic source of emissions.[12]

The waste emission sources in the analysis include components of the Oswego waste stream, which were assumed to be comparable to the composition defaults utilized by the Onondaga County Resource Recovery Agency (OCRRA): food waste, paper products, plant debris, wood or textiles, and all other waste.

C. Information Items

Marine emissions in the Oswego community comprise a community-wide activity, which does not fall under the local government significant influence framework utilized for this analysis. However, marine emissions are a significant source for Oswego (53,895 $MTCO_2e$)[13], and one that defines its identity as a coastal City. It is important to include these emissions as an information item in order to establish a

[12] 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 (source: ICLEI Local Government Operations Protocol).

[13] The non-commercial marine vessel emission estimate was sourced from state-wide Department of Environmental Conservation (DEC) data tracked by county using the EPA's NONROAD model outputs by type of off-road equipment. Commercial marine vessel emissions were estimated based on carbon monoxide data from the 2008 National Emissions Inventory: http://www.epa.gov/ttnchie1/net/2008inventory.html.

baseline for future planning efforts and potential mitigation measures. Community partnerships could result in the City's increased ability to mitigate emissions from marine vessels. Furthermore, planning and outreach efforts must engage all stakeholders, involving the community members who participate in recreational activities or who have the ability to leverage resources to achieve emissions reduction goals. Information item emissions, like other sources, are best assessed in comparison to a baseline. Capturing this sector in the baseline analysis and then evaluating emissions from marine vessels in future analyses will provide a point of comparison and the ability to measure progress in achieving reduction targets over time.

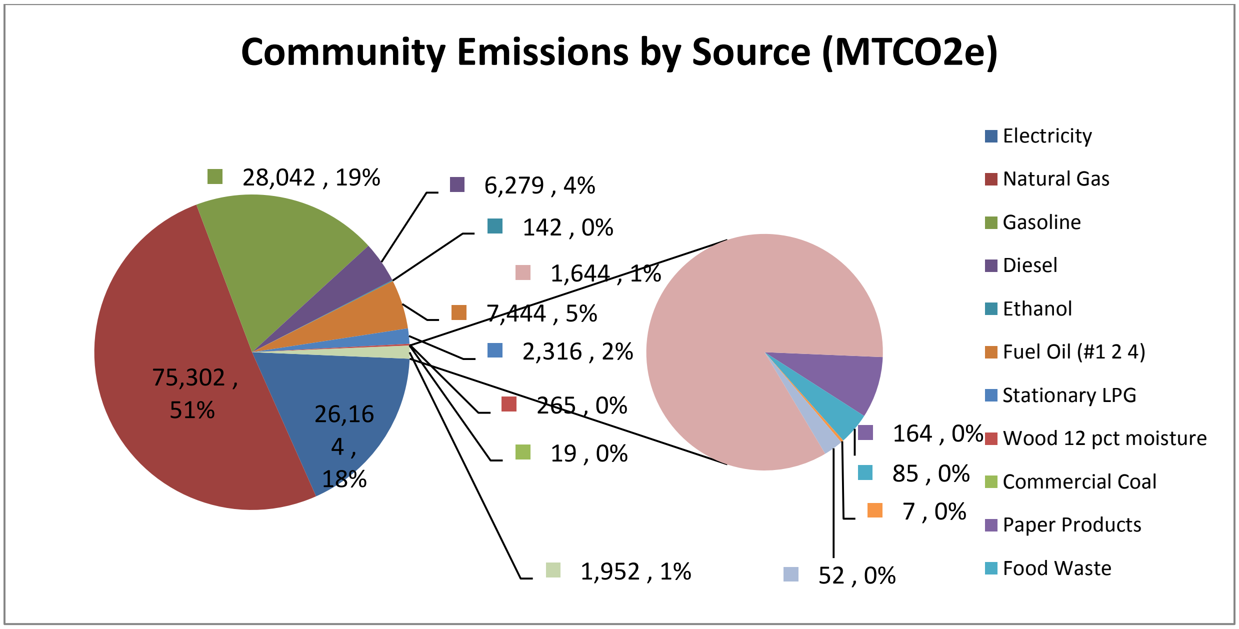


Figure 14 Community Emissions by Source

While the emissions illustrated in Figure 14 Community Emissions by Source necessarily reflect a whole, meaning 100%, it is important to consider, as stated previously in this report, that the City's emissions are not all contained in the sources covered under this analysis. There are other emission sources that could be included and should be considered, if possible, in the future. This graphical representation is meant to align with the boundary and scope of the current analysis and therefore must not be considered all-inclusive.

VI. Emission Forecast

A. Government Operations Forecast

This forecast is based on a business-as-usual scenario, utilizing 2010 Census population data for the single-rate projection. Population data is used due to the fact that it is consistently measured and can be a useful predictor of emissions growth (or decline) as a result of the association between population and demand for municipal services. Additionally, population and the number of households in the City can be used as indicators of emissions for comparison purposes (e.g., emissions per capita). The population for the City of Oswego shows a 1.05% growth rate over ten years (2000-2010 Census data), equating to an annual average rate of change of 0.105%. This annual rate was utilized to generate 2020 emissions estimates for the government operations forecast through a simple compounding estimation method ($FV=PV(1+i)^N$). The forecast year of 2020 was selected due to the 10-year timeframe between the inventory year of 2010 and alignment with assessments conducted using the same time frame (e.g., the Census or American Community Survey).

Government emissions in 2020 are projected to total 5,145 $MTCO_2e$. As stated above, and given the linear growth function used, the percent change from sector to sector over the ten-year timeframe is uniformly 1.05%.

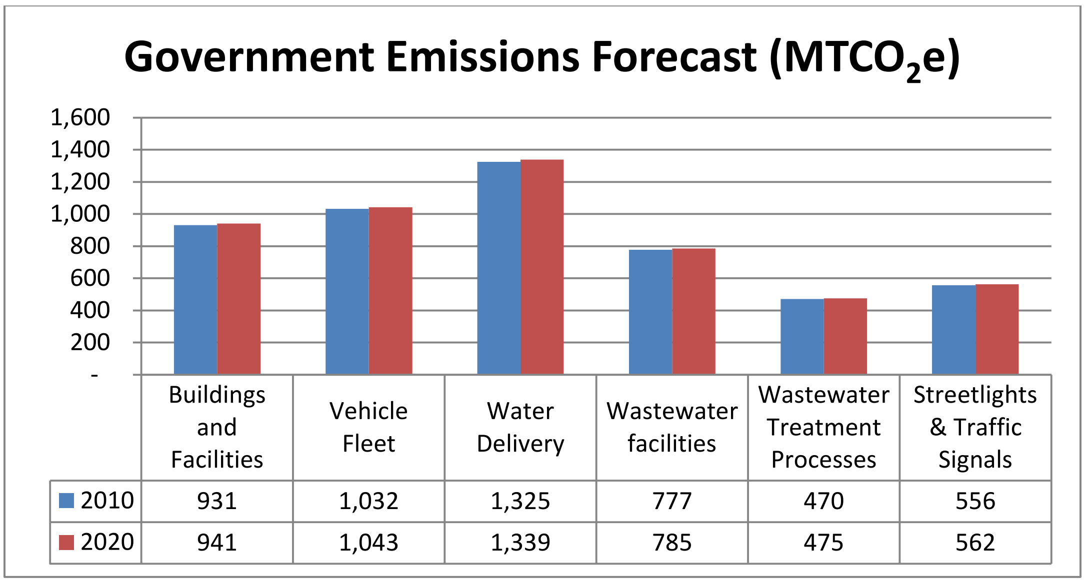


Figure 15 Government Forecast

B. Community Forecast

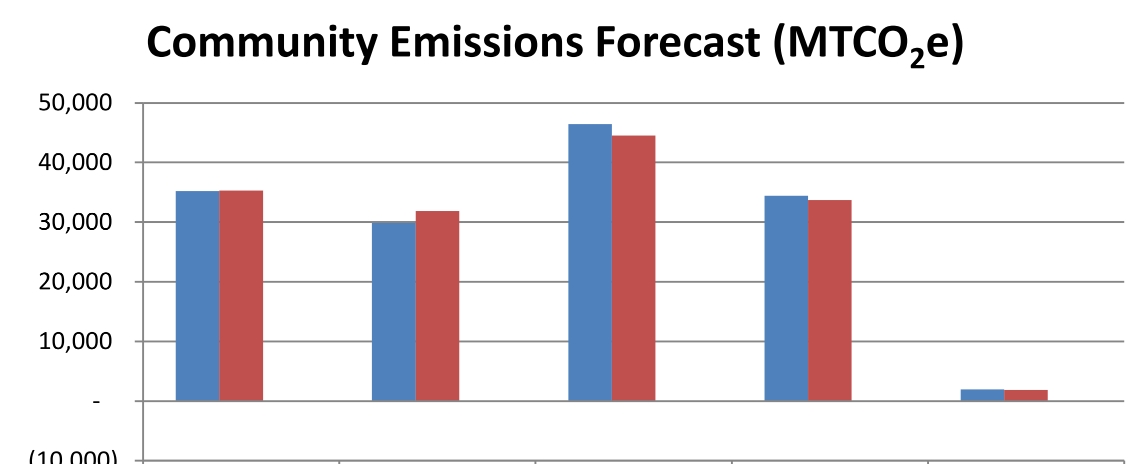
The community forecast utilizes several sources of projections, in an effort to create a dynamic forecast, given the uncertainty of estimating emissions over broad sectors, and given the potential for various factors to influence emissions over time (regulation, development patterns, shifts in energy supply, etc.).

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 6 NYS Energy Plan Demand Rates

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

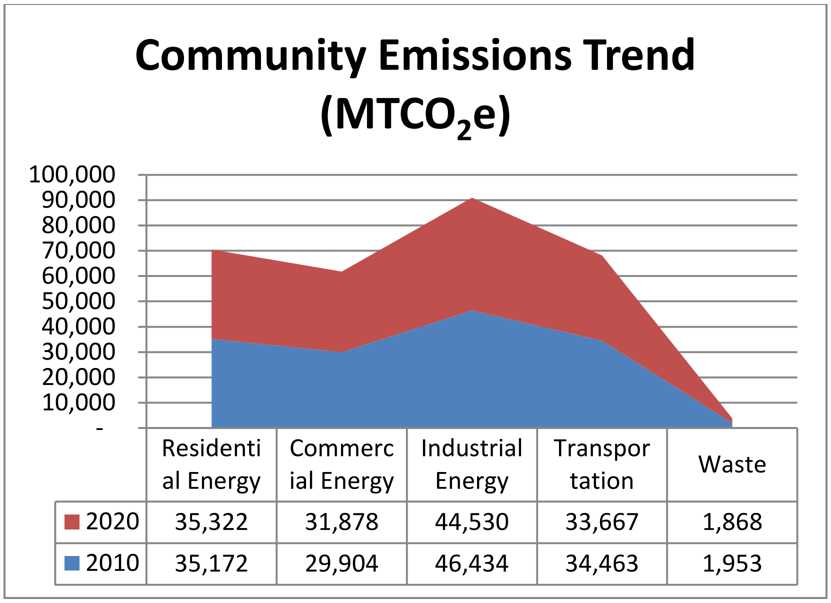
Table 7 EIA Annual Energy Outlook Projections



	Residential Energy	Commercial Energy	Industrial Energy	Transportation	Waste
2010	35,172	29,904	46,434	34,463	1,953
2020	35,322	31,878	44,530	33,667	1,868
% change	0.4%	6.6%	-4.1%	-2.3%	-4.4%

Figure 16 Community Forecast

Community emissions are projected to total 147,265 $MTCO_2e$ in 2020, which equates to a 0.45% overall decline over the ten-year forecast timeframe. The largest change is projected to occur in the commercial energy use sector, which increases 6.6% by 2020. The overall decline in emissions may be reflective of expected declines in energy use and fuel consumption due to greater mechanical efficiency, more stringent performance standards (e.g., fuel economy standards for vehicles), and broader implementation of energy conservation measures.



	Residential Energy	Commercial Energy	Industrial Energy	Transportation	Waste
2020	35,322	31,878	44,530	33,667	1,868
2010	35,172	29,904	46,434	34,463	1,953

Figure 17 Community Emissions Trend

VII. Conclusion

The City of Oswego government operations emitted 5,091 $MTCO_2e$ in 2010. The greater Oswego community footprint totaled 147,926 $MTCO_2e$. Moving forward, additional inventories will allow for comparison against this baseline analysis, and will enable the City to see trends in specific emissions sources and sectors.

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 and shifts in development patterns. Therefore, this inventory will require periodic updates to ensure the most accurate estimates for the City carbon footprint.

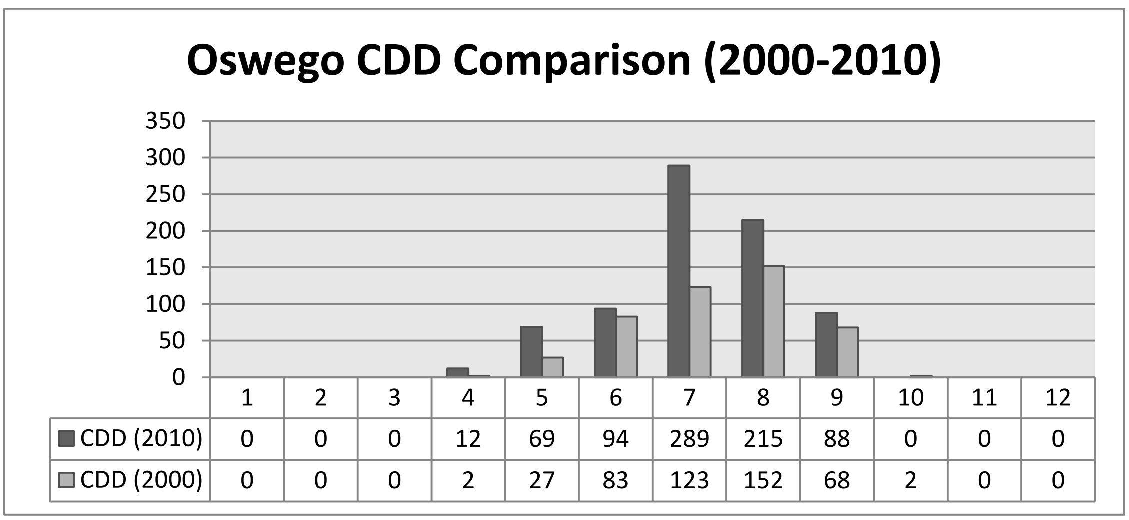
The City has already undertaken a number of sustainability initiatives and greenhouse gas reduction efforts. This inventory represents a foundational step in completing the climate action planning process, which will lead to targeting additional areas for reduction and efficiency. Institutionalizing this process will enable the city to update the baseline GHG analysis more easily.

VIII. Appendices

Appendix 1. Oswego Climate Data

The City of Oswego heating degree and cooling degree days data from 2000 and 2010 is shown in Figure 18 Oswego CDD Comparison and Figure 19 Oswego HDD Comparison.[14] This comparison is helpful in understanding variation in HDDs and CDDs, and shows a 68% increase in CDDs and a 7% decrease in HDDs over the ten-year timeframe. This suggests that hotter temperatures are increasing the need for cooling in the summer months and that the need for heating in winter months is decreasing. However, this is just one indicator of a trend, and must be considered in light of other factors before determining correlation with changes in emissions, such as changes in the type of fuel and energy consumed in these months and years.

Temperature and precipitation data show the variations between seasons regarding the amount of precipitation that falls and the mean temperatures in individual months. This data provides further context for the emissions in a particular year given that temperature affects the amount of energy used (HDDs and CDDs), and precipitation can illustrate variation from year to year. An example of this, in terms of snowfall change, is included in Table 9 Snowfall comparison (2000-2010).



	1	2	3	4	5	6	7	8	9	10	11	12
CDD (2010)	0	0	0	12	69	94	289	215	88	0	0	0
CDD (2000)	0	0	0	2	27	83	123	152	68	2	0	0

Figure 18 Oswego CDD Comparison

[14] NOAA. 2012. Climactic Data Center. Oswego, NY Weather Station. http://www.ncdc.noaa.gov/cdo-web/#t=secondTabLink

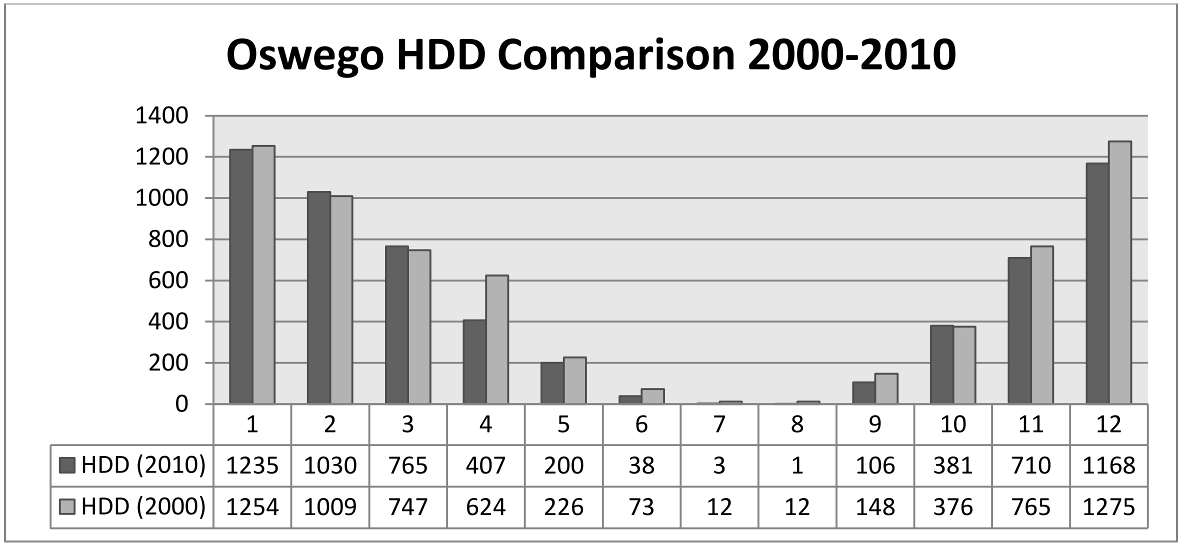


Figure 19 Oswego HDD Comparison

HDD and CDD % changes (2000-2010)	January (1)	February (2)	March (3)	April (4)	May (5)	June (6)	July (7)	August (8)	September (9)	October (10)	November (11)	December (12)
HDD (2000)	1254	1009	747	624	226	73	12	12	148	376	765	1275
HDD (2010)	1235	1030	765	407	200	38	3	1	106	381	710	1168
% change	-2%	2%	2%	-35%	-12%	-48%	-75%	-92%	-28%	1%	-7%	-8%
CDD (2000)	0	0	0	2	27	83	123	152	68	2	0	0
CDD (2010)	0	0	0	12	69	94	289	215	88	0	0	0
% change	0%	0%	0%	500 %	156%	13%	135%	41%	29%	-100%	0%	0%

Table 8 HDD and CDD comparison (2000-2010)

Snowfall % changes (2000-2010)	January (1)	February (2)	March (3)	April (4)	May (5)	June (6)	July (7)	August (8)	September (9)	October (10)	November (11)	December (12)
2000 Snowfall	18.5	27.3	9.1	6.5	0	0	0	0	0	6	20.4	75.1
2010 Snowfall	50.5	38.6	0	0	0	0	0	0	0	0	7	36.5
% change	173%	41%	-100%	-100%	0%	0%	0%	0%	0%	-100%	-66%	-51%

Table 9 Snowfall comparison (2000-2010)

Appendix 2. ICLEI U.S. Community Protocol Compliance Reporting

Emissions Report Summary Table

Include estimates of emissions associated with the 5 basic emissions generating activities

IE- Included Elsewhere
NE- Not estimated
NA- not applicable
NO- not occurring

SI- Local government significant influence
CA- community-wide activities

Emissions Type	Source or Activity	Activity Data	Emissions Factor & Source	Accounting Method	Include	Excluded (IE, NA, NO, NE)	Emissions (MTCO2e)	Notes/Explanations/Comments
Built Environment								
Use of fuel in residential stationary combustion (nat. gas- MMBtu)	source and activity	473,937	53.02 kg CO_2/MMBtu; 1 g CH4/MMBtu; 0.1 g N2O/MMBtu; EPA Mandatory Reporting Rule (MRR)		CA		25,193	Estimate from National Grid (which is the only utility provider in the City of Oswego)
Use of fuel in residential stationary combustion (fuel oil, wood, LPG- MMBtu)	source and activity	43,205	Averaged distillate fuel oil #1, 2,4 EF= 74.5 kg CO_2/MMBtu; LPG= 62.98 kg CO_2/MMBtu; EPA Mandatory Reporting Rule (MRR)	allocated from Oswego County totals by ratio of municipality fuel use and households	CA		1,341	Derived fuel use from 2010 5-year estimated American Community Survey (ACS) data and regional GHG inventory analysis
Use of fuel in commercial stationary combustion (nat. gas- MMBtu)	source and activity	300,115	53.02 kg CO_2/MMBtu; 1 g CH4/MMBtu; 0.1 g N2O/MMBtu; EPA Mandatory Reporting Rule (MRR)		CA		15,953	
Use of commercial stationary combustion (fuel- MMBtu)	source and activity	81,540	Coal/coke mixed commercial sector= 93.4 kg CO_2/MMBtu; Averaged distillate fuel oil #1, 2,4 EFs= 74.5 kg CO_2/MMBtu; LPG= 62.98 kg CO_2/MMBtu; EPA Mandatory Reporting Rule (MRR)		CA		5,327	
Industrial Stationary combustion sources (nat. gas- MMBtu)	source and activity	554,917	53.02 kg CO_2/MMBtu; 1 g CH4/MMBtu; 0.1 g N2O/MMBtu; EPA Mandatory Reporting Rule (MRR)		CA		29,451	
Industrial Stationary combustion sources (fuel- MMBtu)	source and activity	*only emissions data*	EPA GHGRP		CA		3,376	This is the aggregate emissions total reported through the Environmental Protection Agency's Greenhouse Gas Reporting Program for the City of Oswego's industrial stationary fuel use (absent natural gas)
Electricity								
Power generation	source					NE		There is an NRG facility within the city boundary, but it is out of the sphere of influence for the local government
use of electricity by the community (MWh)	activity	115,287	eGrid 2009 subregion factors (EPA)	Collected data from utility providers and input into CACP	CA		26,164	Includes residential, commercial and industrial consumption (National Grid data)
District Heating/Cooling								
District Heating/Cooling facilities in community	source					NE		
Use of district heating/cooling by community	activity					NE		
Industrial process emissions in the community	source					NE		
Refrigerant leakage in the community	source					NE		
Transportation and other Mobile Sources								
On-road passenger vehicles								
on-road passenger vehicles operating within the community (VMT)	source	64,713,962	CACP (Version 3.0) & EPA MRR emission factors for gasoline and diesel (varies by vehicle class for N2O & CH4): LGOP gasoline EF=8.78 kgCO_2/gal; diesel EF= 10.21 kgCO_2/gal	Appendix D: TR.1.B Alternative Method for Estimating In-boundary Passenger Vehicle Emissions; Input VMT estimate into CACP community sector tab	CA		34,463	Estimation method used the NYSDOT Traffic Data Viewer Tool, in conjunction with in-house GIS analysis to determine what portion of AADT and road length existed within the city boundary. The emissions estimate includes all vehicle traffic counted in NYSDOT AADT metrics (no vehicle descriptive data was available; CACP utilizes default fuel allocations: 93% gasoline and 7% diesel, which were adjusted to account for the 10% NYS ethanol blend: 83% gasoline, 10% ethanol and 7% diesel); these totals are distributed to alt method vehicle categories in the software, with the assumption that diesel is used by HDV and gasoline is used by LDV and passenger vehicles.
on-road passenger vehicle travel associated with community land uses (VMT)	activity					NE		Data from the Syracuse Metropolitan Transportation Council (our only MPO) travel demand model only covers 1 county in the CNY region, with partial coverage of two other counties; therefore, the model is not able to provide data for all municipalities or on trip origin or destination, or to exclude trans-boundary trips from VMT estimates.
On-road freight vehicles								
on-road freight and service vehicles operating within the community boundary	source					IE		As stated above, these vehicles operate on roads included in the AADT counts and are therefore assumed to be included in this estimation method; the emissions estimate above includes CACP default metrics for heavy duty vehicles, as they travel many of the roads measured within the city boundary
on-road freight and service vehicle travel associated with community land uses	activity					IE		As stated above, these vehicles operate on roads included in the AADT counts and are therefore assumed to be included in this estimation method; the emissions estimate above includes CACP default metrics for heavy duty vehicles, as they travel many of the roads measured within the city boundary
On-road transit vehicles operating within the community boundary	source					IE		As stated above, these vehicles operate on roads included in the AADT counts and are therefore assumed to be included in this estimation method; the emissions estimate above includes CACP default metrics for transit vehicles (in the case of Oswego, CENTRO buses specifically), as they travel many of the roads measured within the city boundary
Transit Rail								
transit rail vehicles operating within the community boundary	source					NE		
use of transit rail travel by community	activity					NE		
Inter-city passenger rail vehicles operating within the community boundary	source					NE		
Freight rail vehicles operating within the community boundary	source					NE		
Marine								
Marine vessels operating within community boundary	source	only emissions data	Non-commercial vessel data is from NYSDEC NONROAD model reporting by county & commercial vessel data is from the 2008 National Emissions Inventory	This data was provided by the DEC in carbon emissions based on fuel sales/taxes	CA		53,895	Oswego County has the highest community marine emissions in the CNY region, given it's location on the water and the international port located within the boundary. This source is included as an information item in the inventory for planning purposes, and is sourced from the CNY (5-county regional GHG inventory municipal allocation)
use of ferries by community	activity					NE		
Off-road surface vehicles and other mobile equipment operating within community boundary	source					NE		
Use of air travel by the community	activity					NE		

Solid Waste								
Solid Waste								
Operation of solid waste disposal facilities in community	source					NA		Assumed (and was advised that) all city-generated MSW is sent to the Oswego County waste-to-energy facility
generation and disposal of solid waste by the community	source and activity	Estimated tonnage generated by community= 7,963; Total MSW generated by county (in 2010)= 61,723	Utilized the CACP 3.0 waste sector tab for the community analysis; entered estimated tonnage for City residents, selected the controlled incineration disposal method, and entered NYS DEC waste composition estimates *(source: 2008 Beyond Waste Report)*	Process emissions associated with waste incineration at Waste to Energy Facility located outside the City boundary	CA		1,953	Solid waste tonnage for residential households in the City community were assumed to total approximately 1.1 tons per year, on average, per household (source: Oswego Waste-to-Energy facility); this assumption was used to allocate tonnage processed at the County WTE plant to Oswego households in 2010. This estimation method is employed by the WTE as part of their pricing strategy as well.
Water and Wastewater								
Potable Water- Energy Use								
Operation of water delivery facilities in the community	source	kWh= 5,295,044; therms= 23,265	CACP 3.0 eGrid 2009 electricity emission factors; and natural gas emission factors= 53.02 kg CO2/MMBtu; 1 g CH4/MMBtu; 0.1 g N2O/MMBtu		SI	IE	1,325	The energy associated with the operation of water delivery systems and infrastructure, as well as the use of water by the community, is captured in the electricity and natural gas consumption in the Built Environment section above, but the emissions estimate is also included here because it falls under the frame of local government significant influence
Use of energy associated with use of potable water by the community	activity				CA			
Use of energy associated with generation of wastewater by the community	activity	kWh= 2,148,833; therms= 53,541	CACP 3.0 eGrid 2009 electricity emission factors; and natural gas emission factors=53.02 kg CO2/MMBtu; 1 g CH4/MMBtu; 0.1 g N2O/MMBtu		SI	IE	777	The energy used by two treatment facilities to handle wastewater generated by the community is captured in the Built Environment section above; however, the emissions total for this sector is included here as well, given that this is an activity under the frame of local government significant influence
Centralized Wastewater Systems- Process Emissions								
Process emissions from operation of wastewater treatment facilities located in community	source	Westside WWTP= 0.81 MTN2O; Eastside WWTP= 0.71 MTN2O	Method WW.8= EF without nitrification or denitrification= 3.2 g N_2O/person equivalent/year; Method WW.12a= EF for stream/river discharge= 0.005 kg N_2O-N/kg sewage-N discharged	Appendix F: Methods for Conventional Aerobic WWT Systems WW.8 and WW.12a	SI		470	The City of Oswego operates two WWTPs that serve the broader community (a total of approximately 18,700 customers); these facilities practice conventional treatment without nitrification or denitrification processes.
process emissions associated with generation of wastewater by community	activity					NA		The wastewater generated by the community is treated locally and not sent to a regional facility
Use of septic systems in community	source and activity					NE		No data available
Agriculture								
Domesticated animal production	source					NE		Limited agricultural sources in this community
Manure decomposition and treatment	source					NE		
Upstream Impacts of Community-wide Activities								
Upstream impacts of fuels used in stationary applications by community	activity					NE		Not included in scope of analysis due to limited data availability
upstream and transmissions and distribution impacts of purchased electricity used by the community	activity					NE		
upstream impacts of fuels used for transportation in trips associated with the community	activity					NE		
upstream impacts of fuels used by water and wastewater facilities for water used and wastewater generated within the community boundary	activity					NE		
Upstream impacts of select materials (concrete, food, paper, carpets, etc.) used by the whole community (additional community-wide flows of goods & services will create significant double counting issues)	activity					NE		
Independent Consumption-Based Accounting								
Household consumption (e.g., gas & electricity, transportation, and the purchase of all other food, goods and services by all households in the community)	activity					NE		This analysis focused on the sources under local government significant influence, rather than consumption-based accounting
Government consumption (e.g., gas & electricity, transportation, and the purchase of all other food, goods and services by all governments in the community)	activity					NE		
Lifecycle emissions of community businesses (e.g., gas & electricity, transportation, and the purchase of all other food, goods and services by all businesses in the community)	activity					NE		

Appendix 3. Estimation Method for Wastewater Treatment Process Emissions

The ICLEI U.S. Community Protocol was used to estimate the wastewater treatment plant process emissions for Oswego. The City has two plants, which serve different populations, and these populations comprise several communities in and outside of the city boundary. The City has operational control of both plants, however, which is why they are included in the government operations analysis. The methodology employed was outlined in the wastewater treatment appendix to the protocol for centralized treatment systems, under the reporting framework of local government significant influence. The fourth ICLEI WWTP decision tree was utilized to identify the appropriate calculation methods. Given that the facilities do not use anaerobic digestion, do not incinerate solids, and do not practice nitrification or denitrification, the decision tree directed the use of methods WW.8 and WW.12a (specifically, WW.8 Process Nitrous Oxide Emissions from Wastewater Treatment Plants without Nitrification or Denitrification and WW.12 Fugitive Nitrous Oxide Emissions from Effluent Discharge).[15]

Wastewater Treatment Plant (WWTP) Info.				
Eastside WWTP	**Activity Data (2010)**	**Calculation** (Comm. Protocol Methods WW. 8 and 12a)	**Emissions (MTCO2e)**	
Back-up generator (diesel fuel capacity of 600 gal)	consumes 200 gal/yr due to weekly 20-minute testing	*Annual Process N2O emissions = ((P × Find-com) × EF× 10-6) × GWP*		
Population served (broader community)	8700	0.0348	10.79	*Eastside*
Online in 1972; upgrades in 1995				
Westside WWTP				
Back-up generator (diesel fuel capacity of 275 gal)	consumes 200 gal/yr due to weekly 20-minute testing			
Population served (broader community)	10,000	0.04	12.40	*Westside*
Online in 1979; upgrades currently ongoing				
General Data (common between both plants)		*Annual Fugitive N2O emissions= ((P × Find-com) × (Total N load - N uptake x BOD5 load) × EF effluent × 44/28 × (1 – Fplant nit/denite) × 365.25 × 10-3) × GWP*		
No nitrification/denitrification				
Activated sludge treatment used for secondary treatment; centrifuges spin water out of sludge and the remaining material is sent to Ontario Landfill	Approximately 1,000 tons of sludge, on average, sent from Eastside operations; 1,500 tons sent from Westside operations	0.671000123	208.01	*Eastside*
No septic owned or operated by city				
Two natural gas generators; exercised rarely	consumption data for utility energy is centralized in purchasing	0.771264509	239.09	*Westside*
		TOTAL WWTP N2O emissions (2010):	**470.29**	

Figure 20 Wastewater Treatment Emissions Calculation

[15] ICLEI. 2012. U.S. Community Protocol. Appendix F: Wastewater and Water Emission Activities and Sources. pg. 14

Appendix 4. 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 Oswego.[16] Internal GIS data was utilized to generate road lengths within the City 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, which was amended to include state-wide 10% ethanol content, totaling: 7% diesel, 83% gasoline and 10% ethanol) and vehicle class data to generate emissions estimates.

These VMT estimates are for main roads, due to the fact that the NYSDOT tracks traffic counts for main arteries only. Therefore, the VMT total does not represent all of the roads in the City 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 additional over or underestimations in the average daily traffic data when combined with the fact that not all roads are counted. Additionally, the counts do not distinguish between origin and destination; therefore, these counts represent all vehicle trips that begin, end, and travel through the City of Oswego.

The road lengths were originally presented in meters, so they were converted to miles before multiplying them by their respective AADT count to arrive at the daily VMT estimate. Table 10 Oswego VMT Estimate below shows the road lengths and traffic counts used from the NYSDOT and GIS data sources.

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

Community Transportation Data (2010)				
		1 mile=	*1609.34*	*meters*
Road Name	**DVMT (daily vehicle miles travelled)**	**Road length (miles)**	**Road Length in City Boundary (meters)**	**AADT* (annual average daily traffic)**
GEORGE ST	2262.864037	0.440245922	708.51	5140
CHERRY ST	868.684284	0.212029359	341.23	4097
E UTICA ST	4191.095902	0.179236877	288.45	23383
E TENTH ST	1278.463708	0.848913485	1366.19	1506
W SENECA ST	1363.544693	0.605212913	973.99	2253
NY48, WEST FIRST ST	7775.914004	1.570891718	2528.10	4950
GEORGE WASHINGT	2685.155521	0.348043489	560.12	7715
EAST CAYUGA ST	1012.175151	0.790144536	1271.61	1281
WEST FIFTH ST	125.491748	0.110177127	177.31	1139
NY48, WEST FIFTH ST	1039.376532	0.280004454	450.62	3712
E 4TH ST	1112.471064	0.471386044	758.62	2360
HILLSIDE AVE	1501.247349	0.438961213	706.44	3420
E THIRD ST	272.7854616	0.093259987	150.09	2925
ERIE ST	994.9672393	0.458299051	737.56	2171
NY104	11824.20265	0.609809316	981.39	19390
WEST FIRST ST	7781.642686	1.572049028	2529.96	4950
NY48, WEST UTICA ST	2891.621497	0.23005979	370.24	12569
JOHNSON RD	1326.910466	0.874693781	1407.68	1517
E SENECA ST	4066.557891	0.777990796	1252.05	5227
EAST SECOND ST	69.7198255	0.189972277	305.73	367
W SENECA ST	824.3957563	0.273250168	439.75	3017
WEST FIFTH ST	1041.741183	0.280641482	451.65	3712
E 4TH ST	142.5012037	0.190509631	306.59	748
WEST UTICA ST	2902.493017	0.230924737	371.64	12569
WEST UTICA ST	1560.17219	0.210748641	339.17	7403
NY104, E BRIDGE ST	11577.92694	0.569779869	916.97	20320
ST PAUL ST	152.6693503	0.282198429	454.15	541
WEST UTICA ST	3033.597332	0.732752979	1179.25	4140
NY481, E FIRST ST	2718.120406	0.280016525	450.64	9707
SHELDON AVE	907.268023	0.522619829	841.07	1736
E FIRST ST	378.7162426	0.100269061	161.37	3777
EAST SCHUYLER S	143.3438284	0.160699359	258.62	892
NY481, E RIVER RD	6741.672417	0.770124791	1239.39	8754
NY104	10751.04625	0.689744419	1110.03	15587
SYRACUSE AVE	1353.89507	0.618216927	994.92	2190
MITCHELL ST	576.3778307	0.751470444	1209.37	767
NY48, WEST FIRST ST	4552.962582	0.450030897	724.25	10117
ELLEN ST	336.9788299	0.460353593	740.87	732
WEST FIRST ST	1615.258544	0.350305475	563.76	4611
E FIRST ST	2724.868158	0.280711668	451.76	9707
NY104, W SENECA ST	11028.47153	1.199529207	1930.45	9194
MURRAY ST	815.8905219	0.450022351	724.24	1813
E UTICA ST	3951.409038	0.388688672	625.53	10166
EAST CAYUGA ST	134.8822587	0.050011961	80.49	2697
MURRAY ST	644.2396272	0.190041188	305.84	3390
ERIE ST	882.5684816	0.597946126	962.30	1476
LIBERTY ST	361.9752626	0.508392223	818.18	712
E CITY LINE ROA	1749.539825	0.479063479	770.98	3652
WEST FIRST ST	4549.34711	0.449673531	723.68	10117
NY481, E RIVER RD	18313.37201	1.440183392	2317.74	12716
WEST FIFTH ST	2660.187286	0.812270927	1307.22	3275
EAST SECOND ST	344.5711317	0.540080144	869.17	638
E SENECA ST	3294.774085	1.127189218	1814.03	2923
NY104, W BRIDGE ST	7838.676499	0.419809153	675.62	18672
CHURCH ST	366.293373	0.412028541	663.09	889
MUNN ST	630.5796666	1.002511394	1613.38	629
WEST FIRST ST	1624.954003	0.300305674	483.29	5411
MITCHELL ST	390.3972679	0.370747643	596.66	1053
EAST AVENUE	3656.943412	0.792403773	1275.25	4615
WEST FIFTH ST	1983.970669	0.650695529	1047.19	3049
EAST SCHUYLER S	556.2321162	0.572255264	920.95	972
UTICA ST BRIDGE	2463.321891	0.155788129	250.72	15812
EAST UTICA ST	575.0320259	0.036366812	58.53	15812
EAST SECOND ST	0	0.279997631	450.61	0
TOTAL DVMT	**177,299**	**32.53275204**		
ANNUAL VMT	**64,713,961.97**			

Table 10 Oswego VMT Estimate

Appendix 5. CACP Reports

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Government Greenhouse Gas Emissions in 2010
Report by Source

Scope 1 + Scope 2 + Scope 3

	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	434	6	14	436	0	6,556	245,052
Natural Gas	490	1	46	492	0	9,250	119,000
Propane	3	0	1	3	0	54	0
Subtotal	928	7	61	931	0	15,859	364,052
Streetlights & Traffic Signals Sector							
Electricity	554	7	18	556	0	8,368	758,601
Subtotal	554	7	18	556	0	8,368	758,601
Water Delivery Facilities Sector							
Electricity	1,196	16	38	1,202	0	18,072	620,091
Natural Gas	123	0	12	124	0	2,327	29,567
Subtotal	1,319	16	50	1,325	0	20,398	649,657
Wastewater Facilities Sector							
Electricity	485	7	15	488	0	7,334	272,560
Fuel Oil (#1 2 4)	4	0	1	4	0	55	0
Natural Gas	284	1	27	285	0	5,354	67,607
Nitrous Oxide	0	1,517	0	470	0	0	0
Subtotal	773	1,524	43	1,247	0	12,743	340,167
Vehicle Fleet Sector							
Diesel	580	2	2	580	0	7,843	144,121
Ethanol (E100)	0	6	5	2	32	467	0
Gasoline	439	31	25	449	0	6,254	127,294
Subtotal	1,019	38	32	1,032	32	14,565	271,416
Total	4,593	1,593	203	5,091	32	71,934	2,383,893

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

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Oswego

Government Greenhouse Gas Emissions in 2010

Scope Summary Report

Equivalent CO_2

	Scope 1 (tonnes)	Scope 2 (tonnes)	Scope 3 (tonnes)	Total (tonnes)
Buildings and Facilities	495	436	0	931
Streetlights & Traffic Signals	0	556	0	556
Water Delivery Facilities	124	1,202	0	1,325
Wastewater Facilities	759	488	0	1,247
Vehicle Fleet	1,032	0	0	1,032
Total	2,410	2,682	0	5,091

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

12/14/2012 Page 1

Oswego

Community Greenhouse Gas Emissions
Time Series Report

Scope 1 + Scope 2

Year	2010	2020
Residential		
eCO2 (tonnes)	35,061.5	35,209.4
Energy (MMBtu)	645,379.0	648,710.7
Commercial		
eCO2 (tonnes)	30,221.6	32,216.2
Energy (MMBtu)	516,119.1	550,404.3
Industrial		
eCO2 (tonnes)	41,522.2	39,951.6
Energy (MMBtu)	731,159.3	699,940.1
Transportation		
eCO2 (tonnes)	34,462.6	33,667.4
Energy (MMBtu)	510,920.3	499,001.3
Waste		
eCO2 (tonnes)	1,952.7	1,868.4
Total		
eCO2 (tonnes)	143,220.7	142,913.0
Energy (MMBtu)	2,403,577.7	2,398,056.4
Cost ($)	0.0	0.0

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

Community Greenhouse Gas Emissions in 2010
Report by Source

Scope 1 + Scope 2 + Scope 3

	CO_2 (tonnes)	N_2O (kg)	CH_4 (kg)	Equiv CO_2 (tonnes)	Bio CO_2 (tonnes)	Energy (MMBtu)
Residential Sector						
Electricity	8,486	114	271	8,527	0	128,237
Fuel Oil (#1 2 4)	574	6	84	577	0	7,761
Natural Gas	25,128	47	2,370	25,193	0	473,937
Stationary LPG	547	9	94	552	0	8,684
Wood 12 pct moisture	0	112	8,456	212	2,510	26,759
Subtotal	34,735	289	11,275	35,062	2,510	645,379
Commercial Sector						
Commercial Coal	19	0	2	19	0	198
Electricity	8,898	120	284	8,941	0	134,464
Fuel Oil (#1 2 4)	3,470	34	510	3,491	0	46,921
Natural Gas	15,912	30	1,501	15,953	0	300,115
Stationary LPG	1,748	30	302	1,764	0	27,760
Wood 12 pct moisture	0	28	2,105	53	625	6,661
Subtotal	30,048	242	4,703	30,222	625	516,119
Industrial Sector						
Electricity	8,654	116	276	8,696	0	130,771
Fuel Oil (#1 2 4)	3,363	33	132	3,376	0	45,471
Natural Gas	29,422	55	555	29,451	0	554,917
Subtotal	41,439	205	963	41,522	0	731,159
Transportation Sector						
Diesel	6,273	18	19	6,279	0	84,835
Ethanol (E100)	0	433	356	142	2,426	35,461
Gasoline	27,440	1,834	1,560	28,042	0	390,624
Subtotal	33,713	2,286	1,935	34,463	2,426	510,920
Waste Sector						
All Other Waste	0	0	78,274	1,644	0	
Food Waste	0	0	4,052	85	0	

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

Community Greenhouse Gas Emissions in 2010
Report by Source

Scope 1 + Scope 2 + Scope 3

	CO_2 (tonnes)	N_2O (kg)	CH_4 (kg)	Equiv CO_2 (tonnes)	Bio CO_2 (tonnes)	Energy (MMBtu)
Paper Products	0	0	7,827	164	0	
Plant Debris	0	0	333	7	0	
Wood or Textiles	0	0	2,498	52	0	
Subtotal	0	0	92,985	1,953	0	
Total	139,935	3,022	111,862	143,221	5,561	2,403,578

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

Community Greenhouse Gas Emissions in 2010
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	2,510	26,759
Subtotal	0	0	0	0	2,510	26,759
Commercial Sector						
Wood 12 pct moisture	0	0	0	0	625	6,661
Subtotal	0	0	0	0	625	6,661
Transportation Sector						
Ethanol (E100)	0	0	0	0	2,426	35,461
Subtotal	0	0	0	0	2,426	35,461
Total	0	0	0	0	5,561	68,882

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