Local Government and Community Greenhouse Gas Inventory

Town of Richland, New York
September 11, 2015

Town of Richland

1 Bridge Street

Pulaski, NY 13142

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Acknowledgements

The Town of Richland would like to acknowledge the contributions made to this report by the following:

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I. Introduction

Background

The Town of Richland has adopted the Climate Smart Communities Pledge as a commitment to greenhouse gas (GHG) emission reduction and climate change mitigation. The Climate Smart Communities Program represents a partnership between New York State and local governments to reduce energy use and GHG emissions. Major steps involved in the program include:

1. Adopting the Climate Smart pledge
2. Compiling a GHG inventory
3. Developing a plan to reduce emissions (Climate Action Plan), and
4. Carrying out sustainable development projects.

ICLEI-Local Governments for Sustainability recommends a similar path to follow with 5 milestones (see Figure 1).

The first step in climate action planning is to compile a GHG inventory. A GHG emissions inventory is an audit of activities that contribute to the release of emissions. For this GHG inventory, energy use and waste generation information was gathered and methods of calculation explained in the Local Government Operations Protocol (LGOP) and the US Community Operations Protocol developed by ICLEI-Local Governments for Sustainability were utilized to generate emissions figures. Data for municipal and community-wide energy use and waste production were entered into ICLEI's ClearPath software. The outputs were aggregated into metric tons of CO_2 equivalent, and emissions were delineated by sector, source, and scope. Data from the inventory will guide policy decisions and energy improvements, inform sustainability projects, and build public support for broader sustainability initiatives in the Town of Richland.

Figure 1: ICLEI-Local Governments for Sustainability's 5 Milestone Process

Climate Change and Greenhouse Gases

New York State outlined projected climate impacts and vulnerabilities during the 2011 ClimAid assessment.[1] The ClimAid report projects changes to ecosystems, with the increased presence of invasive species and shifts in tree composition, while water quality and quantity may also be impacted due to changes in precipitation. Furthermore, there may be beneficial economic impacts, such as a longer recreation season in the summer, and a longer growing season for the agricultural sector due to rising temperatures. Scientific evidence suggests that the impacts of global climate change will be different in various regions, and will include temperature shifts, sea level rise, and human health risks.

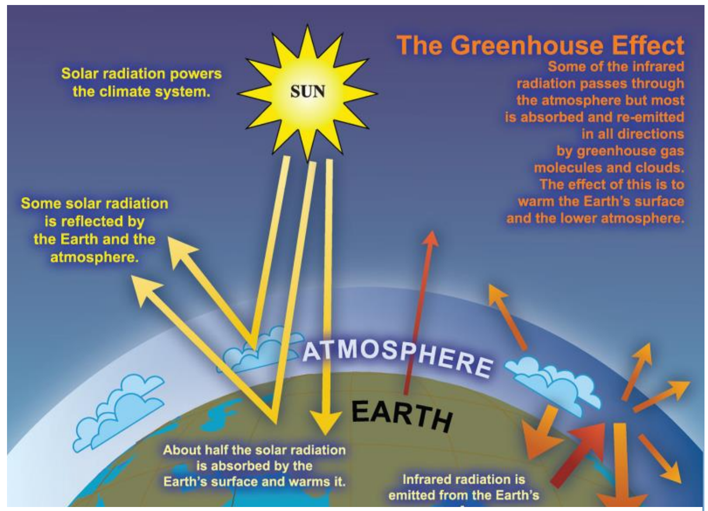

Figure 1: The Greenhouse Effect

Climate change is increasingly recognized as a global concern. Scientists have documented changes to the Earth's climate including the rise in global average temperatures, as well as sea levels, during the last century. An international panel of leading climate scientists, the Intergovernmental Panel on Climate Change (IPCC), was formed in 1988 by the World Meteorological Organization and the United Nations Environment Programme to provide objective and up-to-date information regarding the changing climate. In its 2007 Fourth Assessment Report, the IPCC states that there is **a greater than 95 percent chance that rising global average temperatures, observed since 1750, are primarily a result of greenhouse gas (GHG)-emitting human activities.**[2]

The rising trend of human-generated GHG emissions is a global threat. The increased presence of these gases affects the warming of the planet by contributing to the natural greenhouse effect, which warms the atmosphere and makes the earth habitable for humans and other species (see Figure 2).[3] Mitigation of GHGs is occurring in all sectors as a means of reducing the impacts of this warming trend. However, scientific models predict that some effects of climate change are inevitable no matter how much mitigative action is taken now. Therefore, climate mitigation actions must be paired with adaptation measures in order to continue efforts to curb emissions contributions to global warming, while adapting communities so that they are able to withstand climate change impacts and maintain social, economic, and environmental resilience in the face of uncertainty. Climate adaptation can take shape through infrastructure assessments and emergency planning, as well as through educational efforts to raise public awareness about potential climate change impacts. In New York State, regional climate change impact and vulnerability assessments will likely increase moving forward, but many local governments

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

across the nation are already taking action to lessen climate impacts through GHG reduction measures and climate adaptation planning.

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

The Purpose of a Greenhouse Gas Inventory

Many local governments have decided to gain a detailed understanding of how their emissions and their community's emissions are related to climate change and have committed to reducing GHG emissions at the local level. Local governments exercise direct control over their own operations and can lead by example by reducing energy usage in municipal facilities, using alternative fuels for their fleets, and investing in renewable energy sources. Local governments can also influence community-wide activities that contribute to climate change by improving building codes and standards, providing cleaner transportation options, and educating members of the community about their choices as consumers. Each local government is unique with its own set of opportunities, challenges, and solutions, and therefore climate action needs to be tailored to each community at the local level.

Because local governments typically contribute less than ten percent of the total greenhouse gas emissions generated in a given community, ICLEI recommends developing both local government operations and community-wide greenhouse gas emissions inventories and reduction strategies. Before concerted management and reduction of greenhouse gas emissions can occur within our local governments and communities, local governments must undertake a careful measurement and analysis of all GHG sources. A GHG inventory should facilitate keen insight into the types and sources of GHG emissions within a local jurisdiction, and a GHG emissions forecast will project these emissions levels into the future, allowing for better planning and success in managing those emissions.

There are several major benefits for local governments that undertake emissions inventories:

1. **Fiscal benefits:** Developing climate and energy strategies can help your local government slash energy costs and save taxpayer dollars. Conducting a GHG emissions inventory will show you exactly where energy is being wasted and identify opportunities to become more efficient.

2. **Climate leadership:** By taking action now to address climate change, your local government and elected officials can be recognized for their leadership on climate and energy issues.

3. **Community benefits:** Measures to reduce GHG emissions and energy consumption typically have many co-benefits. They can improve air quality and public health, stimulate the local economy, create green jobs, and make communities more livable and walkable.

4. **Regulatory preparedness:** Although the federal government has yet to produce legislation addressing GHG emissions, a variety of actions at the state and regional levels specifically impact local governments and planning agencies. Taking action now will help your jurisdiction prepare for any future legislative requirements and position your local government for successful compliance.

The Town of Richland is becoming increasingly interested with sustainable initiatives, and in 2015 signed on with a team from the Central New York Regional Planning and Development Board to conduct a greenhouse gas inventory. Through this initiative, the town hopes to monitor and audit their emissions in order to discover new ways to decrease their carbon footprint as well as incorporate sustainable alternatives into their town planning.

Town Profile

The Town of Richland is located in northern Oswego County. The town covers an area of approximately 54.6 square miles, and the majority of the land is used for residential purposes or is vacant. According to the 2010 US Census, the town has a population of about 3,353 residents, with 1,216 occupied housing units. Of the 1,216 occupied housing units, 1,544 units are owner-occupied with an average household size of 2.63 persons, while 736 units are renter-occupied with an average household size of 2.23 persons.

The town provides its residents with many services through the following departments: Town Board, Clerk/Tax Collector, Highway, Court, Zoning, Assessor, Dog Control, Planning Board, and Water.

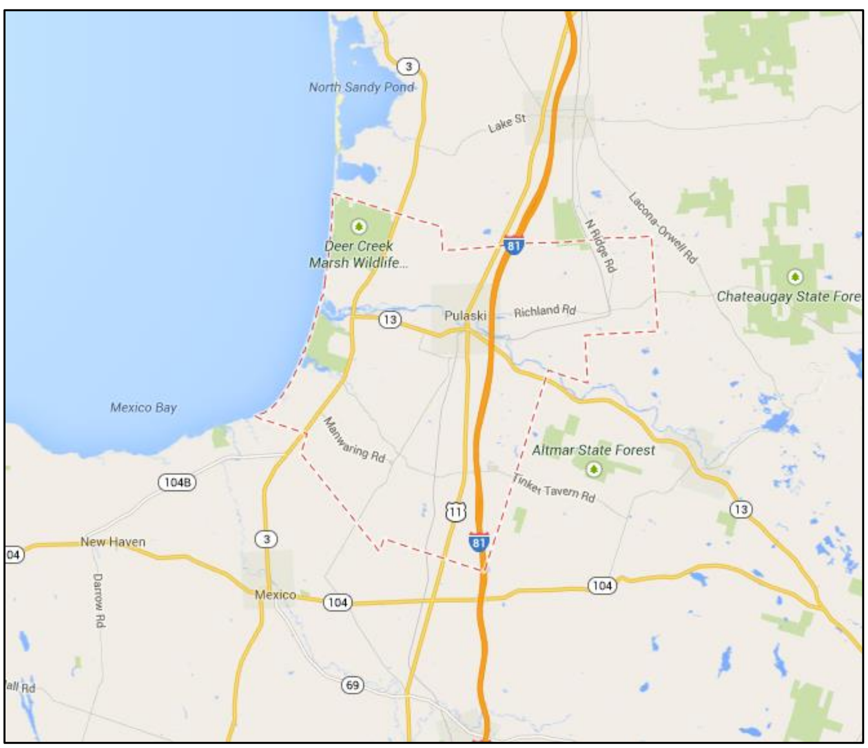

Figure 3: Town of Richland Map

II. Methods

Data Collection and Analysis

Fuel and energy use data associated with GHG emissions were collected for community and municipal operations within the Town of Richland for the baseline year 2011 following ICLEI-Local Governments for Sustainability's Local Government Operations Protocol (LGOP) and the US Community Operations Protocol. Emissions were also forecasted for the year 2025 for both government and community operations based on current and projected energy use trends and waste production trends. ICLEI's ClearPath software was used to analyze energy use and convert information into emissions data, measured in metric tons of carbon dioxide equivalent ($MTCO_2e$). The software streamlines the process of converting different sources, units, and varieties of emissions into comparable energy use and emissions figures.

Reporting

The three most prevalent greenhouse gases, and therefore the focus of this analysis, are carbon dioxide (CO_2), methane (CH_4) and nitrous oxide (N_2O). The units used to discuss these gases in aggregate is carbon dioxide equivalent (CO_2e), which is a conversion based on each gas' Global Warming Potential (GWP), or the impact of 1 unit of each gas in the atmosphere compared to 1 unit of CO_2 (see Table 1). Emissions measured in CO_2e can be categorized in various ways, including by scope, sector, and source.

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

Table 1: Global Warming Potential of Greenhouse Gases

The scope distinction, which labels the emissions sources within a local government as either scope 1, 2, or 3, distinguishes between what is directly emitted (scope 1) and indirectly emitted (scopes 2 and 3) (see Table 2). Local governments inherently have more control over the emissions in scopes 1 and 2 due to the behavioral and often function-specific nature of scope 3 emissions sources, and therefore scope 3 emissions are optional to report in GHG inventories. However, governments and communities are increasingly accounting for all three scopes in their inventory analyses in an effort to conduct more comprehensive carbon footprint assessments.

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

Scope	Emissions Activity	Examples
1	All direct GHG emissions	Onsite governmental emissions, vehicle fleet emissions, onsite commercial, residential, and industrial emissions
2	All indirect GHG gases related to the consumption of purchased energy	Emissions related to purchased steam, heating, cooling, and electricity
3	All other indirect emissions not included in Scope 2	Emissions from wastewater and solid waste processes, employee commute, household waste, and commercial waste

Table 2: Emission Scope Distinctions

Emissions data can also be reported by sector. Sectors are included or excluded in the boundaries of GHG inventories based on availability of data, relevance to emissions totals, and scale to which they can be changed. For example, if a municipality's wastewater is treated at a wastewater treatment facility that is located outside of the municipality's boundaries and is therefore not able to be changed by the municipality alone, facility emissions do not need to be included in the inventory).

Finally, emissions data can be reported by source. Electricity, natural gas, wood, and fuel oil would be sources of emissions within the "Residential Energy Use" or "Commercial Energy Use" sectors, while gasoline, diesel, and ethanol would be sources of emissions within the "Transportation" sector.

III. Government Results

Government Operations Emissions Inventory

In 2011, the Town of Richland's government emissions totaled 216 $MTCO_2e$. The largest sources of government emissions in the Town of Richland in 2011 were electricity and diesel, each accounting for 83 $MTCO_2e$, or 38% of community emissions. Natural gas and gasoline were also large emitting sources, producing 26 $MTCO_2e$ (12%) and 22 $MTCO_2e$ (10%), respectively.

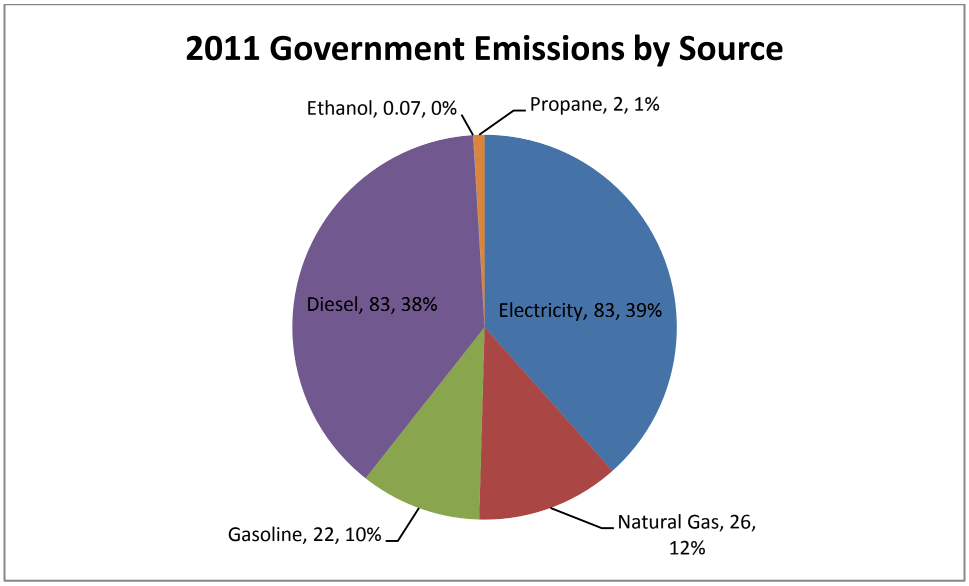

Figure 4: 2011 Government Operations Emissions by Source

Government emission sectors inventoried include: buildings and facilities, streetlights and traffic signals, water delivery facilities, and vehicle fleet. Vehicle fleet contributed to the largest percentage of emissions in the 2011 base year, accounting for 105 $MTCO_2e$, or 48% of the government's total emissions. The buildings and facilities sector was the next highest emitting sector, producing 75 $MTCO_2e$, or 35% of total municipal emissions, followed by the water delivery facilities sector, which produced 28 $MTCO_2e$, or 13% of total emissions, and the streetlights and traffic signals sector, which produced 8 $MTCO_2e$, or 4% of government emissions.

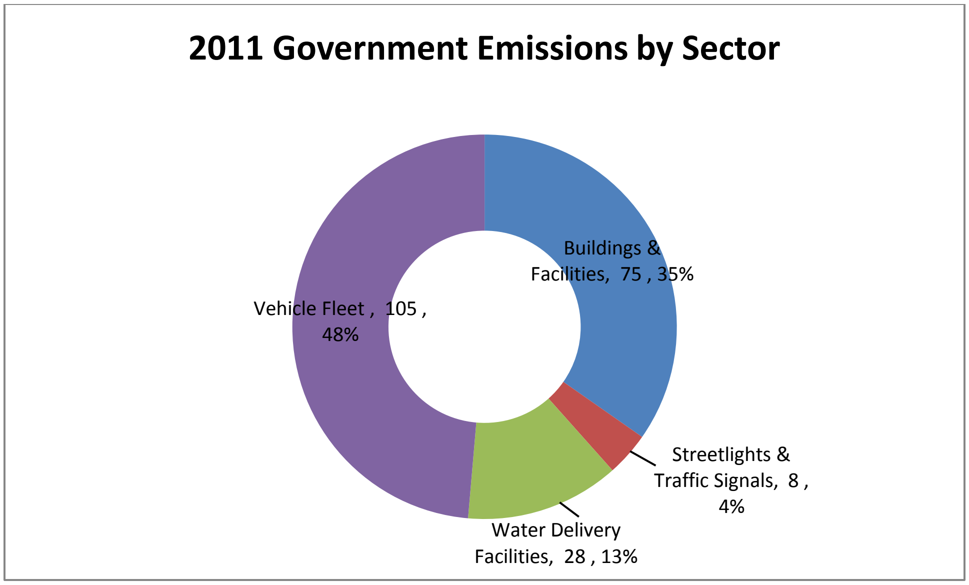

Figure 5: 2011 Government Operations Emissions by Sector

Energy use by sector in the government mimics emissions by sector in the government, with the vehicle fleet sector using the greatest amount of energy in 2011, using 1,452 million Btu (MMBtu) of energy, or 45% of the government's total energy use. The buildings and facilities sector consumed the next highest amount of energy, using 1,229 MMBtu, or 38% of total municipal energy use, followed by the water delivery sector, which consumed 436 MMBtu, or 13% of total energy used, and streetlights and traffic signals, which used 115 MMBtu, or 4% of total energy used by the government.

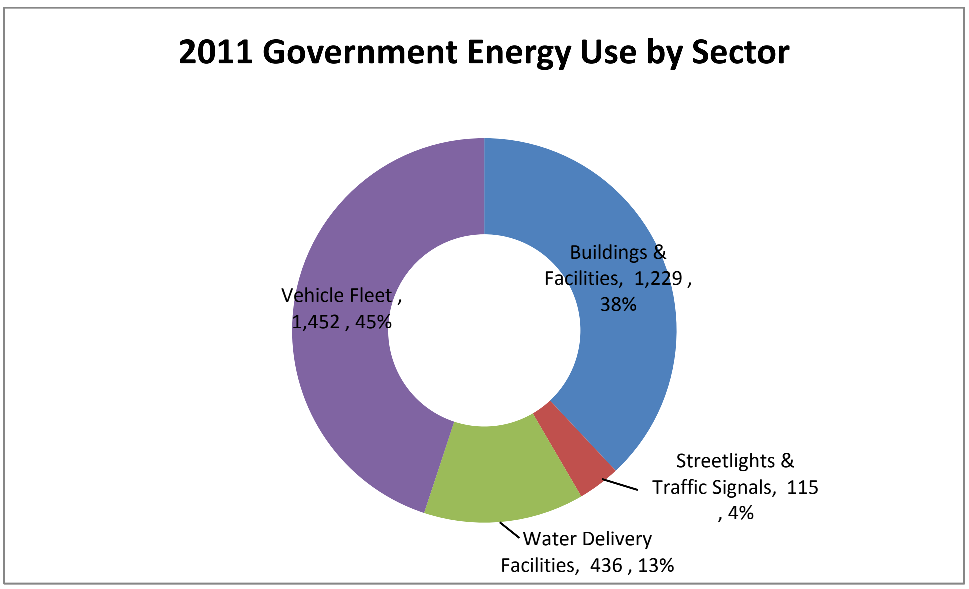

Figure 6: 2011 Government Operations Energy Use by Sector

Government emissions can also be broken down into scope. Scope 1 represents on-site emissions created and totaled 133 $MTCO_2e$, or 62% of government emissions in 2011. Scope 2 represents off-site emissions created by energy used by the municipality and totaled 83 $MTCO_2e$, or 38% of total government emissions in 2011. Scope 3 emissions were not inventoried for this report.

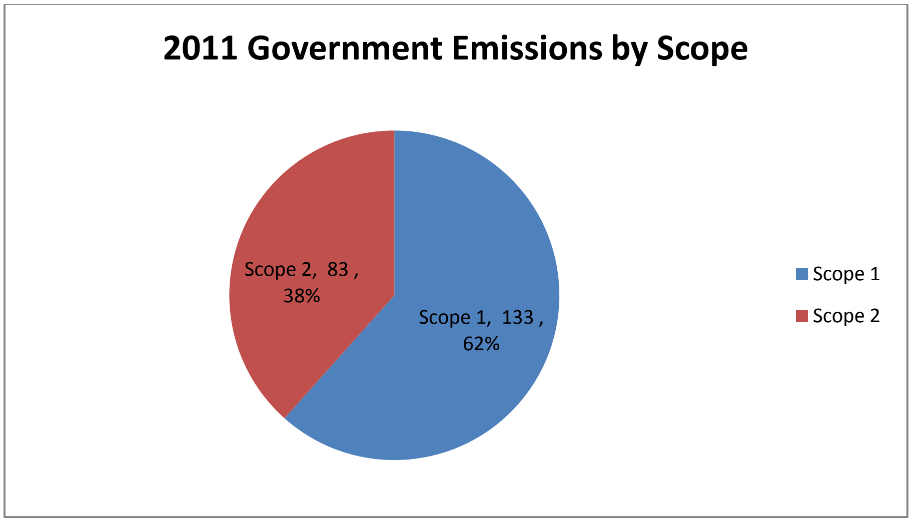

Figure 7: 2011 Government Operations Energy Use by Scope

Government Operations Emissions Forecast

The projected government greenhouse gas emissions for 2025 are 210 metric tons, which is 6 metric tons of CO_2e less than the baseline year total. The projected forecast for 2025 government emissions is based on a single-rate population growth factor. Emissions are expected to decrease very slightly in all sectors.

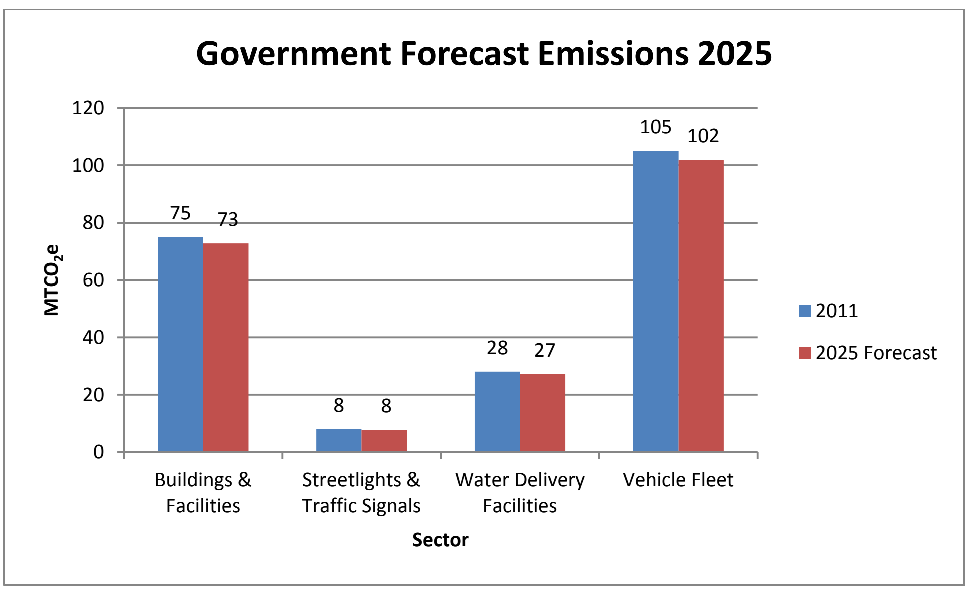

Figure 8: Government Operations Emissions Forecast

IV. Community Results

Community Emissions Inventory

In 2011, the Town of Richland's community emissions totaled 57,366 $MTCO_2e$. The largest source of community emissions in the Town of Richland in 2011 was gasoline, accounting for 31,877 $MTCO_2e$, or 56% of all community emissions. Diesel and electricity were also large emitting sources, producing 11,128$MTCO_2e$ (19%) and 5,902 $MTCO_2e$ (10%), respectively.

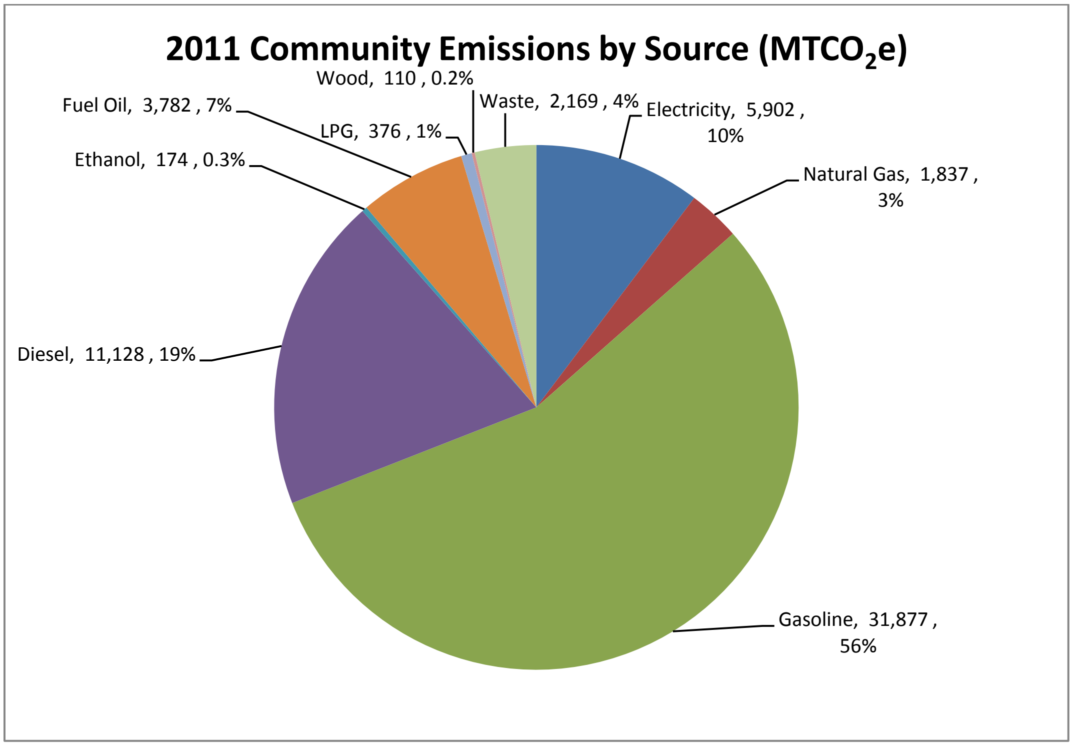

Figure 9: 2011 Community Emissions by Source

Community emission sectors inventoried include: residential energy use, commercial energy use, industrial energy use, transportation, and solid waste. The transportation sector contributed to the largest percentage of emissions in the 2011 base year, accounting for 43,190 $MTCO_2e$, or 75% of the community's total emissions. Commercial energy use was the next highest emitting sector, producing 5,519 $MTCO_2e$, or 10% of total community emissions, followed by the residential energy use sector, which produced 5,164 $MTCO_2e$, or 9% of total emissions, and the waste sector, which produced 2,169 $MTCO_2e$, or 4% of total emissions. The smallest emitting sector was industrial energy use, which produced 1,324 $MTCO_2e$, or 2% of total community emissions.

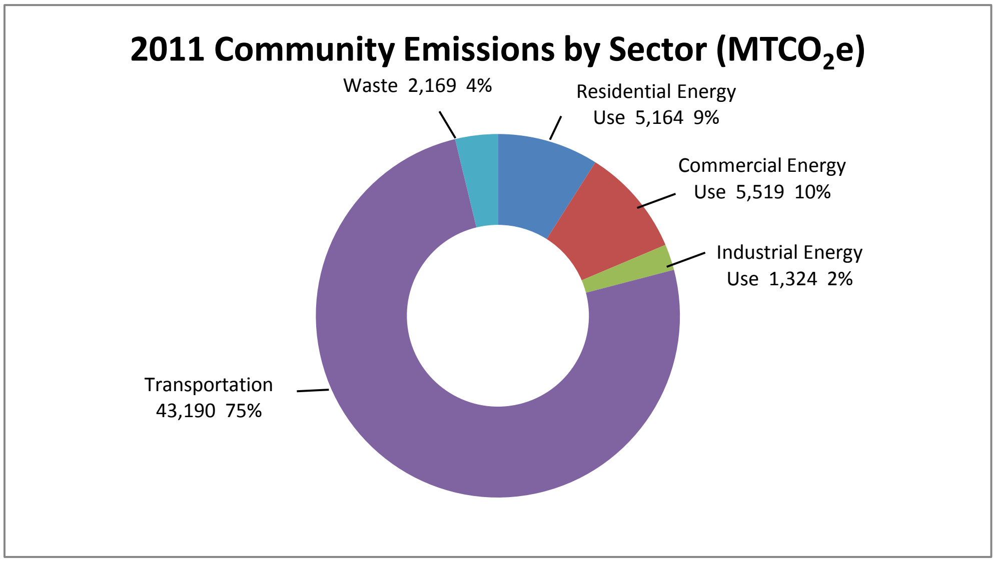

Figure 10: 2011 Community Emissions by Sector

Energy use by sector in the community mimics emissions by sector in the community, with the transportation sector using the greatest amount of energy in 2011, using 646,730 million Btu (MMBtu) of energy, or 77% of the community's total energy use. Commercial energy use consumed the next highest amount of energy, using 91,118 MMBtu, or 11% of total community energy use, followed by the residential energy use sector, which consumed 80,953 MMBtu, or 10% of total energy used, and the industrial energy use sector, which consumed 19,910 MMBtu, or 2% of energy used. The solid waste sector did not use any energy.

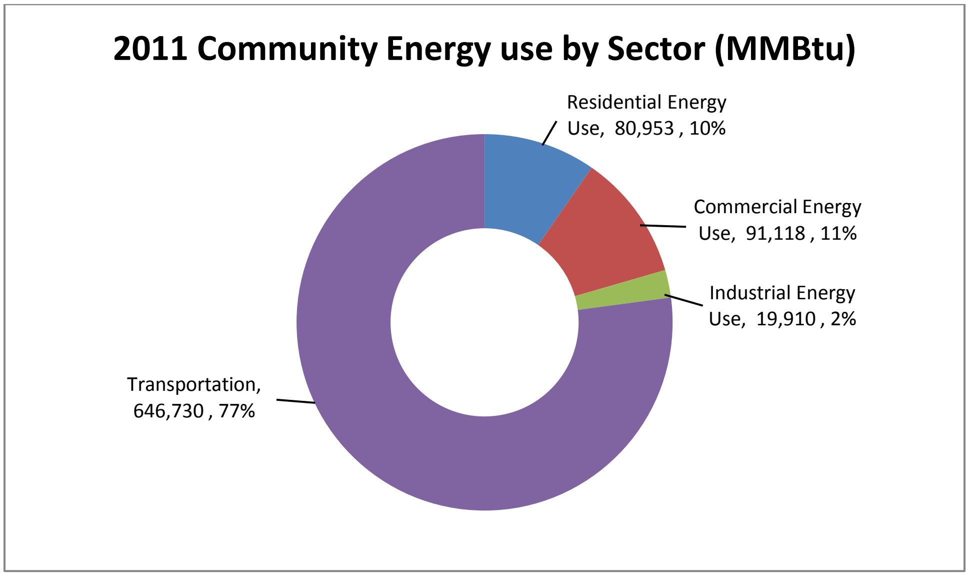

Figure 11: 2011 Community Energy Use by Sector

2025 Community Forecast

Community emissions in the Town of Richland are forecasted to total 60,108 $MTCO_2e$ in 2025, a 4.78% increase from the 2011 baseline year, with decreases in emissions in the residential energy use and waste sectors, and increases in the commercial energy use, industrial energy use, and transportation sectors compared to the 2011 baseline year. This forecast takes into local and statewide energy use and waste production trends.

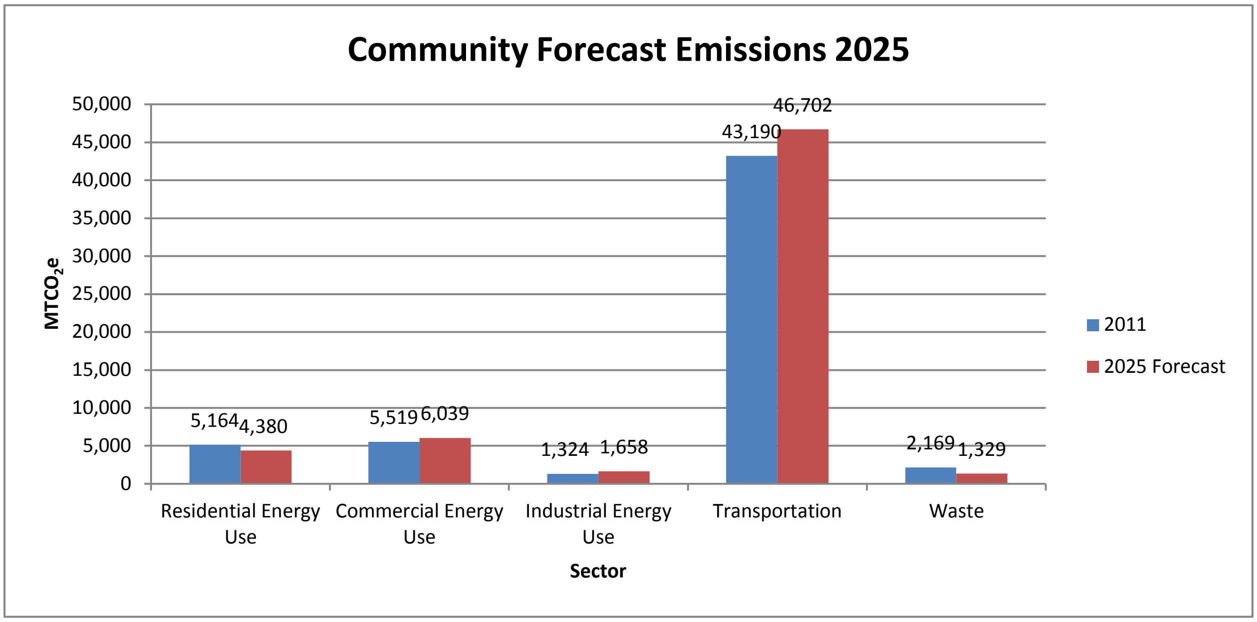

Figure 12: Community Emissions Forecast

V. Discussion

For this study a scope distinction was important because it isolated emissions information into categories that can be addressed with different means and tools. Direct emissions can be linked back to specific fuel types, whereas indirect emissions from the consumption of electricity are more difficult to quantify. Indirect scope 2 and, to a greater degree, scope 3 emissions have lower potentials to be affected by local policy initiatives. The vast majority of government emissions for Richland was scope 1 emissions, and thus should garner the most attention when mitigation plans are considered.

The greenhouse gas inventory and forecast is the first milestone in climate action planning, to be followed by developing a reduction goal and then creation of a climate action plan. The reduction goal and climate action plan should take scope differences into account. Sector and source analyses are also important because they will indicate more specifically where emissions are derived from, and because the scope distinction does not apply to community generated emissions which represent the majority of emissions within a municipality.

The data indicated that the greatest percentage of government emissions came from the vehicle fleet sector. The results of this study also indicate that the largest percentage of community emissions came from the transportation sector for both 2011, and this sector is forecasted to remain the largest emitting sector through 2025. Transportation emissions should be targeted in the town's future Climate Action Plan so that energy use from this sector can be reduced, therefore lowering both energy costs and GHG emissions.

The boundaries of this study did not include several considerable sources of emissions, including, but not limited to: employee commute, and waste generated by government operations. These sources were left out due to lack of clarity in data and low potential for influence. This does not diminish the potential for these sectors to be included in future emissions inventories.

This study is the first of its kind for the Town of Richland. Several other CNY municipalities have undergone inventories, proving that climate mitigation requires local participation. Local participation will no doubt reflect the character and capacity of the particular municipality and should be in accordance with a comprehensive plan. Moving forward, institutionalizing data collection is also important in order to broaden the boundaries of the inventory, streamline further studies, and provide more comprehensive sets. Local participation can continue to be aided with efforts from regional support, including the CNY RPDB, Oswego County, NYS DEC, and the EPA.

VI. Conclusion

As a Climate Smart Community, the Town of Richland has partnered with state and local agencies to combat climate change and pledge to reduce greenhouse gas emissions. The first milestone for meeting climate mitigation goals, according to ICLEI-Local Governments for Sustainability, is to conduct a baseline emissions inventory and forecast. This study was the first attempt to comprehensively quantify these emissions for the Town. It will provide a benchmark for planning purposes with the goal of setting an emissions reduction target and developing a Climate Action Plan.

Emissions for the Town of Richland in the 2011 baseline year totaled 57,582 $MTCO_2e$ for all activity covered in this inventory, 216 $MTCO_2e$ (0.4%) of which was from government activity and 57,366 $MTCO_2e$ (99.6%) of which was from community-wide activity. The majority of government emissions came from scope 1 sources that are easiest to influence through planning initiatives. Although a considerable proportion came from the community, which is outside direct governmental control, the local government can take steps to reduce their energy use and GHG emissions to serve as an example to the community. The local government can also provide information and assistance to community members to encourage them to take related actions.

Appendix A: Community Protocol Compliance

ICLEI protocol-compliant inventories must include a table illustrating included and excluded emissions sources and activities, along with final emissions figures. The table below depicts the included and excluded emissions sources and activities and final emissions figures for this inventory and uses ICLEI's notation keys found in the U.S. Community Protocol, Appendix B.

						IE- Included Elsewhere	SI- Local government significant influence	
Emissions Report Summary Table (2011 baseline year)						NE- Not estimated	CA- community-wide activities	
						NA- not applicable		
Include estimates of emissions associated with the 5 basic emissions generating activities						NO- not occurring		
Emissions Type	**Source or Activity**	**Activity Data**	**Emissions Factor & Source**	**Accounting Method**	**Included (SI, CA)**	**Excluded (IE, NA, NO, NE)**	**Emissions (MTCO2e)**	**Notes/Explanations/Comments**
Built Environment								
Use of fuel in residential stationary combustion (nat. gas- MMBtu)	source and activity	4,712	53.02 kg CO_2/MMBtu; 1 g CH4/MMBtu; 0.1 g N2O/MMBtu; EPA Mandatory Reporting Rule (MRR)	Collected data from National Grid and put into CACP	CA		251	
Use of fuel in residential stationary combustion (fuel oil, wood, LPG- MMBtu)	source and activity	26,305	Averaged distillate fuel oil #1, 2,4 EF= 74.5 kg CO_2/MMBtu; LPG= 62.98 kg CO_2/MMBtu; EPA Mandatory Reporting Rule (MRR)	Used ICLEI's US Community Protocol Appendix C (Built Environment), BE 1.2	CA		1,592	
Use of fuel in commercial stationary combustion (nat. gas- MMBtu)	source and activity	29,828	53.02 kg CO_2/MMBtu; 1 g CH4/MMBtu; 0.1 g N2O/MMBtu; EPA Mandatory Reporting Rule (MRR)	Collected data from National Grid and put into CACP	CA		1,586	
Use of commercial stationary combustion (fuel- MMBtu)	source and activity	42,393	Coal/coke mixed commercial sector= 93.4 kg CO_2/MMBtu; Averaged distillate fuel oil #1, 2,4 EFs= 74.5 kg CO_2/MMBtu; LPG= 62.98 kg CO_2/MMBtu; EPA Mandatory Reporting Rule (MRR)	Used ICLEI's US Community Protocol Appendix C (Built Environment), BE 1.3	CA		2,676	
Industrial Stationary combustion sources (nat. gas- MMBtu)	source and activity	N/A	53.02 kg CO_2/MMBtu; 1 g CH4/MMBtu; 0.1 g N2O/MMBtu; EPA Mandatory Reporting Rule (MRR)		NA			
Industrial Stationary combustion sources (fuel- MMBtu)	source and activity	N/A			NA			
Electricity								
Power generation (natural gas use- therms)	source	N/A			NA			
use of electricity by the community (MWh)	activity	26,002	eGrid 2009 subregion factors (EPA)	Collected data from National Grid and put into CACP	CA		5,902	
District Heating/Cooling								
District Heating/Cooling facilities in community	source	N/A			NA			
Use of district heating/cooling by community	activity	N/A			NA			
Industrial process emissions in the community	source	N/A	EPA GHGRP data reported here: ghgdata.epa.gov		NA			
Refrigerant leakage in the community	source	N/A			NE			
Transportation and other Mobile Sources								
On-road passenger vehicles								
on-road passenger vehicles operating within the community (VMT)	source	87,543,045	CACP (Version 3.0) & EPA MRR emission factors for gasoline and diesel (varies by vehicle class for N2O & CH4): LGOP gasoline EF=8.78 kgCO_2/gal; diesel EF= 10.21 kgCO_2/gal	Used formula: AADT x Road Length x 365 days per year = AVMT. For roads without AADT counts, used "Minimum Maintenance Standards Regulation 239/02," which meant taking length of roadway without AADT counts, multiplying by a factor of 6 for rural roads, and then dividing the sum by total roadway length to receive an average AADT count.	CA		40,601	
on-road passenger vehicle travel associated with community land uses (VMT)	activity	N/A			NE			
On-road freight vehicles								
on-road freight and service vehicles operating within the community boundary	source	N/A			NE			
on-road freight and service vehicle travel associated with community land uses	activity	N/A			NE			
On-road transit vehicles operating within the community boundary	source	N/A			NE			
Transit Rail								
transit rail vehicles operating within the community boundary	source	N/A			NE			
use of transit rail travel by community	activity	N/A			NE			
Inter-city passenger rail vehicles operating within the community boundary	source	N/A			NE			
Freight rail vehicles operating within the community boundary	source	N/A			NE			
Marine								
Marine vessels operating within community boundary	source	N/A			NA			
use of ferries by community	activity	N/A			NA			
Off-road surface vehicles and other mobile equipment operating within community boundary	source	N/A			NE			
Use of air travel by the community	activity	N/A			NE			

Solid Waste								
Solid Waste								
Operation of solid waste disposal facilities in community	source	N/A	Process emissions reported to the EPA GHGRP annually; stationary combustion emissions accounted for in the energy use sector		NA			
generation and disposal of solid waste by the community	source and activity	2,520.28		Used ICLEI's US Community Protocol Appendix E (Solid Waste Emission Activities and Sources), SW 2.2	CA		3221	408.43 tons of waste disposed of at Bristol Hill Landfill and 838.56 tons of waste disposed of at Energy Recovery Facility. Information was calculated separately to yield 252 mtco2e emissions
Water and Wastewater								
Potable Water- Energy Use								
Operation of water delivery facilities in the community	source	N/A	CACP 3.0 eGrid 2009 electricity emission factors; and natural gas emission factors= 53.02 kg CO2/MMBtu; 1 g CH4/MMBtu; 0.1 g N2O/MMBtu		IE			
Use of energy associated with use of potable water by the community	activity	N/A			IE			
Use of energy associated with generation of wastewater by the community	activity	N/A	CACP 3.0 eGrid 2009 electricity emission factors; and natural gas emission factors=53.02 kg CO2/MMBtu; 1 g CH4/MMBtu; 0.1 g N2O/MMBtu		NE			
Centralized Wastewater Systems- Process Emissions								
Process emissions from operation of wastewater treatment facilities located in community	source	N/A	Method WW.8= EF without nitrification or denitrification= 3.2 g N_2O/person equivalent/year; Method WW.12a= EF for stream/river discharge= 0.005 kg N_2O-N/kg sewage-N discharged		NA			
process emissions associated with generation of wastewater by community	activity	N/A			NA			
Use of septic systems in community	source and activity	N/A			NA			
Agriculture								
Domesticated animal production	source	N/A			NE			
Manure decomposition and treatment	source	N/A			NE			
Upstream Impacts of Community-wide Activities								
Upstream impacts of fuels used in stationary applications by community	activity	N/A			NE			
upstream and transmissions and distribution impacts of purchased electricity used by the community	activity	N/A			NE			
upstream impacts of fuels used for transportation in trips associated with the community	activity	N/A			NE			
upstream impacts of fuels used by water and wastewater facilities for water used and wastewater generated within the community boundary	activity	N/A			NE			
Upstream impacts of select materials (concrete, food, paper, carpets, etc.) used by the whole community (additional community-wide flows of goods & services will create significant double counting issues)	activity	N/A			NE			
Independent Consumption-Based Accounting								
Household consumption (e.g., gas & electricity, transportation, and the purchase of all other food, goods and services by all households in the community)	activity	N/A			NE			
Government consumption (e.g., gas & electricity, transportation, and the purchase of all other food, goods and services by all governments in the community)	activity	N/A			NE			
Lifecycle emissions of community businesses (e.g., gas & electricity, transportation, and the purchase of all other food, goods and services by all businesses in the community)	activity	N/A			NE			

Appendix B: Estimation Method for Vehicle Miles Traveled

The New York State Department of Transportation (NYSDOT) Traffic Data Viewer and information collected by the Syracuse Metropolitan Transportation Council (SMTC) provided data on the Annual Average Daily Traffic (AADT) going through the Town of Richland. Internal GIS data was utilized to generate road lengths within the town boundary, and these lengths were multiplied with the traffic counts to derive estimates for daily vehicle miles travelled (DVMT). DVMT was then multiplied by 365 days per year to derive annual vehicle miles traveled (AVMT). These estimates were entered into ClearPath to calculate emissions using the VMT & MPG calculator.[4]

The NYSDOT relies on actual and estimated traffic counts for their model, which may result in slight over or under estimations in the average daily traffic data. Additionally, the counts do not distinguish between origin and destination; therefore, these counts represent all vehicle trips that begin, end, and travel through the Town of Richland, therefore resulting in slight overestimations of town VMT. Also, the NYSDOT tracks traffic counts for main arteries only; therefore, additional calculations for AADT were needed to estimate AVMT for local/collector roads, as well as some main arteries that do not have AADTs available. The total length of roads in Richland with traffic counts is 42,757 miles in 2011, while 97.87 miles of roads do not have AADT counts available.

According to the *Minimum Maintenance Standards Regulation 239/02*, a set of 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 is done by multiplying the number of houses on the roadway by a factor of 6 for rural areas and 10 for urban areas.

This method was applied to the Town of Richland for the roads without AADT counts. It was determined that there are 1,216 occupied households in the Town of Richland, according to the 2010 US Census. It was assumed that all 1,216 homes are on roadways that do not have a count, since most houses are on local/collector roads and almost all local/collector roads in Richland did not have an AADT count. By multiplying 1,216 homes by 6, a combined AADT count of 7,296 was calculated for all 97.87 miles of roads without AADT counts available. In order to calculate VMTs, an average AADT value was needed, and derived by dividing by 7,296 by the 97.87 miles of uncounted roadway. This gave an average AADT value of 75, which was applied to all roadways that did not have a count.

There is some error involved in using this method. For instance, the method is meant to be applied to dead end streets and cul-de-sacs, but this study applied it to all roads in Richland without AADT counts available. In addition, there may have been some double counting if homes in Richland are located on roads that have AADT counts available. However, counting the number of houses on each road that did not have an AADT count would have been time consuming, and this VMT calculation is supposed to serve as a general reference for the town,

[4] Default MPGs and emissions factors from ICLEI's LGOP were used. To account for the 10% ethanol in most modern gasoline blends, VMT was entered for gasoline as 90% of the total VMT and for ethanol as 10% of the total VMT, and the same MPG was used for ethanol calculations as gasoline calculations.

not as an exact figure. Although this method involves some error, it is the best estimation of traffic volume given the availability of data.

BEGINDESC	ENDDESC	TDV_ROUTE	AADT	LENGTH (MILES)	LENGTH IN TOWN OF RICHLAND (MILES)	RATIO OF LENGTH IN TOWN OF RICHLAND	DVMT
RT 104B	RT 13 PORT ONTARIO	NY3	3937	4.253	3.497	0.822	13,766.456
RT 13 PORT ONTARIO	CR 15 CENTER CHURCH	NY3	2562	4.954	2.976	0.601	7,625.492
RT 11	RT 3 END RT 13	NY13	2178	3.170	2.172	0.685	4,730.782
CR 48 PINEVILLE	ACC RT 81I	NY13	2371	4.349	4.022	0.925	9,536.524
LEHIGH RD	I-81 NB (ON)	CR28 to I81 NB	253	0.376	0.376	1.000	95.244
CR 28 (OFF)	I-81 SB (ON)	CR28 to I81 SB	443	0.405	2.649	6.539	1,173.650
CR 41A	CR 41 AND WOOD RD	US11	1512	3.982	3.982	1.000	6,021.419
I-81 SB (OFF)	CR 28 (OFF)	I81 SB to CR28	261	0.283	0.283	1.000	73.989
RT 104 MAPLE VIEW	CR 41A	US11	1393	2.595	1.438	0.554	2,003.771
NY 13 (OFF)	I-81 SB (ON)	NY13 to I81 SB	1561	0.407	0.144	0.353	224.400
JCT CR 2 RICHLAND RD	JCT LAKE ST CR 15 LACONA	I81	15671	5.609	4.820	0.859	75,527.496
CR 5 PULASKI	CR 15 SANDY CREEK	US11	2189	5.758	4.840	0.840	10,594.353
JCT RT 104	JCT CR TINKER TAVERN RD	I81	18890	3.430	2.672	0.779	50,474.776
JCT CR TINKER TAVERN RD	JCT RT 13	I81	16832	3.380	3.145	0.931	52,941.836
I-81 NB (OFF)	NY 13(ON)	I81 NB to NY13	1499	0.226	0.000	0.000	0.000
CR 41 AND WOOD RD	RT 13	US11, SALINA ST	3101	0.768	0.085	0.110	262.546
NYS 13	E VIL LINE	CR 2A, CR 2A	4021	1.579	1.311	0.830	5,270.908
PULASKI VL	RICHLAND TL	RICHLAND RD, CR 2	1730	4.430	4.344	0.981	7,514.840
						Total DVMT:	247,838.48
						Days per year:	365
						Total Annual VMT (AVMT):	90,461,045.96

Table 3: 2011 Town of Richland Traffic Data for Road Segments with Available AADT

# occupied housing units:	1,216
Total AADT for roads not accounted for above:	7,296
Days per year:	365
Average AADT for roads not accounted for above:	75
Total Annual VMT for manually calculated roads:	**2,663,040**

Table 4: 2011 Town of Richland Traffic Data for Road Segments without Available AADT

AVMT for road segments with available AADT and for road segments without available AADT were then added to generate total AVMT for the Town of Richland, 93,124,085.958 miles in 2011.

Appendix C: Estimation Method for Community Waste Sector

Waste generated in the Town of Richland is sent to the Bristol Hill Landfill and the Oswego County Energy Recovery Facility for disposal. Waste information for the Town of Richland was compiled using data received by Frank Visser, Oswego County Department of Solid Waste. Because waste data is not broken down by municipality, additional calculations were needed to determine approximate tons of waste generated by the Town of Richland.

First, total tons of waste processed each facility was determined by information provided by Frank Visser. Tons of waste disposed per person per year was then calculated by dividing Oswego County's total population by the total tons of waste processed at each facility. Finally, tons of waste disposed by the Town of Richland at each facility was determined by multiplying the town's population by the tons of waste disposed per person, calculated in the previous step. See table 5 for more information.

Bristol Hill Landfill

Inventory Year	County Population	Town of Richland population	Total tons waste processed at landfill	Tons of waste disposed per person	Tons of waste disposed from Town of Richland
2011	122,109	3,353	30,062	0.25	825.47

Table 5: Town of Richland Community Waste Calculation from Bristol Hill Landfill

Energy Recovery Facility

Inventory Year	County Population	Town of Richland population	Total tons waste processed at Energy Recovery Facility	Tons of waste disposed per person	Tons of waste disposed from Town of Richland
2011	122,109	3,353	61,721	0.51	1,694.80

Table 6: Town of Richland Community Waste Calculation from Energy Recovery Facility

This information was then put into ICLEI's ClearPath software using the "Waste Generation" calculator for the Bristol Hill Landfill data (noting that the landfill does not have methane collection on the active portion) and the "Combustion of Solid Waste Generated by the Community" calculator for the Energy Recovery Facility data and using the US Community Protocol's estimates for waste share by type.[5]

[5] Default waste characterization found on page 32 of Appendix E, Solid Waste Emission Activities and Sources, of the US Community Protocol.