Local Government and Community Greenhouse Gas Emissions Inventory and Analysis

2010 Baseline

Town of Dewitt, New York

January 2012,
May 2014 updates

Town of Dewitt
Division of Sustainability
5400 Butternut Drive
East Syracuse, NY 13507

ICLEI Local Governments for Sustainability USA

Acknowledgements

The Town of DeWitt would like to acknowledge the following people for their contributions to this report.

SUNY-ESF Student Interns
Andrew Dorr, B.S. Environmental Studies
Ruiqi Li, Environmental Studies M.S. Candidate
Tim Pede, Environmental Science B.S. Candidate

Town of Dewitt Staff
Mike Moracco, Commissioner of Sustainability
Sue Ziemba, Highway Department
Mike Kolceski P. E., Town Engineer
Eugene J. Conway, Chief of Police
Andrew Worden and Jim Conlon, Department of Development and Operations

Central New York Regional Planning and Development Board
Chris Carrick, Energy Program Manager
Sam Gordon, Senior Planner
Carolyn Ramsden, Planner
Amanda Sopchak, Planner

Additional Support
ICLEI Local Governments for Sustainability USA – Jamie O'Connell, *Regional Officer*
National Grid - Theresa Bowen, *Regional Account Manager and Support Services*
Central New York Regional Planning and Development Board - Sam Gordon, *Senior Planner*
Syracuse Haulers Waste Removal Inc. – Nicholas Denierio, *Operations Manager - Residential/Commercial*
Feher Rubbish Removal Inc. - Susan Eldridge, *Office Manager*

Contents

List of Figures

List of Tables

Executive Summary

In 2010, The Town of DeWitt (Town) Town Board unanimously approved a new Sustainability Policy upon the recommendation of the DeWitt Sustainability Committee. The Sustainability Policy set forth a commitment to increase energy efficiency in Town facilities, as well as the Town at large, and therefore reduce the energy consumption and the carbon footprint of the Town. Additionally, the Town was

selected by the Central New York Regional Planning and Development Board (CNY RPDB) as a participant in the Central New York Climate Change Innovation Program (C2IP). Through the C2IP program the Town was asked to conduct a Greenhouse Gas Emissions (GHG) inventory and also to develop an action plan for reducing the Town's emissions, for which the Town will receive both technical and financial assistance. The Town was assisted by several interns from the SUNY College of Environmental Science and Forestry to conduct the GHG inventory.

Greenhouse gas inventories are being conducted nationally and internationally as a measure of community contributions to global warming, or climate change. This inventory follows the ICLEI Local Governments for Sustainability protocol for reporting GHG emissions for the calendar year of 2010 (baseline year). The inventory provides the Town with a better understanding of its contribution to global emissions, and will also serve as the basis for future planning efforts targeted at greenhouse gas emissions reductions.

In 2010, the Town of DeWitt local government operations (LGO) were responsible for 1,782 metric tons of CO_2e (carbon dioxide equivalent). The community's footprint was 609,312 metric tons of CO_2e in 2010 (see Figures 1 and 2). [1]

The Town implemented emissions reductions strategies for government operations in these areas:

Lighting Retrofit at Town Hall - installed efficient lighting, reducing electricity consumption by more than 24,000 kWh (kilowatt hours) and saving more than $1,200 in first six months

Streetlights - replaced all of the Town's streetlights from mercury vapor to high pressure sodium, saving $30,000 to $40,000 per year

Solar - a new 51kW PV system at the Town Hall installed during the Fall of 2011 is expected to produce almost 55,000 kWh per year reducing the Town's greenhouse gas emissions by the equivalent of the electricity use of 4.6 average homes over one year, and saving almost $8,000 in the first year of operation.

[1] While the Village of East Syracuse is located within the Town of DeWitt, the Village has its own government and Village operations are outside of the operational control of the Town. Therefore, the village is not included in the government analysis.

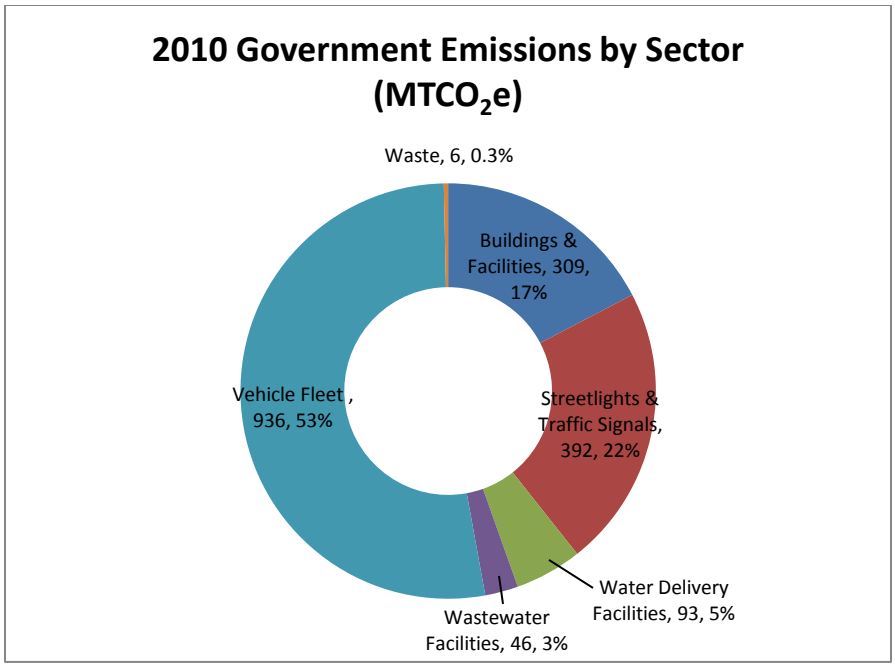


Figure 1 2010 Government Operations Emissions by Sector

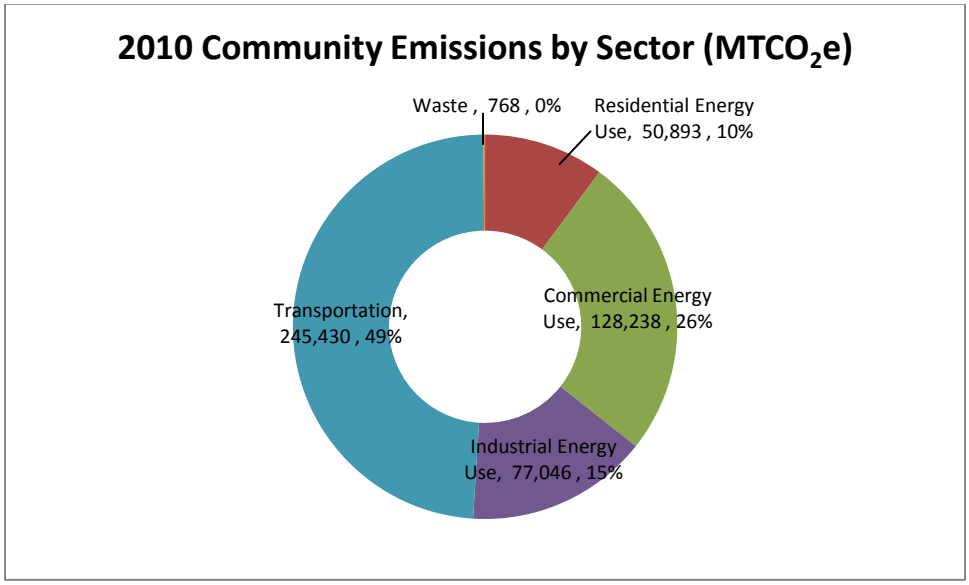


Figure 2 2010 Community Emissions by Sector

1. Background

1.1 Introduction

A greenhouse gas (GHG) inventory identifies and quantifies the emissions produced by both government operations and the community at large in a particular year. The inventory and forecast provide a benchmark against which a community can measure progress toward emission reductions. This emissions analysis identifies the activities that contribute to global warming and the quantity of emissions generated by each of these activities. An inventory is established by collecting data about energy management, recycling and waste reduction, transportation, and land use. A local government can calculate emissions for a base year (e.g. 1990) and for a forecast year (e.g. 2012). Expertise in climate science is not necessary. A wide range of government staff members, from public works to environment and facilities departments, can conduct an inventory. This inventory was conducted with the assistance of student interns from the SUNY College of Environmental Science and Forestry, as well as staff from the Central New York Regional Planning and Development Board.

The Intergovernmental Panel on Climate Change for the United Nations states that six greenhouse gases should be included in an inventory: Carbon Dioxide (CO_2), Nitrous Oxide (N_20), Methane (CH_4), Hydrofluorocarbons (HFCs), Perfluorocarbons (PFCs), and Sulfur Hexafluoride (SF_6). For ease of analysis, all the emissions are converted into an equivalent amount of CO_2 termed CO_2e or CO_2 equivalent. Conducting an inventory is the first step in taking action to reduce GHG emissions in a community.

Knowing the source for emissions is the first step in effectively planning and implementing emissions reduction actions. An emissions inventory provides a quantitative foundation for communities to develop policy and take action to address climate change and sustainability. The Town of DeWitt utilized the Clean Air and Climate Protection (CACP) software developed by ICLEI Local Governments for Sustainability (www.icleiusa.org) to conduct this inventory. GHG emissions inventories typically report data by government and community sectors, and by the type of energy used and GHGs emitted. Data was collected from the following sectors within the Town of DeWitt to determine total emissions:

Municipal Inventory	Community Inventory
• Buildings and Facilities	• Transportation
• Water Delivery	• Waste
• Streetlights and Traffic Signals	• Residential, Commercial and Industrial Energy Use
• Vehicle Fleet	• Transportation

1.1 Town location

The Town of DeWitt covers an area of 34.8 square miles, and is located in a suburban area east of the City of Syracuse in the center of New York State. The Town is bisected by interstates 90 (NYS Thruway), 690, and 481. The most recent U.S. Census data (2010) indicates that approximately 25,838 people reside within the political boundaries of the Town. The Town employs 60 full-time workers within 12 departments and hires seasonal help for summer recreation programs and park maintenance. The Village of East Syracuse operates as a local government independent from the Town, but is included in the larger DeWitt community.

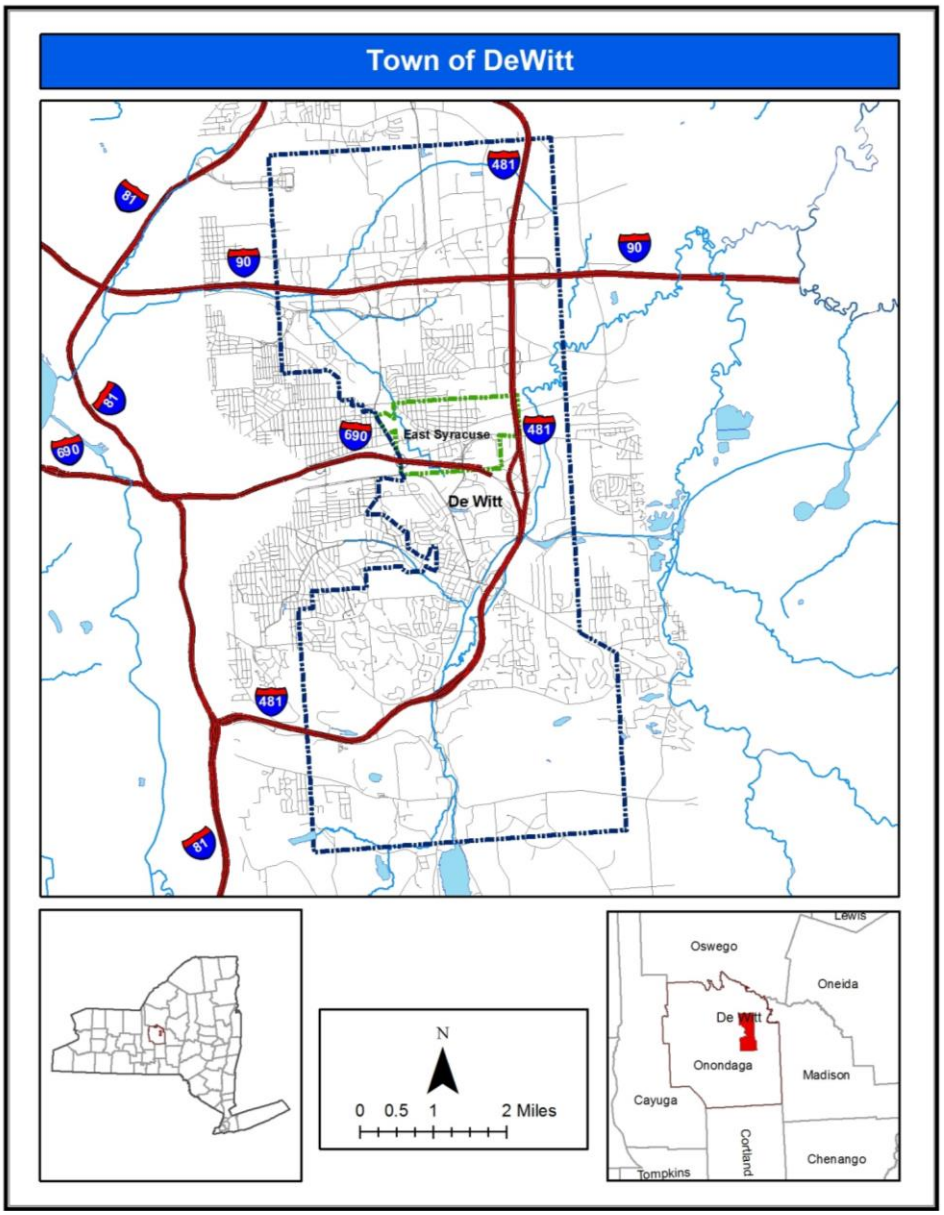


Figure 3 Town of DeWitt map
Map created by Tim Pede 2011

1.1.2 Town of DeWitt Sustainability

In 2010 the Town created and filled a Director of Sustainability position. In addition, the Town formed a Sustainability Committee with the aim of adopting a Sustainability Policy. Members of this Committee include the Town of DeWitt Director of Sustainability, residents of the town, as well as the Town Supervisor, Ed Michalenko (President, Onondaga Environmental Institute), and Chris Carrick (Energy Program Manager at the Central New York Regional Planning and Development Board) .

At the opening meeting the Town Supervisor provided a list of goals:

1. Create a Town Sustainability Mission Statement:
   The Town of DeWitt will provide leadership and pursue practical solutions to improve environmental sustainability in our community while reducing long term costs. The Town will adopt and support programs, policies and actions in pursuit thereof.
2. Set strategy and target date for Town buildings to be close to carbon neutral
3. Propose a change to Town law requiring any new renovation to Town owned buildings or any new construction to Town owned property to be LEED certified.
4. Investigate the use of wind and/or solar power for Town buildings.
5. Explore options for alternative energies to run Town vehicles.
6. Pass a resolution that vendors or service providers to the Town have to achieve certain levels of sustainability; i.e. low VOC cleaning materials, alternatives to pesticides in Highway and Recreation areas.
7. Adopt a “Green Purchasing Policy” including recycled paper.
8. Identify sustainable requirements for commercial building permits within the Town.
9. Formulate sustainable land use and transportation policies.
10. Support local vendors rather than out of region.
11. Maximize Conservation
12. Provide ongoing education.

In April of that year the Town adopted The Town Mission Statement and as a first step the Town Board signed the NYS DEC (New York State Department of Environmental Conservation) Climate Smart Communities Pledge. The DEC Guide for Sustainable Communities was used to develop the Town Sustainability Policy. This includes:

Policy Statement 1: Ensure Energy-Efficient and Environmentally Supportive DeWitt Town Codes, Plans and Policies

Policy Statement 2: Improve Energy Efficiency and Green Practices of Existing Town Buildings.

Policy Statement 3: Build Very Efficient New or Renovated Buildings.

Policy Statement 4: Educate Employees About Sustainable Practices.

Policy Statement 5: Support the Reduction of Energy Use by Homeowners, Developers, and Landlords.

Policy Statement 6: Reduce Dependence on Traditionally Powered Vehicles.

Policy Statement 7: Reduce Storm Water Runoff and Increase Storm Water Quality.

Policy Statement 8: Encourage Green Economic Development.

Policy Statement 9: Include Sustainable Land Use and Transportation Practices in Town Zoning Ordinance and Comprehensive Plan.

Policy Statement 10: Enhance Accessibility of Our Community to People with Disabilities.

The Town immediately started implementing many of these policies (see Appendix A and B) and produced measurable results. The Town educated staff on the motivation for the Sustainability Policies and directed the implementation of these policies.

In 2010 the Town applied for and received a NYSERDA Energy Efficiency and Conservation Block Grant for $102,000. This money was used to establish a base line for energy use by the Town and to research best practices to reduce energy consumption by the town. Collected data from 2010 was used to establish baselines. Benchmarks and milestones were set. Audits of Town energy use (2011) show that the Town has reduced its energy consumption by 30%. This was accomplished by a number of initiatives including installation of solar panels at the DeWitt Town Hall (see Appendix B). In January 2012, solar panels were installed on the Ryder Park pavilion making it a carbon neutral building. Other initiatives include retrofitting Town vehicles to use propane, replacing Town streetlights with energy efficient bulbs and lowering heat in Town buildings.

The Town has shown its commitment to this process by creating a Comprehensive Planning Committee (CPC) that includes members of the Zoning and Planning Boards. The mission of the CPC is to promote Green Industry and sustainable business practices within the Town. The Town has also hired a Town Naturalist.

The Town's sustainability effort is supported by DACC (the DeWitt Advisory Conservation Commission). DACC's mission statement is: "To protect human health and the environment through education and advice to the Town Board and other agencies and groups." DACC has been instrumental in providing community education. DACC's Tree Committee was created in 2009 to facilitate planting of trees throughout the Town.

Most recently, the Town has created a sustainability e-newsletter. The first issue of Sustainability News was emailed in the fall of 2011.

Future goals of the Town include pursuing geothermal energy as a possible energy source, creation of parking lots that prevent/contain storm water runoff through the use of swales and porous pavement and creation of wooded buffers between industrial and residential areas. The Town is also in the process of changing zoning rules to reflect green practices. To this end, the Town has adopted a new Tree Ordinance. Other zoning ordinances require builders to prevent flooding, create buffers and preserve wooded areas wherever possible. These policies will substantially improve the quality of life for Town residents.

1.1.3 Climate Change Science Background

The Earth's weather and climate is driven by energy absorbed from the Sun, but the Earth also radiates energy back into space. However, much of this energy going back to space is absorbed by greenhouse gases in the atmosphere. As a result of this cycle, and because the atmosphere then radiates most of this energy back to the Earth's surface, our planet is warmer than it would be if the atmosphere did not contain these gases. Without this natural "greenhouse effect" temperatures would be about sixty degrees lower than they are now on average and life as we know it would not be possible (US EPA, 2011).

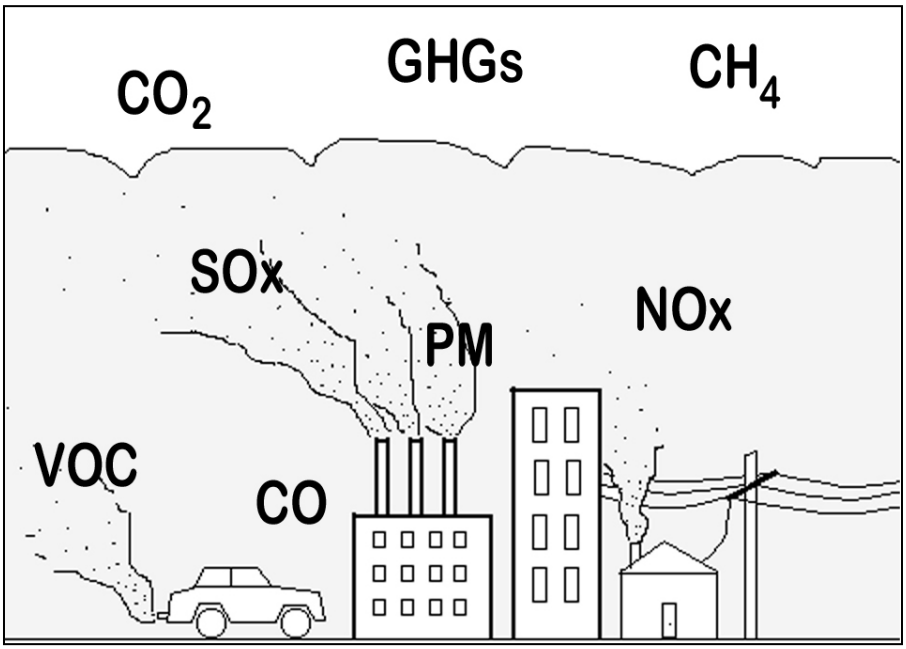


Figure 4 Common GHG Emission Sources (ICLEI, 2005)

There are a number of GHGs contained in the earth's atmosphere: CO_2, N_20, CH_4, SF_6, H_2O (g), HFCs, and PFCs; only CO_2, N_2O, and CH_4 are quantified in this analysis. Some of these gases have a greater capability of trapping heat in the atmosphere than others, and thus, warm the earth more per unit mass released. Simply quantifying the mass of GHGs would not accurately determine the impact on earth's climate, since some gases have a greater warming potential than others. Global Warming

Potential (GWP) is a relative unit used to compare the amount of heat trapped by a certain mass of gas in question to a mass of CO_2. For instance, 1 unit of N_20 has a GWP of 310 and therefore warms the earth 310 times more than 1 unit of CO_2, which has a GWP of 1.

A ton of CO_2e, or any mass of CO_2e, is similar to GWP in that it is a relative unit used to compare the environmental impact of different GHGs released from a given source. Essentially, it is a quantity which takes both GWP and mass of a given GHG into consideration, which is determined by multiplying those two values. Again, 1 ton of N_20 would have a CO_2 equivalent of 310 tons, meaning that it would warm the earth as much as 310 tons of CO_2. The CO_2 equivalent (usually in tons) of all GHGs emitted from a given source can then be totaled to give a single uniform value of how much that particular source contributes to the earth's atmosphere. It is especially useful because sources that emit different types of GHGs can easily be compared. (Refer to Appendix D for CO_2e and GWP equations and more details about GHGs.)

1.1.4 Benefits of Climate Protection to the Town of DeWitt

GHG Inventories act as a map to help identify high energy use and potential energy reduction measures. As mentioned previously, the Town has made efforts to reduce its environmental impact, mainly through energy efficiency projects. Through the resources provided by ICLEI, more efforts can be made in the following years to reach reduction goals and create a healthier, more connected community. The community may also experience the following benefits (identified in the LGO Protocol (2011)) as a result of this inventory:

Risk Management. Voluntarily reporting GHG emissions may help local governments manage climate risk by documenting early actions to reduce GHG emissions. Such information may be accepted by future state, federal or international regulatory GHG programs.

Addressing Inefficiencies. Accounting for emissions has helped many organizations gain better insights into the relationship between improving efficiency (reducing factor inputs and waste) and reducing emissions. As a result, organizations have redesigned business operations and processes, implemented technological innovations, improved products and services, and ultimately saved money and resources.

Readiness for a Carbon Constrained Future. Identifying emissions sources to develop a GHG profile and management strategies may help local governments prepare for and respond to the potential impact of new regulations.

Recognition as an Environmental Leader. Voluntarily reporting GHG emissions provides local governments with a pathway to recognize, publicize, and promote their environmental stewardship.

Stakeholder Education. Assembling an annual GHG emissions inventory can help inform management, constituents, employees, and the public about a local government's GHG emissions profile.

1.1.5 ICLEI Five Milestone Process

ICLEI Five Milestone Process

The Town of DeWitt became a member of ICLEI Local Governments for Sustainability prior to commencing the inventory process, and the completion of the municipal and community analyses is the first component of ICLEI's Five Milestones for Climate Mitigation (see Figure 5). The five milestones include:

1. Conduct a baseline emissions inventory and forecast
2. Adopt an emissions reduction target for the forecast year
3. Develop a Local Climate Action Plan
4. Implement policies and measures
5. Monitor and verify results

Following the completion of Milestone 1 the Town will seek to move through the remaining 4 milestones.

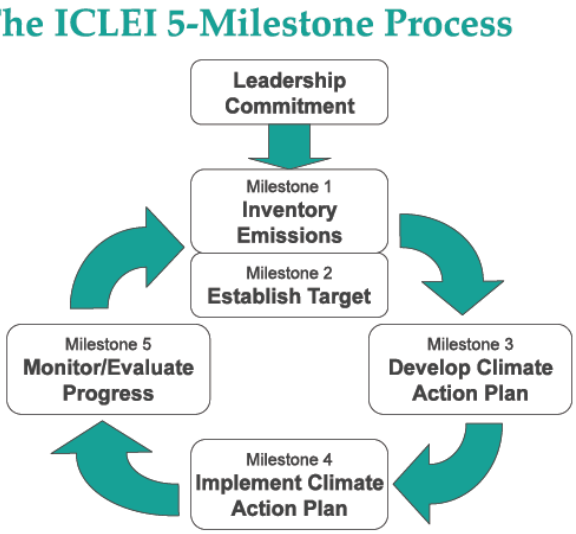


Figure 5 ICLEI Five Milestone Process

The ICLEI Protocol identifies five General Principles to aide in the Inventory process in an effort to simplify the report.

Relevance: reflect the areas over which local governments exert control and hold responsibility in order to serve the decision-making needs of users.,

Completeness: All GHG emission sources and activities within the chosen inventory boundary shall be accounted for; include any exclusions.,

Consistency: allows for meaningful comparisons over time.,

Transparency: factual and coherent.

Accuracy: Accuracy should be sufficient to enable users to make decisions with reasonable assurance as to the integrity of the reported information.

2. GHG Emissions Inventory Methodology

2.1 General Principles and Scopes

Using these Guidelines, this inventory does not include the government operations of the Village of East Syracuse, as they operate under separate codes and enforcement. Due to the small amount of roads, time, and available data, vehicle miles traveled on Village roads are included in the DeWitt Community Analysis, but represent a small portion of the emissions.

Operational activities and energy sources require numerous fuels and produce direct and indirect emissions. The Local Government Operations Protocol (LGOP) identifies three scopes for recording LGO GHG emissions. Emissions sources for an LGO are categorized according to where they fall relative to the operational boundaries:

Scope 1: Direct emissions from sources within a local government's organizational boundaries that the local government owns or controls.

Scope 2: Indirect emissions associated with the consumption of purchased or acquired electricity, steam, heating, and cooling. Scope 2 emissions occur as a result of activities that take place within the organizational boundaries of the reporting entity, but that occur at sources owned or controlled by another entity.

Scope 3: All other indirect emissions not covered in Scope 2, such as emissions from up-stream and downstream activities that occur as a result of activities within the operational boundaries of the local government, emissions resulting from the extraction of and production of purchased materials and fuels, contracted services, and waste disposal.

Community emissions sources are derived in terms of where they occur in relationship to the geographic boundaries of a place and within the timescale of an inventory. In other words, an inventory can include any emissions source generated within the political boundary or by anyone that resides within that boundary, but may create emissions outside of the community. The following details the community scopes:

Scope 1: Emissions which occur within the boundaries of a community (fuel consumption for energy use, on-road tailpipe emissions, and emissions from waste facilities within community).

Scope 2: Emissions which occur outside of the community boundaries, but are a direct result of community activities (electricity consumed for vehicular travel and consumption of electricity).

Scope 3: Emissions from up-stream processes or lifecycle/lifetime energy embodiment and process emissions (emissions from transportation of energy sources, tailpipe emissions from community residents outside of the community, and future emissions from wastewater treatment).

Refer to Appendix C for a more detailed guide to LGO and Community scopes.

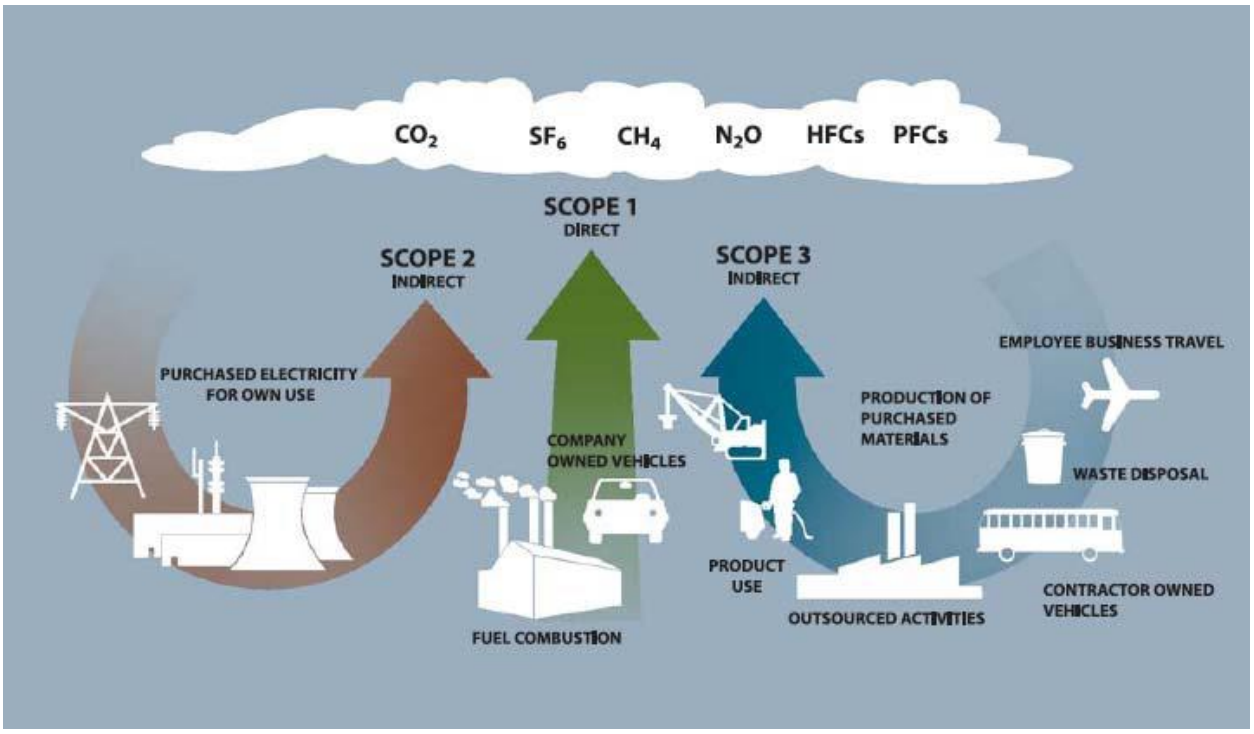


Figure 6 Emissions Sources by Scope

Source: WRI/WBCSD GHG Protocol Corporate Standard, Chapter 4 (2004)

2.2 Government Operations Analysis

The operational boundary considers all emissions sources owned, operated, and managed by the local government. Methodology for quantifying GHG emissions followed the *Local Government Operations Protocol For the quantification and reporting of greenhouse gas emissions inventories Version 1.1* (May 2010). GHG emissions were quantified prior to inputting the raw data into the Clean Air Climate Protection software (CACP) for organizational purposes. Energy use accounts were organized by Account ID number, which correlates with the department responsible for paying for the services (see below). These numbers reflect the methodology to identify which department or sector (2.2.1 – 2.2.4) the National Grid meter numbers are assigned.

Department	Account ID
Town General Fund	10162
Highway	10513
Parks and Recreation	10711
Water Delivery	65831
Wastewater	70812

2.2.1 Buildings and Other Facilities

For buildings under government operational control, GHG emission sources can be categorized as direct (Scope 1) or indirect (Scope 2 or Scope 3). The municipal buildings GHG analysis includes both scope 1 and scope 2. Energy consumption data (monthly) was provided by the Town energy supplier, National Grid. In their report, the following three sectors (Streetlights and Traffic Signals, Water Delivery Facilities, and Waste Water Facilities) were also included in either the community or government summaries; these sector methodologies will be the same as the buildings and facilities sector. The data was arranged by department and summarized by yearly totals which allowed for easy input into CACP.

2.2.2 Streetlights and Traffic Signals

Electricity use of streetlights and traffic signals are included in the National Grid account summaries previously mentioned and follow the same methods as described in section 2.2.1.

2.2.3 Water Delivery Facilities

Energy use for water delivery services was separated out by meter for each water pump as the Town receives drinking water from relatively distant sources (Lake Ontario and Skaneateles Lake).

2.2.4 Waste Water Facilities

These facilities include pumps for sewage and wastewater. The Town does not own or operate a wastewater treatment facility, but rather pumps the water to the City of Syracuse METRO facility. Therefore, the electricity use included in this report is for the pumps and pumping stations.

2.2.5 Port Facilities

The Town does not own or operate port facilities, so they are not included in this inventory.

2.2.6 Airport Facilities

While the Syracuse Hancock International Airport falls within the Town's geopolitical boundaries, it is operated by a separate regional airport authority and therefore is outside of the Town's operational control.

2.2.7 Vehicle Fleet

This section of the LGO analysis includes the GHG emissions from all vehicles owned and operated by the Town of DeWitt, which encompasses passenger vehicles, construction equipment and small-scale combustion sources such as lawnmowers, motorized hedge trimmers, weed-whackers, chainsaws, etc. CO_2, N_2O, and CH_4 emissions were quantified for the town's six departments: 1) the Department of Development and Operations, 2) the Highway Department, 3) the Parks and Recreation Department, 4) the Police Department, 5) the Water Department, and 6) the Dog Control Department. The Highway Department keeps detailed data on fuel consumption and type for the Town fleet, which includes miscellaneous fuel keys (typically for the small-scale combustion vehicles). However, data on mileage, which is necessary for N_2O and CH_4 calculations, is not documented for each vehicle. Miles traveled

were estimated based on a particular vehicle's fuel economy, which was obtained from Fuel Economy.gov for passenger cars and SUVs and the US DOE's 2010 *Transportation Energy Data Book* for heavy-duty vehicles. (See Appendix E for detailed methods regarding LGO Fleet.)

2.2.8 Transit Fleet

The Town does not own or operate a transit fleet and therefore this is not included in the inventory. The public transit system (CENTRO) that provides services to the Town is owned and operated by the Central New York Regional Transportation Authority (CNYRTA) and therefore emissions from the transit fleet (busses) is included under the community analysis in the VMT calculations (section 4.3).

2.2.9 Power Generation Facilities

The Town does not own or operate power generation facilities.

2.2.10 Solid Waste Facilities

The Town contracts the hauling services of Feher Rubbish Removal to transport the waste generated to the Onondaga County Resource Recovery Agency's (OCRRA) Waste-to-Energy (WTE) Facility, managed by Covanta. Data was obtained through the cooperation of the hauler in order to include this as a Scope 3 source of emissions. As per the protocol, it is best to record the data in tons within the respective waste categories. While the hauler was not able to provide a detailed breakdown for waste content, MSW composition was derived from facility specific averages provided by OCRRA's 2005 Waste Composition Study (see Figure 7). For each waste category listed in the software, the appropriate waste disposal technology (in this case, controlled incineration) should also be selected to utilize the most appropriate emission factors.

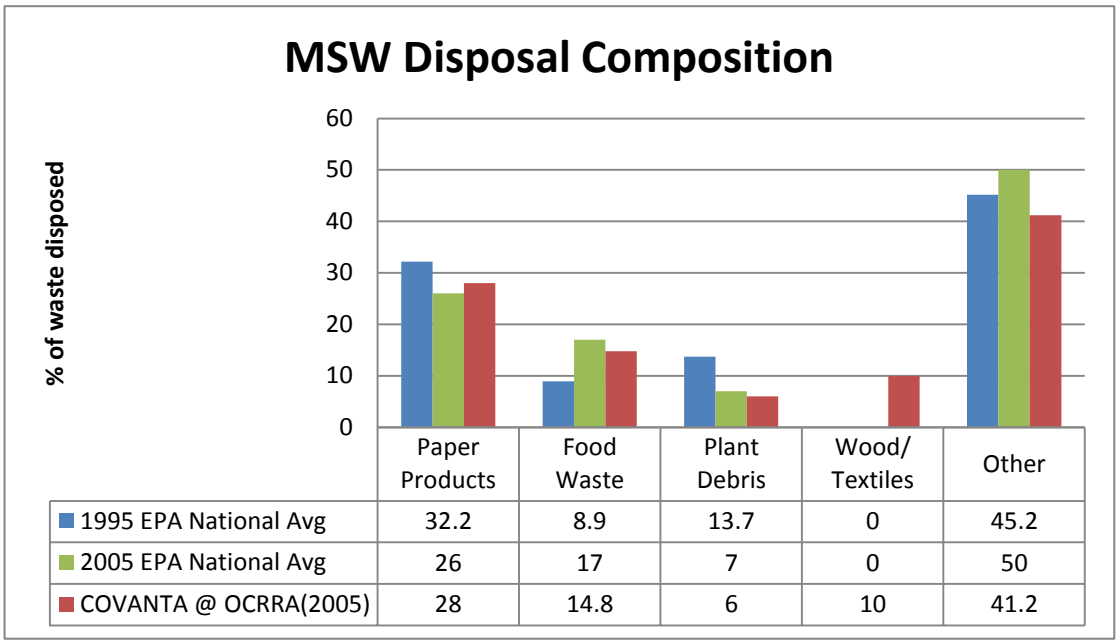


Figure 7 OCRRA 2005 Waste Composition Study Results

2.2.11 Other Process and Fugitive Emissions

After considering the examples listed in Chapter 11 of the LGOP, there were no emission sources that meet these criteria and this category is excluded from the inventory.

2.3 Community Analysis

ICLEI defines the parameters of the community by geopolitical or geographic boundaries. The protocol identifies sectors within the community, which are listed below. The methodology used for this analysis follows the *Clean Air and Climate Protection Software User Guide* (June 2003).

2.3.1 Residential, Commercial, and Industrial Energy Use

This data was also provided by National Grid and broken down by the respective sector. It was assumed that the only energy sources used within the community are provided by National Grid, which includes electricity and natural gas. Due to the aggregate data presented by National Grid, energy use for individual community accounts cannot be identified.

2.3.2 Transportation

Data on fuel consumption for the entire Town of DeWitt was unobtainable. Therefore, GHG emissions for this section of the community analysis were estimated based off average annual daily traffic counts (AADTs) and road length. AADT counts were obtained from the Syracuse Metropolitan Council (SMTC) and road lengths were provided by the Highway Department, or calculated using O'Brien & Gere GIS

software (contractor to the Town). With these two pieces of information it was possible to estimate the annual vehicle miles traveled (VMT), which was then entered into the CACP software. Based on the USDOT's statistical breakdown of vehicle types on the road and average fuel economies, the software can take an annual VMT value and quantify GHG emissions similar to the methods utilized in the LGO vehicle fleet analysis. It is important to note that due to the limited availability of traffic volume data on a year to year basis, it was only possible to estimate a constant annual VMT value based on AADT counts collected over almost an entire decade. This value does not change on a year-to-year basis, and it was assumed that the traffic volume in the Town of DeWitt has not significantly changed over the three year period covered in this analysis; however, emissions from the transportation sector decrease slightly in each year of the inventory due to improvements in fuel economy.

2.3.3 Waste

Solid waste disposal within the community is contracted through private hauling services. The Town contracts with private services for residential pick-up through a town-wide refuse district, fees are paid by individual property owners based on service level through the annual end of year tax bill. Data was obtained in tonnage for the residential services, but an actual content breakdown was not available. Residential waste disposed in the Town of DeWitt, along with most municipal solid waste in Onondaga County, is sent to the Covanta WTE facility where incineration of waste produces electricity equivalent to powering over 30,000 homes annually (Waste-to-Energy, 2011).

3. Government Results and Discussion

3.1 LGO Emissions Summary

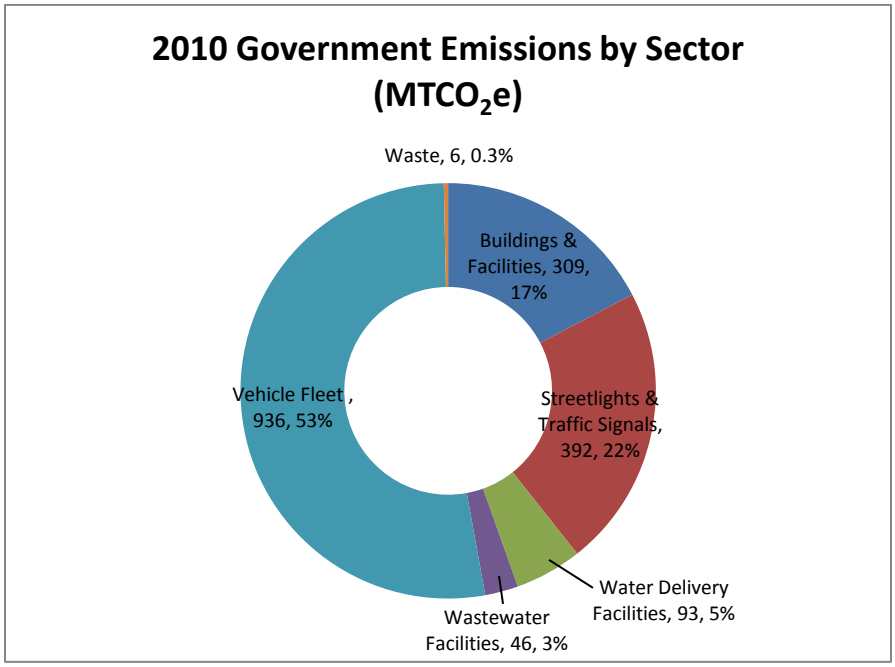


Figure 8 2010 DeWitt Government Operations Emissions by Sector

In the inventory year of 2010, emissions for the Town of DeWitt totaled 1,782 metric tons of CO_2e. The vehicle fleet was responsible for the majority of emissions at about 53% of this total. Streetlights and traffic signals followed, generating 22% of 2010 emissions (see Figure 8).

Town energy use is depicted in Figure 9, below. As represented by the emissions totals, the vehicle fleet fuel use translates into the highest energy use at 12,785 MMBtu in 2010.

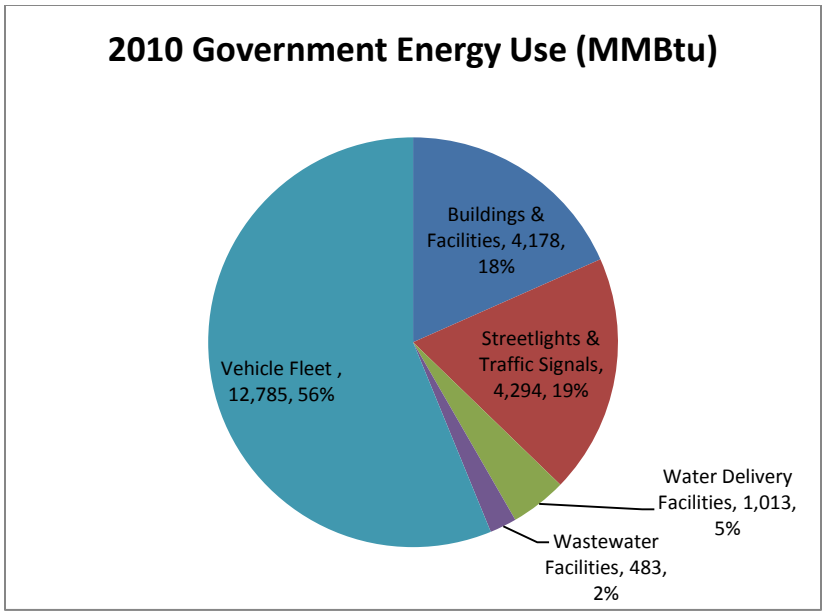


Figure 9 DeWitt Government Energy Use 2010

Variations in energy use are often attributed to weather and temperature, which equates to the annual heating degree days and cooling degree days for a region. Figure 10 depicts the average monthly temperatures during 2010 and the corresponding energy consumption (MMBtu) for the Town.

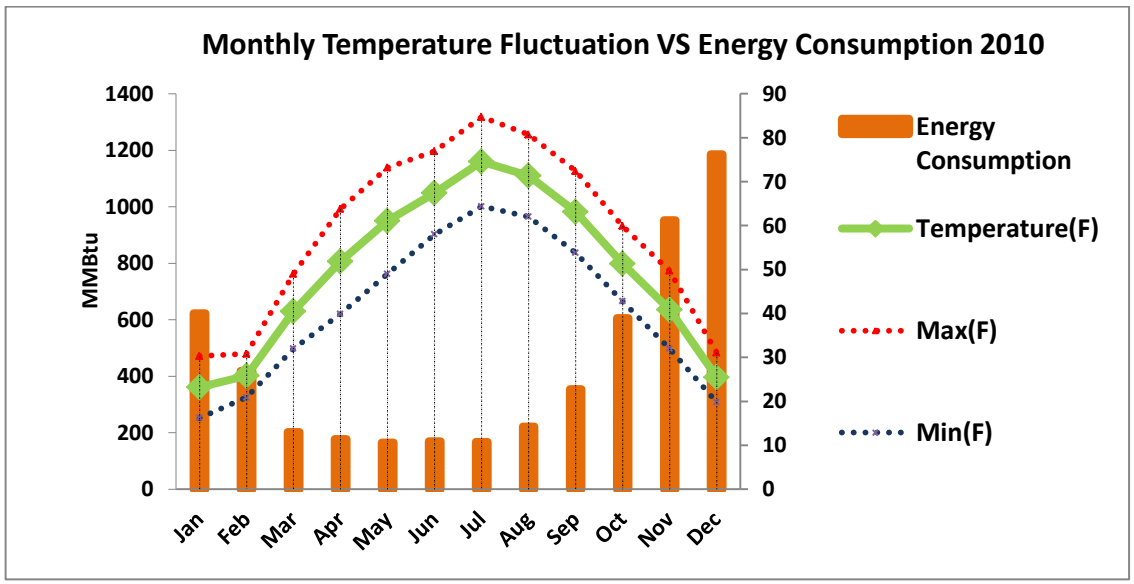


Figure 10 Temperature and Energy Consumption Trends (2010)

This graph helps to understand the relationship between energy use and temperature.
Source: http://www.nws.noaa.gov/climate/index.php?wfo=bgm

3.2 Buildings and Other Facilities

Energy use for municipal facilities is highlighted in Table 1. The Town Hall houses the majority of the departments and has a General Fund to pay for energy costs at the building and represents approximately 71% of yearly energy use. Due to the relatively small number of facilities, it may be possible for the Town to reduce its greenhouse gas emissions by focusing on improving the energy efficiency of its buildings.

Acct #	Address	Acct ID	2010
	Town Hall General Fund		
2314989101	0 BUTTERNUT DR DEWITT NY 13214	10162	468,640
	Highway Department		
2934988102	5953 BUTTERNUT DR DEWITT NY 13214	10513	114,127
	Parks and Recreation Department		
3795184103	6547 BADGLEY RD EAST SYRACUSE NY 13057	10711	22,400
4412566104	6499 ROUTE 173 JAMESVILLE NY 13078	10711	3,407
5379130001	0 BADGLEY RD, PAVILLION EAST SYRACUSE NY 13057	10711	68
5934984125	5889 BUTTERNUT DR, SYRACUSE NY 13214	10711	23,190
7374987226	40 CATON DR *APT 44A SYRACUSE NY 13214	10711	250
7472565117	0 CEDAR BAY RD FAYETTEVILLE NY 13066	10711	153
7738428000	38 CATON DR *OTHR SYRACUSE NY 13214	10711	21,202
8014987269	52 CATON DR *APT 56A SYRACUSE NY 13214	10711	608
8034987372	50 CATON DR *APT 53A SYRACUSE NY 13214	10711	2,228
9075184118	600 ROBY AVE EAST SYRACUSE NY 13057	10711	2,994

Table 1 Buildings and Facilities (kWh)

The Parks and Recreation Department is responsible for 10 electric accounts and averages 11% of Town electricity consumption. The majority of their electricity load is used for lighting park facilities as well as their maintenance facility located at 5889 Butternut Drive. There have been decreases in kWh used at the Town Hall due to the lighting upgrades implemented in 2008, where the T12 bulbs were replaced with T8 bulbs.

Acct #	Address	Acct ID	2010
	Town Hall General Fund		
5294989106	5400 BUTTERNUT DR DEWITT NY 13214	10162	11,364
	Highway Department		
4574989105	5953 BUTTERNUT DR EAST SYRACUSE NY 13057	10513	-

	Parks and Recreation Department		
4412566104	6499 ROUTE 173 JAMESVILLE NY 13078	10711	1,675
5374989120	5889 BUTTERNUT DR SYRACUSE NY 13214	10711	4,890
5414989106	5400 BUTTERNUT DR DEWITT NY 13214	10711	630
7374987226	40 CATON DR *APT 44A SYRACUSE NY 13214	10711	671
8014987269	52 CATON DR *APT 56A SYRACUSE NY 13214	10711	53

Table 2 Buildings and Facilities (therms)

Natural gas accounts are fewer in number than electric accounts as they are typically only used to heat facilities in the winter months.

3.3 Streetlights and Traffic Signals

Figure 12 highlights the streetlight and traffic signal energy use. Streetlights, traffic signals, and parking lot lights are all sub-sectors where significant emission reductions could be realized through switching to light emitting diodes (LEDs), or implementing renewable energy technologies.

Streetlights and Traffic Lights (kWh)		
Acct #	Address	**2010**
1515036022	5400 Butternut Dr, Town Consolidated	1,074,828
3277400006	5400 Butternut Dr *Lite 3-2 Orvilton Park	15,299
3413882106	5400 Butternut Dr, City Lights Lites	4,422
3873880108	5400 Butternut Dr, B'Ford Hght Lites	27,564
4033880101	5400 Butternut Dr, Nottingham Lites	54,578
4053880107	5400 Butternut Dr, Apple Cross Lites	30,907
8777252014	5400 Butternut Dr *Lite 288 Muni Owned UG	50,678

Table 3 Streetlights and Traffic Signals (kWh)

Streetlights and traffic signals are responsible for approximately 56% of the electricity consumption contributing to government emissions. Over the last three years, annual energy costs for these facilities totaled approximately $950,000.

3.4 Water Delivery

Water delivery in the town relies on widespread pumping facilities due to the fact that drinking water supplies originate from Skaneateles Lake and Lake Ontario. The water is pumped into the City of Syracuse and then redirected to Town pipelines via the pumps and pumping stations listed below.

Water Delivery Annual (kWh)		
Acct #	**Address**	**2010**
1949091008	7132 CORONATION CIR *PUMP FAYETTEVILLE NY 13066	221
2112562108	0 ACCESS SCHOOL RD FAYETTEVILLE NY 13066	1,028
2412560100	0 NOTTINGHAM RD SYRACUSE NY 13224	47
4274989109	0 ERIE BLVD E, WATER DEPT SYRACUSE NY 13214	3
4332567105	0 SOLVAY RD JAMESVILLE NY 13078	407
5152562103	106 MAPLE DR FAYETTEVILLE NY 13066	183,240
5172565100	0 NOTTINGHAM RD, PUMP STATION SYRACUSE NY 13210	90,515
5272567106	0 WESTCLIFFE RD DEWITT NY 13214	2,541
5792567102	6654 E SENECA TPKE JAMESVILLE NY 13078	11,035
6892567105	0 GREENWOOD RD JAMESVILLE NY 13078	1,043
6912567103	0 STATE ROUTE 173, WATER DEPT JAMESVILLE NY 13078	2,357
6932567109	0 PECK HILL RD, WATER DEPT JAMESVILLE NY 13078	2,676
8092577107	0 GATES RD JAMESVILLE NY 13078	1,809

Table 4 Water Delivery (kWh)

Water Delivery (therms)			
Acct #	**Address**	**Acct ID**	**2010**
5152562103	106 MAPLE DR FAYETTEVILLE NY 13066	65831	36
5172565100	0 NOTTINGHAM RD, PUMP STATION SYRACUSE NY 13210	65831	47

Table 5 Water Delivery (therms)

3.5 Waste Water Facilities

The energy used in waste water facilities is required to transport wastewater to the METRO treatment plant in the City of Syracuse.

Wastewater Facilities (kWh)		
Acct #	**Address**	**2010**
275193103	6740 COLLAMER RD EAST SYRACUSE NY 13057	2,238
312566108	227 EDWARDS DR FAYETTEVILLE NY 13066	7,827
894989103	0 TOWPATH RD *PUMP DEWITT NY 13214	24,425
1475181108	6621 KINNE ST *PUMP EAST SYRACUSE NY 13057	2,141

1537027018	6765 FLAMETREE DR, PUMP STATION FAYETTEVILLE NY 13066	1,465
1695184109	6757 MYERS RD EAST SYRACUSE NY 13057	2,821
1994989106	0 BUTTERNUT DR EAST SYRACUSE NY 13057	3,276
2099128017	6890 COLLAMER RD EAST SYRACUSE NY 13057	2,222
2592566108	0 POSTER LN DEWITT NY 13214	2,383
3996481016	0 PECK HILL RD, PUMP STATION JAMESVILLE NY 13078	1,954
5192567100	0 WAITSFIELD DR *PUMP DEWITT NY 13214	7,124
5212567108	0 SINGLETREE LN JAMESVILLE NY 13078	10,142
5593765108	0 HIGHBRIDGE RD *PUMP, LYMESTONE HILL FAYETTEVILLE NY 13066	29,846
5955184107	0 FLY RD EAST SYRACUSE NY 13057	5,909
6034984100	333 BUTTERNUT DR EAST SYRACUSE NY 13057	21,197
6034992102	0 ENTERPRISE PKWY EAST SYRACUSE NY 13057	5,348
6192562106	6774 GLEASON PL *PUMP FAYETTEVILLE NY 13066	7,522
9816615003	4545 SOLVAY RD *PUMP JAMESVILLE NY 13078	3,644

Table 6 Wastewater Facilities (kWh)

3.6 Vehicle Fleet

In 2010, 12,785 MMBtu of fuel was consumed which resulted in the emission of 936 metric tons of CO_2e.

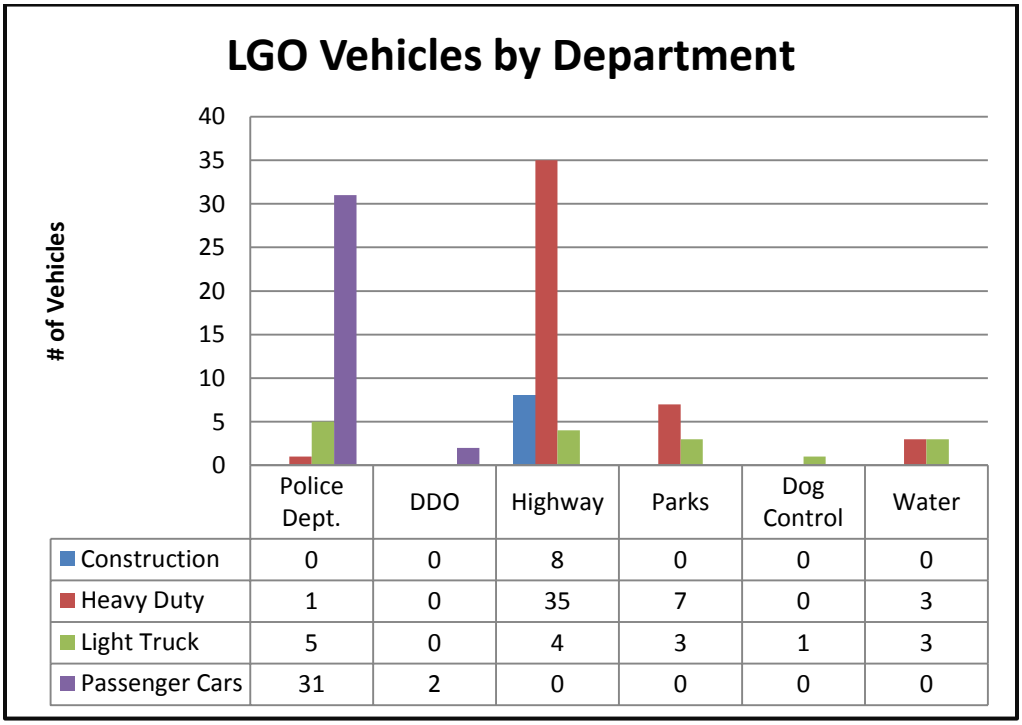
As stated earlier, this analysis tracked emissions of three GHGs: CO_2, N_2O, and CH_4. During the baseline year, CO_2 was the most prevalent source of emissions from vehicle operations. In metric tons of CO_2e, CO_2 averaged 99.3% of total emissions. On the other hand, N_2O only comprised an average of 0.6% and CH_4 comprised less than 0.1%. Therefore, some of the error encountered while estimating vehicle mileage only affects less than 1% of the total GHG emissions. The primary greenhouse gas emitted by vehicles is CO_2, and these emissions are quantified using fuel consumption data, by fuel and vehicle type.

The Highway Department vehicle fleet is the largest emitter because the department has the largest fleet. Specifically, this is due to the fact that the majority of Highway Department vehicles are classified as heavy-duty, which means they have lower fuel economies (Figure 11). Additionally, approximately 80% of the fuel consumed annually by the Highway Department fleet is diesel. The CO_2 emissions factor for diesel is 10.21 kg/gallon, while the emission factor for gasoline is only 8.78 kg/gallon. This means that more CO_2 is released per gallon of consumed diesel than gasoline.

The second largest producer of emissions is the Police Department. While the fleet contains a handful of SUVs, it is mainly composed of full-sized passenger cars. The fleet is fueled entirely by gasoline,

which- as mentioned above- has a lower CO_2 emissions factor than diesel. Although police vehicles operate at a higher frequency than other fleets, the department has fewer emissions than the Highway Department due to more fuel-efficient cars and a higher percentage of gasoline consumption.

The Water and Parks & Recreation Departments emit relatively equal amounts of emissions on an annual basis. However, it should be noted that the Parks & Recreation Department operates eight busses for their Summer Recreation program which amount to 43% of the department's annual fuel use. If the fuel use from the busses were not included, the Parks Department would emit nearly half the quantity of GHGs. The Department of Development and Operations and the Dog Control Department generate the least emissions. Fleet size and frequency of use are key factors in the low emissions for these units.



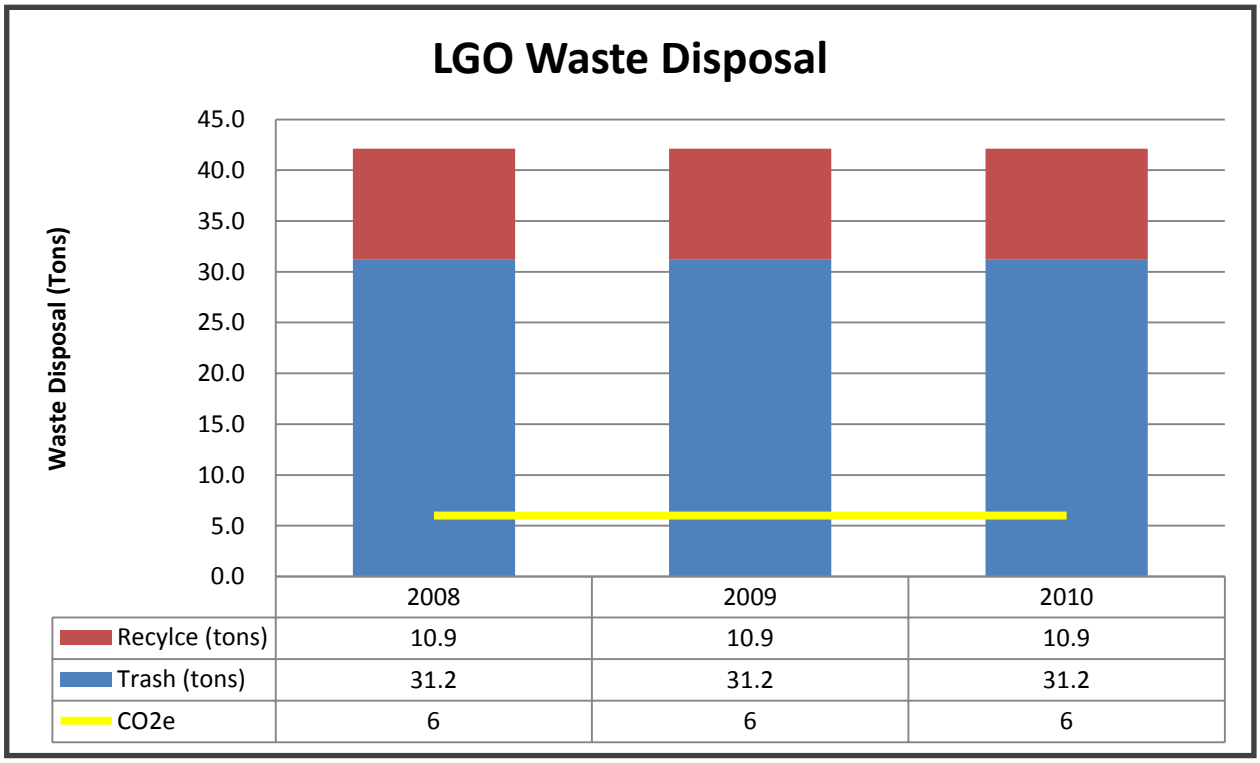
	Police Dept.	DDO	Highway	Parks	Dog Control	Water
Construction	0	0	8	0	0	0
Heavy Duty	1	0	35	7	0	3
Light Truck	5	0	4	3	1	3
Passenger Cars	31	2	0	0	0	0

Figure 11 Government Vehicle Fleet by Department (2010)

3.7 Solid Waste Facilities

The Town does not currently operate a solid waste facility, nor are there any facilities that are located within the Town boundary. The Town did operate a landfill between the years of 1954 and 1990, but due to lack of information, the landfill is not included in this report. The Town has been able to determine waste disposed for its operations as a Scope 3 emission source, given that the town is responsible for generating the waste (and the associated emissions) but does not dispose of the waste within its operational boundary.

Feher Rubbish Removal provides the Town with an 8-ton dumpster for trash services as well as a 6-ton dumpster for cardboard, with both picked-up weekly. From Feher's estimates, based on the volume of the dumpsters, approximately 31 tons of waste (annually) is disposed of using the 8-ton dumpster and 11 tons (annually) of cardboard is recycled each year with the 6-ton dumpster. Figure 12 represents the yearly waste disposal totals for 2008-2010 as provided by Feher Rubbish Removal and the estimated GHG emissions created from "controlled incineration".



	2008	2009	2010
Recylce (tons)	10.9	10.9	10.9
Trash (tons)	31.2	31.2	31.2
CO2e	6	6	6

Figure 12 Government Waste Disposal Totals 2008-2010

4. Community Results and Discussion

4.1 Community Emissions Summary

Town of Dewitt Community Greenhouse Gas Emissions		
Year		2010
Residential	eCO2 (tonnes)	50,893
	Energy (MMBtu)	901,813
Commercial	eCO2 (tonnes)	128,238
	Energy (MMBtu)	2,178,497
Industrial	eCO2 (tonnes)	77,046
	Energy (MMBtu)	1,335,867
Transportation	eCO2 (tonnes)	245,430
	Energy (MMBtu)	3,382,529
Waste	eCO2 (tonnes)	768
	Energy (MMBtu)	0
Total	eCO2 (tonnes) Energy (MMBtu)	502,375 7,798,706

Table 7 Community Emissions 2010

Community emissions totaled 502,375 metric tons of CO2e in 2010 (see Table 7). The transportation and commercial energy use sectors are the highest emissions sources during the baseline year.

4.2 Residential, Commercial, and Industrial Energy Use

The methodology for each of the three community energy use sectors was the same for this analysis, and the aggregate data has been converted to CO_2e in CACP for 2010, as shown in Figure 13.

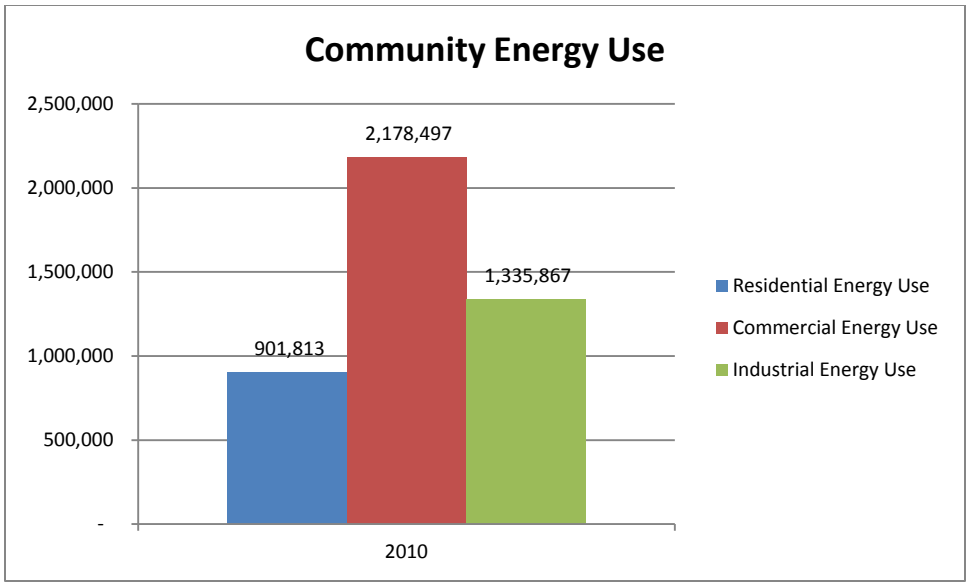


Figure 13 Residential, Commercial and Industrial Energy Use 2010

In 2010, the commercial energy use sector was responsible for 26% of annual community emissions. The residential and industrial energy use sectors comprise 10% and 15%, respectively, of total community emissions in 2010.

4.3 Transportation

The total annual VMT calculated for the Town of DeWitt is approximately 420.6 million (Figure 14). Most of the VMT are derived from limited access highways, comprising 46% of the total. The next largest roadway contributor to the annual VMT total is major arterial roads, representing 30%. The smallest contributor is local/collector roads, representing 24% (Table 8).

The three road type categories used to classify roadways were specified by ICLEI's protocol for tracking community vehicle emissions. (See Appendix F and G for definitions and details on how roadways were classified.)

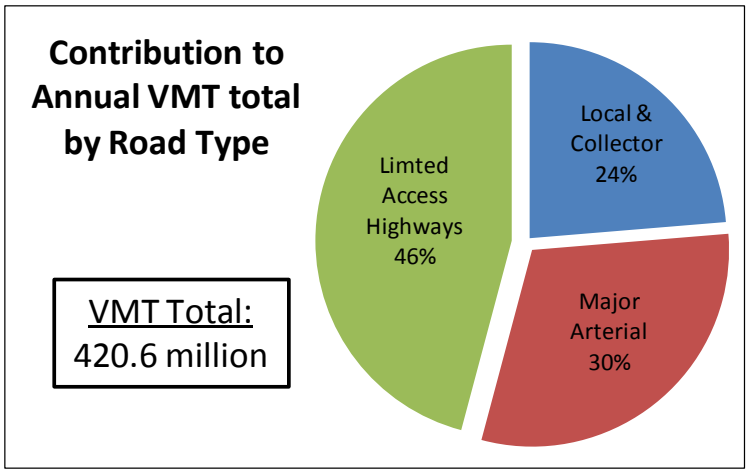
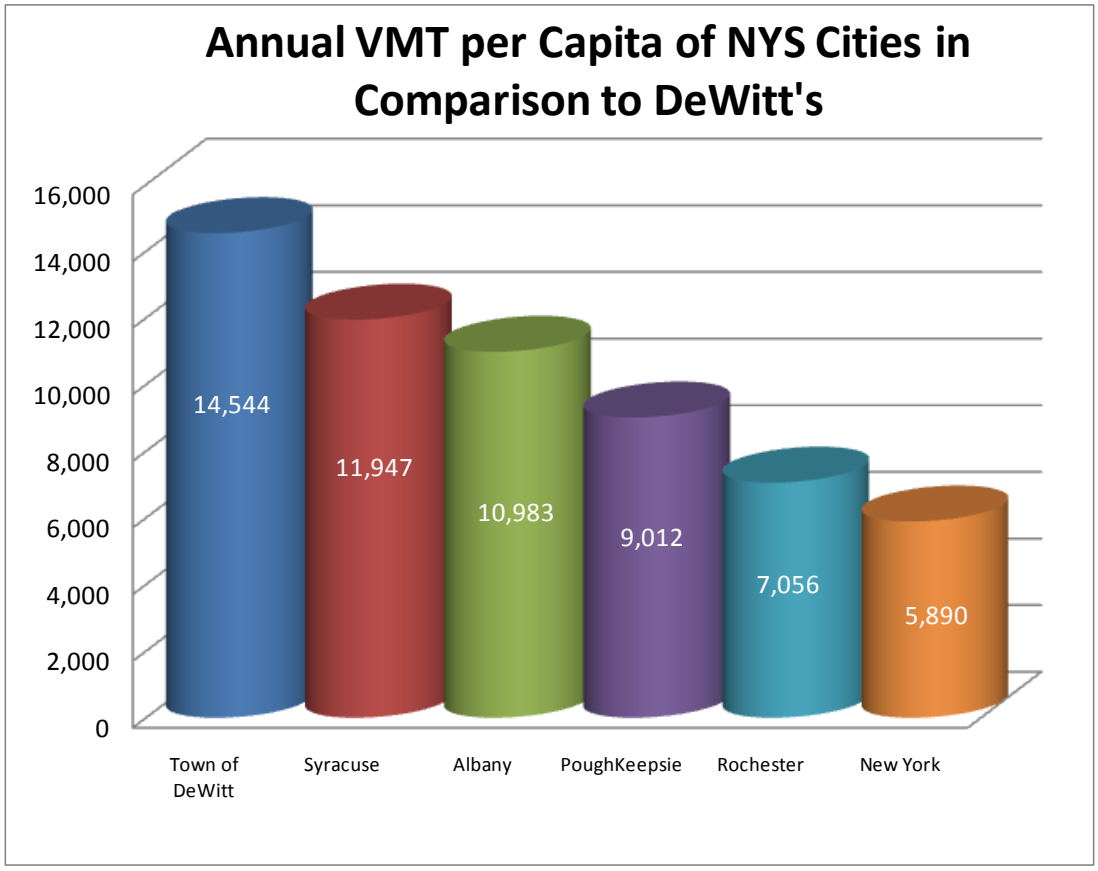


Figure 14 Annual VMT by Road Type

Annual VMT by Road Type (in millions)
Local/Collector Roads
99.6
Major Arterial Roads
128.1
Limited Access Highways
192.9

Table 8 VMT by Road Type

A 2010 population (US Census Bureau) count indicates there are 25,838 residents living in The Town of DeWitt and Village of East Syracuse; the annual VMT per capita for DeWitt is 14,544 miles. In 2008, The Brookings Institution ranked the largest 100 US cities (in terms of employment) by their annual VMT per capita value for 2005. New York City, NY was ranked 1st, with an annual VMT per capita value of 5,890 and Jackson, MS was ranked 100th with a value of 13,473. There were also a number of CNY cities that made the list (Figure 15).



Source: Brookings, 2008; VMT values are from 2005

Figure 15 Annual VMT per Capita for NYS Cities

There are two possible explanations for DeWitt's comparatively large VMT value. The first is the fact that the town is intersected by three major limited access highways, Interstate 481, 690, and 90. Together, Interstate 481 and 690 carry all vehicles traveling from the East, North East, and South East into the City of Syracuse. DeWitt has a relatively small population; however, the town's traffic count includes almost half of the vehicles headed toward the city. This certainly contributes to DeWitt's annual VMT total. If the traffic volume from limited access highways is not included in DeWitt's VMT total, the annual VMT per capita is only 7,873.

The second possible explanation is the method utilized for estimating the traffic volume of some local and community roads. If a roadway classified as such did not have an AADT value, an average daily traffic volume of 591 vehicles was applied as a default traffic count. This AADT value is moderately high for some residential roads. However, the annual VMT calculated for roadways without a listed AADT count only amounts to 23.1 million, less than 6% of the total. Although this method of estimation may have resulted in some minor error, the assumption did not drastically increase the annual VMT value for DeWitt.

It is difficult to compare the VMT of suburban or rural areas, such as the town of DeWitt, to more urban areas. Aside from the fundamentally larger populations in urban centers compared to suburban towns, this is often because urban areas have a widespread and reliable public transportation system. In DeWitt and other suburban areas, there is a greater reliance on private transportation since bus, train, and subway systems are not extensive enough for commuters to utilize on a regular basis. As a result, cities tend to have a lower annual VMT per capita value. However, Dewitt's value of 14,544 is not considerably more than most cities and there is no reason to believe that the value is a significant overestimation of traffic volume throughout the community.

In 2010, approximately 145,430 metric tons of CO_2e was released annually by all vehicles traveling on roadways within the Town of DeWitt's boarders. In addition, roughly 3,382,529 MMBtu of fuel was consumed.

4.4 Waste

DeWitt community waste disposal is contracted through Syracuse Haulers and waste is taken to the Onondaga County Resource Recovery Agency waste-to-energy facility, operated by COVANTA. Waste generation appears to be decreasing since 2008 (Figure 16), which may be a response to the economic recession, as mentioned by a spokesperson for COVANTA.

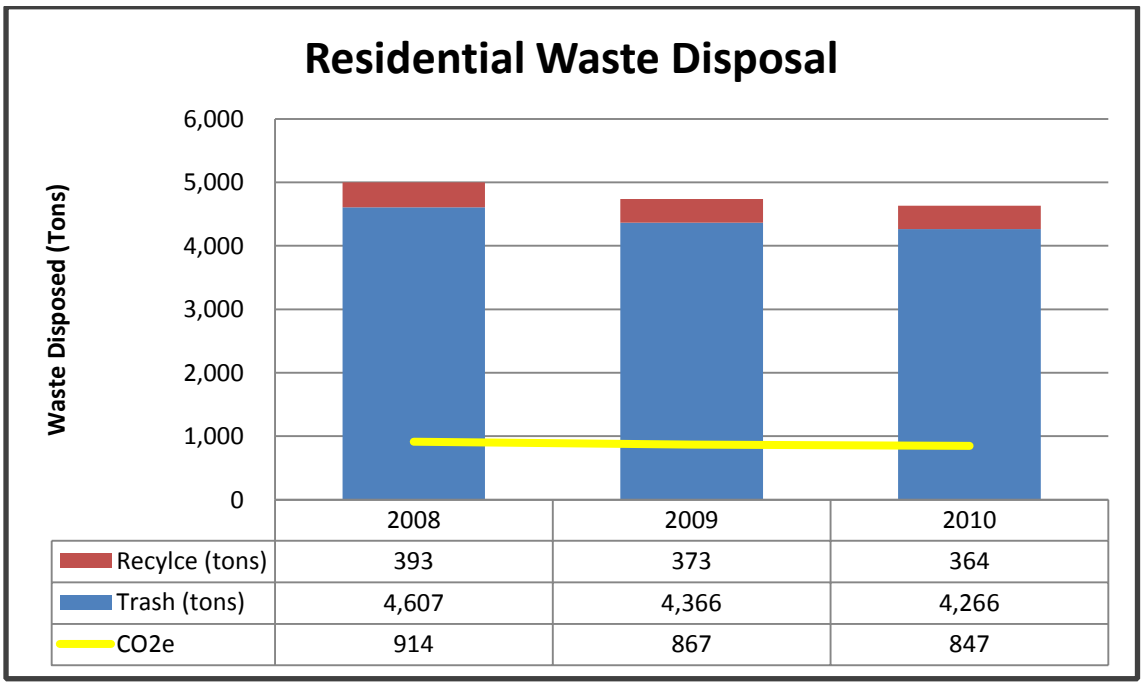


Figure 16 Community Waste Disposal 2008-2010

While waste reduction is good for the environment, WTE facilities rely on a minimum volume of trash to fuel energy generation processes. The average DeWitt community household (approximately 7,000 residencies are contracted through Syracuse Haulers) disposes of nearly 1,500lbs of waste each year, as seen in Figure 17.

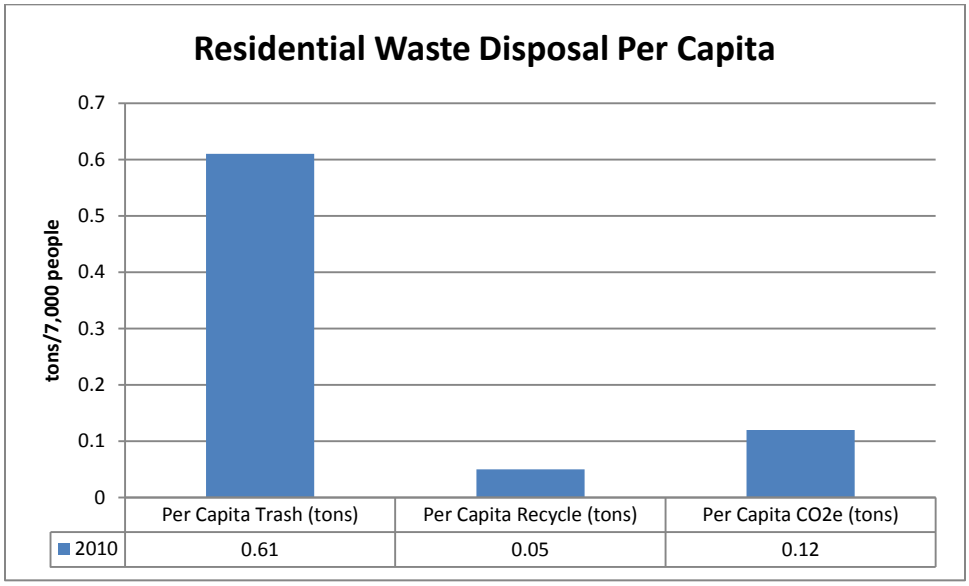
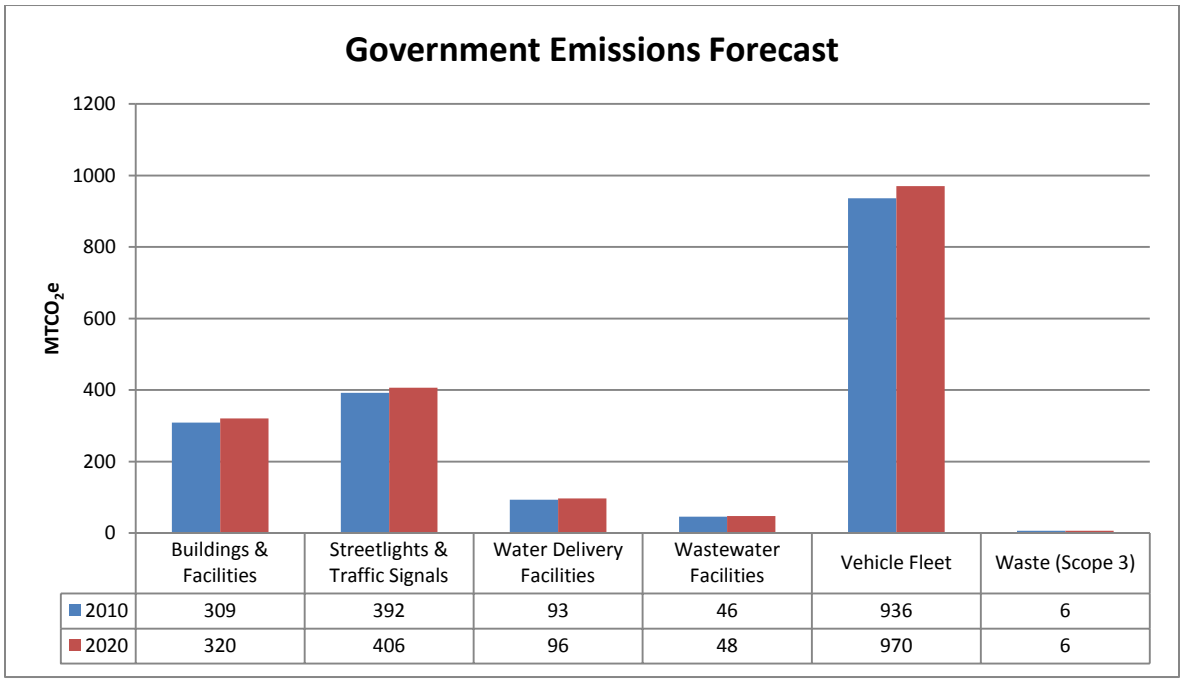


Figure 17 2010 Community Waste Disposal per capita

5. Emissions Forecast

5.1 Government Forecast

The Town of DeWitt government emissions forecast is based on the continuation of existing services and processes, as a business-as-usual scenario, with the application of a population growth factor. The population of the Town of DeWitt has seen a 3.6% increase from 2000-2010 (U.S. Census 2010), and under the assumption that population will continue to grow at a similar rate over the next ten years, the demand for government services and associated emissions are assumed to grow at the same rate. However, this forecast should be reevaluated in the context of any major capital planning projects taking place in the Town between now and 2020, given that any significant increases in development and energy use have the potential to increase the carbon footprint of the Town.



	Buildings & Facilities	Streetlights & Traffic Signals	Water Delivery Facilities	Wastewater Facilities	Vehicle Fleet	Waste (Scope 3)
2010	309	392	93	46	936	6
2020	320	406	96	48	970	6

Figure 18 Government Emissions Forecast (2020)

The single-rate growth factor of population is annualized for the past ten years to 0.36%, and applied using the standard compounding method ($FV=PV(1+i)^n$). These projections provide an estimate that must be revisited as social and economic conditions change in the Town of DeWitt.

5.2 Community Forecast

The community emissions forecast utilized fuel demand growth rates developed in the 2009 NYS Energy Plan, electricity demand growth rates from the EIA's Annual Energy Outlook, and waste generation growth projections from OCRRA. Each of the growth (and in some cases decline) rates was entered into the CACP community forecast tool for their respective sectors. The NYS Energy Plan is

currently undergoing updates for 2013, and all of these growth rates should be evaluated against new projections as they become available (see Table 9).

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%	

***Liquefied Petroleum Gas (i.e. Propane)**

Table 9 NYS Energy Plan annualized demand growth rates 2009-2028

The EIA's 2020 electricity consumption projections for the mid-Atlantic region, which includes New York State, are shown in Table 10. While these projections span a large region, encompassing more than just New York, the EIA's reporting provides a consistent and standardized mode of projection.

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

Table 10 EIA Annual Energy Outlook (2011) electricity consumption projections

OCRRA's mid-level waste projection (2011-2021) was used to generate the community waste sector forecast for 2020. OCRRA's waste projections are listed in Table 11. These projections are broken out into low-level, mid-level and high-level waste generation scenarios, primarily based on economic predictions, with the mid-level projection assumed to be the most realistic for the OCRRA service area.

OCRRA Municipal Solid Waste Projections	
Year	**MSW (tons)**
2011	285,600
2012	287,900
2013	289,500
2014	290,800
2015	292,300
2016	293,900
2017	295,300
2018	296,800
2019	298,200
2020	299,700

Table 11 OCRRA waste projections 2011-2020

The community emissions forecast shows an overall increase in emissions of approximately 8% from 2010 to 2020, based on the 2010 total of 502,375 metric tons of CO_2e and the 2020 projection of 540,776 metric tons of CO_2e. It is important to consider other potential growth factors that might affect DeWitt community emissions in the future. In 2020, the largest emissions sources in the community will continue to be commercial energy use and transportation (see Figure 19). Identifying growth patterns in these sectors and their associated emissions, will allow for a more targeted emissions forecast in the future. While municipal policies may not always directly impact these community sectors, this emissions estimate establishes a framework in which to evaluate ongoing sustainability initiatives in the context of community growth.

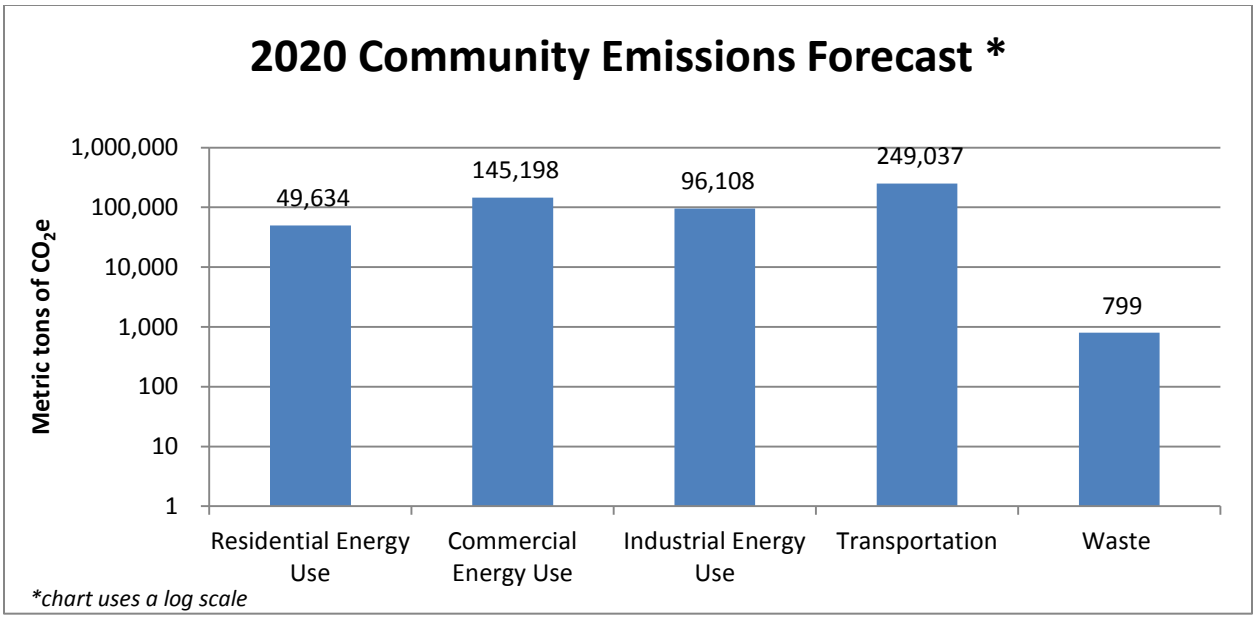


Figure 19 Community Emissions Projection for 2020

6. Conclusion

In the inventory year of 2010, the Town of DeWitt government operations generated 1,782 metric tons of CO_2e. Community emissions totaled 502,375 metric tons of CO_2e in 2010. Through ongoing and planned sustainability initiatives the Town of DeWitt has committed to reducing these greenhouse emissions. Projects such as the lighting upgrades at various town buildings and HVAC upgrades at the Town Hall represent efforts that result in emissions reductions. (Refer to Appendix B for a more complete list of existing sustainability initiatives.)

Ongoing monitoring and updates to this greenhouse gas emissions analysis will ensure that quantifiable reductions occur in both government operations and community sectors. The Town of DeWitt has already begun the sustainability planning process and, following the completion of this inventory, will move forward with the development of sustainability measures and targets for a climate action plan. These efforts will help to reduce the community's carbon footprint, and build a more resilient community.

7. References

Chapter 1

ICLEI (2005) Clean Air and Climate Protection Software Overview. Page 5 "Common GHG emission sources". http://www.4cleanair.org/webcastSIslides.pdf

(LGOP) California Air Resources Board et. al. (2010) Local Government Operations Protocol: *For the quantification and reporting of greenhouse gas emissions inventories.* Version 1.1 May 2010

U.S. Environmental Protection Agency. Climate Change-Science. Retrieved June 27, 2011 http://www.epa.gov/climatechange/science/index.html

Chapter 2

EPA MSW http://www.epa.gov/epawaste/nonhaz/municipal/msw99.htm

Local Government Operations Protocol *For the quantification and reporting of greenhouse gas emissions inventories* Version 1.1 May 2010

OCRRA 2005 Waste Study http://www.ocrra.org/trash_waste_study.asp#trash

Waste-to-Energy (2011) http://www.ocrra.org/trash_wte.asp

World Resources Institute and World Business Council for Sustainable Development, GHG Protocol Corporate Standard, Revised Edition (2004).

Chapter 4

Brookings Institute. (2008). *Vehicle miles traveled (VMT)*. Retrieved from: http://www.brookings.edu/reports/2008/~/media/4DD7C188F57849CC8390ED686CAB3A26.ashx

Chapter 5

Energy Information Agency. (2011). Annual Energy Outlook for Mid-Atlantic Region. http://205.254.135.7/forecasts/aeo/er/early_consumption.cfm

New York State Energy Research and Development Authority. (2009). NYS Energy Plan. http://www.nysenergyplan.com/Supporting_Documents/Energy%20Price%20and%20Demand%20Annual%20Long-Term%20Forecast%20revised.pdf (pg. 16)

Onondaga County Resource Recovery Agency. (2011). Forecast for MSW Generation. http://www.ocrra.org/documents/Forecast_MSW_083111.pdf (pg. 2)

8. Appendices

8.1 Appendix A: Town of DeWitt Sustainability Policy, Statements and Goals

Policy Statement 1: Ensure Energy-Efficient and Environmentally Supportive DeWitt Town Codes, Plans and Policies:

Goal: *Review and revise Town codes, plans and policies to support energy efficiency, renewable energy systems and green practices.*

Initiatives:
1. Create an ongoing DeWitt Sustainability Committee ("DSC"), which shall be chaired by a member of the DeWitt Town Board, as appointed by the Supervisor. The DSC shall consist of such members as the chair or Supervisor shall in their discretion so choose. The DSC will assist with increasing awareness, providing feedback on the effectiveness of outreach efforts, assisting with and monitoring the Town's implementation efforts. The DSC would provide recommendations to the Town Board on conditions that affect the environment. The DSC would issue an annual report to the Town Board and community measuring the Town's progress towards sustainability as outlined in this report.

2. Develop incentives for residential and commercial buildings to exceed state building and energy standards for renovations, additions, or new construction.

3. Revise building Codes as needed, to ensure that Green Infrastructure, including green roofs, porous pavement, rain barrels, rain gardens, grey water systems, wind turbines, and roof and exterior mounted solar collection systems are allowed. Recommend new residential construction to be solar ready. The Codes should have exceptions for experimental architectural and energy innovations (beyond current codes and established practices) for architects and engineers seeking to advance building performance. Reduce front yard setback requirements.

4. The Town should enact a law that protects the rights of property owners to install, operate and maintain solar energy systems and to promote the use of such systems by requiring solar site orientation for any new residential or commercial development.

5. Protect trees in the town by passing a tree ordinance. Upgrade landscaping requirements for residential, industrial, and commercial developments to ensure that trees are saved, grassy areas are minimized and wood lots and natural areas are maximized.

6. Consider, as a future concept, the creation of an internal "Green Team," consisting of the Supervisor, Comptroller, Police Chief, Sustainability Coordinator, and the heads of each of the departments. The Green Team will meet quarterly; individual members will be responsible for the implementation of the plan within their departments and throughout Town government.

Policy Statement 2: Improve Energy Efficiency and Green Practices of Existing Town Buildings:

Goal: *Using a baseline year 2010, reduce the energy use of buildings by ten (10%) percent per year and encourage green practices.*
Initiatives:
1. Contract with NYSERDA or other organization to conduct an energy audit on Town buildings and assist in the funding of energy efficient improvement projects identified through the assessment.

2. Evaluate changes in building operations and housekeeping that would lead to energy conservation and green practices. For example:

a. Set thermostats to 78 degrees in summer and 68 degrees in winter;
b. Use environmentally-friendly cleaning materials;
c. Eliminate the use of lawn pesticides, herbicides, and fertilizers on Town property;
d. Use low VOC paints;
e. Develop a green procurement policy based upon the Climate Smart Communities green purchasing policies.

3. Review exterior lighting to reduce the energy consumed and ensure appropriate lighting intensity.

4. Each time an incandescent "Exit" sign is replaced, use an LED sign, which is much more efficient than standard lighting.

5. Investigate the use of dual flush toilets, composting toilets, and waterless urinals in Town facilities.

Policy Statement 3: Build Very Efficient New or Renovated Buildings:

Goal: *All future Town buildings of 5,000 square feet or more as well as renovations should meet the Leadership in Energy and Environmental Design's silver certification or comparable standard. A waiver may be granted if the project is an "unreasonable burden" (defined as a 10% or greater cost premium based on life-cycle cost assessment methodology) or has a negative impact on a historic structure.*

Initiatives:
1. When Town buildings need roof repair or replacement, at a minimum, conduct an analysis to quantify the value of additional means to reduce energy loss (e.g.: increased insulation, green roof and overhangs).

2. Perform an economic analysis on new or renovated Town buildings that compares various traditional heating and cooling systems with alternatives. (Traditional systems include fossil fuel fired furnaces and electric air conditioning. Alternative systems include heat pumps, air, water or geothermal sourced energy and passive solar designs.)

3. Explore the use of solar water heaters, photovoltaic and wind energy (panels, siding, shingles, glass, etc.), on Town buildings.

Policy Statement 4: Educate Employees About Sustainable Practices:

Goal: *Implement a plan for raising employee awareness and promoting resource efficient behaviors among Town employees.*

Initiatives:
1. Make the Department of Development and Operations responsible for implementing Town environmental and energy policies.

2. Maximize recycling at all Town facilities and at Town sponsored events.

3. Train Town staff in energy efficiency, materials and resource conservation, and waste reduction practices related to their roles.

4. Incorporate resource efficiency standards into the Employee Manual and establish a training protocol for new hires.

5. Implement a coordinated energy-efficiency/environmentally friendly purchasing program that require all equipment and appliances to use less energy than the items being replaced, meets current Energy Star standards.

6. Encourage ride sharing and utilization of alternative modes of transportation.

Policy Statement 5: Support the Reduction of Energy Use by Homeowners, Developers, and Landlords:

Goal: *Educate the community to encourage energy use reduction.*

Initiatives:
1. Conduct aggressive citizen outreach on ways to reduce home energy use, using the Town's website, mailings, partnerships with schools, retailers, churches and civic organizations by leveraging existing initiatives such as the Alliance for Climate Action's "10% Challenge" or the US EPA's "Change the World, Start with Energy Star" campaign.

2. Create a competition to encourage individuals and groups to reduce energy use.

3. Encourage a light bulb exchange program in partnership with the State and/or local retailer(s) to discourage the use of incandescent light bulbs.

4. Partner with governmental agencies and educational institutions to educate commercial property owners, landlords, homebuilders, and home renovation firms on the benefits of energy efficiency, and provide training programs for energy conservation systems on residential and commercial buildings.

5. Investigate using Town resources, State programs, and/or grant funds to develop and implement a financing program for home efficiency projects and for the installation of renewable energy systems and energy conservation systems on residential and commercial buildings.

6. Develop a program that encourages landlords to upgrade the energy efficiency of their buildings and appliances.

7. Strongly encourage sellers to provide or permit an energy audit before the sale of a home. This policy does not require homeowners to make energy-efficiency improvements.

8. Investigate car sharing, ride sharing and other modes of transportation.

Policy Statement 6: Reduce Dependence on Traditionally-Powered Vehicles:

Goal: *Reduce the amount of gasoline and diesel fuel used by the Town fleet.*

Initiatives:
1. Reduce the use of traditional gasoline and diesel powered Town vehicles by installation of idle-reduction software; implementation of anti-idling policies; reductions in trips; and improved efficiency of existing vehicles.

2. Convert to alternative fuel vehicles and equipment that will improve the Town's fleet fuel efficiency.

3. Minimize lawn areas and required mowing on Town property and rights-of-way.

Policy Statement 7: Reduce Storm Water Runoff & Increase Storm Water Quality:

Goal: *Limit the effects of storm water runoff and nonpoint source pollution on Town waterways and wetlands.*

Initiatives:
1. Encourage residents and businesses to use "rainwater harvesting" techniques. ***(Footnote 20)***

2. Encourage and demonstrate the use of permeable surfaces to reduce storm water runoff. Consider the use of a Town owned parking lot for this demonstration.

3. Encourage businesses and residents to use sustainable drainage techniques such as rain gardens, grassed swales, parking lot filter strips, bio-retention basins, and green roofs to reduce storm water runoff.

4. Develop an urban forestry master plan. ***(Footnote 20a)*** To help prevent street flooding, create a town leaf composting facility using green technology.

5. Provide education and work with homeowners and developers to enhance environmental benefits of trees. Maximizing the benefits requires consideration of tree species selection, tree location relative to homes or other buildings, and tree management procedures, such as pruning. The benefits include:

a) Flood reduction. Transpiration by trees removes water from the soil, which creates storage space for water that infiltrates in storms.
b) Energy saved for heating and cooling buildings by consideration of the solar path in different seasons when planting and managing trees around buildings to optimize the annual solar input to a house**.** Reductions of energy use for air conditioning result from shading in summer. However, even deciduous trees significantly reduce solar energy in winter, when solar energy reduces energy use for heating.
c) Energy saved for heating and cooling by reductions in wind speed. Windbreaks of conifers are especially effective for reducing wind speed, but even deciduous trees scattered throughout a neighborhood provide significant reductions in wind speed.
d) Other environmental benefits such as reduced noise levels though tree effects on sound propagation and improved comfort for people outdoors. Though tree influences on noise are sometimes overestimated, there are possibilities for reducing noise by dense tree plantings.

6. Develop a website page to educate residents about the amount of storm water runoff generated by individual parcels, the impact of runoff on local waterways, ways to reduce storm water volume, and landscaping methods that do not rely on environmentally harmful products. Educate property owners on the use and sale of fertilizers and lawn care products containing non-toxic chemicals.

Policy Statement 8: Encourage Green Economic Development:

Goal: *Develop environmentally friendly and energy efficient Town policies to leverage economic development.*

Initiatives:
1. Encourage, for example, redevelopment using green technology and showcase the redeveloped property as a demonstration and educational center for renewable energy, resource conservation, recycled materials, and green building techniques.

2. Identify and encourage businesses that design or manufacture energy efficient or renewable energy equipment, businesses that install or build structures that use such technology, and energy consultants that provide advice and design solutions which would improve the energy use of buildings to locate in Dewitt.

3. Encourage the Buy Local First campaign.

4. The Town should foster development of energy efficient businesses by encouraging building energy upgrades on a neighborhood scale, which stimulates demand, provides economies of scale for contractors, and allows retrofit projects to be done more cost effectively.

Policy Statement 9: Include Sustainable Land Use and Transportation Practices in Town Zoning Ordinance & Comprehensive Plan:

Goal: *The Town's zoning ordinance and comprehensive plan will encourage sustainable land use and transportation.*

Initiatives:
1. Update zoning and the comprehensive plan based on the principles of Smart Growth, New Urbanism, Traditional Neighborhood Development (TND), and the livability principles of the Partnership for Sustainable Communities.

a. Use form based codes to promote unique character and architectural style along with environmental and accessibility amenities.
b. Strengthen and direct development toward existing built-up areas with existing public infrastructure (e.g., roads, water and sewer) with a focus on re-use and re-development of existing buildings.
c. Encourage compact, walkable, mixed-use neighborhoods with public spaces.
d. Develop complete streets and a well-connected street network to increase safety and mobility for pedestrians, bicyclists, motorists and transit riders.
e. Provide a variety of transportation choices, including safe walking, biking and transit.
f. Encourage Transit-Oriented Development (TOD) and Pedestrian Oriented Development (POD).
g. Preserve open space, farmland and critical environmental areas such as wetlands and floodplains.
h. Encourage cluster subdivisions rather than conventional subdivisions.

2. Encourage new neighborhood development and redevelopment to meet the standards of LEED for Neighborhood Development (LEED ND).

Policy Statement 10: Enhance Accessibility of Our Community to People with Disabilities:

Goal: *Promote a sustainable community that facilitates aging in place, and promotes full participation for people with disabilities.*

Initiatives:
1) Enhance the safe and easy access of buildings and infrastructure within the Town so that residents can maximize participation in our community and age in place.

2) Actively review and enhance the implementation of the Americans with Disabilities Act (ADA) and related legislation so that the Town maintains and promotes continued compliance with building design choices in land use and property development.

3) Encourage building professionals, businesses, and residents to use inclusive design elements in property development; thus, working to reduce physical barriers to access for people in wheelchairs as well as those with other mobility impairments.

4) Encourage building professionals, businesses, and residents to learn more about available options for building and financing inclusive design housing.

8.2 Appendix B: Town of DeWitt LGO Past Sustainability Projects and Initiatives

Lights in Town Facilities - Town Hall, Highway Garage, Police Department, Parks Building and Ryder Park Pavilion

- Replace T12 florescent bulbs with T8 florescent bulbs
- Reduced Co2 yearly by 144,644 pounds
- Decreased our kWh use per month by 11,242 and saving more than $1,200 in the first six months
- Replacement T8 bulbs cost less (save .46 cents per bulb)
- T8 bulbs last 20% longer then T12

HVAC Town Hall

- 28 zones have been reset at a range of 68 to 76 (Summer) had been set at 68 to 71
- Override in the Court clerks off has been turned off (Their zone was on 24 hours)
- Fresh air unit has been hooked up in Court Clerk's office
- Thermostat s have been moved to central locations
- Filters are being changed every 60 days
- Location of air vents have been moved due to building changes, this will provide a more efficient air flow

ICLEI

- Established our energy use and Co2 footprint , based on this our goal is to reduce our energy use and Co2 by 20%
- Air Pollutants Emissions for 2008 and 2009 have been established

Ryder Park Pavilion

- Old hot water tank was removed and replaced with on the spot hot water unit; should save us over $400 yearly
- Rain garden has been built next to the pavilion and a rain barrel has been installed

Highway Building

- Main truck garage bay - sensors have been installed that turn off the heat when doors are open in the winter
- Light sensors have been installed in individual rooms , turning off light when not occupied
- Recycling bins added for metal and cans
- Recycled motor oil from town trucks is used to heat the garage bay

Town Hall Building

- New energy efficient roof has been put on saving 20% heat loss and additional insulation has been added
- 50 kWh polycrystalline solar unit will be built this June and expected to produce almost 55,000 kWh per year, reducing the Town's greenhouse gas emissions by the equivalent of the electricity use of 4.6 average homes over one year, saving almost $8,000 in the first year of operation.
- Skylights sealed and re-caulked to prevent energy loss and looking at window covers for skylights
- Light sensors have been set up in bathrooms, supply rooms and other rooms where lights normally would be left on.
- Compost has been set up behind the Town Hall
- 85 trees have been planted along Town's Right-Of-Way
- Green cleaning supplies are being used at all Town Facilities
- Recycled paper is now being used in all departments
- Rain garden was put in last year along with rain barrel

Stay up-to-date with sustainability initiatives via the Town's website.
http://www.townofdewitt.com/GreenInitiatives.aspx

8.3 Appendix C: LGO and Community Emission Source Guidance

Government Operations Emission Sources Guidance

UNFCCC Sector		Scope 1 Emissions	Scope 2 Emissions	Scope 3 Emissions
Energy	Stationary Energy	Utility - delivered fuel consumption (e.g., natural gas)	Electricity / heat / steam / cooling consumption	Emissions from facilities operated by contracted businesses performing essential government services
		Decentralized fuel consumption (e.g., propane kerosene, fuel oil, stationary diesel, biofuels, coal)		
		Government owned utility - consumed fuel for electricity/heat generation		
	Transport	Tailpipe emissions from government owned and operated vehicles	n/a	Tailpipe emissions from vehicles operated by government employees traveling to and from work
				Tailpipe emissions from vehicles operated by contracted businesses performing essential services
				Upstream / downstream emissions
	Fugitive Emissions	Fugitive emissions from energy production	n/a	Upstream / downstream emissions
Industrial Process		Fugitive emissions from industrial processes	n/a	Upstream / downstream emissions

Agriculture	Methane emissions from government owned livestock		
Land Use, Land Use Change and Forestry	Net biogenic carbon flux of government owned / operated sources		
Waste	Analysis year methane emissions from government owned and operated landfill, incineration, compost, and wastewater facilities		Analysis-year emissions from government waste disposed to date. Embodied future emissions associated with analysis-year waste generation.

Community Emission Sources Guidance				
UNFCCC Sector		**Scope 1 Emissions**	**Scope 2 Emissions**	**Scope 3 Emissions**
Energy	Stationary Energy	Utility - delivered fuel consumption	Utility - delivered electricity / heat / steam cooling consumption. Decentralized electricity / heat / steam consumption	Upstream / downstream emissions (e.g., mining/transport of coal)
		Decentralized fuel consumption		
		Utility - consumed fuel for electricity / heat generated		
	Transport	Tailpipe emissions from on-road vehicles.	Electricity consumption associated with vehicle movement within the community (e.g., light rail)	Tailpipe emissions from vehicles operated by community residents.
		Tailpipe emissions from rail, sea, airborne and non-road vehicles operating within the community.		Upstream/downstream emissions (e.g., mining/transport of oil)
				Tailpipe emissions from rail, sea, and airborne vehicles departing from or arriving into the community.
	Fugitive Emissions	Fugitive emissions not already accounted for.	n/a	Upstream / downstream emissions
Industrial Process		Decentralized process emissions	n/a	Upstream / downstream emissions
Agriculture		Emissions from livestock and managed soils		Upstream / downstream emissions from fertilizer/pesticide manufacture
Land Use, Land Use Change and Forestry		Net biogenic carbon flux		n/a
Waste	Solid Waste Disposal	Direct emissions from landfill, incineration and compost facilities located inside the community.		Present-year emissions from wastewater produced to date inside the community.
	Wastewater Treatment and Discharge	Direct emissions from wastewater facilities located inside the community.		Future emissions from treated wastewater.

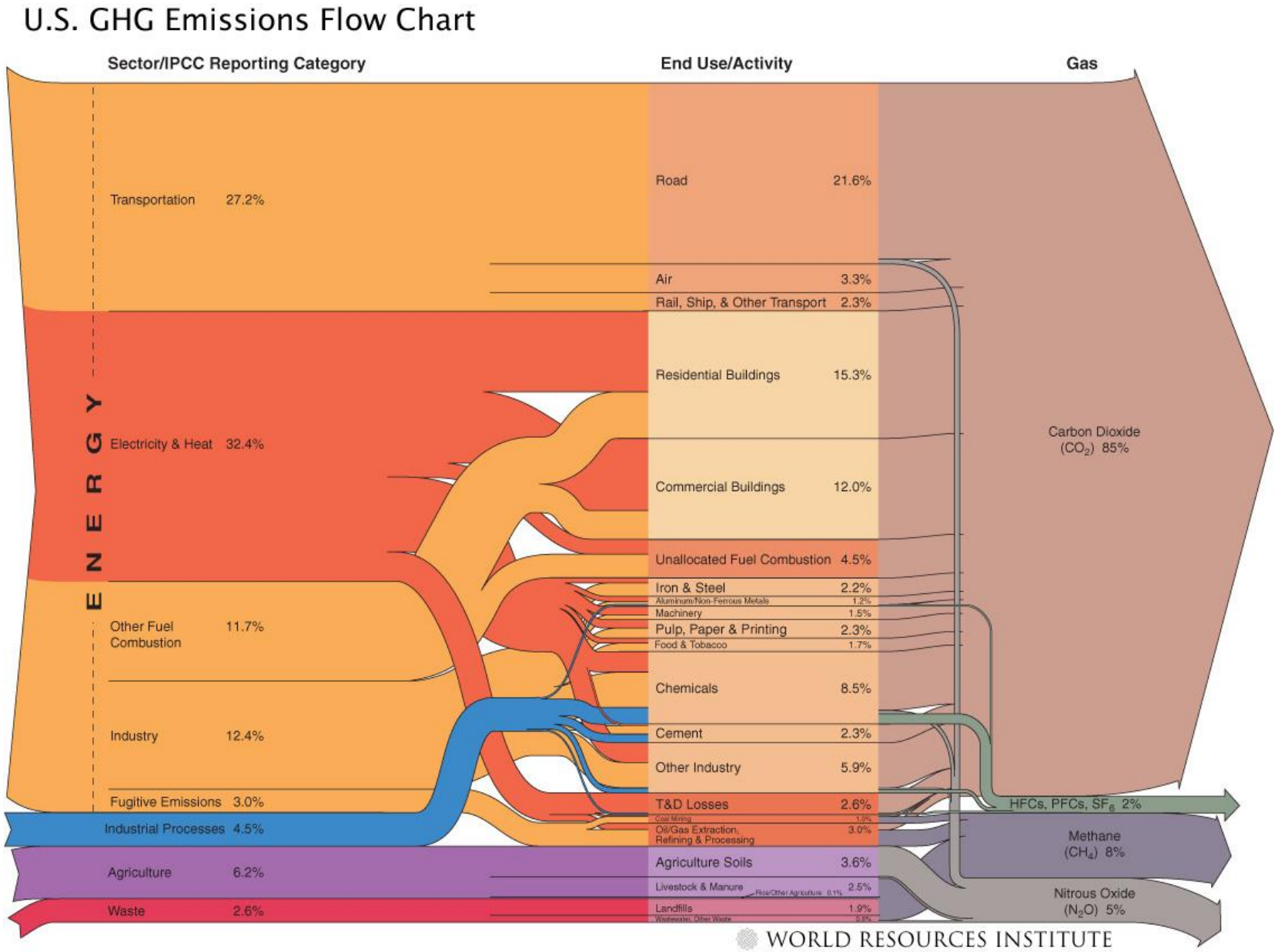


Figure D1. This flow chart shows world GHG emission sources and contributions by sector.

8.4 Appendix D: Equations and Calculations Background

Greenhouse Gases[1]

The term greenhouse gases refers to a broad group of chemicals and substances which all have one thing in common: they have been found to cause changes in the atmosphere which have been shown to, or are suspected of changing climatic conditions on earth. In most cases, these chemicals and substances have a very long life in the atmosphere, and therefore continue to affect climate over a long period of time. The primary greenhouse gases include:

Carbon Dioxide

Carbon dioxide is the primary greenhouse gas that has raised the alarm of atmospheric scientists due to current and projected levels and the highly correlated temperature regression curve that has been observed, predicting a future path of rising carbon dioxide levels and associated increases in temperature. Carbon dioxide is a naturally occurring, odorless and colorless gas. It has natural sources, including bacterial, plant, animal, and fungal respiration; the evaporation of oceans; the decomposition of organic matter; and volcanic out gassing. Man-made sources include the burning of coal, oil, natural gas, and wood. Carbon dioxide is removed from the atmosphere by photosynthesis, is dissolved into lakes and oceans water, and transferred to the soil.

Currently, carbon dioxide concentrations in the atmosphere are around 370 parts per million (ppm). Comparatively, prior to the Industrial Revolution, about 250 years ago, CO2 levels were 278 ppm, and over the past 650,000 years carbon dioxide levels have fluctuated between 180 and 300 ppm, making present day atmospheric CO2 levels substantially greater than at any point in the past 650,000 years.5. The concentration of carbon dioxide is projected to increase to a minimum of 540 ppm by 2100 as a direct result of man-made activities.

Equation	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	Calculating CH_4 Emissions From Stationary Combustion (MMBtu)
Fuel/Sector A CH_4 Emissions (metric tons) = Fuel Use (MMBtu) × Emission Factor (kg CH_4/MMBtu) ÷ 1,000 (kg/metric ton)	
Fuel/Sector B CH_4 Emissions (metric tons) = Fuel Use (MMBtu) × Emission Factor (kg CH_4/MMBtu) ÷ 1,000 (kg/metric ton)	
Total CH_4 Emissions (metric tons) = CH_4 from Type A (metric tons) + CH_4 from Type B (metric tons) + … (metric tons)	

Equation	Calculating CH_4 Emissions From Stationary Combustion (gallons)
Fuel/Sector A CH_4 Emissions (metric tons) = Fuel Use (gallons) × Emission Factor (kg CH_4/gallon) ÷ 1,000 (kg/metric ton)	
Fuel/Sector B CH_4 Emissions (metric tons) = Fuel Use (gallons) × Emission Factor (kg CH_4/gallon) ÷ 1,000 (kg/metric ton)	
Total CH_4 Emissions (metric tons) = CH_4 from Type A (metric tons) + CH_4 from Type B (metric tons) + … (metric tons)	

Methane

Methane has both natural and man-made sources. In nature, it is released as part of biological processes such as in swamplands. Man-made sources include the combustion of fossil fuels, and biomass burning. Human activities such as raising cattle, using natural gas, and mining coal have increased the concentration of methane in the atmosphere in recent times. Methane is extremely effective at absorbing atmospheric radiation. Compared to other greenhouse gases, its 10 to 12 year life span is brief.

Nitrous Oxide

Nitrous oxide occurs naturally in soil and water, resulting from microbial processes. It is also produced by fertilizer which contains nitrogen. Man-made sources include nitric acid production, fossil-fuel powered power plants and vehicle emissions. Nitrous oxide is a colorless greenhouse gas which can cause dizziness, euphoria, and sometimes slight hallucinations. Extended use can cause brain damage. It is used as an aerosol propellant, and as a food preservative, as well as a race car fuel.

Equation	Calculating N_2O Emissions From Stationary Combustion (MMBtu)
Fuel/Sector A	
N_2O Emissions (metric tons) =	Fuel Use (MMBtu) × Emission Factor (kg N_2O/MMBtu) ÷ 1,000 (kg/metric ton)
Fuel/Sector B	
N_2O Emissions (metric tons) =	Fuel Use (MMBtu) × Emission Factor (kg N_2O/MMBtu) ÷ 1,000 (kg/metric ton)
Total N_2O Emissions (metric tons) =	N_2O from Type A (metric tons) + N_2O from Type B (metric tons) + … (metric tons)

Equation	Calculating N_2O Emissions From Stationary Combustion (gallons)
Fuel/Sector A	
N_2O Emissions (metric tons) =	Fuel Use (gallons) × Emission Factor (kg N_2O/gallons) ÷ 1,000 (kg/metric ton)
Fuel/Sector B	
N_2O Emissions (metric tons) =	Fuel Use (gallons) × Emission Factor (kg N_2O/gallons) ÷ 1,000 (kg/metric ton)
Total N_2O Emissions (metric tons) =	N_2O from Type A (metric tons) + N_2O from Type B (metric tons) + … (metric tons)

Chlorofluorocarbons

CFCs were first synthesized in 1928, and do not occur in nature. They were used for aerosol propellants, refrigerants and cleaning solvents. They were found to be a cause of the reduction in stratospheric ozone, and as a result, a global effort was undertaken to stop their production. This effort was extremely successful, and levels of the major CFCs are now remaining stagnant or declining. Their long atmospheric lifetimes mean that some = will remain in the atmosphere for over 100 years. CFCs are nontoxic, nonflammable, insoluble, and chemically unreactive in the air at the earth's surface. CFCs are known to cause cardiac arrhythmia and asphyxiation.

Hydrofluorocarbons

Hydrofluorocarbons are man-made chemicals that are used as a substitute for CFCs. They are used in automobile air conditioners, and as refrigerants. Prior to 1990, the only significant emissions were of HFC-23. HFC-134a emissions are now increasing due to its use as a refrigerant.

Perfluorocarbons

Perfluorocarbons (PFCs) are produced in the production of aluminum and semiconductors. They do not break down through the chemical processes in the lower atmosphere. Ultraviolet rays about 60 kilometers above earth's surface are able to destroy them. As a result, PFCs have very long lifetimes of between 10,000 and 50,000 years. Health Effects: None.

Sulfur Hexafluoride

Sulfur hexafluoride is used for insulation in electric power transmission and distribution equipment, in the magnesium industry, in semiconductor manufacturing, and as a tracer gas for leak detection. Sulfur hexafluoride is an odorless, colorless, nontoxic, nonflammable and inorganic gas. In high concentrations in confined areas, it displaces the oxygen needed for breathing, and can cause suffocation.

Aerosols

Aerosols include sulfate aerosols, which are emitted when fuel with sulfur in it is burned, and black carbon (or soot) which is emitted during bio mass burning and the incomplete combustion of fossil fuels. Aerosols can warm the atmosphere by absorbing and emitting heat and can cool the atmosphere by reflecting light. Cloud formation can also be affected by aerosols. Particulate matter regulation has been lowering aerosol concentrations in the United States; however, global concentrations are increasing as a result of fossil-fuel burning around the world.

Water Vapor

Water vapor has a significant influence on global warming, and is the most abundant and variable transporter of greenhouse gases in the atmosphere. Water vapor maintains a climate necessary for life. As the temperature of the atmosphere rises, more water is evaporated in rivers, oceans, reservoirs and soil. When the air is warmer, the relative humidity can be higher, leading to more water vapor in the atmosphere. This higher concentration of water vapor is able to absorb more of the indirect thermal energy radiated from the earth, further warming the atmosphere. The warmer atmosphere can then hold more water vapor, creating a "positive feedback loop." The feedback loop in which water is involved is critically important to projecting future climate change.

Global Warming Potential (GWP)[2]

Global Warming Potential (GWP) is defined as the cumulative radiative forcing effects of a gas over a specified time horizon resulting from the emission of a unit mass of gas relative to a reference gas. The GWP-weighted emissions of direct greenhouse gases in the U.S. Inventory are presented in terms of equivalent emissions of carbon dioxide (CO2), using units of teragrams of carbon dioxide equivalents (Tg CO2 Eq.).

Conversion: Tg = 10^9 kg = 10^6 metric tons = 1 million metric tons

The molecular weight of carbon is 12, and the molecular weight of oxygen is 16; therefore, the molecular weight of CO2 is 44 (i.e., 12+[16 x 2]), as compared to 12 for carbon alone. Thus, carbon comprises 12/44ths of carbon dioxide by weight.

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

Table 2.1: Greenhouse Gases[3]			
Gas	**Chemical Formula**	**Activity**	**Global Warming Potential (CO_2e)**
Carbon Dioxide	CO_2	Combustion	1
Methane	CH_4	Combustion, Anaerobic Decomposition of Organics (Landfills, Wastewater), Fuel Handling	21
Nitrous Oxide	N_2O	Combustion, Wastewater Treatment	310
Hydrofluorocarbons	Various	Leaked Refrigerants, Fire Suppressants	43-11,700
Perfluorocarbons	Various	Aluminum Production, Semiconductor Manufacturing, HVAC Equipment Manufacturing	6,500-9,200
Sulfur Hexafluoride	SF_6	Transmission and Distribution of Power	23,900

References:
[1]EPA. Glossary of Climate Change Terms. Global Warming Potential
[2]Intergovernmental Panel of Climate Change. 2007. Climate Change 2007: The Physical Science Basis: The Working Group I contribution to the IPCC Fourth Assessment Report. http://www.ipcc.ch/pdf/assessment-report/ar4/wg1/ar4-wg1-errata.pdf
[3]Terra Nova Planning and Research, Inc. 2010. *Town of Apple Valley Climate Action Plan*. Pages II3-II5

8.5 Appendix E: LGO Vehicle Fleet Detailed Methods

Background Information on DeWitt's LGO Vehicle Fleet

The vehicle fleet section of the local government operations analysis includes all GHG emissions derived from mobile combustion sources that are owned and operated by the Town of DeWitt. They are utilized by the town's departments to perform various services needed by the community, which include everything from police patrols to road maintenance. This portion of the inventory does not only account for emissions from the town's vehicles, but incorporates all government owned mobile combustion sources as well, such as lawn mowers, forklifts, bulldozers, chainsaws, and other pieces of construction equipment. There are no trains or ships owned by DeWitt, so these forms of transportation are not included.

There are a total of six departments within the local government that own and operate a vehicle fleet that services the community: the Department of Development and Operations, the Highway Department, the Parks & Recreation Department, the Police Department, the Water Department and the Dog Control Department. There are other departments, but they do not utilize any government vehicles. Although the town is serviced by a volunteer fire department, it is run independently of the local government and is technically owned and managed by the fire department. Therefore, vehicles operated by the fire department, such as fire trucks and ambulances, are not included in this section of the GHG inventory. In addition, school buses that service the Jamesville-DeWitt and East Syracuse-Minoa school district are not managed by the local government. As a result, emissions from school buses and other vehicles utilized by the school districts are not counted in this part of the inventory either.

The Department of Development and Operations (DDO) is responsible for the code enforcement of residential and commercial businesses, as well as zoning and planning. It also assists in approving construction permits. This line of work does not require a very extensive or energy intensive vehicle fleet. In fact, the department operates using the second smallest vehicle fleet, with only two passenger cars that use comparatively little gasoline on an annual basis

The Highway Department operates very similar to a department of public works and performs a number a various jobs to maintain the community. These duties include road maintenance, sewer repairs, sidewalk repairs, road maintenance, traffic sign upkeep, snow plowing in the winter, and many other tasks. It is not responsible for trash pick-up. That work is contracted out to private companies, such as Syracuse Haulers, which handle all residential and commercial waste disposal. Due to the nature of its work, the Highway Department has the largest fleet of all municipalities, consisting of 47 vehicles; the majority being heavy-duty which consume vast quantities of fuel compared to passenger cars and light trucks. The department's fleet also includes an assortment of construction equipment, such as paint-strippers, forklifts, bobcats, and backhoes.

The Parks & Recreation Department mainly performs park upkeep as well as landscaping, mowing the medians between major roadways, gardening, and some minor repairs and maintenance on government owned buildings. The Parks Department's vehicle fleet is one of the smaller ones, composed of only 10 vehicles. The

busses used to transport students for the Summer Rec program are also include in the department's annual fuel total, and comprise an average of 43% of the department's fuel use. Most of the vehicles are heavy duty pickup trucks, and none are passenger cars. There is only one dump truck, which is heavy-duty and runs off diesel. In addition, the trucks typically only travel from worksite to worksite within the town, so vehicles use comparatively little fuel.

The Police Department has the second largest fleet, consisting of 37 vehicles. Almost all of which are full-sized passenger cars, such as Ford Crown Victorias or Chevy Impalas. There are however a handful of Chevy Tahoe SUVs, classified as light trucks. The only heavy-duty vehicle is the SWAT van. Since the police perform patrols and spend most of the time driving, their vehicles consume large amounts of fuel, all of which is gasoline.

The Water Department mainly maintains the water mains and sewer systems within the Town of DeWitt, and performs major repairs on these systems when necessary. The water vehicle fleet is relatively small and only consists of 6 vehicles; half being heavy-duty and half light trucks. Similar to the Parks Department, employees of the Water Department typically only travel from job to job, so their fuel usage is fairly minimal.

The Dog Control Department manages stray animals and approves pet licenses for dogs and cats. The department has the smallest fleet of all departments, operated by only one employee with one van, classified as a light truck. In addition, the department does not perform patrols or extensive travel, so the fuel usage by this fleet is very small.

It is important to note that although the Village of East Syracuse is technically within the Town of DeWitt's boarders, the village has its own departments (police department, DPW, etc...) that are not considered part of DeWitt's vehicle fleet. This is due to the fact that the Village of East Syracuse is run by its own local government, which is a separate entity from DeWitt's local government. Therefore, the emissions released from the vehicles in East Syracuse's municipality fleet are not counted in this analysis. However, the village is included in the community section of the inventory for vehicle emissions.

It is also important to note that the community and government's vehicle emissions analyses produce two separate sets of results and should not be added together to derive a total emissions count. The methods for conducting each are substantially dissimilar and involve different assumptions and data. In addition, the government vehicle fleet is already included in the AADT counts used to calculate the community's vehicle emissions. Totaling the two would result in double counting. The government analysis is intended to quantify the emissions derived from the local government's vehicle fleet, whereas the community analysis is intended to provide an estimate for the emissions released by all vehicles within the town. Although they can be used in collaboration with one-another, they ultimately answer two separate questions.

Methods

This section of the analysis covers the GHG emissions from all vehicles owned and operated by the Town of DeWitt's departments. The calculations were initially performed manually, using the equations given in Chapter 7 of ICLEI's *Local Government Operations Protocol*. While these manual calculations produced more representative results for the Town's emissions, the government fleet emissions were ultimately reported as the

totals from CACP output (based on departmental fuel use and vehicle types) in order to ensure consistency and uniformity for future inventory updates and analyses. The alternate emissions calculations methods used may prove helpful for future analyses and planning, and are described below, for this purpose.

The below formulas are numbered according to the LGO protocol. For the 2010 year covered in this analysis, the total mass of three emitted GHGs were calculated. They were carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O). Due to the lack of data availability, emitted GHGs derived from refrigerants of the government's vehicle fleet were not quantified. Once the amounts of all 3 GHGs released by the fleet were calculated, they were converted to CO_2 equivalent (Equation 7.8). This gave the amount of CO_2 equivalent (in tons) released by the Town of DeWitt's municipality vehicle fleet for the calendar year 2010.

Equation 7.8	Converting to CO_2 equivalent 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)

Carbon Dioxide Emissions

According to ICLEI's *Local Government Operations Protocol* (LGOP), CO_2 emissions, which account for the majority of the GHG emissions released from mobile sources, are directly related to the quantity of fuel combusted and are thus, capable of being calculated using exclusively data on fuel consumption and type.

Data on mileage is only necessary for CH_4 and N_2O emissions. This analysis was able to utilize the recommended approach for quantifying CO_2 emissions (section 7.1.1.1 of the LGOP), which involves identifying the total annual fuel consumption, by fuel type, and determining the appropriate emissions factor**.** The Town of DeWitt's vehicle fleet only consumes diesel and gasoline, and the emission factors for each were given in Table G9 in Appendix G of the LGOP.

Essentially, the emissions factor for each fuel type (kg/gallon) was multiplied by the total amount of that type of fuel consumed (gallons), and then that value (kg) was divided by 1,000. This gave the tonnage of CO_2 released by each fuel type, which were combined to derive a total amount of CO_2 (in tons) released by the vehicle fleet in a given year (Equation 7.2).

Equation 7.2	Calculating CO_2 Emissions From Mobile Combustion
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)

Carbon Dioxide Data Acquisition

The Highway Department keeps track of all fuel usage for each individual vehicle using gas keys. The program Gas Boy can provide annual reports of the type and quantity of fuel used by each vehicle based off these gas keys. Therefore, CO_2 emissions were actually calculated for each vehicle, and then summed to calculate to the total annual CO_2 emissions.

Most of the forklifts, backhoes, and other large pieces of construction equipment have their own gas key. However, it was still necessary to account for all the fuel used by lawn mowers, weed whackers, and other small mobile combustion sources that do not have a gas key. The Highway and Parks Department both have miscellaneous gas and diesel keys used for random pieces of equipment, such as small lawn mowers and chainsaws. It was assumed that all of the fuel withdrawn using these gas keys was used to fill small-scale construction and lawn equipment. This is the method in which this analysis accounts for the emissions released from small-scale mobile combustion sources. Although these miscellaneous fuel keys are typically used for small pieces of equipment, a motor vehicle may occasionally be filled using them if the vehicle's actual gas key is temporarily unavailable. However, these situations are not very frequent and result in negligible error.

Methane and Nitrous Oxide Emissions

CH_4 and N_2O emissions were slightly more complicated to quantify than CO_2 emissions since they are based off several variables as opposed to simply fuel type and quantity. In addition, CH_4 and N_2O emissions are directly proportional to, and thus, calculated using mileage as opposed to fuel consumption (section 7.1.3.1 of the LGOP). Essentially, both the CH_4 and N_2O emissions factors for each vehicle were determined using Table G10 in Appendix G of the Protocol, which is based off model year, vehicle type, and fuel type. It is important note that the table only lists model years until 2005. If a vehicle was produced after that year, it was given the emissions factor from 2005. The emissions factors (g/mile) were multiplied by each vehicle's annual mileage to give the amount of CH_4 and N_2O released (in g). That value was then divided by 1,000,000 to give the annual amount of CH_4 and N_2O (in tons) released by each vehicle **(**Equations 7.6 and 7.7**)**. The CH_4 and N_2O emissions for each vehicle were then summed, giving the government's total annual CH_4 and N_2O emissions derived from its vehicle fleet.

Equation 7.6	**Calculating CH_4 Emissions From Mobile Combustion**
Vehicle Type A **CH_4 Emissions** (metric tons) = Annual Distance × Emission Factor ÷ 1,000,000 (miles) (g CH_4/mile) (g/metric ton)	
Vehicle Type B **CH_4 Emissions** (metric tons) = Annual Distance × Emission Factor ÷ 1,000,000 (miles) (g CH_4/mile) (g/metric ton)	
Total CH_4 Emissions = CH_4 from Type A + CH_4 from Type B + … (metric tons) (metric tons) (metric tons)	

Equation 7.7	**Calculating N_2O Emissions From Mobile Combustion**
Vehicle Type A **N_2O Emissions** (metric tons) = Annual Distance × Emission Factor ÷ 1,000,000 (miles) (g N_2O/mile) (g/metric ton)	
Vehicle Type B **N_2O Emissions** (metric tons) = Annual Distance × Emission Factor ÷ 1,000,000 (miles) (g N_2O/mile) (g/metric ton)	
Total N_2O Emissions = N_2O from Type A + N_2O from Type B + … (metric tons) (metric tons) (metric tons)	

It was also necessary to account for the CH_4 and N_2O emissions from construction equipment and small-scale combustion sources, such as lawn equipment. The following method was utilized to quantify CH_4 and N_2O emissions for all vehicles classified as construction and the miscellaneous fuel keys. Again, it was assumed that the miscellaneous fuel keys were used to fill small-scale combustion sources, such as lawnmowers, motorized hedge trimmers, weed-whackers, chainsaws, etc. Construction equipment and other small-scale mobile combustion sources do not typically have odometers, so mileage is unobtainable. Therefore, the LGOP calls for calculating these sources' emissions from the same fuel usage data listed in the CO_2 section. Using Table G12 in Appendix G of the LGOP, the CH_4 and N_2O emissions factors were determined based off fuel and equipment type. All miscellaneous fuel keys and construction equipment were classified as "construction" on the table and assigned the appropriate emissions factors. Each emissions factor (g/gallon) was multiplied by the source's fuel consumption (gallons), not the mileage, to derive the annual amount of CH_4 and N_2O released (in g). Those values were then converted to tons and totaled using the same steps as regular vehicles. Construction equipment and small-scale mobile combustion sources only needed data on fuel consumption by fuel type to have their CH_4 and N_2O emissions quantified.

Methane and Nitrous Oxide Data Acquisition

In order to be calculated, CH_4 and N_2O emissions required several pieces of information, specific to each individual vehicle (the exception to this is construction equipment and small-scale mobile combustion sources which only require fuel type and quantity consumed). These pieces of information include vehicle type, such as light truck or passenger car, model year, fuel type, and mileage. A few of the vehicles were missing data on one or more of these required pieces of information, so some assumptions were necessary. See appendix K for assumptions specific to individual vehicles.

Table G10 in Appendix G of the LGOP was used for determining vehicles' CH_4 and N_20 emissions factors, and required three pieces of information: fuel type, model year, and vehicle type. Fuel type for each vehicle was already determined while calculating CO_2 emissions, and taken from the Gasboy fuel consumption reports provided by the Highway Department. The Town of DeWitt also keeps vehicle inventories that list make, model, and year for all of the vehicles owned by the town's departments. If for some reason a vehicle did not have its make, model, or year listed, that information was taken from the registration form in the vehicle file.

For determining emissions, the LGOP classifies vehicles in three categories: Passenger Cars, Light Trucks, and Heavy-Duty Vehicles. The passenger car category is pretty straightforward, and includes two/four door subcompact/compact, mid-size, and full-size cars mainly intended to carry passengers. Light trucks include most residential size vans, SUV's, pickup trucks and Jeeps. The Heavy-Duty vehicle category primarily consists of large-scale industrial sized vehicles, such as dump, garbage, and Mack trucks.

Typically, classifying vehicles as a passenger car or light truck was done by looking at the make and model. However, there were some cases where larger pickup trucks and vans were actually classified as heavy-duty. According to the LGOP, heavy-duty vehicles have a Gross Vehicle Weight Rating (GVWR) of over 8,500 lbs. This means that these vehicles will weigh over 8,500 lbs. when carrying their estimated maximum load. It is important to note that the protocol does not classify heavy-duty vehicles based off their curb weight. Larger pickup trucks, such as the Chevy Silverado 2500HD and Ford F-350 or F-450, had a GVMR around 9,200 lbs. Therefore, these vehicles were actually classified as heavy-duty. To ensure that they were classified properly, all SUVs, vans, and pickup trucks had their GVWR examined to determine if it was rated over 8,500 lbs. This data was available in the vehicle files kept by each department. However, the police department's vehicle files were not examined due to security reasons, but the fleet mainly consists of passenger cars and Chevy Tahoes, which are not heavy duty. The only vehicle in the police department's fleet that was classified as heavy-duty was the SAWT van.

The Town of DeWitt does not keep track of odometer readings on municipality vehicles. Therefore, the alternative method for quantifying CH_4 and N_2O emissions was utilized (section 7.1.3.2.1 of the LGOP). This involved estimating each vehicle's mileage based off its fuel usage and fuel economy (Equation 7.9). Each department was interviewed to estimate what percentage of the time their vehicles spend city and highway driving. For the most part, municipality vehicles spend almost all time city driving, which resulted in lower fuel economies (Table F1).

Equation 7.9	Estimating Mileage Based on Fuel Use

Estimated Annual Mileage =

$$\underset{\text{(gallons)}}{\text{Fuel Use}} \times [(\underset{\text{(mpg)}}{\text{City FE}} \times \text{City \%}) + (\underset{\text{(mpg)}}{\text{Highway FE}} \times \text{Hwy \%})]$$

FE = Fuel Economy

Table F1 – *A breakdown of the percent estimates that each department spends city and highway driving. These values were used with Equation 7.9 to estimate each vehicle's annual mileage.*

	City Driving Percentage	Highway Driving Percentage
DDO	95%	5%
Highway	95%	5%
Parks	100%	0%
Police	85%	15%
Water	95%	5%
Dog Control	95%	5%

Fuel economies for passenger cars and light trucks were obtained from Fuel Economy.gov. The website was created in 1999 by the US Department of Energy's Office of Energy Efficiency and Renewable Energy, in cooperation with the US Environmental Protection Agency. It was designed as part of the Energy Policy Act of 1992 to provide accurate MPG ratings for consumers, as well as information on emissions by vehicle. The website lists a given vehicle's MPG rating based off its make, model, model year, number of cylinders, engine volume (in L), number of speeds, whether its 4X/2X drive, and whether it is automatic/standard. For instance, a 2005 Ford F-150 may have five different fuel economies listed for versions of the model year that contain different engine sizes, speeds, number of cylinders, etc.

Those types of stats, for each passenger car and light truck, were obtained from different forms contained in the vehicle files of each department. As mentioned earlier, stats on the police department's fleet came from interviews with employees within the department due to the limited access of vehicle files. Fuel Economy.gov does not list the fuel economies of most heavy-duty vehicles. This is primarily due to the fact that the website was only intended to assist typical consumers gain insight while purchasing new and used vehicles. Fuel economies for heavy-duty vehicles came from Table 5.4 of the US DOE's 2010 *Transportation Energy Data Book*. The table lists a general fuel economy for different intervals of GVWRs. For example, heavy-duty vehicles with a GVWR between 26,001 and 33,000 lbs. are listed as having an average fuel economy of 6.4 MPG. Unlike Fuel Economy.gov, this source only requires a vehicle's GVWR to determine its MPG rating, and the ratings are not specific to highway or city driving. Therefore, the fuel economies for the vehicles in DeWitt's fleet classified as heavy-duty are not as accurate as the ones classified as light trucks or passenger cars.

Sources:

US Department of Energy. (2010). *Transportation Energy Data Book: Edition 29* (ORNL-6985). Oak Ridge, TN: Davis, S. C., Diegel, S. W., Boundy, R. G. Retrieved from: http://cta.ornl.gov/data/tedb29/Edition29_Full_Doc.pdf

US Department of Energy: Energy Efficiency and Renewable Energy. (2011). *FuelEconomy.Gov*. Retrieved from: http://www.fueleconomy.gov/#findacar

8.6 Appendix F: Detailed Community VMT Methods

Scope and Overview of Methods:

The community vehicle section includes the GHG emissions released by all on-road vehicles within the Town of DeWitt's boarders. Only on-road vehicles were included because data on fuel consumption for off-road vehicles, such as construction equipment, agricultural equipment, snow mobiles, etc., was unavailable. In addition, the City of Syracuse is in the process of conducting a GHG audit using ICLEI's protocol and is already taking the GHG emissions from certain transportation facilities into account. These include Hancock International Airport (which is technically in the Town of DeWitt's boarders) and all railroads in the Greater Syracuse Area. To avoid double counting GHG emissions from these sources, they were not included in this inventory. The Town of DeWitt is essentially landlocked and contains no sea ports or major waterways. The few, if any, water vehicles that travel through the Town of DeWitt release negligible GHG emissions. As a result, these sources are also not included in this analysis.

ICLEI's recommended approach for calculating vehicle GHG emissions for the entire community involves obtaining data on total fuel consumption within the town's boarders. However, the Town of DeWitt does not keep records on the community's total fuel consumption. The only method of obtaining this information would involve contacting every gas station in DeWitt and asking for annual fuel sales. Most gas stations, being privately owned, would be hesitant to share this information and even if the data was obtained, it would not account for community members that fill their gas tanks outside of the town's boarders.

Therefore, the alternative method was utilized. This involved estimating GHG emissions based off traffic counts and road length. Essentially, the total annual vehicle miles traveled (VMT) for the entire town was estimated and then entered into the CACP software. With this data, the program was able to calculate fuel consumption and distance traveled by vehicle type using the USDOT's statistical brake-down of vehicle types on the road and average fuel economy. Using this information, the CACP software estimates annual GHG emissions similar to the methods used for the LGO vehicle fleet section. It is important to note that due to the limited availability of traffic volume data on a year to year basis, it was only possible to calculate a constant annual VMT value based off traffic volume data collected over almost an entire decade. This value does not change on a year-to-year basis. Therefore, the quantity of emissions released from the community's transportation sector changes only slightly over the three years covered in this inventory.

As mentioned in the LGO vehicle fleet methods, this analysis does not track GHG emissions derived from the Village of East Syracuse's government vehicle fleet. However, the community section of the analysis does include traffic counts from East Syracuse, and thus, community vehicle emissions from the village. Community emissions are quantified using traffic counts from various sections of roads. Due to data availability and the amount of time it would have taken to remove and disregard traffic counts from sections of roadways that pass through East Syracuse, the village was simply included in the community vehicle section to ease the complexity of the analysis.

VMT Overview and Methods of Estimation:

Vehicle Miles Traveled (VMT) is essentially a measure of travel along a roadway over a period of time. It could be a day, month, or year. In this case, it was a year. These values account for the number of trips made, as well as the length of those trips (USDOT, 2004). Essentially, the term VMT refers to the total of all miles traveled by every vehicle in a given area, over a certain period of time. In addition to vehicle emissions, VMT estimates are used for calculating energy consumption, assessing traffic impact, distributing highway funds, and determining pavement performance (Kumapley et al., 1996). In order to determine the emissions released from the entire Town of DeWitt, the CACP software needed the total annual VMT of all roadways within the community. Basically, the software needed an estimate of how many miles are traveled by every vehicle that is driven within, or through, the town's boarders in a given year. In order to determine that value, two variables for each roadway were needed: Average Annual Daily Traffic (AADT) and length (in miles).

The Town of DeWitt's Highway Department keeps track of all the road lengths that the town plows in the winter. For most local and collector roads, the lengths were provided by the Highway Department**.** However, there are some county, state, and interstate roadways, such Route 92 and 298, that are not plowed by the town and thus, did not have any road length recorded. In these cases, it was necessary to calculate road length using the measuring tool in O'Brian and Gears GIS Program**.** Appendix **I** contains a detailed list of which roads were missing road length and needed to have it manually calculated.

Table F1 – The total mileage of each road type by category. These values were used to calculate the annual VMT for DeWitt. See Appendix G for the definitions of each category and the methodologies for categorization.

Total Mileage By Road Type	
Road Type Category	**Miles**
Local & Community	159.89
Major Arterial	21.91
Limted Acess Highway	15.75

Average annual daily traffic (AADT) is the daily traffic volume of a roadway or freeway, averaged over an entire year. Ideally, all vehicles passing through would be counted for an entire year, and then that count is divided by 365. However, AADT counts are almost never this accurate and are only conducted over a fraction of the year. That count is then extrapolated to determine the yearly average. Roadways need to be monitored for at least 2 full continuous weeks, and then averaged to give an average weekday traffic count (AWT). It is then necessary to multiply that value by a seasonal adjustment factor (SAF), which accounts for varying traffic with different seasons. This gives the AADT for that particular roadway, which basically provides an estimate of how many vehicles will pass through that area over the course of any given day of the year (Franklin Regional Council of Government, 2008). AADT counts do not take vehicle types into consideration, simply the number of passing vehicles.

AADT counts for most major roadways in the Town of DeWitt were conducted by the New York State Department of Transportation (NYSDOT) and the Onondaga County Department of Transportation (OCDOT).

The Syracuse Metropolitan Transportation Council (SMTC) posts all of these studies on its website under the "traffic count" page, and they are accessible by the public. Almost all of these counts were conducted using an automatic traffic counter, placed at a particular section of a roadway to count the number of vehicles passing through for 4-8 weeks depending on the study. That value was then extrapolated and adjusted to give an AADT count using methods similar to the ones mentioned above. There were AADT counts for some exit/entrance ramps to limited access highways on the SMTC's website, but not all. Due to the limited data on traffic volume and mileage for highway ramps, emissions from vehicles traveling on those roadways are not included in this inventory.

The AADT counts from the SMTC's website typically only cover a certain section of a road or freeway. Therefore, a given road may have as many as 6 AADT counts, each applying to a different segment. In order to derive a single AADT value for those roadways, it was necessary to take a weighted average based off the lengths of the road segment that each AADT count covered. For instance, if an AADT count was conducted over a section that covered ¼ of the roadway, it would impact the average AADT value for that road more than an AADT count that only covered 1/8 of the roadway. In addition, some AADT counts posted on the SMTC's website were more recent than others. Typically, the most recent count for a road or road segment was used, but there were some cases when an older AADT count covered a better section for calculating a weighted average. A detailed explanation of how each roadway's AADT value that required a weighted average was determined and with which counts is available in Appendix J.

Data on AADT counts was somewhat limited. The NYSDOT and OCDOT do not conduct traffic counts for every roadway in every year. One road might have a count from 2003 and another might have a count from 2009. Due to this, it was only possible to calculate a single annual VMT for the entire community. That is the reason why this value does not change on a year to year basis, and remains constant. However, the traffic volume in the Town of DeWitt has not drastically changed over the past decade, so this only results in some minor error.

Although there were ample AADT counts available for freeways and arterial roads, there were only a few counts listed on the SMTC's website for local and collector roads. Most local roads, and even some arterial roads, did not have a traffic count. Therefore, some extrapolation was necessary. According to the *Minimum Maintenance Standards Regulation 239/02*, a set guidelines produced by the Association of Municipalities of Ontario to help local communities estimate traffic volume, while conducting an AADT count, it is possible to estimate the traffic volume for dead-ends and cul-de-sacs to avoid resource intensive counts. This can be done by counting the number of houses on the roadway, and multiplying by a factor of 6 for rural areas and 10 for urban areas.

To apply the method to this community, it was determined that there is a combined total of 11,682 households in the Town of DeWitt and Village of East Syracuse according to the 2010 US Census, and that there are 118.61 miles of roadways that do not have a traffic count. It was assumed that all 11,682 homes were on roadways that did not have a count, since most houses are on local/collector roads and almost all local/collector roads in DeWitt did not have an AADT count. By multiplying 11,682 homes by 6, a combined AADT count of 70,092 was calculated for all 118.61 miles. In order to calculate VMTs, an average AADT value was needed, and

derived by dividing by 70,092 by the 118.61 miles of uncounted roadway. This gave an average AADT value of 591, which was applied to all roadways that did not have a count.

The AADT count of 591 is slightly large for most local and collector roads, mainly due to some error involved in this method. For instance, the method is meant to be applied to dead end streets and cul-de-sacs. However, this study applied it to all local, collector, and some arterial roads. In addition, there was some double counting because there are a small number of houses in DeWitt located on minor or major arterial roads. However, counting the number of houses on each road that did not have an AADT count would have been too time consuming. There was also double counting due to the fact that some local and collector roads did have AADT counts. Although there was some error in this method, it was the best estimation of traffic volume given the availability of data.

Calculating DeWitt's Annual VMT Value

Once road lengths and AADT counts were determined, it was possible to calculate the annual VMT for each road. This was done by multiplying the AADT count by the road length and then by 330. Simply multiplying the AADT count by the road length would give the daily VMT, since AADT counts are a daily value. Multiplying by 365 gives the annual VMT. However, the Protocol instructs to multiply by 330, as opposed to 365, to account for weekends and holidays when there is less traffic **(**Formula F1**)**. To determine the annual VMT for roadways with no AADT count, their total mileage of 118.61 was multiplied by the average local/collector road AADT value of 591, and then 330. To determine the total annual VMT for the entire Town of DeWitt, all of the roadways' VMT values were summed, in addition to the estimated VMT for all the roadways which did not have an AADT count. This value was then entered into the CACP software, which calculated the community vehicle emissions for each year.

Formula F1: **Annual VMT** = AADT * Road Length (miles) * 330

Sources:

Association of Municipalities of Ontario. (2002). *Minimum maintenance standards regulation 239/02: Highway classification and AADT calculation.* Toronto, ON. Retrieved from: http://www.ogra.org/lib/db2file.asp?fileid=1807

Franklin Regional Council of Governments. (2008). *Average annual daily traffic (AADT) count data 1991-2007*. Greenfield, MA. Retrieved from: http://www.frcog.org/pubs/transportation/TrafficCount/TCBooklet.pdf

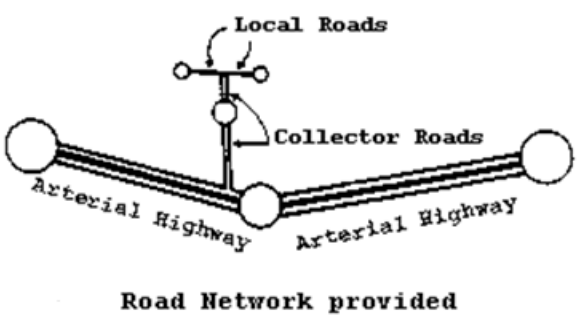
Kumapley, R. K. and Fricker, J. D. (1996). Review of methods for estimating vehicle miles traveled. *Transportation Research Record*, v. 1511, pp. 59-66.

US Department of Transportation (USDOT). (2004*). Evaluation of different methods to calculate heavy-truck VMT* (MTC Project 2002-02). Ames, IW: University Transportation Centers Program. Retrieved from: http://www.intrans.iastate.edu/reports/vmt.pdf

8.7 Appendix G: Roadway Category Definitions and Categorization Methods

The Federal Highway Administration's (FHWA) *Functional Classification Guidelines* are the US standard by which streets and highways are grouped into classes based on the service they are intended to provide (FHWA, 1989). In general, and as it pertains to this inventory, **local roads** are characterized by low speeds and pedestrian priority. They mainly serve for direct property access and are at the bottom of the road hierarchy (Figure G1). **Collector roads** provide direct and indirect access for land uses within a specific area to the road network. They essentially serve as a connection between local roads and larger roadways with greater traffic volume. In addition, collector roads typically have a higher AADT count than local roads. **Arterial roads** can be divided into 2 sub categories: major and minor arterial roads. **Major arterial roads** carry external through traffic to a specific area containing local and connector roads. **Minor arterial roads** carry through traffic between multiple areas and arterial roads (Eppell et al., 2001). It is important to note that minor arterial roads are **not** classified under ICLEI's major arterial roads category in this analysis and for GHG emission purposes.

Limited access highways, such as Interstate 81 or the NYS Throughway, are major transportation systems that only allow access at certain points, typically on-ramps. Drivers are unable to access these roadways by simply turning on at an intersection. This restriction exists mainly to increase driver and passenger safety, since vehicles traveling on these roadways do so at great speeds and need time to alter their speed prior to entry or exit. (CTDOT, 2010).



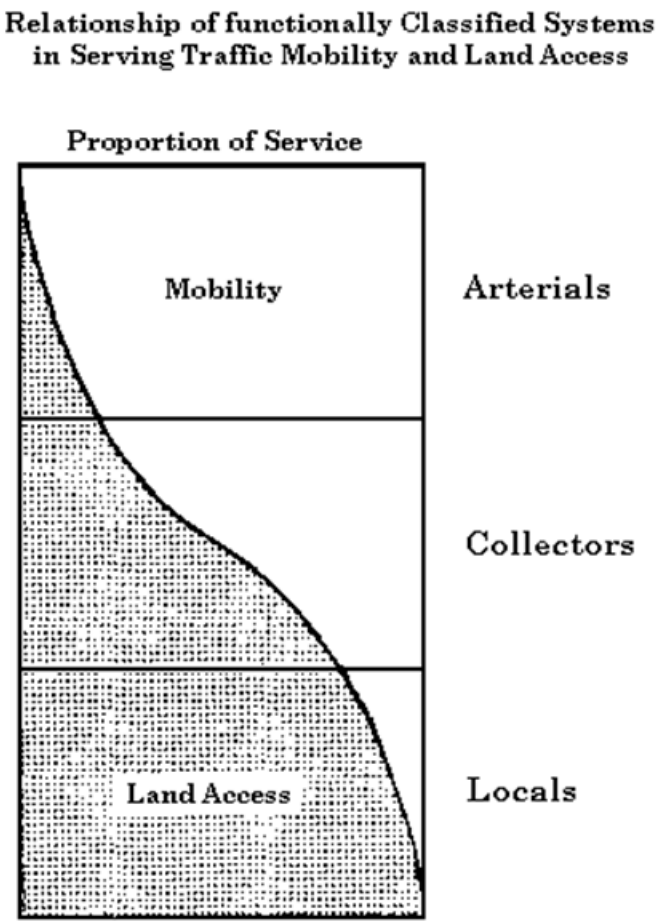


Figure G1 – *A graphical representation of the difference between local, collector, and arterial roads. Notice that local roads, on the bottom of the hierarchy, are intended for land access and have limited mobility. However, arterial roads have much more mobility but less land access. In addition, collector roads primarily join local roads to arterial roads. Limited access highways are not included in these diagrams. The figures were extracted from* (FHWA, 1989).

Although it does not affect the annual VMT value or total GHG emissions, the Protocol instructs to classify all roadways into 3 categories: local/collector roads, major arterial roads, and limited access highways. This separation is mainly for displaying results and indicating the types of roadways responsible for the most vehicle emissions in a given community. Roadway categorization was done using *The 2005 Town of DeWitt Map and Community Guide*. This source of information provides a map of all the roads in the community and classified them as limited access highway, limited access highway (toll), divided US/state highway, divided arterial highway, US/state highway, arterial road, and local road. These categories did not match ICLEI's or the FHWA's, so some assumptions were necessary. The **local/collector road** category includes roads listed on the DeWitt map as arterial roads and local roads. The **major arterial road** category includes divided US/state highways, divided arterial highways, and US/state highways. The **limited access highway** category includes limited access highways and limited access highways (toll). Using this system it was possible to categorize all of the roads within the Town of DeWitt into ICLEI's 3 categories.

Sources:

Connecticut Department of Transportation (CTDOT). (2010). *Limited access state numbered highways*. Newington, CT: Bureau of Policy and Planning Data Inventory and Statewide Coordination Division of Systems Information. Retrieved from: http://www.ct.gov/dot/lib/dot/documents/dpolicy/laccess.pdf

Eppell, V. A. T., McClurg, B. A., and Bunker, J. M. (2001). *A four road hierarchy for network planning and management*. Melbourne, Australia: Proceedings from the AARB Conference. Retrieved from: http://eprints.qut.edu.au/2349/1/2349.pdf

Federal Highway Administration (FHWA). (1989). *FHWA functional classification guidelines: Concepts, criteria and procedures*. Washington, DC: US Department of Transportation.

8.8 Appendix H: AADT Count Assumptions

This is a detailed list of all the assumptions made in determining the AADT count for roadways with multiple AADT values. All of the values came from the Syracuse Metropolitan Transportation Council's (SMTC's) website, which compiles the most recent traffic counts conducted by the New York State Department of Transportation (NYSDOT), the Onondaga County Department of Transportation (OCDOT), and the New York State Throughway Authority (NYSTA). It is important to note that if a roadway is not on this list, it either did not have an AADT count or only had one AADT count listed on the website that covered the entire roadway, so no assumptions were necessary.

Local and Collector Roadways

Butternut Drive – The SMTC's website only gave one AADT value from Pickwick Road to Kinne Road. However, the DeWitt Highway Department's spreadsheet breaks Butternut Drive into 3 sections. It was assumed that the AADT count was applicable to all 3 sections, including the cul-de-sac at the north end of the roadway.

East Molloy Road – There were 5 different AADT counts provided by the SMTC's website for this road. The value from (NYSDOT, 2009) was used since it was the most recent and covered the entire length of the road. The measurement extended from Town Line Road to Northern Boulevard.

Franklin Park Drive – There were AADT values given for 3 years: 2002, 2005, and 2009. The most recent AADT count from 2009 was used.

Jamesville Road – Due to its intersection by 481 and several other arterial roads, AADT counts covering different sections of Jamesville Road vary greatly. In fact, the SMTC's website listed 7 different AADT counts. To derive a weighted average, Jamesville Road was split into 5 different sections. (NYSDOT, 2001, 2002, and 2004) were disregarded since the sections they covered did not match up well with the rest or were not the most recent.
AADT Weighted Average = 6,849

1.) **Rock Cut Rd to Route 481:** there were 3 AADT counts for this section. The two values from 2004 were averaged together, and the count from 2003 was disregarded since it was not as recent. Average AADT = **9,589** => approx. 1/5 of road (OCDOT, 2004) *for both counts*
2.) **Route 481 to Nottingham Rd: 8,225** => approx. 3/20 of road (OCDOT, 2002)
3.) **Nottingham Rd to Quintard Rd: 3,891** => approx. ¼ (OCDOT, 2005)
4.) **Quintard Rd to Randal Rd: 4,126** => approx. 1/5 (OCDOT, 2005)
5.) **Randal Rd to Rt 298: 9,498** = approx. 1/5 (OCDOT, 2002)

Jamesville Toll Road (Rock Cut Rd) – The AADT value for Rock Cut road was used since the two names for the road are interchangeable.

Kirkville Road – The SMTC's website had 11 AADT counts for different sections of Kirkville Road. 4 of the counts were used to calculate an AADT weighted average across 5 sections of the road. (NYSDOT, 1999) was disregarded since there was a more recent count of the same segment. One of the counts from (NYSDOT, 2008) and 3 of the counts from (NYSDOT, 2002) were disregarded because the segments did not match up well with the rest: **AADT Weighted Average = 14,313**

1.) **Manlius Town Line to Roberts Road:**
   14,380 => approx. ¼ (NYSDOT, 2008)
2.) **Roberts Road to Rt 481**
   15,900 => approx. 1/8 (NYSDOT, 2002)
3.) **Rt 481 to Fly Road**
   17,300 => approx. 1/8 (NYSDOT, 2008)
4.) **Fly Road to Franklin Park Drive**
   11,500 => approx. ¼ (NYSDOT, 2004)
5.) **Franklin Park Drive to Kinne Street**: There was no count listed for this section, so the 4 AADTs above were averaged and this value was applied to this section of Kirkville Road
   14,770 => approx. ¼ (average)

New Venture Gear Drive – there were 2 AADTs provided by the SMTC for the years 2004 and 2007. However, they were both the exact same value, so the discrepancy was not an issue and (NYSDOT, 2007) was used.

Nottingham Road – There were 5 different AADT counts from 2002 to 2006. (NYSDOT, 2006) was used since it was the most recent and extended from Jamesville Road to Lewiston Drive. There is a section of Nottingham Road that extends approx. ¾ mile north of Lewiston Drive that did not have an AADT count listed. It was assumed that the count from Jamesville Road to Lewiston Drive was applicable to the entire roadway.

North Street – The AADT weighted average was calculated using AADT counts from 2 segments of the street.
AADT Weighted Average = 9,136

1.) **Rt 173 to Solvay Rd** – There were AADT values from the years for this section of the street. The most recent one was used. **9,623** => approx. 1/3 (OCDOT, 2007)
2.) **Solvay Rd to Rock Cut Rd** – there were 2 AADT counts, and the most recent was used. **8,893** => approx. 2/3 (OCDOT, 2006).

Fly Road – A weighted average was calculated between 3 different segments of the road:
AADT Weighted Average = 4,847

1.) Route 298 to Cicero Town Line = **3,200** => approx. 1/6 of road (NYSDOT, 2004)
2.) Kirkville Road to Rout 298 = **5,549** => approx. 2/3 of road (NYSDOT, 2009)
3.) Hartwell Ave to Kirkville Road = **3,867** approx. 1/6 of road (OCDOT, 2005)

Quintard Road – There were 2 AADT values given by the SMTC's website, one from the year 2004 and one from the year 2005. Both AADTs extended across the entire length of the road. (OCDOT, 2005) was used since it was more recent.

Kinney Road – (NYSDOT, 2005) was used because it covered all segments of the road, and the other 2 AADT counts were from 2000 and over a decade old.

Siawassia Street - The SMTC provided an AADT value for 2 years (1990 and 2004). The more recent value given for the year 2004 was used.

Tecumseh Rd – There were 3 AADT counts for this road provided by the SMTC's website, 1 from NYSDOT and 2 from OCDOT. (NYSDOT, 2004) was used because it was the most recent and included the entire road.

Local and Collector Roadway Segments

Thompson Road (Local Road Section) – The Town of DeWitt GIS Program did not have the entire section of the road that passes through Hancock Airport recorded. The "2005 Town of DeWitt Map and Community Guide" was utilized to estimate the length using the provided scale and a ruler.

James Street (Local Road Section) – The only AADT count listed on the SMTC's website for the portion of James Street classified as a local road is a section from Kinne Street to Silver Street. However, it was assumed that this applied to the entire section of James Street that is classified as a local/community road (from Kinne Street to Hartwell Ave).

Thompson Road (Arterial Road Section) – The SMTC's website did not provide AADT figures for the entire length of this section of Thompson Road. However, a weighted average was calculated based off the 3 sections listed below. There were also no AADT counts listed on the SMTC's website for the portion of Thompson Rd that is classified as an arterial road that extends from Erie Blvd to Kinne Rd, so it was assumed that this count applied to the entire road. **Weighted AADT Average = 8,025**

1.) **Near Hancock Field** – there were two AADT values for this section given on the website and the most recent one was used. **1,659** => approx. ¼ (NYSDOT, 2003)
2.) **Brooklyn Parkway to Tarbell Road – 9,237** => approx. 5/8 (OCDOT, 2010)
3.) **0.2 Miles W of I90 Exit 35 over I90 –** This section slightly overlaps with the Brooklyn Parkway to Tarbell Road section. However, it is still necessary to account for the heavier traffic in this section for the weighted AADT average. **14,700** => approx. 1/8 (NYSDOT, 2003)

Bridge Street (Arterial Road Section) – There were 3 AADT counts for the portion of Bridge Street between Route 5 and I-690. (NYSDOT, 2006) was used because it was the most recent count. There is a small portion of the street that is classified as minor arterial and outside of Rout 5 and I690. However, it was assumed that this was the AADT count for the entire portion of Bridge Street that is Arterial.

Kinne Street (Arterial Road Section) – The SMTC's website did not have AADT counts for every section of the street that is classified as a minor Arterial Road. However, the weighted average was calculated based off the 3 sections below. There were also 3 counts on the website that were not used because they were older or did not match up with the rest of the sections very well. **Weighted AADT Average = 5,203**

1.) **Route 298 to Franklin Park Drive: 6,248** => approx. 1/3 (OCDOT, 2003)
2.) **Franklin Park Drive to Kirkville Road: 4,475** => approx. 1/3 (OCDOT, 2003)
3.) **Midland Ave to James Street:** It was assumed that this AADT count applied to the rest of James Street (from Midland Ave to Rte. 290) **4,885** => approx. 1/3 (OCDOT, 2008)

Major Arterial Roadways

Route 91: There was no AADT count listed for this route on the SMTC's website. The closest estimate available was looking at the AADT count of Route 173, right were Route 91 feeds in. There is an AADT count for Route 173 from North Street to South Street of **10,900** from (NYSDOT, 1999). Route 91 intersects Route 173 less than 1/16 a mile from where North Street and South Street intersect it. Therefore, it was assumed that all the traffic in that area would be relatively similar and that this count would be applicable to Route 91.

Route 92 - This route is mainly comprised of E Genesee Street and some of High Bridge Road. **The Route 92 and Route 5 Overlap is accounted for in this section** for both distance and AADT weighted average. There were a total of 8 AADT counts listed for Route 92 and 3 AADT counts listed for East Genesee Street on the SMTC's website. 2 of the counts for Rt 92 were disregarded because the section they covered did not match up well with the rest. The weighted average was calculated using 4 sections. **AADT Weighted Average = 38,627**

1.) **Syracuse/Town Line to Start of Rt 5 Overlap**: There were 3 counts listed for this section from the years 2000, 2005, and 2008. (NYSDOT, 2008) was used because it is the most recent.
    12,260 => approx. 1/6 (NYSDOT, 2008)
2.) **Start of Overlap to Route 481**: (NYSDOT, 2002) for this section was disregarded because it was not the most recent.
    34,400 => approx. 1/6 (NYSDOT, 2005)
3.) **Route 481 to End of Overlap:**
    53,600 => approx. ½ (NYSDOT, 2003)
4.) **End of Overlap to Woodchuck Hill**: This road intersects with 92 outside of DeWitt. However, it was assumed that this AADT count applied to the section that was inside of DeWitt's boarders. (NYSDOT, 2002) was disregarded since it was not the most recent.
    24,300 => approx. 1/6 (NYSDOT, 2005).

Route 5 (Section composed of Erie Boulevard) – There were 3 AADT counts on the SMTC's website listed under Erie Boulevard from Rt 930P to the start of the Route 5 and Route 92 Overlap, done by the NYSDOT. There were also 3 counts on this section of Erie from the OCDOT, listed as Route 5 on the website. (NYSDOT, 2006) listed under Erie Boulevard was used because it was the most recent count and covered the entire length of this section of Route 5.

Route 5 (Sliver of E Genesee after Overlap) – There were 3 different AADDT counts on the SMTC's website for this section from the end of the overlap to the Fayetteville/DeWitt Town boarder. (NYSDOT, 2008) was used because it was the most recent.

Route 635 – There were 6 AADT values given for this route that encompassed nearly the entire portion that passes through the Town of DeWitt. (NYSDOT, 2009) was used for the whole roadway because it was the most recent.

Route 173 – This AADT was calculated using a weighted average of 3 different sections of the roadway. There were a total of 5 AADT counts on the SMTC's website for this route. There was also a very small section (less than 1/8 mile) between North Street and Route 91 that had no count listed. Therefore, this section of Route 173 did not have any influence on the weighted average. **AADT Weighted Average = 6,602**

1.) **Onondaga/DeWitt Boarder to South Street**: There was no count listed for this section so it was derived from the average of the two AADT counts listed below.
    7,830 => approx. 2/5 (average)
2.) **South Street to North Street**:
    10,900 => approx. 1/10 (NYSDOT, 1999)
3.) **Route 91 to Sweet Road:** These two roads intersect outside of DeWitt. However, it was assumed that the AADT count for that section applied to the portion that was inside of DeWitt. There were also 4 different counts listed on the SMTCO's website, but (NYSDOT, 2009) was used because it was the most recent.
    4,760 => approx. ½ (NYSDOT, 2009)

Route 290 – the weighted average was calculated based off 4 sections off the route. However, the SMTC's website did not provide AADT counts for the entire length of Route 290 that ran through the Town of DeWitt, so some estimation was necessary. **Weighted AADT Average = 13,806**

1.) **Syracuse City Line to Thompson Road** – There were 2 AADT counts for this section from different years. The most recent was used. **18,500** => approx. 1/8 (NYSDOT, 2005).
2.) **Thompson Road to E Syr Village Line** – It was assumed that this was the traffic count through the entire village. In addition, there were 3 counts provided for this section on the website and the most recent was used. **12,810** => approx. 5/8 (NYSDOT, 2008).
3.) **Drott Drive to Butternut Drive** – There were 2 AADT counts both from (NYSDOT, 1999). They were averaged together to calculate the AADT for this section of the route. Avg. = **19,150** => approx. 1/8.
4.) **Fisher Road to Town Line** – There were 2 AADT counts both from (NYSDOT, 2008). They were averaged together to calculate the AADT for this section of the route. Avg. = **8,750** => approx. 1/8.

Route 298: The SMTC's website only had the AADT counts listed to derive a weighted average from Old Collamer Road (basically Carrier Circle) to the Town of Manlius Boarder. The Town Supervisor gave a rough estimate that the traffic after Carrier Circle to the Syracuse City Line has about 35% more traffic than the section before (from the Manlius/DeWitt Boarder to Carrier Circle). Therefore, the AADT value for the section of Route 298 from Old Collamer Road to the city line was determined taking an initial weighted average of the section from Manlius to Old Collamer Road, and increasing that value by 35%. A weighted average for the entire route that goes through DeWitt was then calculated assuming the section from the Manlius boarder to Old Collamer road is approximately 2/3rds of the route and the section from Old Collamer Road to the Syracuse City Line is approximately 1/3rd. **Total AADT Weighted Average = 13,488**

1.) **Manlius/DeWitt Boarder to Old Collamer Road: 12,079 => 2/3**
2.) **Old Collamer Road to City/DeWitt Boarder: 16,307 => approx. 1/3**

The weighted average of the 1st section above (from the Manlius/DeWitt Boarder to Old Collamer Road) was determined using 5 AADT counts from different sections. It is important to note that the below road length proportions are only relative to the section that extends from the Manlius Boarder to Old Collamer Road, and are not the length proportions that the segments make up of the entire part of Route 298 that runs through DeWitt.

1.) **Fremont Road to I-481**: Fremont Road is technically outside of DeWitt, but it was assumed that this count is still applicable to the part of the road that falls within the Town's boarders. There were a total of 3 AADT counts listed for this section, so the most recent was used.
10,100 => approx. 1/5 (NYSDOT, 2007)
2.) **I-481 to Fly Road:** There were 2 AADT counts listed for this section, so the most recent was used.
10,640 => approx. 1/10 (NYSDOT, 2008)
3.) **Fly Road to Northern Boulevard**: There were 3 AADT counts, so the most recent was used.
9,800 => approx. 1/4 (NYSDOT, 2007)
4.) **Northern Boulevard to Kinne Street**: There were 3 AADT counts for this section listed, so the most recent was used. **16,500** => approx. ¼ (NYSDOT,2007)
5.) **Kinne Street to Old Collamer Road**: There was only 1 AADT count listed for this section.
12,100 => approx. 1/5 (NYSDOT, 2002)

Northern Boulevard – There were 12 AADT counts provided by the SMTC's website and all of which included the entire portion of the boulevard that passes through the Town of DeWitt. (NYSDOT, 2006) was used because it was the most recent of the NYSDOT AADT counts. There were a few AADT counts from OCDOT, but they did not match the NYSDOT AADT counts very well and were disregarded.

Limited Access Highways

Interstate Route 481 – This highway stretches over 10 miles through the Town of DeWitt and its AADT weighted average is based off the 6 sections below. **AADT Weighted average = 38,493**

1.) **Town Line to Route 92/5** – Technically, this AADT count only covers from Jamesville Road to Route 92/5. However, there are no exit/entrance ramps between the town line and Jamesville Road, so it was assumed that this count could be applied to the whole section. There were a total of 3 counts for this section listed on the SMTC's website, so the most recent from 2007 was used. **31,200** => approx. ¼ (NYSDOT, 2007)
2.) **Route 92/5 to Interstate Route 690** – There were a total of 5 AADT counts listed for this section, so the most recent from 2006 was used. **55,600** => approx. 1/5 (NYSDOT,2006)
3.) **Interstate Route 690 to Kirkville Road** – There were 2 AADT counts for this section, so the most recent from 2008 was used. **44,750** => approx. 1/6 (NYSDOT, 2008)
4.) **Kirkville Road to Interstate Route 90** – There were 3 AADT counts for this section, so the most recent was used. **38,460** => approx. 1/6 (NUSDOT,2008)
5.) **Interstate Route 90 to Route 298** – There was only 1 count listed for this section on the SMTC's website. **29,700** => approx. 1/10 (NYSDOT, 2001)
6.) **Route 298 to Northern Boulevard** – These 2 roadways actually intersect outside of DeWitt's boarders. However, it was assumed that this count could be applied to the section that only extended through the town's boarders. There was only 1 count listed on the SMTC's website for this section. **24,300** => approx. 7/60 (NYSDOT, 2001)

Interstate Route 690 – This highway stretches just 2 miles through the town, and its AADT average is only based off two sections. **AADT Weighted Average = 45,900**

1.) **Syracuse City Line to Bridge Street** – There were two AADT counts for this section of I-690, so the most recent count was utilized. **39,900** => approx. ½ (NYSDOT, 2006)
2.) **Bridge Street to I-690 End** – **51,900** => approx. ½ (NYSDOT, 2000)

Interstate Route 90 (NYS Throughway) – This weighted average was calculated using two different segments. There is also a portion from I-481 to the DeWitt/Manlius boarder that did not have an AADT count. That section does not have any influence over the AADT average. **AADT Weighted Average = 29,267**

1.) **Syracuse City/DeWitt Line to Rt 298** – This count is actually from I-81 to Rt 298, which extends outside of DeWitt's boarders. In addition, the count for this section from 2004 was disregarded since it was not the most recent. **31,400** => approx. 2/3 (NYSTA, 2006)
2.) **Rt 298 to I-481** – The older count from 2004 was disregarded. **25,000** => approx. 1/3 (NYSTA, 2006)

8.9 Appendix I: Manually Measured Roadways

This is a list of all the roadways that did not have any length recorded. Their length was estimated using *O'Brien and Gere's GIS software. They are listed in categories of how they are classified in the* 2005 Town of DeWitt Map and Community Guide *and not by ICLEI's three categories.*

Local Roads

Road	**Length** (miles)
Azalea Dr	0.06
Bradford LA/1 PROPERTY	0.01
Brooklawn Pky	0.14
cricklewood green la	0.20
DEWEY AVE	0.28
Fietta Dr	0.45
GolfView	0.09
HAZELHURST AVE	0.10
JAMES STREET MANOR	0.10
Maple View Rd/MAPLE CREST	1.23
MCCOOL AVE	0.67
Rams Gulch Road	0.09
RIVER BIRCHFIELD LA	0.42
South St/Apulia Rd	0.64
Sparrow Lane	0.04
symphony path	0.06
Winslow Dr	0.08
Yellow Wood PKY	0.65

Parts of larger roadways that are classified as local roads on *the 2005 Town of DeWitt Map and Community Guide*

Road	**Length** (miles)
Thompson Road	1.68
James Street	0.57
Kinnie Street	0.59

Arterial Roads

Road	Length (miles)
Ceader Bay Road	0.54
Col. Eileen Collins Blvd	0.78
E Molly Road	2.05
East Taft Road	0.85
Exeter St	0.69
FLY RD	3.50
Franklin Park Dr	0.91
Gates Road	0.63
Hartwell Ave	0.88
Jamesville RD	2.36
Jamesville Toll RD (Rock Cut RD)	1.76
Kimber RD	0.83
Kirkville Road	1.95
New Court Ave	0.65
New Venture Gear Dr	1.06
North Street	0.87
Nottingham RD	2.65
Quintard	1.09
South St/Apulia Rd	0.64
Tecumseh RD	0.72
Townline Road	1.18

Major Arterial Roads

Road	Length (miles)
Northern Boulevard	1.39
Route 173	4.45
Route 290	3.22
Route 298	5.53
Route 5	1.86
Route 5 (sliver of E Genesee before Rt 92 overlap)	0.45
Route 635	2.28
Route 91	0.59
Route 92 (includes Rt 5 Overlap)	2.14

Limited Access Highway

Road	Length (miles)
Interstate Route 481	10.02
Interstate Route 690	1.87

8.10 Appendix J: Community/Local Roads with No AADT Count

This is list of the roads in the Town of DeWitt which fell under ICLEI's "community/local road" category and did not have an AADT count. If a particular roadway is not on this list, than an AADT count was provided by the SMTC's website. This category includes roadways classified as Local or Arterial on the 2005 Town of DeWitt Map and Community Guide. *For these roads, their total traffic volume was determined by multiplying the number of homes in DeWitt by 6 (see Appendix F for details***).** *The roads are listed in groups of how they are classified in* the 2005 Town of DeWitt Map and Community Guide.

Local Roads

ADDISON DR	BOSS RD
ADLER DR	BOVINGTON LA
AGWAY DR	BOXWOOD LA
AIRWAYS PARK DR	BRADFORD DR
ALDEN AVE	BRADFORD DR SPUR
ALTMONT DR	BRADFORD HEIGHTS RD
ALWYN RD	Bradford LA/1 PROPERTY
AMBERGATE RD	BRADFORD PKY
ANDREWS RD	BRADFORD PKY
APPLECROSS RD	BRAMPTON RD
AQUARIUS DR	BRANDON CIR
ARDSLEY DR	BRANDON RD
ASHDALE AVE	BRAXTON CIR
ASPEN PARK BLVD	BRIARCLIFFE RD
AVON ST	BRIARWOOD LA
Azalea Dr	BRIDLE PATH RD
BADGLEY RD	BRITTONFIELD PK
BAIRD AVE	BROADMORE LA
BAKER ST	BROCKTON LA
BALL RD	BROCKWAY LA
BAMERICK ROAD	Brooklawn Pky
BAPTIST WAY	BUFFINGTON
BARTON CIR	BURKE LANE
BASTABLE RD	BURNS AVE
BEARD ST	BURNSIDE DR
BEAVER RUN	BURT LA
BENEDICT RD	CALHOUN ST
BENNETT ST	CALHOUN ST
BERGENFIELD WAY	CAMPUSWOOD DR
BESSBROOK	CANADA DR
BITTERSWEET LAN	CANDLEWOOD DR

CANTERBURY RD
CARNEGIE DR
CARRIAGE CIR
CARSON DR
CATON DR
CEDAR HEIGHTS DR
CEDAR LA
CHARING RD
CHARING RD EXT
CHERRY HILL RD
CHRYSLER LA
CLARA RD
CLARET CIR
CLARMAR RD
CLAY MASTER
CLEARVIEW RD
CLOVERRIDGE DR
COLE AVE
COLFAX AVE
COLLAMER CIR
COLLAMER CROSSING
COLLAMER DR
COLONIAL DR
COMMERCE BLVD W
COMMONS PKY
COOPER LA
CORNWALL DR
CORONATION CIR
CORPORATE CIR
CORPORATE DR
COTTY DR
COVE LN
CRAIG CIR
CRAIGIE ST
CREEK CIR
CRICKET LA W
cricklewood green la
CROSS RD
CROSSBOW DR
CROYDEN LA
CURWOOD CT

CURWOOD DR
CUTLER ST
DANBURY DR
DANZIG ST
DANZIG ST
DEERE RD
DEERFIELD RD
DERRINGER DR
DERRY WAY
DEWEY AVE
DEWITTSHIRE RD
DEWITTSHIRE RD south
DEWOLFE RD
DONRIDGE DR
DOWNING RD
DROTT DR
DROVERS LA
DRUMLINS TERRAC
DUNBARTON RD
DUNHAM RD
DUNLAP DR
DUTCH HILL RD
E COLVIN ST
E HAMPTON PLACE
E JAMES ST
EASTBOURNE DR
EASTERLY TERRAC
EASTERN AVE
EDEN ROCK CIR
EDINGER DR
EDWARDS DR
ELLICOTT DR
ELMRIDGE RD
ELMSFORD RD
ELY DR
EMILIE LA
ENDERBERRY CIR
ENTERPRISE PKY
ERREGGER DR
ETHRIDGE RD

FAIR LAKES RD
FAIRWAY DR
FALSO DR
FALSTAFF RD
Fietta Dr
FIORDAN RD
FIR TREE LA
FIRESTONE DR
FLAME TREE DR
FREDERICK ST
GALSON RD
GALSTER DR
GIRDEN RD
GLEASON PLACE
GolfView
GRANITE CIR
GRAPHIC RD
GREEN BANK DR
GREENTREE DR
GREENWOOD RD
GRENFELL RD
GRODNO ST
GROVER ST
HADDONFIELD DR
HADDONFIELD PLA
HALE AVE
HALTON RD
HAMILTON PKY
HAMLET CREST
HAMMERSMITH DR
HAMPSHIRE DR
HARD STONE RD
HARMONY DR
HARPERS CT
HARVEST HILL DR
HATHAWAY RD
HAVERHILL DR
HAVERHILL PLACE
HAZEL AVE
HAZELHURST AVE

HAZELNUT CIR
HEMINGWAY RD
HIGHFIELD RD
HOBSON AVE
HOLLISTON CIR
HOOK CIR
HUMBERT AVE
JAMAR DR
JAMES STREET
JAMES STREET MANOR
JONES AVE
JOY DR (aka Joy Rd.)
JUTLAND DR
KAME WAY
KASSONTA DR
KENT PKY
KERMIT LA
KEYSTONE WAY
KINGSLEY RD
KINNE ST (NORTH)
KIRKPATRICK ST
KITTELL RD
KNOLLWOOD PLACE
KNOLLWOOD RD
KRAVEC DR
LACONIA CIR
LANSDALE RD
LANSDOWNE RD
LAW DR
LEDGEWOOD DR
LEO AVE
LEPAGE PLACE
LEVERETT LA
LEWIS AVE
LILLIAN AVE
LINKS RD
LITCHFIELD DR
LITTLE FOX CIR
LONE WOLF DR
LONGRIDGE RD

LONGWOOD DR
LOUCKS RD
LUAN CIR
LYNACRES BLVD
LYNBROOK CIR
LYNDALE CT
LYONS ST
MACONI AVE
MANDERSON RD
Maple View Rd/MAPLE CREST
MARGINAL DR
MARISA HEIGHTS
MARMOT CIR
MARSH DR
MASTERS RD
MAUTZ RD
MCCOOL AVE
MEAD RD
MERIDAN RD
MERMAN DR
MICHAELS DR
MIDLER PARK DR
MILES AVENUE
MONTGOMERY RD
MOORE RD
MOREHOUSE FLATS
MORTON RD
MYERS RD
MYERS RD
N CENTER ST
N COLLINGWOOD A
N EDWARDS AVE
N HIGHLAND AVE
NELSON AVE
NEWBROOK AVE
NEWFEILD RD
NORTHRIDGE RD
OAK HOLLOW RD
OAKMONT DR
OGLE RD

OLD BARKER HILL
OLD COLLAMER RD N
OLD FARM RD
OLD LYME RD
OLD QUARRY RD
OLD THOMPSON
OLD WOODCHUCK HILL
OLIVA DR
OLYMPIA AVE
ORRICK RD
ORVILTON DR
PADDOCK DR
PAGE HOLLOW PL
PALMETER AVE
PARKWOOD DR
PATSY LA
PAULA DR
PEBBLE HILL NORTH
PEBBLE HILL SOUTH
PELHAM RD
PHEASANT ST
PHYLLIS LA
PICKARD DR
PICKWICK RD
PINE VALLEY DR
PITTMAN LA
POINT EAST DR
POOLE RD
POSTER LN
POZNAN STREET
PYLE DR
QUAKER HILL
QUINLAN AVE
RADCLIFF RD
RALPH LA
Rams Gulch Road
REVERE AVE
REVERE RD
RICHLAND DR
RICHWOOD DR

RIDGECREST RD
RIDGEWOOD DR
RIDINGS RD
RIVER BIRCHFIELD LA
ROBBINS LA
ROBERTS ST
ROBY AVE
ROSEWELL MEADOW
ROSSITER RD
ROYAL BIRKDALE
ROYCROFT RD
RUSH CREEK DR
RUSSELL LA
RUTGER RD
SADDLEBROOK DR
SAGINAW DR
SALEM RD
SAND HILL RD
SANDERS CREEK
SARATOGA CIR
SARGENT RD
SAYBROOK LA
SCHUYLER RD
SCHUYLER RD
SCOTLAND RD
SCOTT AVE
SEDALIA CIR
SERAH LA
SEWICKLEY RD
SHALIMAR WAY
SHAPLEIGH DR
SHEARIN AVE
SHERBROOKE CIR
SHERBROOKE RD
SHERWOOD DR
SHORT RD
SILVER FOX DR
SILVER ST EXT
SINGLETREE DR
SINGLETREE LA

SMOKEY HOLLOW
SOLVAY RD
SOUTH GATE RD
South St/Apulia Rd
Sparrow Lane
SPRINGWATER DR
ST ANDREWS CIR
ST PAUL DR
STANDISH DR
STANDISH TERRACE
STANTON DR
STEINWAY DR
STEINWAY DR (3 LOTS)
STEINWAY DR S
STILLWATER DR
STILLWELL CIR
STONECREST DR
STONERIDGE DR
SUNNY SQUARE DR
SUTTON PLACE
SWANKA RD
SYCAMORE TERRACE
symphony path
TAFT AVE
TARBELL RD
TAYLOR RD
TECHNOLOGY PL
TEMPLE DR
TERESE TERRACE
TERRACE CIR
TERRACEVIEW RD
THE HAMLET
THISTLEWOOD LA
THOMAS RD
THOMPSON RD
THOMPSON RD
THORNTREE HILL
THUNDERHEAD LA
TIFFANY CIR
TILDEN DR

TIMBERLAND DR
TITIAN CIRCLE
TRANS AMERICAN
TUCKER AVE
TULIPWOOD LA
TURNWOOD DR
TWIN OAKS DR
V I P PKY
VINCENT DR
WAITSFIELD DR
WALDORF PKY
WALKERTON DR
WALTERS DR
WARING RD
WARWICK RD
WASHBURN DR
WATERFORD WOOD WAY
WATERFORD WOOD WAY
WAVEL ST
WEDGEWOOD TERRA
WEIGHLOCK DR
WELLINGTON RD
WELLS DR
WEMBRIDGE COURT
WEMBRIDGE DR
WEST BENEDICT RD
WESTCLIFFE RD
WESTERLEY TERRA
WESTMINSTER RD
WETHERSFIELD RD
WEXFORD RD
WHIRLYBIRD LA
WIDEWATERS PKY
WIESNER LA
WILBUR RD
WILL O WIND DR
WINCHESTER RD
WINDSOR DR
Winslow Dr
WINSTON WAY

WINTERTON DR
WOLFBORO RD
WOODBERRY LA
WOODSIDE RD
WORTHINGTON WAY
WYNCREST DR
YALE AVE
Yellow Wood PKY
YORK RD
YORKTOWN CIR
YVONNE LA

Segments of larger roadways that are classified as local roads on t*he 2005 Town of DeWitt Map and Community Guide*

Road	**Length** (miles)
Thompson Road	1.68
James Street	0.57

Arterial Roads

Ceader Bay Road
Col. Eileen Collins Blvd
COURT STREET RD
East Taft Road
Gates Road
N MIDLER AVE
New Court Ave
South St/Apulia Rd
TOWPATH RD
WOODCHUCK HILL Road

Segments of larger roadways that are classified as arterial roads on *The 2005 Town of DeWitt Map and Community Guide*

Partial Minoa Arterial Road	**Length (Miles)**
East Manlius Street	0.16

These are the Local Roads that did have an AADT count

Road	Length (Miles)		AADT	Source	Date
LYMEKILN RD	0.11		**80**	NYSDOT	2000
SIAWASSIA ST	0.20		**180**	NYSDOT	2004
MARVELLE RD	0.29		**300**	NYSDOT	2005
BAY HILL CIR	0.81		**340**	NYSDOT	2005
HOLLY CIR	0.05		**360**	NYSDOT	1999
TERRACE DR	0.05		**460**	NYSDOT	2001
FISHER RD	0.36		**1,850**	NYSDOT	2002
BUTTERNUT DR	0.86		**2,250**	NYSDOT	2005
BUTTERNUT DR	1.38		**2,250**	NYSDOT	2005
BUTTERNUT DR EX	0.08		**2,250**	NYSDOT	2005
OLD COLLAMER RD S	0.44		**2,500**	NYSDOT	2007
OLD COURT STREET RD	1.10		**2,850**	NYSDOT	2005
NORTH AVE	0.41		**6,100**	NYSDOT	2002

8.11 Appendix K: LGO Vehicle Fleet Assumptions

This is a list if assumptions made for vehicles of the LGO fleet that were missing various pieces of information. The list is separated by department.

Highway Department

22H (missing!!)	1995	IH / S 2600 Dump	(missing)	1HTGKAUR3SH655039

- missing vehicle file, assumed it was Heavy Duty

Parks Department

PK BUS

-this vehicle includes all the buses that are used by the Summer Rec. program to transport students, and their fuel consumption was provided in one lump sum. The CH_4 and N_2O emissions were determined by assuming that all the buses were heavy-duty diesel, and the factors for which are not dependent on model year.

Police Department

1973	SWAT Van		

-The Police Department did not have a lot of information on this vehicle due how old it is. It was assumed that this vehicle was a Heavy Duty, and the appropriate CH_4 and N_2O emission factors and fuel economy were assigned.

Water Department

5W	1996	Spare Van	Ford - Econoline (E250)	used by summer help only 1F1FE24HXTHB05030

- Vehicle file did not have GVWR; assumed it was a Light Truck.

BUS
MSCG

-these gas keys were listed in 2008 and were under a miscellaneous department and had no other information. As a result, the emissions from these vehicles were disregarded. However, they had a combined fuel usage total of only 85.2 gallons, so their emissions are negligible.

8.12 Appendix L: Project Recommendations

It is the recommendation of the preparation team that the Town of DeWitt look into community and employee engagement. Emissions reduction goals derived from a top-down government need to be met with bottom-up initiatives. In other words, community members and employees need to feel as though they have an investment in emissions reductions. The following is a list of recommendations, provided by the preparers, identified from case studies around the country:

- *Bicycle Facilities*
  By providing bike racks people visiting or working at the facilities will feel safe leaving their bike out. Major deterrents for bicycle riders are the lack of bike facilities like the bike racks. Some larger organizations/businesses are able to provide shower facilities for employees to accommodate their commute needs. As transportation tends to be the largest emissions contributor to a community analysis, encouraging alternative modes of transportation to and from work can significantly reduce environmental impacts. Implementing bicycle lanes that extend to parks around DeWitt or connect to other existing bicycle lanes will also increase bicyclists' activity. As opposed to converting current traffic lanes or extending the width of roads, the town should focus on adding bike lanes to roads with wide shoulders. These roadways can have a bike lanes added with no major road work and at low costs.

- *Conserve Open Space*
  While wooded lots and other open spaces were not quantified in terms of GHG sequestration sinks, it is important to recognize the potential health and social benefits to expanding such areas within the town limits. This effort would reduce storm water runoff and improve air quality in the immediate vicinity.

- *Preparation and maintenance/sustainable educational training-*
  Each employee should be required to participate in monthly educational forums to share best management practices (BMP) across the disciplines. These forums have the authority to implement GHG reduction policies that impact behavioral changes. An example of this might be a mandated office policy that all lights and computers be turned off when a worker leaves the office.

- *Online survey to gauge sustainable behavior-*
  All employees should complete a sustainability assessment survey in which they indicate a sustainability score. Criteria for this survey include number and type of office appliances used, amount of time lights and appliances are used per day, etc.

- *Employee commuter survey -*
  Emissions from employee commutes make up an important optional source of emissions for local government's operations. Since the scale of employee commutes is often large in comparison with many other facets of government operations, local government may be able to affect their employees' commutes through a variety of incentives. ICLEI recommends estimating emissions from employee commutes as part of a complete GHG inventory.

- *Smart meters-*
  A smart meter is a real-time feed which displays current fuel and electricity consumptions as well as GHG emissions. This is a useful tool because it is a live dashboard displaying the direct emissions effects of the town's actions. The emissions data can be converted into a more understandable unit such as number of vehicles on the road.

- *Purchasing of Energy Star products-*
  Older municipal products and appliances should be replaced with Energy Star approved products. Energy Star products improve efficiency which reduces GHG emissions. Small savings of these products add up over time and make a large impact. Examples of Energy Star products and services which could be used by the Town of Dewitt include computers, refrigerators, seals, windows, doors, heating and cooling systems, light bulbs, plumbing products, and green building policies.

- *Supply Chain Management-*
  The town's supplies should be concentrated around sustainable goods. This would include products which are sustainably manufactured and products which are manufactured either within the town or in close proximity to the town.

- *Interdepartmental energy and waste reduction team-*
  Representatives from each town department should work closely together to ensure the compliance of GHG reduction policies and emphasize the importance of energy reduction within the work environment.

- *Commercial/Industrial Accountability*
  Establish a baseline or tool that suggests how much energy should be consumed by building dependent upon the type of business and hold the industrial/commercial sectors accountable for high energy use. The penalty could come in the form of an extra tax on X amount over

allotted use and roll into a general sustainability fund or go towards the town budget to reduce homeowners' taxes.

- *Utilizing more fuel efficient vehicles*
  Although purchasing hybrid vehicles or eclectic cars may be expensive, there are some other ways to reduce fuel usage which are much less complicated and costly. For instance, the Police Department could limit the usage of Chevy Tahoes to the winter months, or whenever necessary. This will increase the utilization of passenger cars, which have more efficient fuel economies. In addition, neither the Parks nor Highway Departments have a passenger car. Perhaps these departments could be issued one to be used by employees to travel to and from events which do not require a truck or heavy-duty vehicle, such as conferences and meetings. These simple changes would not only reduce GHG emissions, but also save money on fuel usage.

- *Community Workshops/Seminars*
  Sustainability workshops for employees and the community could provide a great resource to homeowners and promote positive environmental impacts. The City of Syracuse has numerous groups that specialize in community sustainability ranging from gardening to sustainable businesses to community activism. Utilizing those groups and community leaders may help to educate the community about their environmental impacts and motivate them to implement positive change.

- *Tracking LGO Vehicle Fleet Mileage*
  Currently, none of DeWitt's vehicle fleets track annual mileage which is necessary for N_2O and CH_4 calculations. A very simple way to do this is have each employee that operates a government vehicle record the odometer value on the first day of the year that the vehicle is used. The annual mileage can then be determined by subtracting that value from the previous year's value. This would track annual mileage without placing an extreme burden on employees.

The following is a short list of sustainability groups that operate in the Syracuse area:

40 Below - http://www.40belowsummit.com/
Cornell Cooperative Extension - http://www.cce.cornell.edu/~onondaga/
F.O.C.U.S. Greater Syracuse - http://www.focussyracuse.org/
Onondaga Environmental Institute - http://www.onondagaenvironmentalinstitute.org/
Syracuse First - http://syracusefirst.org/
Syracuse Grows - http://www.syracusegrows.org/