Local Government and Community Greenhouse Gas Emissions Inventory
Baseline 2010

City of Cortland, New York
February 2013,
January 2014 updates

City of Cortland

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Executive Summary

The City of Cortland 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 in 2010. Conducting a greenhouse gas (GHG) inventory represents the first step in effective climate action planning. The 2012 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 4,706 metric tons of carbon dioxide equivalents ($MTCO_2e$). These emissions span five sectors, including buildings and facilities, streetlights and traffic signals, vehicle fleet, water delivery, and wastewater treatment. Community emissions, which include the government operations emissions, totaled 164,359 $MTCO_2e$ in 2010. This total represents five sectors, namely residential, commercial and industrial energy use, transportation, and waste.

The City of Cortland, 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)

Introduction

City of Cortland Overview

The City of Cortland is located in Cortland County, and is the largest metropolitan area in the county, with a population of 19,204 compared to a total county population of 49,336 in 2010 (see Table 1).[2] The employment hubs for the City include SUNY Cortland, the Cortland Regional Hospital and the City School District, which is illustrated in Table 2 with employment by NAICS sector.

Cortland is located along the Tioughnioga River, which lies in the Chesapeake Bay watershed, and is known as the "crown city" due to its geographical position among seven valleys in Cortland County.[3]

City of Cortland Snapshot[4]	
Land Area (square miles)	3.9
Occupied Households	6,819
Population	19,204
Population Density (population per square mile)	4,924
Municipal Employees	165

Table 1 City Demographics

Cortland Jobs by NAICS Industry Sector[5]	Count	Share
Accommodation and Food Services	1,216	15.2%
Administration & Support, Waste Management and Remediation	479	6.0%
Agriculture, Forestry, Fishing and Hunting	7	0.1%
Arts, Entertainment, and Recreation	37	0.5%
Construction	80	1.0%
Educational Services	1,222	15.3%
Finance and Insurance	207	2.6%
Health Care and Social Assistance	1,999	25.0%
Information	65	0.8%
Management of Companies and Enterprises	95	1.2%
Manufacturing	430	5.4%
Mining, Quarrying, and Oil and Gas Extraction	0	0.0%
Other Services (excluding Public Administration)	457	5.7%
Professional, Scientific, and Technical Services	231	2.9%
Public Administration	762	9.5%
Real Estate and Rental and Leasing	62	0.8%
Retail Trade	441	5.5%
Transportation and Warehousing	59	0.7%
Utilities	2	0.0%
Wholesale Trade	158	2.0%

Table 2 Cortland Employment by Sector

[2] 2010 Census data. http://www.census.gov/2010census/data/
[3] Thoma Development. City of Cortland 2011 Comprehensive Plan. Chapter 2. http://www.thomadevelopment.com/customers/projects/planning_projects/CortlandCompPDF/Chapter2.pdf
[4] 2010 Census data. http://www.census.gov/2010census/data/
[5] Ibid.

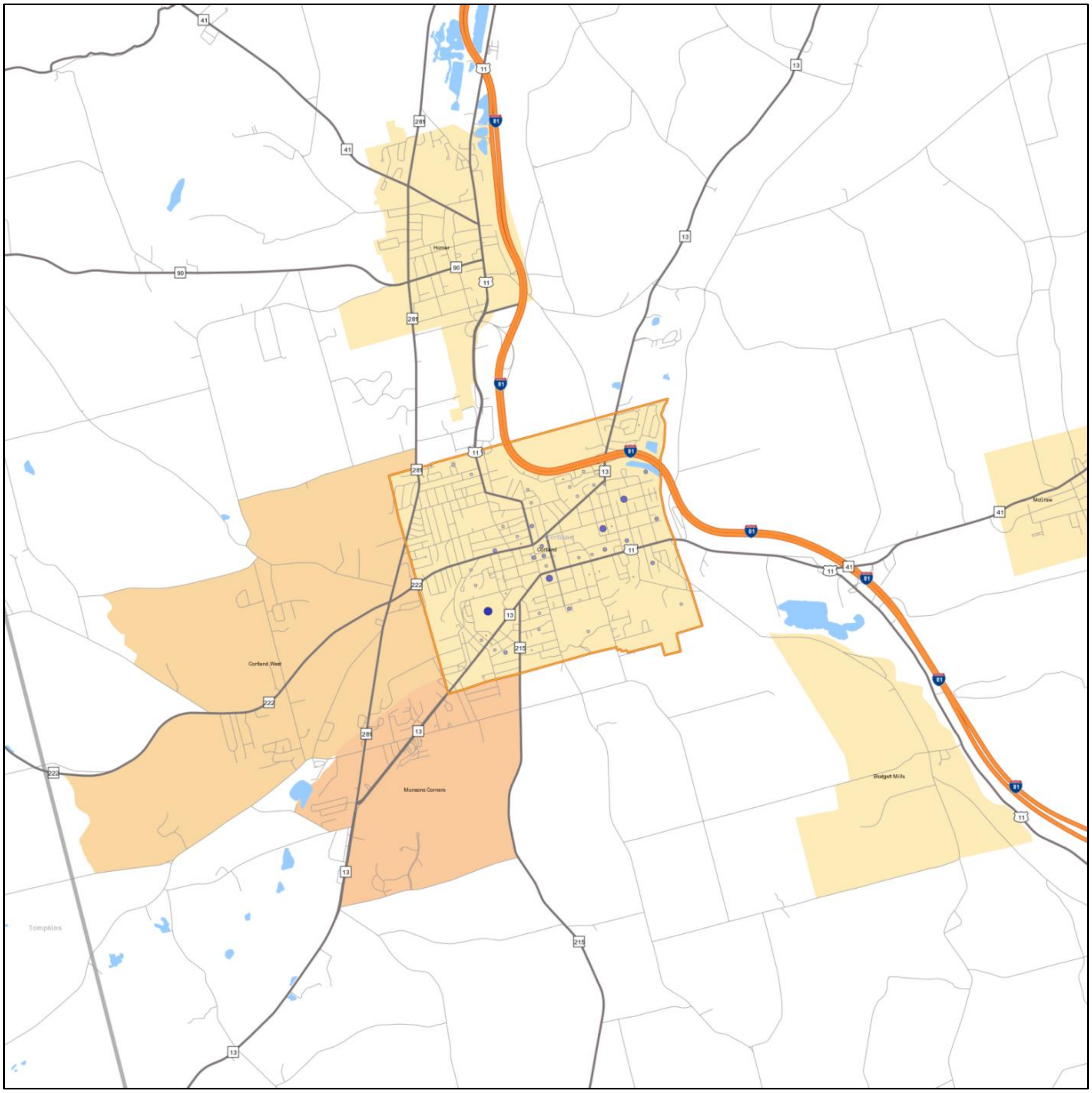


Figure 1 Cortland Boundary

Historically, Cortland has been both an agricultural and industrial center. The City supported the development of railroad in the 1800s, which transformed its economy into a manufacturing hub. Today, the City functions as the metropolitan center of Cortland County, with Interstate-81 bringing travelers from surrounding areas. There is a thriving commercial business district in downtown Cortland, a significant portion of County recreational areas in the City park system, and the previously mentioned top employers (SUNY, hospital, school system), which all reside within the City boundary.[6]

[6] Thoma Development. City of Cortland 2011 Comprehensive Plan. Chapter 3. http://www.thomadevelopment.com/customers/projects/planning_projects/CortlandCompPDF/Chapter2.pdf

Climate Change Background

New York State outlined projected climate impacts and vulnerabilities during the 2011 ClimAid assessment.[7] The ClimAid report projects changes to ecosystems, with the increased presence of invasive species and shifts in tree composition, while water quality and quantity may also be impacted due to changes in precipitation. Furthermore, there may be beneficial economic impacts, such as a longer recreation season in the summer, and a longer growing season for the agricultural sector due to rising temperatures. Scientific evidence suggests that the impacts of global climate change will be different in various regions, and will include temperature shifts, sea level rise, and human health risks.

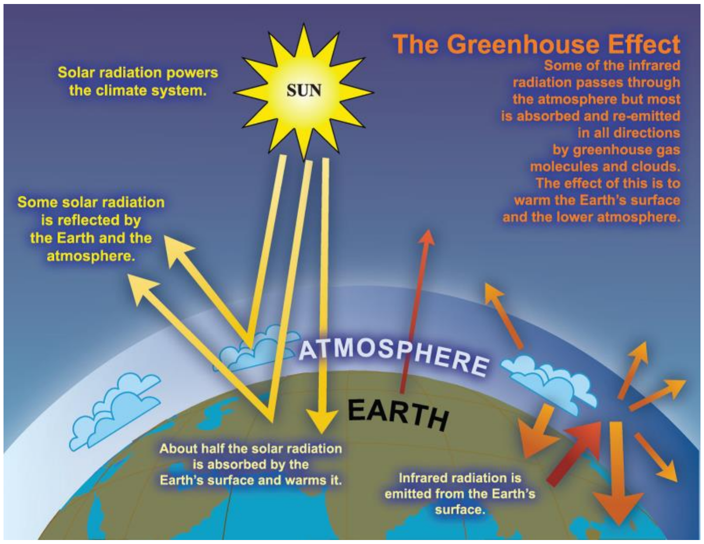


Figure 2 Greenhouse Effect

Climate change is increasingly recognized as a global concern. Scientists have documented changes to the Earth's climate including the rise in global average temperatures, as well as sea levels, during the last century. An international panel of leading climate scientists, the Intergovernmental Panel on Climate Change (IPCC), was formed in 1988 by the World Meteorological Organization and the United Nations Environment Programme to provide objective and up-to-date information regarding the changing climate. In its 2007 Fourth Assessment Report, the IPCC states that there is **a greater than 90 percent chance that rising global average temperatures, observed since 1750, are primarily a result of greenhouse gas (GHG)-emitting human activities.**[8]

The rising trend of human-generated GHG emissions is a global threat. The increased presence of these gases affects the warming of the planet by contributing to the natural greenhouse effect, which warms the atmosphere and makes the earth habitable for humans and other species (see Figure 1).[9] Mitigation of GHGs is occurring in all sectors as a means of reducing the impacts of this warming trend. However, scientific models predict that some effects of climate change are inevitable no matter how much mitigative action is taken now. Therefore, climate mitigation actions must be paired with adaptation measures in order to continue efforts to curb emissions contributions to global warming, while adapting communities so that they are able to withstand climate change impacts and maintain social, economic, and environmental resilience in the face of uncertainty. Climate adaptation can take shape through infrastructure assessments and emergency planning, as well as through educational efforts to raise public awareness about potential climate change impacts. In New York State, regional climate change

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

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

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

Climate Change Innovation Program

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

The City of Cortland was selected by CNY RPDB, as one of seven municipalities in Central New York, to receive technical assistance and financial incentives to complete carbon foot-printing and sustainability planning processes.

In addition to completing an emissions inventory, the City was eligible for a sub-grant of up to $30,000 through C_2IP, which enabled Cortland to implement a demonstration project. The City is moving forward with upgrades and efficiency improvements to its wastewater treatment plant for the C_2IP demonstration project.

Specifically, the Cortland wastewater treatment plant is in the process of installing three high-efficiency turbo blowers, which will generate a projected savings of 599,038 kWh per year, cost savings of $71,885 and projected GHG savings of 150 $MTCO_2e$. In 2015, the facility will also install a combined heat and power system that is expected to cover 40-60% of facility energy use with on-site generation. The City will also undertake other treatment process efficiencies at the plant by 2020, and it will be important to capture the reduction impact of these measures in future GHG inventory assessments.

ICLEI Partnership

This inventory utilized the ICLEI Local Governments for Sustainability 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 1 below).

Figure 3 ICLEI Five Milestones for Climate Mitigation

The five milestones include:

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

Inventory Methodology

There are established methods for conducting municipal inventories, as well as broader community assessments. The City of Cortland GHG inventory utilizes a variety of tools, with the understanding that protocols and guidelines will continue to evolve and develop.

Organization by Sector

The Cortland GHG inventory analyzed both government operations and community-generated emissions. The sectors covered within these analyses are listed in Table 3 Government and Community Sectors below. The ability to determine larger sources of emissions, through individual sector assessment, allows a local government to more efficiently target specific actions or processes for emissions reductions. Furthermore, government operations inventories are distinctly different from community analyses due to the operational control local governments have over their emissions and the lack of operational control they have over community emissions sources. Organizing the inventory by sectors delineates this distinction.

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

Table 3 Government and Community Sectors

Greenhouse Gases Covered

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 4 Greenhouse Gases).

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

Table 4 Greenhouse Gases

Organization 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 5 Emissions Scopes). Local governments inherently have more control over the emissions in scopes 1 and 2, due to the behavioral and often function-specific nature of scope 3 emissions sources. However, governments and communities are increasingly accounting for all three scopes in their inventory analyses in an effort to conduct more comprehensive carbon footprint assessments.

It is important to use the scope distinction, rather than just an aggregate emissions total, when evaluating the local government GHG footprint because other government inventories (such as Cortland County) 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	City Sector by Scope
1	All direct GHG emissions (with the exception of direct CO2 emissions from biogenic sources).	Vehicle Fleet, Wastewater Treatment Plant Processes, Buildings & Facilities (fuel use)
2	Indirect GHG emissions associated with the consumption of purchased or acquired electricity, steam, heating, or cooling.	Buildings & Facilities, Streetlights & Traffic Signals, Water Delivery, WWTP Facilities (electricity use)
3	All other indirect emissions not covered in Scope 2, such as emissions resulting from the extraction and production of purchased materials and fuels, transport-related activities in vehicles not owned or controlled by the reporting entity (e.g., employee commuting and business travel), outsourced	Employee commute, government-generated waste

	activities, waste disposal, etc.	

Table 5 Emissions Scopes[10]

Calculation Tools

The City GHG analysis followed the methods outlined in ICLEI's Local Government Operations Protocol (2010).[11] The protocol provides recommended and alternate approaches to calculating total emissions by individual sector, and provides emissions factors and global warming potential (GWP) to use in assessing the impact of each emissions source and greenhouse gas on government and community operations. ICLEI also provides members with its Clean Air and Climate Protection (CACP) Tool to use to aggregate emissions and generate forecast projections. An example fuel calculation from ICLEI's LGOP is shown below:

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

In addition to the ICLEI local government guidance discussed above, this analysis also utilized the ICLEI U.S. Community Protocol, which was released in 2012.[12] The guidance found in the protocol was used to estimate wastewater treatment process emissions (see Appendix 1. Wastewater Treatment Process Emissions Method), and community emissions from solid waste disposal (see Appendix 4. City Waste Emissions from Cortland Landfill).

The NYSDOT Traffic Data Viewer tool was utilized, in conjunction with GIS data on City road lengths, to create the community transportation vehicle miles travelled (VMT) emissions estimate (see Appendix 2. VMT Estimation Method). Lastly, utility data gathered during the 2010 Central New York regional GHG inventory for five counties (including Cortland County) was utilized to provide estimates of community stationary energy use for the City of Cortland.

[10] ICLEI. 2010. Local Government Operations Protocol.
[11] ICLEI. 2010. Local Government Operations Protocol.
[12] ICLEI. 2012. U.S. Community Protocol for Accounting and Reporting of Greenhouse Gas Emissions.

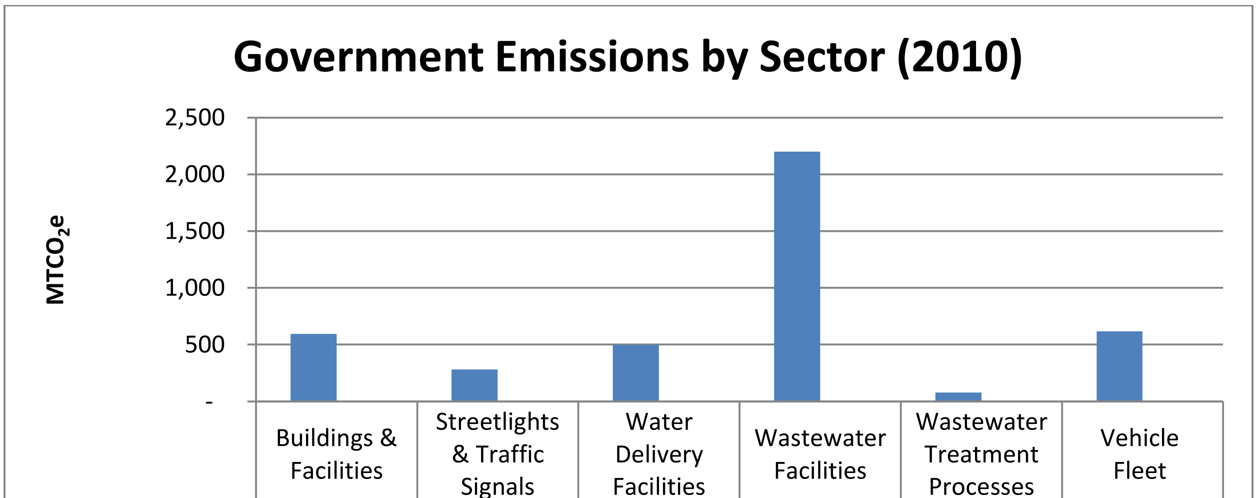
Inventory Results

Government Operations Emissions

Emissions by Sector

City government emissions totaled 4,270 metric tons of CO_2e in 2010. This total covers emissions from City government buildings and facilities, streetlights and traffic signals, water delivery facilities, wastewater treatment facilities and processes, and government vehicles.

The largest source of emissions within city operations results from wastewater treatment facility energy use (2,199 $MTCO_2e$), followed by the City's vehicle fleet fuel use (618 $MTCO_2e$), and other buildings and facilities energy use (595 $MTCO_2e$). The buildings and facilities sector encompasses all facilities under City government operational control but does not include water delivery and wastewater treatment facilities. This would result in double-counting, due to the fact that these facilities are assessed as separate sectors.

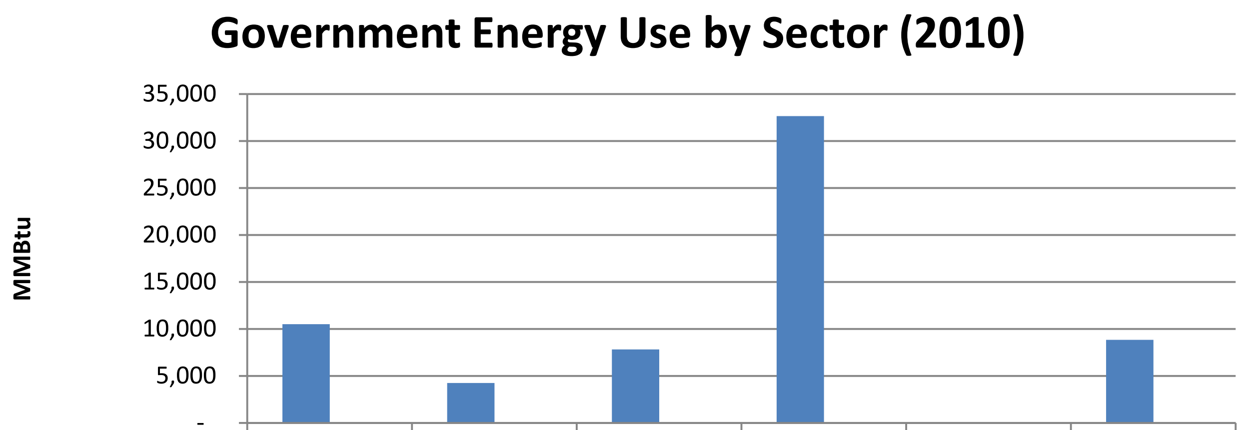


	Buildings & Facilities	Streetlights & Traffic Signals	Water Delivery Facilities	Wastewater Facilities	Wastewater Treatment Processes	Vehicle Fleet
2010	595	281	498	2,199	79	618
% of total CO2e	13.9%	6.6%	11.7%	51.5%	1.9%	14.5%

Figure 4 Government Emissions by Sector

Utility data used to determine the energy use and associated emissions for Cortland government sectors was organized separately for different departments. The facilities energy use for the Department of Public Works (DPW), City Hall, and the Buildings and Grounds department are tracked centrally, while the energy use for the wastewater treatment plant (WWTP) and pumps, and for water delivery infrastructure is tracked individually by those departments.

Additionally, fuel use (gasoline and diesel) for the City government vehicle fleet (Fire, Police, DPW, Codes, WWTP, Water, Sewer, Public Safety and Youth Bureau Departments) is tracked centrally by the county because the City of Cortland has a fuel purchasing agreement with the Cortland County Highway Department.



	Buildings & Facilities	Streetlights & Traffic Signals	Water Delivery Facilities	Wastewater Facilities	Wastewater Treatment Processes	Vehicle Fleet
2010	10,505	4,223	7,822	32,649	-	8,814
% of total MMBtu	16.4%	6.6%	12.2%	51.0%	0.0%	13.8%

Figure 5 Government Energy Use by Sector

Government operations energy use is highest within the wastewater treatment facilities sector mainly due to high electricity use in the wastewater treatment buildings and pump stations (WWTP electricity use totaled 8,450,523 kWh in 2010). This sector also includes natural gas use in these facilities (1,156 therms), as well as fuel oil used to power back-up generators (26,752 gallons in 2010). The wastewater treatment process emissions category shows no energy use due to the fact that this area covers only fugitive process emissions, rather than emissions resulting from consumption.

Energy procurement is a unique process in the City of Cortland. Contracts with commodity (electricity and natural gas) providers have historically been bid out to companies that offer the lowest price, which is not unusual; however, the City has used a system which allows the commodity provider to change mid-year, if the price being offered is more competitive than another provider. Therefore, the City's utility bills span up to five providers in one year (as was the case in 2010), in addition to National Grid and NYSEG who facilitate the transmission and distribution of the commodities to the City.

Emissions by Scope

Government emissions are highest in scope 2 consumption sectors (2,786 $MTCO_2e$). This is due to the use of utility-provided electricity.

Scope 1 emissions total 1,484 $MTCO_2e$ and these sources include the City department vehicle emissions that result from travel within the City boundary, as well as the wastewater treatment plant process emissions that occur within the City boundary that serve city residents and surrounding communities.

These emissions are direct, meaning they occur within the City and in the service of the Cortland community population.

All scope emission sources can be targeted and reduced through City government operations; however, scope 3 sources, such as employee commuting, are the most challenging because governments cannot mandate the personal choices of their employees. Local governments can influence behavior choices through incentives, competitions, or other programmatic efforts that encourage and recognize staff participation and contribution to reductions in municipal GHG emissions. In the future, the City of Cortland could conduct a survey of employee commuting habits to determine whether that sector could be targeted for reduction.

Scope	Emissions ($MTCO_2e$)	Sectors
Scope 1 (direct)	1,484	Fuel Use: Vehicle Fleet, WWTP, Buildings & Facilities, Water Delivery
Scope 2 (indirect)	2,786	Electricity Use: Buildings & Facilities, Lighting, WWTP, Water Delivery
Scope 3 (other indirect)	0	N/A

Table 6 Government Emissions by Scope

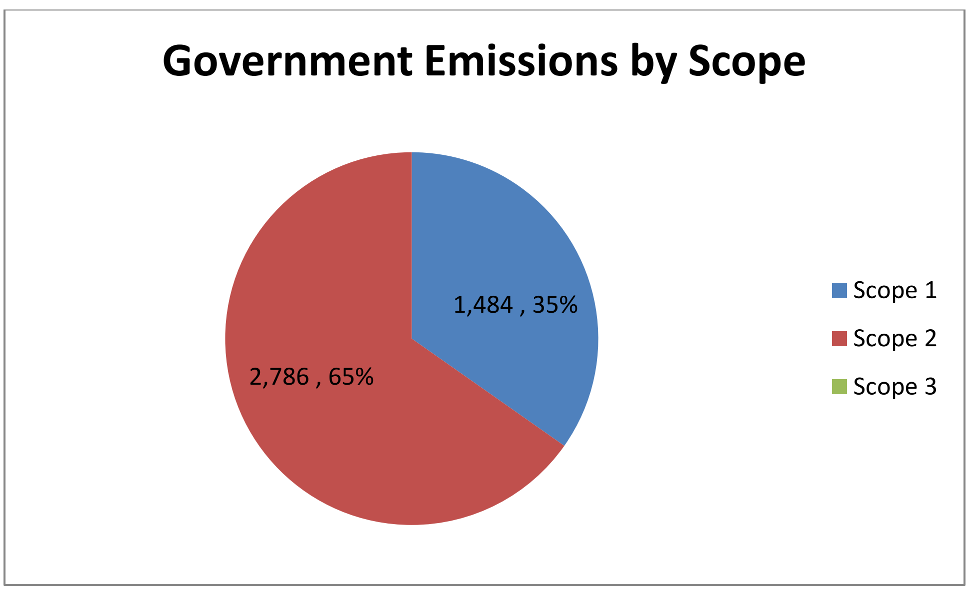


Figure 6 Government Emissions by Scope

Emissions by Source

When considering government emissions by source, electricity comprises over half (65%) of the City carbon footprint (see Figure 7 Government Emissions by Source). Natural gas emissions and gasoline emissions follow at 12% and 8%, respectively, of government CO_2e totals. Diesel and fuel oil make up a combined 12% of government operations emissions, while nitrous oxide from wastewater treatment forms the remaining (2%) government operations emissions. While estimates of nitrous oxide from treatment plant operations vary based on a number of factors (e.g., equipment efficiency and treatment processes), the potency of the gas (nitrous oxide has 310 times the global warming potential of carbon dioxide) means that a small source of N_2O emissions has a large impact.

Estimation methods used for the City wastewater treatment plant involve default metrics provided by the ICLEI U.S. Community Protocol, in addition to City-specific population and operations data (e.g., daily N-load, nitrification, and process information). The approach is described further in Appendix 1. Wastewater Treatment Process Emissions Method.

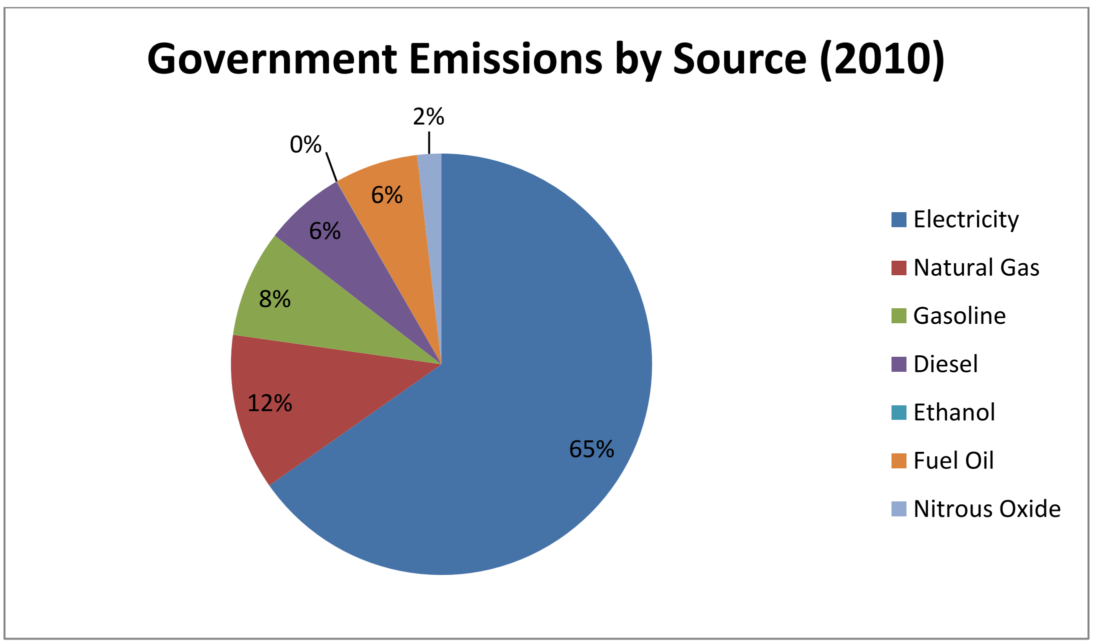


Figure 7 Government Emissions by Source

Community Emissions

Community emissions are often outside the operational and financial control of local governments. The activities of many commercial and industrial businesses, for example, do not fall under the authority of municipalities and are not always directly impacted by municipal decision-making. However, the actions taken by local governments can have a direct impact and influence on all community members, and conducting an assessment of community emissions provides governments with a framework to evaluate what sectors have the potential for the most impact.

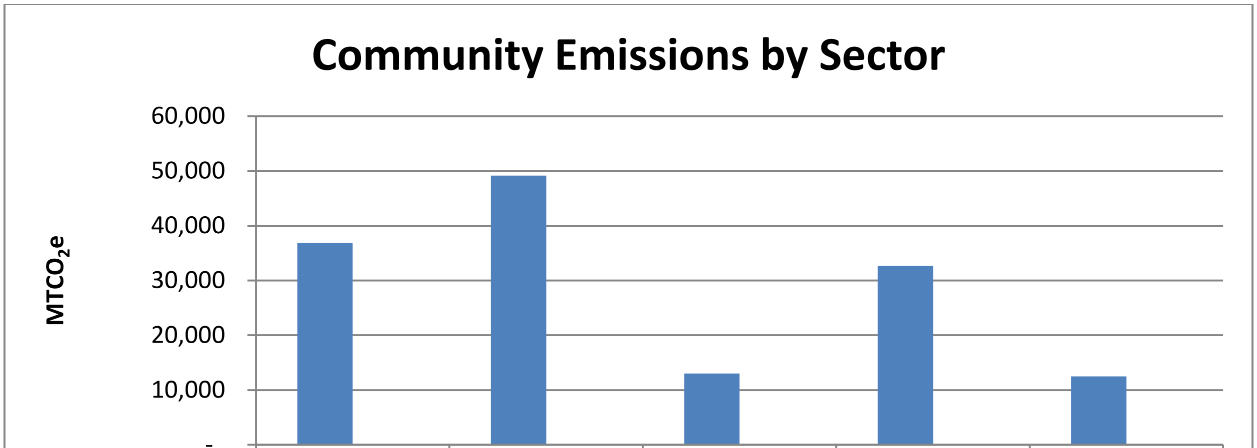
As previously noted, the inventory analysis was conducted using the framework of local government significant influence, where assessed sources make up those that the City of Cortland can impact through mitigation efforts. All community sectors are comprised of community-wide emissions-generating activities, 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. Conducting a Cortland community analysis contributes to the ability of the City government to work with community partners to achieve mutual GHG reduction goals. Government operations emissions are a subset of the overall community carbon footprint; therefore, it is important to examine community emissions as they are impacted by local government actions, whether through ownership, operational control, regulatory authority, enforcement, or budgetary oversight. These elements can help determine what actions and community partnerships are mutually beneficial to achieve long-term energy, cost and associated GHG savings.

Emissions by Sector

The sectors covered in the Cortland community analysis include residential, commercial and industrial energy use, transportation and waste. In 2010, total emissions for the City of Cortland community were 144,265 $MTCO_2e$. This equates to approximately 7.5 $MTCO_2e$ per capita, for 2010.

Commercial energy use comprises the bulk of community emissions at 49,157 metric tons of CO_2e (see Figure 8 Community Emissions by Sector). Waste emissions from landfilling City municipal solid waste and construction and demolition materials was estimated to total 12,510 tons in 2010 (see Appendix 4. City Waste Emissions from Cortland Landfill). Waste represents the lowest emitting sector in the community analysis.

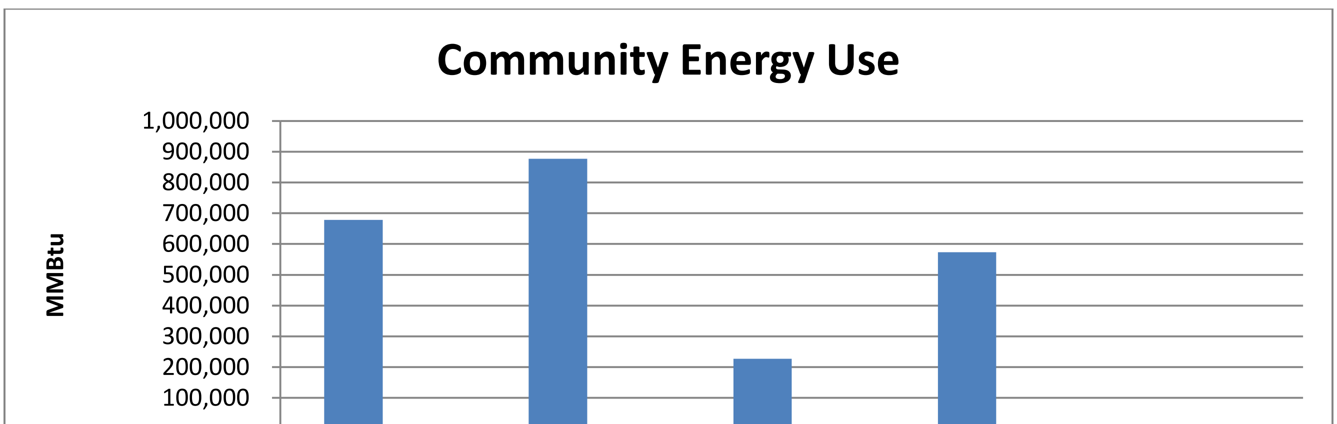
Transportation sector emissions are based on vehicle miles traveled (VMT) and associated fuel use for the community, and total 32,690 $MTCO_2e$. The estimate developed for this analysis covers only main roads through the City boundary and is therefore not inclusive of all vehicles travelling in and around the City. The estimated annual VMT for the area totaled over 72 million. The method used to generate the community VMT estimate is outlined in Appendix 2. VMT Estimation Method.



	Residential Energy Use	Commercial Energy Use	Industrial Energy Use	Transportation	Waste
2010	36,873	49,157	13,035	32,690	12,510
% of total CO2e	26%	34%	9%	23%	9%

Figure 8 Community Emissions by Sector

Community energy use data show that commercial and residential sectors comprise the majority of community MMBtu (37% and 29%, respectively), followed by transportation at 24% of total community energy use (see Figure 9 Community Energy Use).



	Residential Energy Use	Commercial Energy Use	Industrial Energy Use	Transportation	Waste
2010	677,944	876,643	227,508	573,518	0
% of total MMBtu	29%	37%	10%	24%	0%

Figure 9 Community Energy Use

Energy use is calculated based on total electricity, natural gas and fuel use by sector. A snapshot of the energy use data used to calculate Cortland commercial sector emissions is shown in Table 7 Commercial Sector Energy Use.[13]

Commercial Energy Source	Quantity
Electricity	31,526 MWh*
Natural Gas	673,911 MMBtu*
Fuel Oil	67,028 MMBtu
Commercial Coal	871 MMBtu
Stationary LPG (liquefied petroleum gas)	16,040 MMBtu
Wood	11,197 MMBtu

Table 7 Commercial Sector Energy Use

**MWh= megawatt hour*
**MMBtu= million Btu*

Transportation energy use is determined by default allocations of vehicle miles traveled (VMT) estimated for City roadways. The ICLEI Clean Air Climate Protection software applies the input of annual VMT to vehicle categories (heavy duty, light duty, passenger) and fuel types (7% diesel, 10% ethanol and 83% gasoline) to arrive at energy use estimates for this sector.

Emissions by Source

Natural gas consumption is the largest source of emissions for the City of Cortland community (51%), followed by gasoline (22%) and electricity use (12%). Combined with diesel consumption, the various components of the waste stream and stationary fuel use make up the remaining emission sources for the community sector (see Figure 10 Community Emissions by Source).

[13] Some energy use data sourced from the 5-county Central New York regional GHG inventory utility-supplied reports.

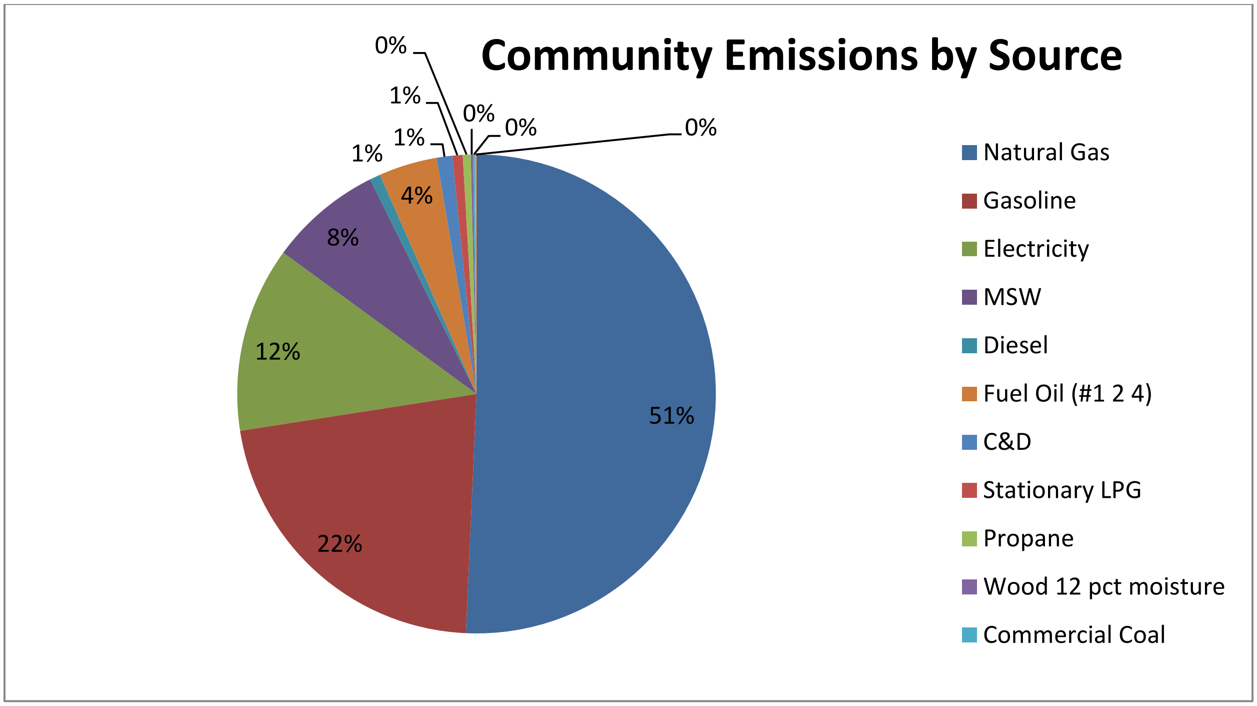


Figure 10 Community Emissions by Source

The sources noted as MSW and C&D represent the tonnage of the waste emissions attributable to municipal solid waste or construction and demolition waste. In the absence of Cortland Landfill waste composition data, these sources of emissions were allocated in this way (88% of waste CO2e= MSW; 12% of waste CO2e= C&D). There are methods to estimate waste emissions that can employ more specific waste composition data and associated emission factors; in the future, it will be important to determine the most appropriate and replicable approach that also complies with U.S. Community Protocol methods (see Appendix 4. City Waste Emissions from Cortland Landfill for more detail).

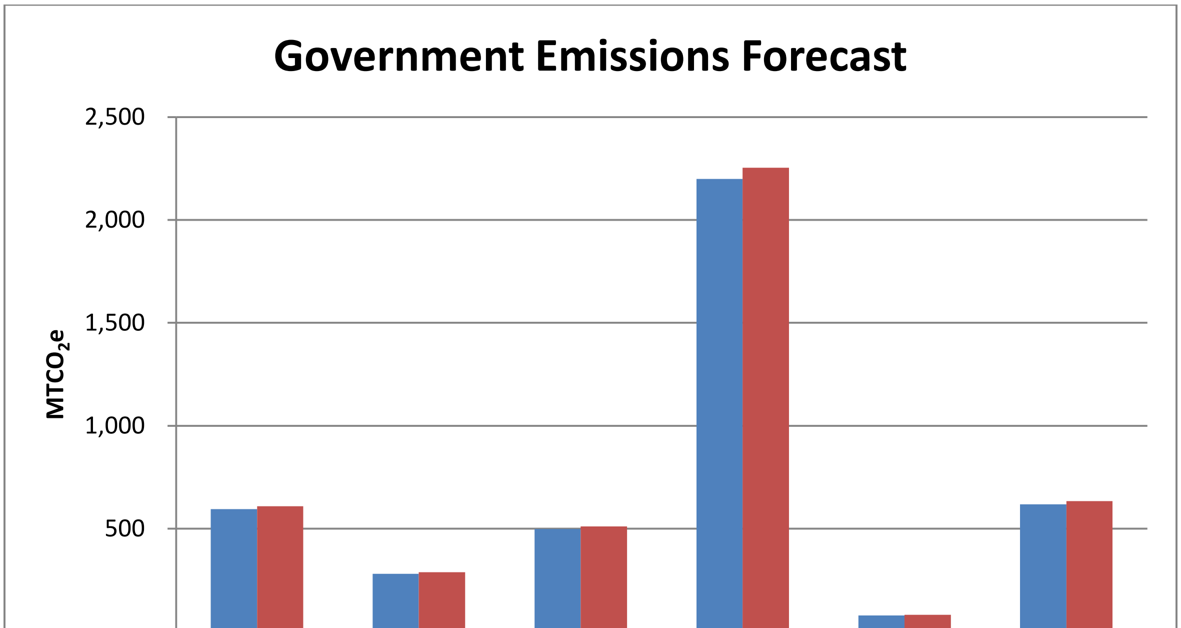
Emission Forecasts

Government Operations Forecast

The City government operations forecast was generated using a single rate compounding method ($FV=PV(1+i)^n$). This approach utilizes baseline data and a growth factor (in this case population), applied to the number of years between the baseline and the forecast year. The City forecast followed the ten-year Census timeframe and population estimates.

Given the slight City population growth (2.5%) from 2000-2010 (18,740 in 2000 to 19,204 in 2010), the government forecast shows growth from 2010 emissions levels in 2020 (see Figure 11 Government Emissions Forecast 2020). The sectors with the highest emissions in 2010 remain the areas with the highest emissions in 2020, due to the linear forecast: wastewater treatment, vehicle fleet and buildings and facilities; however, all sectors increase by 2.5% as a reflection of the increasing population rate and the assumed increase in demand for municipal services.

It is important to consider the impact of changes in population, capital planning initiatives, or energy conservation measures on the forecast projection. Projects such as wastewater treatment plant equipment upgrades and efficiency measures will impact the City's overall energy use and associated GHG emissions and costs. The forecast is an estimate, and requires updates based on periodic re-evaluation of the GHG inventory baseline and other government planning efforts.



	Buildings & Facilities	Streetlights & Traffic Signals	Water Delivery Facilities	Wastewater Facilities	Wastewater Treatment Processes	Vehicle Fleet
2010	595	281	498	2,199	79	618
2020	610	288	510	2,254	81	633

Figure 11 Government Emissions Forecast 2020

Community Forecast

The Cortland community forecast involves the use of several different sources to create a multi-rate projection for 2020. The use of several rates leads to a more dynamic forecast, that, when paired with municipal data on development patterns and population trends, can enable a local government to create more effective targets and reduction strategies.

The rates used in the community analysis include those from the 2009 New York State Energy Plan, the Energy Information Agency's 2011 Annual Energy Outlook, and transportation estimates generated from New York State Department of Transportation traffic count models (see Appendix 2 for more detail).

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

Table 8 NYS Energy Plan Fuel Demand Rates

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

Table 9 EIA Annual Energy Outlook (2011) Electricity Consumption Projections

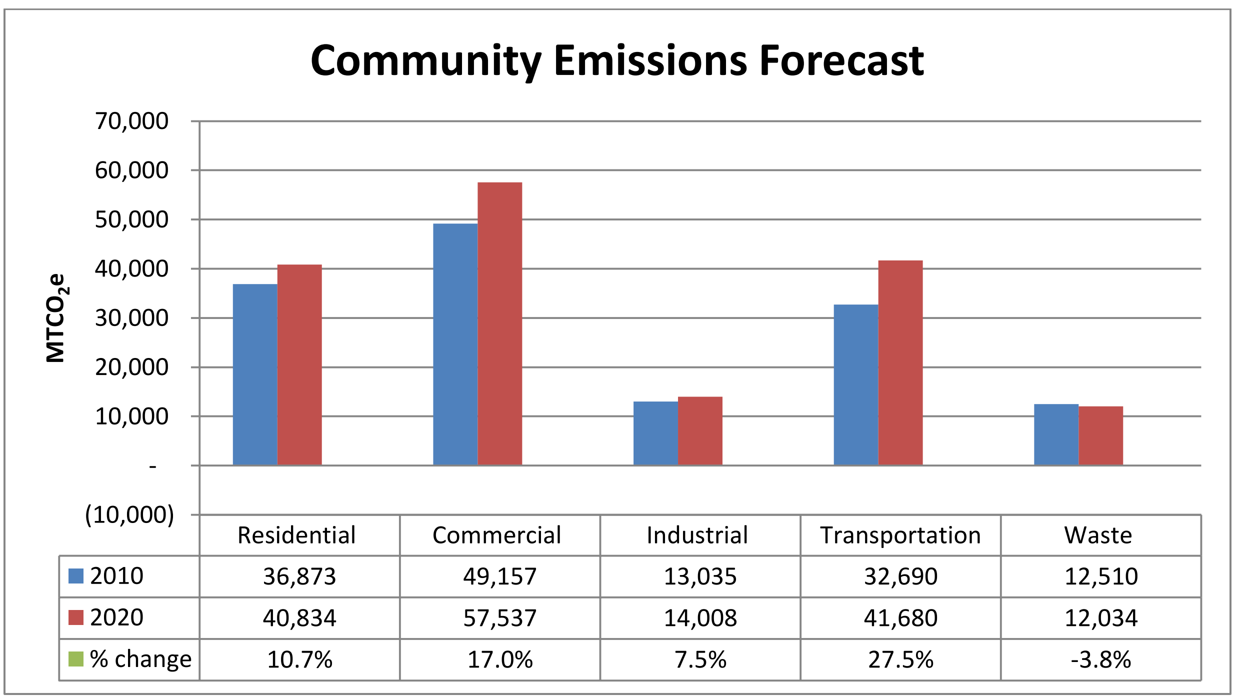


Figure 12 Community Emissions Forecast

From 2010 to 2020, the largest community emissions source remains the commercial energy sector, which increases by 17%. While emissions projections are subject to change due to a number of factors (e.g., targeted reduction measures, fuel prices), it is likely that the largest sources of emissions will remain so in the near future, all else constant. The waste sector shows a decline of approximately 4%

over the 10-year period, which should be adjusted if landfill gas capture systems are installed or other emissions-reducing activities occur by 2020.

Community emissions increase 15% overall during the 10-year forecast timeframe. However, it is important to note that increased fuel efficiency in the transportation sector, and changes in energy supplies for the residential, commercial and industrial sectors will likely create slight increased or decreased emissions totals by 2020.

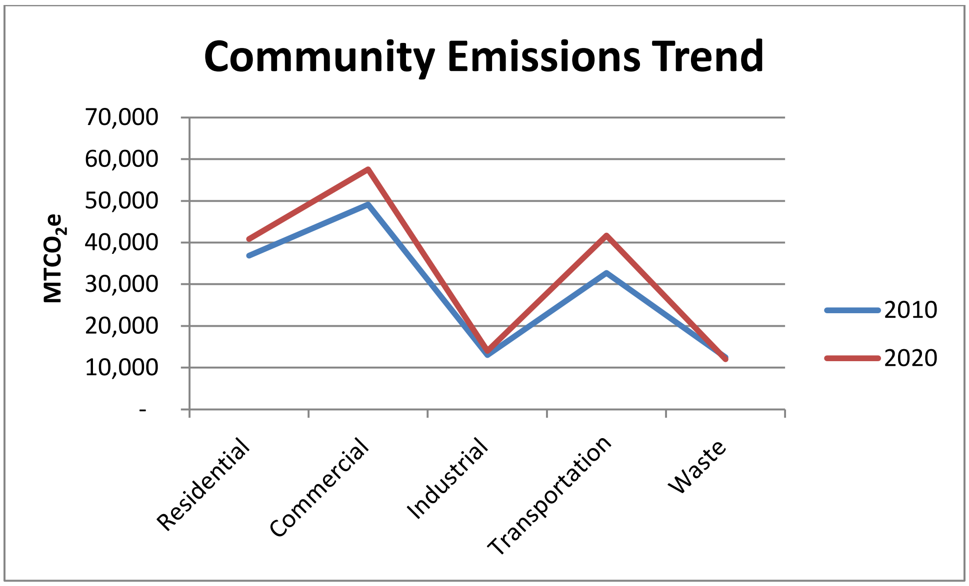


Figure 13 Community Emissions Trend

Conclusion

Emission totals for the City of Cortland in 2010 were 4,270 $MTCO_2e$ for government operations and 144,265 $MTCO_2e$ for the broader community. Under a business as usual scenario, emissions are not expected to increase substantially by 2020; however, ongoing monitoring and updates to forecast projections are needed as development patterns or energy conservation strategies change over the next seven years. Additionally, this inventory should be re-conducted and updated periodically to ensure accurate planning and to measure progress made toward reduction goals.

As GHG accounting tools and methods are refined, the City should consider the inclusion of additional emission sources. The institutionalization of inventory data collection processes and tracking will enable the City to repeat this analysis more easily and achieve greater efficiency.

Appendices

Appendix 1. Wastewater Treatment Process Emissions Method

The ICLEI U.S. Community Protocol was used to estimate the wastewater treatment plant process emissions for the City of Cortland. The City has one plant, which serves 32,000 customers in the City and surrounding communities (the Village of Homer, Village of McGraw and the Town of Cortlandville). The City has operational control of the treatment plant, which is why it is included in the government operations analysis.

The methodology employed is outlined in the wastewater treatment appendix to the ICLEI community protocol for centralized treatment systems, under the reporting framework of local government significant influence.

The fourth ICLEI WWTP decision tree for centralized treatment systems was utilized to identify the appropriate calculation methods. Given that the facilities do not use anaerobic digestion, do not incinerate solids, and practice nitrification or denitrification, the decision tree directed the use of methods WW.7 and WW.12a (specifically, WW.7 Process Nitrous Oxide Emissions from Centralized Wastewater Treatment Plants with Nitrification/Denitrification and WW.12 Fugitive Nitrous Oxide Emissions from Effluent Discharge).[14] The table below shows the resulting calculations for Cortland wastewater treatment process nitrous oxide (N_2O) emissions, using the N_2O global warming potential of 310:

Calculation (Comm. Protocol Methods WW.7 and WW.12)	Emissions (MTCO2e)
(WW.7): Annual process N2O emissions = ((P × Find-com) × EF× 10-6)	*× GWP*
*((32,000*1.25)*7*10^-6)*	
0.280	86.80
Assumed significant industrial and commercial inputs	
(WW.12): Annual fugitive N2O emissions=(N-Load ×EFeffluent× 365.25 × 10-3× 44/28)	*× GWP*
*0.009568*0.005*365.25*10^-3*(44/28)*	
0.00002746	0.009
0.28002746	
Total WWTP N2O Emissions (MTCO2e):	**86.81**

Figure 14 WWTP Emissions Estimate

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

Appendix 2. VMT Estimation Method

The Syracuse Metropolitan Transportation Council, which tracks transportation data for portions of the Central New York region, is not able to project down to the level of the City of Cortland to determine vehicle miles traveled in the community. Given that the SMTC's model is informed by state-level data, such as traffic counts, the Cortland VMT estimate was derived using an existing New York State Department of Transportation (NYSDOT) tool.

The NYSDOT Traffic Data Viewer provided data on the Annual Average Daily Traffic (AADT) going through the City boundary in 2010.[15] 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). This daily VMT estimate was converted to an annual VMT estimate (by multiplying the sum of the daily VMT by 365 days per year) and entered into CACP where the program uses default fuel allocations (7% diesel and 83% gasoline with 10% ethanol content) and vehicle class data to generate emissions estimates.

These VMT estimates are for highly traveled roads, due to the fact that the NYSDOT only tracks traffic data for main arteries. 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 as models evolve.

[15] NYS DOT. 2012. Traffic Data Viewer. http://gis.dot.ny.gov/tdv/

BEGINDESC	ENDDESC	TDV_ROUTE	MUNI	COUNT_AADT	LenMiles	Length for count	DVMT
RT 222	CITY OF CORTLAND	NY281	TOWN OF CORTLANDVILLE	18632.00000	0.00346400173		64.54128031
GRANT ST	N CHURCH ST	US11, GRANT ST	CITY OF CORTLAND	2141.00000	0.12071158266		258.4434985
N CHURCH ST	E MAIN ST	NY41, MAIN ST	CITY OF CORTLAND	2141.00000	0.07001398310		149.8999378
HOMER AVE CORTLAND	MAIN ST	NY222, GROTON AVE	CITY OF CORTLAND	9630.00000	0.19014853605		1831.130402
PORT WATSON ST	CITY LINE	KELLOG ROAD	CITY OF CORTLAND	1938.00000	0.41354878848		801.4575521
START 11/13/41 OLAP	END 11/13/41 OLAP START 11/41 OLAP	NY13	CITY OF CORTLAND	9394.00000	0.29992018642		2817.450231
HOMER AVE	CORTLAND CL / CORTLANDVILLE TL	NY41, HOMER AVE	CITY OF CORTLAND	10444.00000	0.32378470091		3381.607416
SAUNDERS	CITY LINE	PENDLETON ST EX	TOWN OF CORTLANDVILLE	2567.00000	0.01884092494		48.36465431
NY13 (OFF)	I-81 SB (ON)	NY13 to I81 SB	CITY OF CORTLAND	0.00000	0.19820000819		0
GROTON AVE	BROADWAY	TOWNLEY AVE	CITY OF CORTLAND	5553.00000	0.11541576558		640.9037462
JCT 41	JCT RT 13 CLINTON AVE	I81	TOWN OF CORTLANDVILLE	18861.00000	0.47791616572	2.339879	9013.976802
CORTLAND CITY LINE	HOMER AVE CORTLAND	NY222, GROTON AVE	CITY OF CORTLAND	13038.00000	0.80972746343		10557.22667
CITY OF CORTLAND	CORTLAND CL / CORTLANDVILLE TL	NY281, WEST ST	CITY OF CORTLAND	15427.00000	0.62083530516		9577.626253
TOMPKINS ST	CITY OF CORTLAND	OWEGO ST	CITY OF CORTLAND	4475.00000	0.57640552143		2579.414708
N CHURCH ST	E MAIN ST	US11, MAIN ST	CITY OF CORTLAND	2141.00000	0.06905338041		147.8432875
MAIN ST	RTS 11 & 13 & 41 END RT 222	NY222, CLINTON AVE	CITY OF CORTLAND	11256.00000	0.13967677029		1572.201726
TOWNLEY	TOMPKINS ST	BROADWAY	CITY OF CORTLAND	6590.00000	0.66136744744		4358.411479
GROTON AVE	N MAIN ST	HOMER AVE	CITY OF CORTLAND	5443.00000	0.49843238051		2712.967447
END 11/13/41 OLAP START 11/41 OLAP	GRANT ST	NY41, NORTH CHURCH ST	CITY OF CORTLAND	2141.00000	0.24006804513		513.9856846
MAIN ST		GROTON AVE	CITY OF CORTLAND	9630.00000	0.19054308947		1834.929952
ACC RT 81I	CORTLAND CL / CORTLANDVILLE TL	NY13	CITY OF CORTLAND	6991.00000	0.41060821320		2870.562018
GROTON AVE	GRANT ST	MAIN ST	CITY OF CORTLAND	4980.00000	0.28983948637		1443.400642
END 11/41 OLAP START 11/13/41 OLAP	END 11/13/41 OLAP START 11/41 OLAP	US11	CITY OF CORTLAND	9394.00000	0.29942146520		2812.765244
CITY OF CORTLAND	RT 215	NY13	CITY OF CORTLAND	16428.00000	0.92992816865		15276.85995
HOMER AVE	CORTLAND CL / CORTLANDVILLE TL	US11, HOMER AVE	CITY OF CORTLAND	10444.00000	0.32817370474		3427.446172
CORTLAND CL / CORTLANDVILLE TL	CR 500	NY13	TOWN OF CORTLANDVILLE	4320.00000	0.00117686927		5.084075248
I-81 SB (OFF)	NY31 (ON)	I81 SB to NY13	CITY OF CORTLAND	0.00000	0.34783985001		0
MAIN ST	RTS 11 & 13 & 41 END RT 222	CLINTON AVE	CITY OF CORTLAND	11256.00000	0.13967677029		1572.201726
ROU281	CORTLAND CL / CORTLANDVILLE TL	WEST ST	CITY OF CORTLAND	15427.00000	0.62388040654		9624.603032
PORT WATSON ST	CLINTON AVE	POMEROY ST	CITY OF CORTLAND	4949.00000	0.57699176366		2855.532238
POMEROY ST	ACC RT 81I	NY13	CITY OF CORTLAND	17332.00000	0.13998455830		2426.212364
GRANT ST	E MAIN ST	MAIN ST	CITY OF CORTLAND	2141.00000	0.07063627157		151.2322574
E MAIN ST	HOMER AVE	NY41, MAIN ST	CITY OF CORTLAND	6738.00000	0.30006191048		2021.817153
GROTON AVE	WEST MAIN ST	FLORAL AVE	CITY OF CORTLAND	1694.00000	0.49971406710		846.5156297
END 11/41 OLAP START 11/13/41 OLAP	END 11/13/41 OLAP START 11/41 OLAP	NY41	CITY OF CORTLAND	9394.00000	0.30001938852		2818.382136
N MAIN ST	CORTLAND CL / CORTLANDVILLE TL	HOMER AVE	CITY OF CORTLAND	10444.00000	0.32888991203		3434.926241
NY13 (OFF)	NY13 (OFF)	NY13 to I81 NB	CITY OF CORTLAND	0.00000	0.39969017470		0
TOMPKINS ST	GROTON AVE	MAIN ST	CITY OF CORTLAND	6459.00000	0.24992046033		1614.236253
JCT RT 13 CLINTON AVE	ACC RT 11	I81	CITY OF CORTLAND	26248.00000	0.89379776172	1.729914	23460.40365
POMEROY ST	END 11/41 OLAP START 11/13/41 OLAP	NY41	CITY OF CORTLAND	13587.00000	0.57002214571		7744.890894
RT 281	CITY OF CORTLAND	NY13	TOWN OF CORTLANDVILLE	13222.00000	0.00658442553		87.05927433
CLINTON AVE	GRANT ST	NORTH CHURCH ST	CITY OF CORTLAND	2141.00000	0.23557221695		504.3601165
END 11/13/41 OLAP START 11/41 OLAP	GRANT ST	US11, NORTH CHURCH ST	CITY OF CORTLAND	2141.00000	0.24011594315		514.0882343
END 11/13/41 OLAP START 11/41 OLAP	POMEROY ST	NY13	CITY OF CORTLAND	11534.00000	0.63993743537		7381.03838
E MAIN ST	HOMER AVE	US11, MAIN ST	CITY OF CORTLAND	6738.00000	0.30019680260		2022.726056
CITY OF CORTLAND	POMEROY ST	NY41	CITY OF CORTLAND	11371.00000	0.42830926785		4870.304685
CORTLAND CL / CORTLANDVILLE TL	ACC RT 81I TOWN CORTLANDVILLE VIL	NY281	TOWN OF CORTLANDVILLE	15349.00000	0.00011881379		1.823672796
RT 281 W OF CORTLAND	CORTLAND CITY LINE	NY222	TOWN OF CORTLANDVILLE	11863.00000	0.00275461108		32.67795128
RT 215	START 11/13/41 OLAP	NY13	CITY OF CORTLAND	16558.00000	0.39991898339		6621.858527
I-81 NB (OFF)	NY13 (ON)	I81 NB to NY13	CITY OF CORTLAND	0.00000	0.20165592489		0
GRANT ST	N CHURCH ST	NY41, GRANT ST	CITY OF CORTLAND	2141.00000	0.11997800563		256.87291
POMEROY ST	END 11/41 OLAP START 11/13/41 OLAP	US11	CITY OF CORTLAND	13587.00000	0.57052319658		7751.698672
NORTH MAIN ST	N CHURCH ST	GRANT ST	CITY OF CORTLAND	2141.00000	0.12525530886		268.1716163
E MAIN ST	HOMER AVE	MAIN ST	CITY OF CORTLAND	6738.00000	0.29921445379		2016.10699
HOMER AVE	WEST ST	WEST MAIN ST	CITY OF CORTLAND	3390.00000	0.59920543292		2031.306418
CITY OF CORTLAND	POMEROY ST	US11	CITY OF CORTLAND	11371.00000	0.42406137200		4822.001861
	CORTLAND CITY LINE	GROTON AVE	CITY OF CORTLAND	13038.00000	0.81187469283		10585.22225
CITY OF CORTLAND	RT 13	NY215, OWEGO ST	CITY OF CORTLAND	4475.00000	0.57640552143		2579.414708
CITY CORTLAN L	CR 112 & 112B	LOCUST AVE, CR 113	TOWN OF CORTLANDVILLE	1833.00000	0.00004697372		0.086102828
N CHURCH ST	RICKARD ST	GRANT ST	CITY OF CORTLAND	4350.00000	0.17551821210		763.5042226
NY222	N FRANKLIN ST	ELM ST	CITY OF CORTLAND	3346.00000	0.73604489925		2462.806233
CR 121A	CITY CORTLD LN	KELLOGG RD, CR 121	TOWN OF CORTLANDVILLE	464.00000	0.00404127453		1.875151382
PORT WATSON ST	CITY LINE	PENDLETON ST	CITY OF CORTLAND	4666.00000	0.73812988652		3444.11405
CITY LINE	TOMPKINS ST	MAIN ST	CITY OF CORTLAND	3210.00000	0.71980224199		2310.565197
					22.09361329216		**198,599.14**
						Total Daily VMT	**198,599.14**
						Total Annual VMT	**72,488,685.25**

Figure 15 VMT Estimate

Appendix 3. U.S. Community Protocol Reporting

This analysis utilized the framework of local government significant influence in assessing community emission sources. The City of Cortland can have an impact, and target areas for improvement, in the residential and commercial energy use sectors as well as the transportation and waste sectors of the broader community. Additionally, the City is already undertaking efficiency upgrades to its wastewater treatment facility. These actions will affect the carbon footprint of the City moving forward. The table below illustrates Cortland's compliance with community inventory methods, as outlined in the ICLEI U.S. Community Protocol.

Cortland Community Emissions Report Summary Table

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

IE- Included Elsewhere | SI- Local government significant influence
NE- Not estimated | CA- community-wide activities
NA- not applicable
NO- not occurring

Emissions Type	Source or Activity	Activity Data	Emissions Factor & Source	Accounting Method	Included (SI, CA)	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	546,657	53.02 kg CO_2/MMBtu; 1 g CH4/MMBtu; 0.1 g N2O/MMBtu; EPA Mandatory Reporting Rule (MRR)		CA		29,058	Estimates from National Grid and NYSEG, which are the primary utility providers in the City of Cortland
Use of fuel in residential stationary combustion (fuel oil, wood, propane, coal- MMBtu)	source and activity	39,369	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 Cortland County totals (ACS) by ratio of City fuel use and households	CA		1,704	Residential fuel use is based on 2010 5-year estimated American Community Survey (ACS) data for household heating and the 2010 regional GHG inventory analysis municipal allocation estimates for the City of Cortland
Use of fuel in commercial stationary combustion (nat. gas-MMBtu)	source and activity	673,911	53.02 kg CO_2/MMBtu; 1 g CH4/MMBtu; 0.1 g N2O/MMBtu; EPA Mandatory Reporting Rule (MRR)		CA		35,822	All fuel use data is from the regional GHG inventory analysis and a combination of sources: actual utility data, EPA MRR data, and state-wide estimation methods for other fuels. In every case possible, actual data for the City of Cortland was used instead of estimations.
Use of commercial stationary combustion (fuel oil, coal, LPG, wood- MMBtu)	source and activity	95,135	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		6,180	same as above
Industrial Stationary combustion sources (nat. gas- MMBtu)	source and activity	155,906	53.02 kg CO_2/MMBtu; 1 g CH4/MMBtu; 0.1 g N2O/MMBtu; EPA Mandatory Reporting Rule (MRR)		CA		8,274	Industrial natural gas consumption was reported directly from utility reports for the City of Cortland.
Industrial Stationary combustion sources (fuel- MMBtu)	source and activity					NA		
Electricity								
Power generation	source					NE		
use of electricity by the community (MWh) (residential, commercial & industrial consumption)	activity	79,437	eGrid 2009 subregion factors (EPA)	Data provided by utilities for regional GHG inventory	CA		89,870	Electricity use data for the Cortland community was sourced from utility-provided records acquired through the regional inventory analysis; these records should be made available in the future on an annual basis
District Heating/Cooling								
District Heating/Cooling facilities in community	source					NO		
Use of district heating/cooling by community	activity					NO		
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	72,488,685	CACP (Version 3.0) 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	Input VMT estimate into CACP community sector tab	CA		29,656	Estimation method shown in "Comm Results" tab 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. **emissions estimate included in the activity-based method below*
on-road passenger vehicle travel associated with community land uses	activity					IE		The emissions estimate above includes all vehicle traffic counted in reported NYSDOT AADT totals (no vehicle descriptive data was available at the community scale; CACP utilizes default fuel allocations: 93% gasoline and 7% diesel, which was adjusted to account for the 10% ethanol content in gasoline to total 83% gasoline, 10% E100 & 7% diesel); these totals are distributed to alt. method vehicle categories in CACP, with the assumption that diesel is used by HDV and gasoline is used by both LDV and passenger vehicles.
On-road freight vehicles								
on-road freight and service vehicles operating within the community boundary	source					NE		
on-road freight and service vehicle travel associated with community land uses	activity					NE		
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 (HDV) (which, in the case of Cortland, would include Cortland Transit busses), 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					NE		
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		

Figure 16 ICLEI Community Protocol Compliance Table

Solid Waste								
Solid Waste								
Operation of solid waste disposal facilities in community	source							
generation and disposal of solid waste by the community	activity	9,537 tons MSW; 1,337 tons C&D	Methods SW.4 and SW.5 from the ICLEI Community Protocol; used MSW emission factor of 0.60 lbs. of CH4/wet ton due to lack of landfill-specific composition data	Methods SW.4 and SW.5; accounting for CH4 from landfill and process diesel emissions	SI			The Cortland Landfill Extension is operated by Cortland County, and the City of Cortland sends its waste there, along with other municipalities in the county. The ability to determine what proportion of the waste sent to the landfill comes from the City is limited; therefore, an estimate was developed based on the proportion of the City's population to the county's (38.9%) and allocating total waste for 2010 by this percentage (25,114 tons).
Water and Wastewater								
Potable Water- Energy Use								
Operation of water delivery facilities in the community	source	1,807,736 kWh; 16,523 therms	CACP 3.0 eGrid 2009 electricity emission factors; and natural gas emission factors= 53.02 kg CO2/MMBtu; 1g CH4/MMBtu; 0.1g N2O/MMBtu		SI		452	Electricity for the City of Cortland water supply is used by several pieces of infrastructure; the pumps, pump houses, and water treatment buildings/facilities as part of the chlorination process and surface water supply. The pumps and pump houses are under the operational control of the City and electricity and natural gas are accounted for separately from other departments.
Use of energy associated with use of potable water by the community	activity							
Use of energy associated with generation of wastewater by the community	activity	26,752 gallons (fuel oil); 8,450,523 kWh; 1,156 therms	CACP 3.0 eGrid 2009 electricity emission factors; and natural gas emission factors=53.02 kg CO2/MMBtu; 1g CH4/MMBtu; 0.1g N2O/MMBtu		SI		1,995	The City of Cortland operates 1 wastewater treatment facility.
Centralized Wastewater Systems- Process Emissions								
Process emissions from operation of wastewater treatment facilities located in community	source	0.28 MTN2O	Method WW.7= EF with nitrification or denitrification= 7g N_2O/person equivalent/year; Method WW.12= EF for stream/river discharge= 0.005kg N_2O-N/kg sewage-N discharged	Appendix F: Methods for Conventional Aerobic WWT Systems WW.7 and WW.12	SI		87	The City's WWTP serves 32,000 residents in the City of Cortland, Town of Cortlandville, Village of Homer, Village of McGraw; the plant will undergo upgrades in 2013-2014, and will install a biodigestor in 2015, but will also take on an additional industrial client. Energy use and process emissions will likely be affected by these projects.
process emissions associated with generation of wastewater by community	activity					NE		
Use of septic systems in community	source and activity					NE		
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		

Figure 17 ICLEI Community Protocol Compliance Table (Cont.)

Appendix 4. City Waste Emissions from Cortland Landfill

The assessment of waste emissions from the Cortland community was completed using Method SW.4 and SW. 5 from the ICLEI U.S. Community Protocol. To arrive at the proportion of waste that the community was contributing to the Cortland County Landfill, the ratio of the total number of households in the City versus the total in the county was used (the City makes up 38% of the occupied households in Cortland County). This percentage was then multiplied by the total municipal solid waste and construction and demolition tonnages delivered to the County landfill in 2010 to arrive at the estimated tonnage sent to the landfill by the City.

This tonnage total was input into calculation SW. 4 and SW. 5, along with the default parameters shown in the graphic below, to determine the methane emissions attributable to the City from landfilling processes, as well as the process emissions attributable from equipment used in the landfill (it was assumed that this equipment used diesel fuel only).

There are potential areas for future improvement in this approach, particularly given that the default emissions factor for Mixed MSW was used in the absence of applicable waste composition data for the Cortland Landfill, and that the total tonnage estimate included C&D waste, which did not have an associated emissions factor. In future analyses, these areas, along with emissions sources such as the collection and transport of waste to the landfill, should be considered for inclusion in this sector analysis.

The 2020 waste forecast followed the estimation methods used for 2010 emissions. The estimated tonnage delivered to the Cortland County Landfill for 2020 was derived from the Environmental Protection Agency's State Inventory Tool, which was used in the development of the 5-county Central New York regional GHG inventory. Based on historical data and other inputs, the tool generates future waste estimates. This estimate was allocated to the City in the same way described above for 2010. The C&D portion of City waste for 2020 was left the same as the total for 2010, due to a lack of projection data for this source.

ICLEI Community Protocol					
Method SW.4 Landfill Decomposition Emissions	CH4 emissions= GWPCH4*(1-CE)*(1-OX)*M*(SUM Pi *Efi)				
			2010	**2020**	
M =	Total mass of waste entering landfill (wet short ton)	User Input	10,874	10,460.29	
Pi =	Mass fraction of waste component i (proportion)	User Input	1	1	
Efi=	Emission factor for material i (mtCH4/wet short ton)	Table SW.5	0.060	0.060	
CE=	Default LFG Collection Efficiency	No Collection, 0	0	0	
		Collection, 0.75			
OX=	Oxidation rate	0.1	0.1	0.1	
GWP CH4=	Global warming potential of methane	21	21	21	
Cortland Proportion of Landfill CH4 Emissions (2010)	587.2 **12,331.53**	MTCH4 **MTCO2e**	Cortland Proportion of Landfill CH4 Emissions (2020)	564.9 **11,861.97**	MTCH4 **MTCO2e**
			assumed same C&D amount as 2010		
Cortland Proportion of Landfill process emissions (diesel fuel) 2010	**178.34**	**MTCO2e**	Cortland Proportion of Landfill process emissions (diesel fuel) 2020	**171.55**	**MTCO2e**
Cortland Collection emissions	***217.49***	***MTCO2e***	*information item*		
Cortland Transportation emissions	***12.18***	***MTCO2e***	*information item*		
TOTAL	**12,509.87**	**MTCO2e**	**TOTAL 2020**	**12,033.52**	**MTCO2e**

Figure 18 Landfill Emissions Estimate

Appendix 5. CACP Output

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Cortland

Government Greenhouse Gas Emissions in 2010

Summary Report

Scope 1 + Scope 2 + Scope 3

	CO_2 (tons)	N_2O (lbs)	CH_4 (lbs)	Equiv CO_2 (tons)	Bio CO_2 (tons)	Energy (MMBtu)	Cost ($)
Buildings and Facilities	652	7	99	655	0	10,505	102,187
Streetlights & Traffic Signals	308	8	20	310	0	4,223	322,741
Water Delivery Facilities	547	13	47	549	0	7,822	125,443
Wastewater Facilities	2,412	623	224	2,511	0	32,649	415,755
Vehicle Fleet	672	59	49	682	24	8,814	155,127
Total	4,591	710	439	4,706	24	64,012	1,121,254

This report has been generated for Cortland, NY using ICLEI's Clean Air and Climate Protection 2009 Software.

**Note: CACP Output tables reflect emissions in tons of CO_2 and CO_2e, whereas emissions are reported throughout document in metric tons ($MTCO_2e$), or tonnes.*

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Cortland

Government Greenhouse Gas Emissions in 2010

Scope Summary Report

Equivalent CO_2

	Scope 1 (tons)	Scope 2 (tons)	Scope 3 (tons)	Total (tons)
Buildings and Facilities	460	195	0	655
Streetlights & Traffic Signals	0	310	0	310
Water Delivery Facilities	97	452	0	549
Wastewater Facilities	396	2,114	0	2,511
Vehicle Fleet	682	0	0	682
Total	1,635	3,070	0	4,706

This report has been generated for Cortland, NY using ICLEI's Clean Air and Climate Protection 2009 Software.

Government Greenhouse Gas Emissions in 2010
Report by Source

Scope 1 + Scope 2 + Scope 3

	CO_2 (tons)	N_2O (lbs)	CH_4 (lbs)	Equiv CO_2 (tons)	Bio CO_2 (tons)	Energy (MMBtu)	Cost ($)
Buildings and Facilities Sector							
Electricity	194	5	12	195	0	2,655	59,263
Natural Gas	459	2	87	460	0	7,850	42,925
Subtotal	652	7	99	655	0	10,505	102,187
Streetlights & Traffic Signals Sector							
Electricity	308	8	20	310	0	4,223	322,741
Subtotal	308	8	20	310	0	4,223	322,741
Water Delivery Facilities Sector							
Electricity	450	12	29	452	0	6,170	115,618
Natural Gas	97	0	18	97	0	1,652	9,825
Subtotal	547	13	47	549	0	7,822	125,443
Wastewater Facilities Sector							
Electricity	2,104	57	135	2,114	0	28,841	339,004
Fuel Oil (#1 2 4)	301	6	88	303	0	3,692	76,085
Natural Gas	7	0	1	7	0	116	667
Nitrous Oxide	0	560	0	87	0	0	0
Subtotal	2,412	623	224	2,511	0	32,649	415,755
Vehicle Fleet Sector							
Diesel	293	2	2	293	0	3,596	64,204
Ethanol (E100)	0	9	7	1	24	319	0
Gasoline	379	49	40	387	0	4,899	90,923
Subtotal	672	59	49	682	24	8,814	155,127
Total	4,591	710	439	4,706	24	64,012	1,121,254

This report has been generated for Cortland, NY using ICLEI's Clean Air and Climate Protection 2009 Software.

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Community Greenhouse Gas Emissions in 2010
Report by Source

Scope 1 + Scope 2 + Scope 3

	CO_2 (tons)	N_2O (lbs)	CH_4 (lbs)	Equiv CO_2 (tons)	Bio CO_2 (tons)	Energy (MMBtu)
Residential Sector						
Commercial Coal	106	4	24	107	0	1,010
Electricity	6,705	182	429	6,738	0	91,918
Fuel Oil (#1 2 4)	776	15	228	781	0	9,516
Natural Gas	31,949	121	6,026	32,031	0	546,657
Propane	838	30	300	846	0	12,366
Wood 12 pct moisture	0	153	11,479	144	1,704	16,477
Subtotal	40,374	504	18,486	40,646	1,704	677,944
Commercial Sector						
Commercial Coal	91	3	21	92	0	871
Electricity	7,849	213	503	7,887	0	107,596
Fuel Oil (#1 2 4)	5,465	107	1,606	5,498	0	67,028
Natural Gas	39,386	149	7,429	39,487	0	673,911
Stationary LPG	1,114	38	384	1,124	0	16,040
Wood 12 pct moisture	0	104	7,800	98	1,158	11,197
Subtotal	53,905	614	17,743	54,186	1,158	876,643
Industrial Sector						
Electricity	5,223	142	334	5,249	0	71,602
Natural Gas	9,112	34	344	9,121	0	155,906
Subtotal	14,335	176	678	14,369	0	227,508
Transportation Sector						
Diesel	7,747	45	46	7,754	0	95,046
Ethanol (E100)	0	1,071	879	175	2,996	39,730
Gasoline	33,974	4,544	3,857	34,719	0	438,742
Subtotal	41,721	5,660	4,782	42,648	2,996	573,518
Total	150,334	6,955	41,690	151,850	5,858	2,355,614

This report has been generated for Cortland, NY using ICLEI's Clean Air and Climate Protection 2009 Software.

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Cortland

Community Greenhouse Gas Emissions

Time Series Report

Scope 1 + Scope 2

Year	**2010**	**2020**
Residential		
eCO2 (tons)	40,646.0	40,833.5
Energy (MMBtu)	677,944.2	681,796.8
Commercial		
eCO2 (tons)	54,186.2	57,537.5
Energy (MMBtu)	876,642.8	931,758.4
Industrial		
eCO2 (tons)	14,369.4	14,008.5
Energy (MMBtu)	227,508.2	220,449.6
Transportation		
eCO2 (tons)	42,648.4	41,680.3
Energy (MMBtu)	573,518.3	560,346.4
Total		
eCO2 (tons)	151,849.9	154,059.8
Energy (MMBtu)	2,355,613.6	2,394,351.2
Cost ()	0.0	0.0

This report has been generated for Cortland, NY using ICLEI's Clean Air and Climate Protection 2009 Software.

Community Greenhouse Gas Emissions in 2010
Report by Source

Information Items

	CO_2 (tons)	N_2O (lbs)	CH_4 (lbs)	Equiv CO_2 (tons)	Bio CO_2 (tons)	Energy (MMBtu)
Residential Sector						
Wood 12 pct moisture	0	0	0	0	1,704	16,477
Subtotal	0	0	0	0	1,704	16,477
Commercial Sector						
Wood 12 pct moisture	0	0	0	0	1,158	11,197
Subtotal	0	0	0	0	1,158	11,197
Transportation Sector						
Ethanol (E100)	0	0	0	0	2,996	39,730
Subtotal	0	0	0	0	2,996	39,730
Total	0	0	0	0	5,858	67,404

This report has been generated for Cortland, NY using ICLEI's Clean Air and Climate Protection 2009 Software.