

**TOMPKINS COUNTY COMMUNITY GREENHOUSE GAS EMISSIONS  
REPORT, 1998-2008**

**Tompkins County Planning Department**

**June 2010**

**TOMPKINS COUNTY COMMUNITY GREENHOUSE GAS  
EMISSIONS REPORT, 1998-2008**

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## EXECUTIVE SUMMARY

In 2001, Tompkins County joined the Cities for Climate Protection (CCP) campaign, a project of the International Council on Local Environmental Initiatives (ICLEI). This action recognized the need to address the global warming problem swiftly and effectively at the local level. These efforts to reduce greenhouse gas emissions are also anticipated to save taxpayer dollars, improve local air quality, and increase the quality of life in the community.

The first Greenhouse Gas Emissions Inventory for both the Tompkins County government operations and the community as a whole was completed in 2001, tracking data from 1998 as the baseline year. In 2002, after the completion of the first inventory, the County Legislature established a 10-year emissions reduction goal of 20 percent below 1998 emissions levels by 2008. In 2003, the County adopted a Local Climate Action Plan for County government that identified six initiatives for curbing government emissions. The County then developed governmental policies to address these initiatives and has begun implementation. Two subsequent inventories were completed for the County government for 2006 and 2008, first to monitor progress and then to evaluate the success of the ten-year goal. In 2010, the County completed a 10-year report for government operations emissions and progress toward its initial 20 percent reduction goal. This is the corresponding 10-year report for community emissions.

Emissions Inventories for the Tompkins County community yield the following totals:

Year	Short Tons eCO2*
1998	1,223,446
2006	1,274,730
2008	1,292,920

Included in the 2008 figure, however, are the 154,153 tons eCO2 of emissions associated with local power generation at the Cornell Combined Heat and Power Plant and the Groton Electric Company, which were included in the 2008 inventory and not included in the 1998 and 2006 inventories. Excluding this addition so as to compare sectors for which we had data in 1998 and 2008, Tompkins County community emissions in 2008 drop to 1,138,767 tons eCO2, showing a **6.9 percent decrease in emissions between 1998 and 2008.**

Now, the County is launching a broad community effort to reduce emissions by 20 percent by 2020 as part of a long-term reduction goal of 80 percent reductions by 2050 for the Tompkins County community. These new goals are based on 2008 countywide emissions figures.

This report supplies the 2008 baseline emissions figures that the community will utilize to measure future emissions reduction progress. It also documents the history of Tompkins County community emissions from 1998-2008, providing a sense of how the community utilizes energy as well as changes in local energy consumption and associated emissions that have occurred without a strategy in place for reducing emissions.

In 2008, the Tompkins County community used 13,375,524 MMBtus of energy, and emitted 1,292,920 tons eCO2. Emissions from buildings (residential, commercial and industrial sectors combined) accounted for the largest proportion of community emissions at 595,045 tons eCO2 or 46.0 percent of all community emissions. Transportation emissions levels in 2008 were 449,158 tons eCO2, accounting for more than a third of all community emissions. Gasoline used for transportation was the primary energy source consumed in the County in 2008 and emitted 371,848 tons eCO2, or 28.8 percent of all community emissions, by energy source. Electricity was the second most used energy source locally, at 21.8 percent, followed by natural gas at 19.3 percent.

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\* All emissions in this report are in U.S. short tons to provide continuity from previous emissions inventories.

A number of trends in Tompkins County community energy consumption and emissions were noted between 1998-2008. Residential, commercial and industrial buildings combined consistently emit the highest proportion of emissions in the community, peaking at 53.8 percent in 1998 and dropping to 46.0 percent in 2008. Of the seven identified sectors, the transportation sector is the highest emitter. Transportation regularly contributes roughly a third of all community emissions, uses more than 5,000,000 MMBtus of energy and produces more than 400,000 tons eCO<sub>2</sub> annually. These transportation sector figures are more than 1.5 times the residential sector energy consumption and emissions, which is the second highest community energy consumer and emitter. The only notable change in energy use for the transportation sector is a drop in vehicle miles traveled that occurred between 2006-2008, which is attributed to a significant spike in transportation fuel costs. Pricing is the key predictor for changes in this sector as vehicle miles traveled decrease when prices increase, which directly impacts fuel usage and emissions from transportation.

For all buildings, electricity is the dominant energy source, though its use has declined in the commercial and industrial sectors. Due to improved methods for production and transmission in electricity, emissions from this energy source have dropped. Natural gas has experienced a spike in use and resulting emissions for building heating in all three of these sectors between 1998-2008.

Comparing 1998 to 2008 data, emissions from three of the seven identified sectors have declined: residential emissions were down 16.5%, commercial emissions were down 4.6 percent, and industrial emissions stayed relatively flat with a decline of 0.2 percent. Emissions from the transportation sector increased 7.9 percent. Emissions from two of the sectors changed dramatically between 1998 and 2008, with emissions from waste declining 59.9 percent and emissions from agriculture increasing 44.3 percent. Better data availability and substantial methodological updates in these sectors account for the bulk of the reported shifts in emissions. The seventh sector, local power, was tracked for the first time in the 2008 inventory.

## **INTRODUCTION**

A greenhouse gas emissions inventory provides an accounting of the amount of greenhouse gases emitted to the atmosphere during a specific period of time (e.g., one year). A greenhouse gas inventory also provides information about the activities that cause emissions (combustion of fossil fuel for heat, electricity, or for transportation as well as waste decomposition and natural and animal emissions) and emission reductions as well as methods used to calculate these figures. This information is then used to track emissions trends, develop strategies and policies, and assess progress.

The Intergovernmental Panel on Climate Change for the United Nations states that six greenhouse gases should be included in an inventory: Carbon Dioxide (CO<sub>2</sub>), Nitrous Oxide (N<sub>2</sub>O), Methane (CH<sub>4</sub>), Hydrofluorocarbons (HFCs), Perfluorocarbons (PFCs), and sulfur hexafluoride (SF<sub>6</sub>). For ease of analysis, all the emissions are converted into an equivalent amount of CO<sub>2</sub> called as eCO<sub>2</sub>. Conducting an inventory is the first step in taking actions to reduce GHG emissions in a community.

Knowing the source of emissions helps in effectively planning and implementing emissions reduction actions. An emissions inventory creates a quantitative foundation for a community to take concrete actions to address climate change and sustainability. Tompkins County is using the Clean Air and Climate Protection (CACP) software developed by ICLEI to conduct the inventories. Emissions inventories report data by sector of the community and by the particular type of energy used/greenhouse gas emitted. For 2008, data was collected from the following community sectors of Tompkins County to determine total community emissions:

- 1) **Residential:** Electricity, heating oil, natural gas, and propane utilized by all households within Tompkins County.
- 2) **Commercial:** Electricity, heating oil, and natural gas used by commercial properties within the County, including publicly-owned buildings and educational facilities.

- 3) **Industrial:** Electricity, heating oil, natural gas, and propane used by all industrial establishments within the County.
- 4) **Transportation:** Gasoline and diesel fuel use by personal and commercial vehicles as well as passenger buses operating within the County borders.
- 5) **Waste:** Amount and type of waste, which produces methane while decomposing, that was sent to landfill from the County.
- 6) **Agriculture:** Methane emissions from livestock within the County borders.
- 7) **Local Power Generation:** Carbon dioxide, nitrous oxide, and methane released from large, local power generators in the County (Cornell Combined Heat and Power Plant and Groton Electricity).

Data was also reported by emissions source for the following energy/greenhouse gas types:

• Electricity	• Heating Oil	• Natural Gas
• Propane	• Gasoline	• Diesel
• Methane	• Carbon dioxide	• Nitrous oxide

Tompkins County followed ICLEI’s approach to addressing climate change that measures achievement through five milestones. As was originally proscribed, Tompkins County initially focused on establishing goals for County government operations, while also tracking community emissions concurrently. The milestones in this process are: 1) Conduct a greenhouse gas emissions inventory; 2) Establish an emissions reduction target; 3) Develop a local climate action plan; 4) Implement policies and measures; and 5) Monitor progress and report on results.

The Tompkins County community has achieved the first four milestones and is now working on milestone 5. The milestones are as follows:

- 1) The community inventory completed in 2008 will serve as the baseline inventory;
- 2) A community emissions reduction target of 80 percent reduction from 2008 emissions levels by 2050 was established by the County Legislature when adopting the Energy and Greenhouse Gas Emissions (EGGE) Element of the County Comprehensive Plan in December 2008;
- 3) Tompkins County’s EGGE Element of the County Comprehensive Plan is effectively its Local Climate Action Plan for reducing community emissions;
- 4) To implement initial policies and measures to reach the first 20 percent of the 80 percent reduction goal, Tompkins County will, in July 2010, complete the 2020 Energy Strategy that identifies new measures as well as existing initiatives to implement and achieve projected reductions by 2020;
- 5) Monitoring progress through community inventories and reporting on emissions is scheduled as follows: in 2013, using 2012 data; in 2017, using 2016 data; and in 2021, using 2020 data.

The County is now launching a broad community effort to reduce emissions by 20 percent by 2020 as part of a long-term reduction goal of 80 percent reductions by 2050 for the Tompkins County community. These new goals are based on 2008 countywide emissions figures, provided in this report.

## **2008 COMMUNITY GREENHOUSE GAS EMISSIONS INVENTORY**

In Summer 2009, the Tompkins County Planning Department completed a greenhouse gas emissions inventory of the Tompkins County community, using 2008 data. This inventory showed that the County community emitted **1,292,920 tons eCO<sub>2</sub>** in 2008, which is broken down by sector and source below.

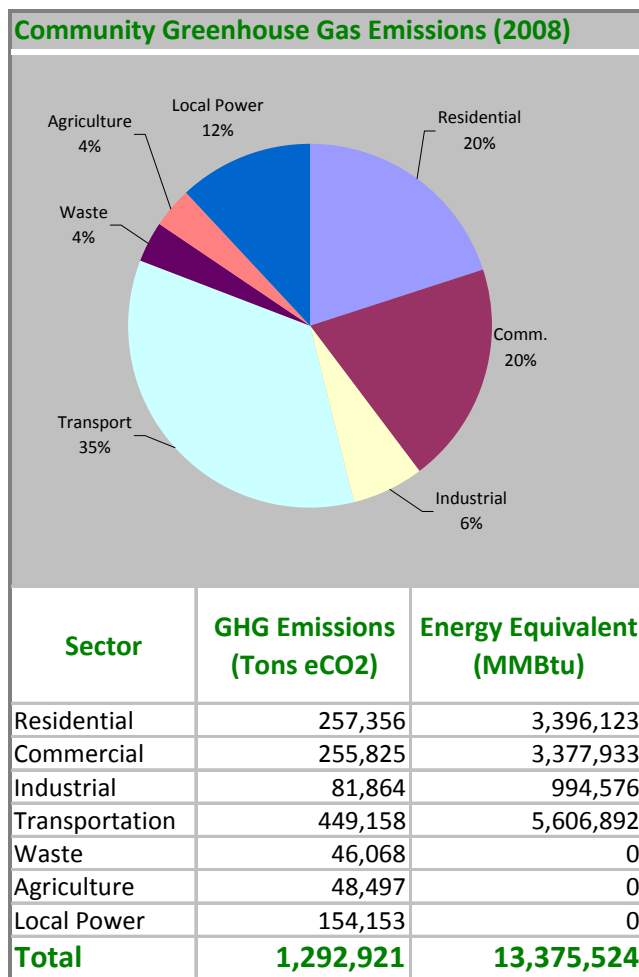
Of the seven identified sectors, transportation was the largest single sector emitter in the County in 2008, with more than a third of all community emissions. Emissions from buildings (residential, commercial and industrial sectors combined) resulted in 595,045 tons eCO<sub>2</sub>, accounting for 46.0 percent of all community emissions.

Gasoline used for transportation was the primary energy source consumed in the County in 2008 and emitted 371,848 tons eCO<sub>2</sub>, or 28.8 percent of all community emissions, by energy source.

**2008 Emissions, by Sector**

Residential sector – The average Tompkins County housing unit emitted 6.50 tons eCO<sub>2</sub> in 2008. Electricity represented the greatest share of emissions for the residential sector in 2008, at 41.3 percent. Natural gas was close behind at 38.7 percent, and fuel oil and propane contributed 7.8 and 12.1 percent, respectively.

Commercial sector – The commercial sector had the third highest rate of emissions of all sectors in the community in 2008, fractionally behind the residential sector. Natural gas use represented 63 percent of total commercial energy consumed. Emissions from natural gas and electricity for this sector were almost equal at 48.9 and 49.3 percent, respectively. Fuel oil accounted for 1.9 percent of total commercial sector emissions. It is important to note that commercial emissions include all educational facilities in the County, including Ithaca College and Cornell University.



Industrial sector – In 2008, there were 394 industrial properties in the County, therefore, industrial entities emitted an average 208 tons eCO<sub>2</sub>. Electricity accounted for 61.2 percent of industrial emissions in 2008, followed by natural gas at 30.3 percent, propane at 8.2 percent, and fuel oil at 0.4 percent.

Transportation sector– In 2008, the transportation sector released more than one third of the total Tompkins County community emissions. Gasoline use, almost exclusively from personal vehicles, resulted in 83 percent of all transportation emissions, while diesel emissions accounted for 17 percent of this sector’s total.

Waste sector – In 2008, 172,112 tons of waste\* was generated in Tompkins County, producing 46,068 tons eCO<sub>2</sub>. However, in 2008 only 70,730 tons of this waste was actually sent to landfill, as 59 percent of waste was diverted to recycling or reuse.

Agriculture sector – In 2008, the agricultural sector emitted 4.6 million pounds of methane which resulted in almost 50,000 tons eCO<sub>2</sub>. Emissions from 2008 were determined using data from the 2007 Agricultural Census.

Local Power – In 2008, data was collected for the first time for local power generation: for the Cornell Combined Heat and Power Plant (CHP) and Groton Electric Company. Cornell’s CHP, which provides heat

to the Ithaca campus, released 154,139 tons eCO<sub>2</sub>. Meanwhile, Groton electric, which services the Village of Groton, emitted 14 tons eCO<sub>2</sub>. While the waste, agriculture and local power sectors generate greenhouse gas emissions, they do not use thermal energy (MMBtus) in the method tracked by the CACP software.

In addition, data was collected for two local emissions sources that will be tracked into the future but are not being attributed to the County community emissions at this time. The first is the AES Cayuga Power plant

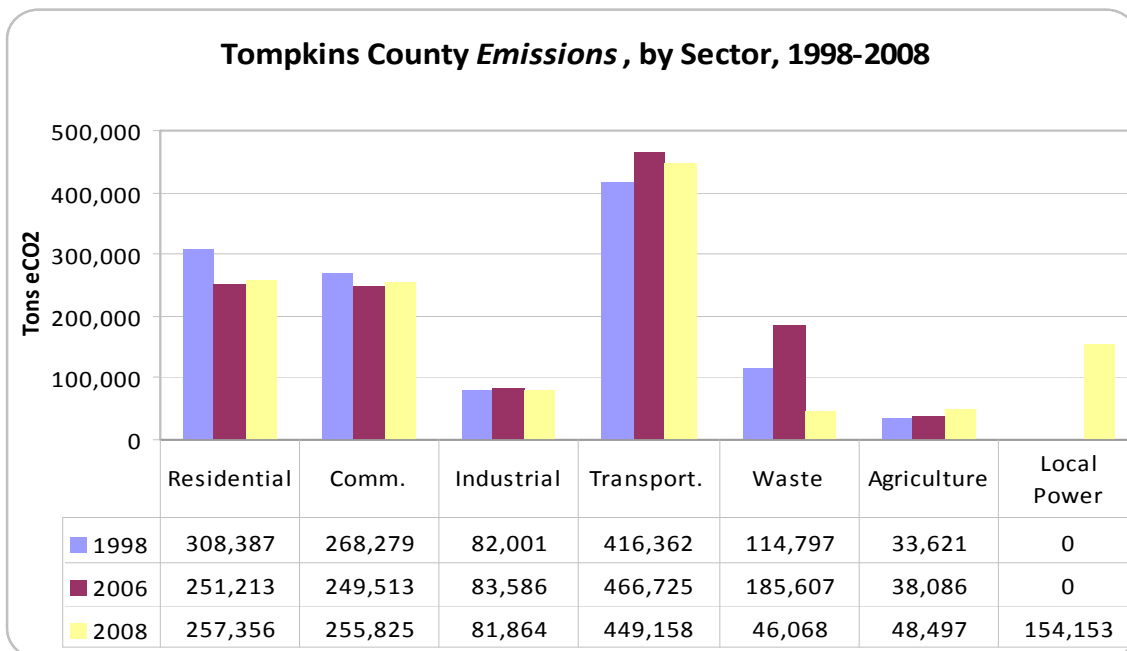
\* Solid waste is reported in U.S. short tons.

located on the east side of Cayuga Lake near the Tompkins County line. This power plant generates electricity for the region using coal for power. In 2008, its operation produced 2.2 million tons eCO<sub>2</sub>, eclipsing all other community emissions. This power source is not being counted in the community emissions, as it is distributed widely through the electricity grid far beyond Tompkins County's boundaries. Emissions are counted at the point of use rather than source point.

Finally, total emissions were calculated for all commercial flights in and out of the Ithaca-Tompkins County airport for 2008. Utilizing jet fuel data for commercial flights, round trip air flight within the County's boundary was found to have released 916 tons eCO<sub>2</sub>. This methodology is very new and the data is certainly incomplete, as it does not include private air flight within the County. For these reasons, the air flight emissions are tracked but not counted into the 2008 community emissions. Emissions associated with commercial flight will receive more scrutiny in the County's Green Airport master planning process, which is currently underway.

**1998-2008 COMMUNITY GREENHOUSE GAS EMISSIONS FINDINGS**

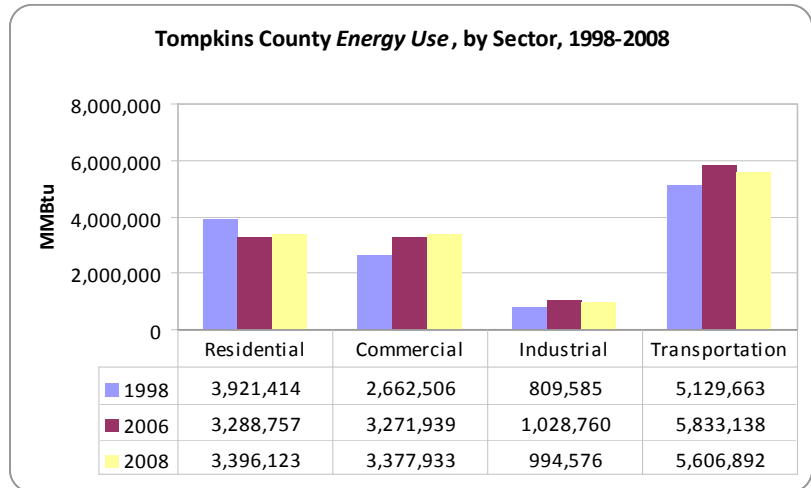
Three community greenhouse gas emissions inventories have been completed for the Tompkins County community to date. The first inventory was completed in 2001, using 1998 data. Subsequent inventories have been completed using 2006 and 2008 community energy data. Evaluated together, these inventories present trends of community energy consumption and related emissions over a 10-year period, which are presented through analysis of each community sector.



**Community Energy Consumption and Emissions Trends**

A number of trends in Tompkins County community energy consumption and emissions were noted between 1998-2008. Energy consumption has grown across all sectors, except for residential which saw a 13.4 percent decline during this 10-year period. Emissions, however, generally declined across sectors, with residential emissions declining 16.5 percent by 2008, commercial emissions declining 4.6 percent, and industrial declining 0.2 percent. The notable exception is a 7.9 percent rise in emissions from the transportation sector. Overall, when comparing sectors for which we had data in 1998 and 2008, the community saw a 6.9 percent decrease in emissions from 1998 to 2008.

Emissions from residential, commercial and industrial buildings combined consistently emit the highest proportion of emissions in the community, peaking at 53.8 percent in 1998 and dropping to 46.0 percent in 2008. For all buildings, electricity is the dominant energy source, though its use has declined in the commercial and industrial sectors. Due to improved methods for production and transmission of electricity, emissions from this energy source have dropped. The overall reduction in emissions appears to be related to this factor, as well as a shift in fuel types and their associated emissions. Natural gas has experienced a substantial jump in both use and resulting emissions across these three sectors between 1998-2008. While emissions from buildings declined 9.7 percent from 1998 to 2008, energy use actually increased 5.1 percent. The increase in energy use was primarily seen in the commercial sector, where natural gas use increased 132.4 percent, fuel oil went up 23.4 percent, and electricity use declined 30.1 percent. Some of this increase in energy use can be attributed to new building construction at the institutions of higher education, which are included in the commercial sector, as well as the significant expansion of retail that occurred during the decade.



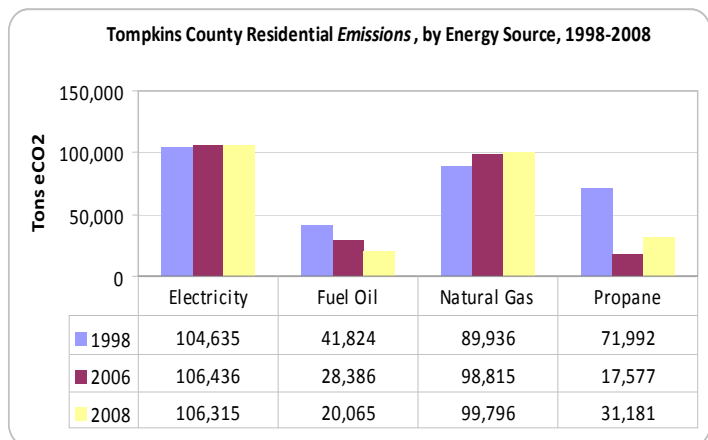
Of the seven identified sectors, the transportation sector is perpetually the highest emitter. Transportation regularly contributes roughly a third of all community emissions, uses more than 5,000,000 MMBtus of energy and produces more than 400,000 tons eCO<sub>2</sub> annually. These transportation sector figures are more than 1.5 times residential sector energy consumption and emissions, which is the second highest community energy consumer and emitter. The only notable change in energy use for the transportation sector is a drop in vehicle miles traveled that occurred between 2006-2008, which is attributed to a significant spike in transportation fuel costs. Pricing is the key predictor for changes in this sector as vehicle miles traveled decrease when prices increase, which directly impacts fuel usage and emissions from transportation.

Emissions from two of the sectors changed dramatically between 1998 and 2008, with emissions from waste declining 59.9 percent and emissions from agriculture increasing 44.3 percent. Better data availability and substantial methodological updates in these sectors account for the bulk of the reported shifts in emissions. The seventh sector, local power, was tracked for the first time in the 2008 inventory.

**Residential Sector**

In 2008, the residential sector accounted for 19.9 percent of total community emissions, releasing 257,356 tons eCO<sub>2</sub> from 3,396,123 MMBtus of energy used. As there were 37,443 households in Tompkins County in 2008, each household released an average of 6.9 tons eCO<sub>2</sub> as compared to about 6.5 tons eCO<sub>2</sub> per household in 1998. (Change to housing units?)

Total emissions for the residential sector decreased by 16.5 percent from 1998-2008. Electricity was the dominant energy source utilized by the residential sector from 1998-





2008 followed by natural gas. Use of fuel oil and propane have fallen since 1998, and associated emissions have tracked this reduction in use with fuel oil emissions falling 52 percent and propane 56 percent in the last ten years.

From 1998-2008, residential sector energy use and emissions decreased. Overall, energy use declined by 13.4 percent from 1998-2008, and emissions declined by 16.5 percent. This is somewhat due to improvements in the production and transmission of electricity, and also reflects a shift to natural gas away from fuel oil and propane for home heating.

### Commercial Sector

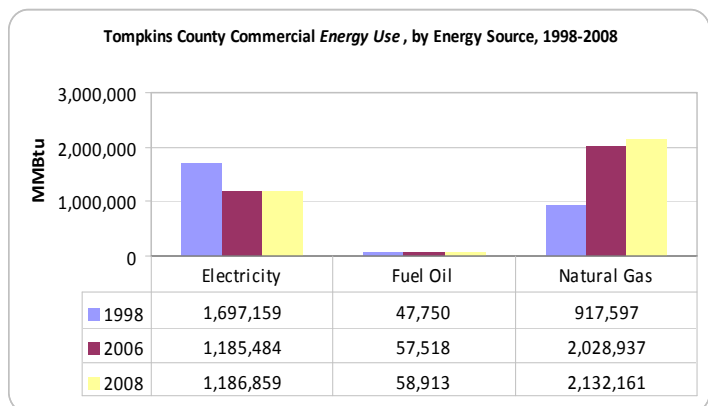
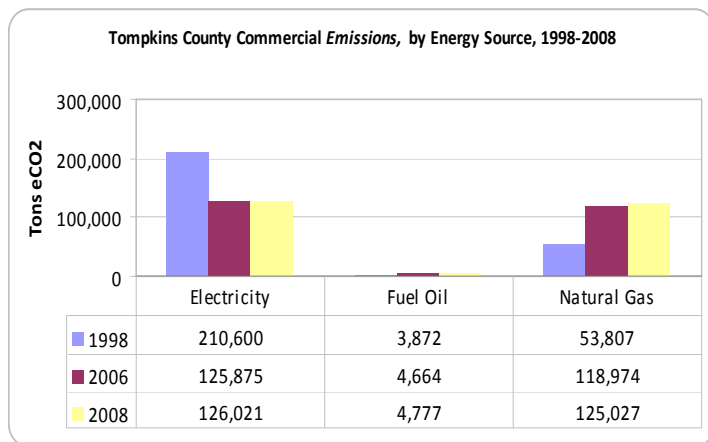
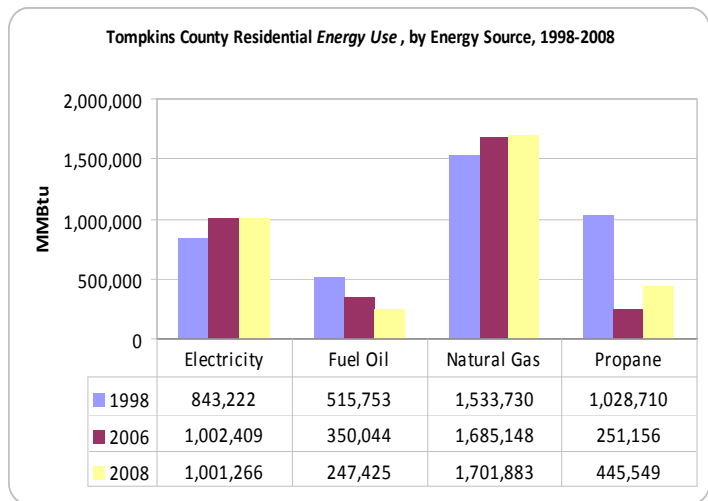
The commercial sector had the third highest rate of emissions among community sectors in 2008, producing 255,825 tons eCO<sub>2</sub> from 3,377,933 MMBtus of energy. It should be noted that commercial property estimates include the community's significant educational uses, including Cornell University and Ithaca College. Therefore, it is difficult to accurately assess an average commercial business emissions rate.

The commercial sector has historically relied heavily on electricity as its main fuel source. However, electricity use has declined and with it electricity-generated emissions dropped a substantial 40.2 percent from 1998-2008 (due to drop in use as well as cleaner electricity production in recent years).

Meanwhile, natural gas use among commercial operations has increased sharply, and by 2008 represented 63 percent of total commercial energy consumed. Natural gas emissions for the commercial sector still trail electricity emissions. Electricity use constitutes 35 percent of all energy used for commercial business in 2008 and the remaining 3 percent of energy use is fuel oil.

Propane is not commonly used as an energy source for commercial establishments, and no regional data on its use is collected, therefore, it was not considered for this sector.

Emissions figures for the commercial sector in Tompkins County are likely to be higher than expected because they include energy used by educational facilities. As Tompkins County is home to several large educational institutions, energy use in this sector might be proportionally higher than other comparably-sized municipalities. Efforts to increase energy efficiency of educational and governmental facilities and



decrease consumption by students and government employees would be reflected in emissions totals.

### Industrial Sector

Industrial emissions have remained fairly static between 1998 and 2008, decreasing slightly by 0.2 percent. The industrial sector of Tompkins County emitted 6.3 percent of total community emissions in 2008, by consuming 994,576 MMBtus of energy. In 2008, there were 394 industrial properties in the County, therefore, industrial entities emitted an average 208 tons eCO<sub>2</sub>.

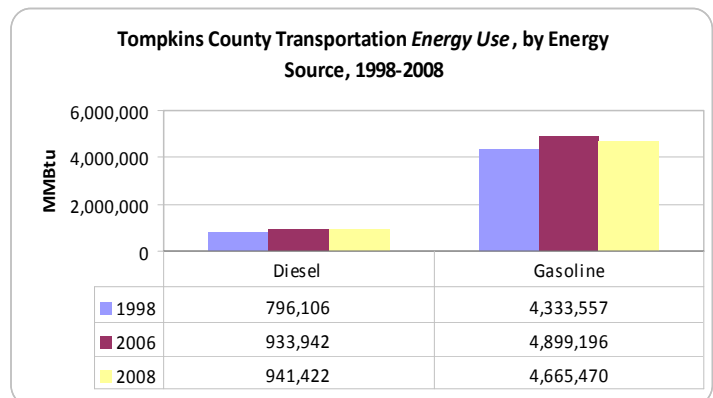
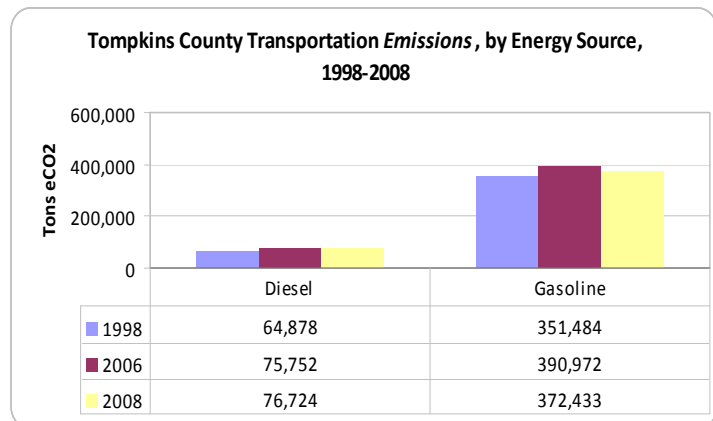
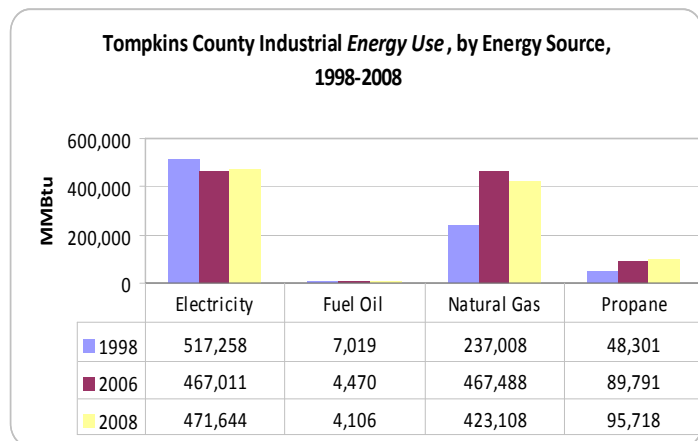
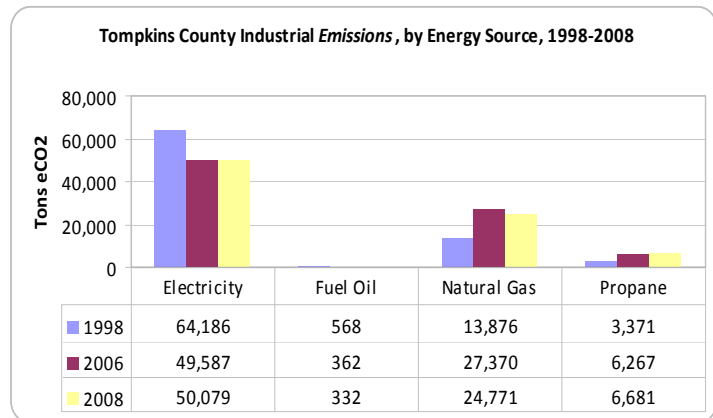
Similar to the commercial sector, electricity use has been declining since 1998 in favor of natural gas. Natural gas use has increased by 79 percent since 1998. The use of electricity has declined by 9 percent. This reversal from electricity to natural gas was likely a financial decision, as electricity was the costliest source of fuel between 1998-2008. Fuel oil, which was a lesser-used fuel for industrial use, has experienced declining use while propane use has more than doubled.

Though electricity usage declined by 9 percent from 1998-2008, emissions from electricity dropped by 22 percent, again representing cleaner electricity production. The emissions from natural gas and propane have shown a general increasing trend. Fuel oil emissions, which contribute only about 1 percent to industrial emissions, have decreased since 1998.

### Transportation Sector

Emissions for the transportation sector grew by 7.9 percent from 1998-2008. Gasoline emissions increased by 5.9 percent from 1998 baseline levels, while diesel emissions have risen by 18.2 percent. This sector has seen a steady increase in emissions, due to increasing vehicle miles traveled in the region, though between 2006-2008 there was a slight decline in emissions as passenger trips were curtailed due to a spike in fuel costs in 2008.

The transportation sector's emissions reporting figures have been altered after both the 2006 and 2008 inventories, to reflect improvements in modeling and methodology

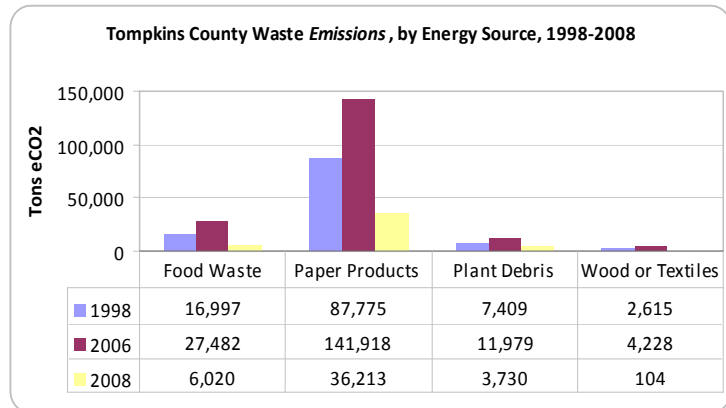


that have occurred since 1998. Transportation emissions for 1998 were updated in 2008, to present improved modeling that more accurately depicts vehicle miles traveled using Census 2000 household data. This updated 1998 figure is much more in line with a steady increase in personal vehicle miles traveled – the key determinant of emissions for the transportation sector.

### Waste Sector

Tompkins County has two small landfills that had been closed for a number of years prior to the first emissions inventory. All local waste is held locally in a transfer station, then moved to Seneca Meadows Landfill – a managed landfill facility in Waterloo, NY.

In 2008, the County community produced 172,112 tons of waste, representing a 59 percent increase from 1998 from 108,026 tons of waste. Emissions from waste, on the other hand, have actually reversed. This is due to a successful, local comprehensive waste reduction and diversion program instituted by the Tompkins County Solid Waste Division in 2000. By 2008, only 70,730 tons of all community waste was sent to landfill as the remaining 59 percent of waste was diverted to recycling, reuse or compost. In comparison, in 1998, 49 percent of the total 108,026 tons of community waste generated in the County was diverted.



Updates to waste methodology, as well as local management practices, have created a huge swing in waste emissions reporting. First, the EPA modified its previous attribution for categories. In the past, negative values were assigned to some waste emissions from plant debris and wood, based on the premise that some solid waste packed tightly never decays, even after extremely long periods of time. The carbon in this waste was considered to be “sequestered,” and so a proportion of the carbon in waste sent to landfill was thus removed from circulation. However, the EPA has modified this methodology to attribute these types of waste with a neutral emissions factor. Meanwhile, the County has aggressively sought to divert waste where possible, reversing emissions growth even as waste tonnage increased. Paper recycling and construction and debris material recycling has accelerated greatly in Tompkins County in the past two years. Therefore, it is difficult to accurately assess waste emissions, as the methodology and solid waste programming in place have effectively obscured the reasoning behind the results. Moving forward, waste emissions inventories utilizing 2008 base figures are expected to provide better and clearer outcomes.

### Agricultural Sector

Livestock in Tompkins County – dairy and beef cattle, goats, sheep, horses, and swine – release methane as a byproduct of the production of biological waste. Livestock populations have grown since 1998, as agriculture continues to be an important component of the Tompkins County economy. With this increase, in cattle in particular, emissions from the agricultural sector increased between 1998-2008. By 2008, the agricultural sector emitted 4.6 million pounds of methane. It is important to state that this increase is likely primarily due to improved data from the 2007 Agricultural Census, which was available for the 2008 inventory. Previous inventories relied on a headcount estimate process that was not nearly as reliable.

### Local Power Generation

The 2008 inventory marks the first time that data for energy consumption (primarily coal) used in power generation at three different local facilities was gathered and emissions were calculated. Two of the three power generators produce power that is consumed locally as well, therefore, the emissions associated with these processes was included in the 2008 inventory. These two energy producers are the Cornell Combined Heat and

Power Plant which produces heat for the Cornell campus and Groton Electric, which generates electricity for the Village of Groton. The Cornell power plant made a substantial contribution to the eCO<sub>2</sub> emissions, as it used 65,420 tons of coal resulting in 154,439 tons eCO<sub>2</sub>. The village of Groton generated 39,464 kWh of electricity, releasing 14 tons eCO<sub>2</sub>.

The AES Cayuga power plant, on the other hand, produces electricity that feeds the Finger Lakes Region. Due to the scope of transmission as well as the fact that emissions are associated with the energy consumer, not producer, the AES Cayuga power plant is tracked in this inventory but not included in community emissions totals. AES Cayuga produced about 2.2 million tons eCO<sub>2</sub> in 2008 in operating its plant. This is almost double the total emissions of the Tompkins County community.

### **Air Travel**

Total emissions were calculated for all commercial flights in and out of Ithaca-Tompkins County airport for 2008. Utilizing jet fuel data for commercial flights, round trip air flight within the County's boundary resulted in 916 tons eCO<sub>2</sub>. This methodology is very new and the data is certainly incomplete, as it does not include private air flight within the County. For these reasons, the air flight emissions are tracked but not included in the 2008 community emissions. Emissions associated with commercial flight will receive more scrutiny in the County's Green Airport master planning process, which is currently underway.

## **STEPS TO ACHIEVE COMMUNITY-WIDE EMISSIONS REDUCTIONS**

Since Tompkins County established itself as a regional leader on the issue of climate change in 2001 when it joined Cities for Climate Protection and ICLEI, the County has made significant strides to develop a community approach to energy and greenhouse gas emissions. Three community inventories have been completed, a Local Action Plan for Local Government has been implemented, and the framework for community-wide emissions reduction is now in place.

### **Energy and Greenhouse Gas Emissions (EGGE) Element Policies and Action Items**

The EGGE element amendment was adopted by the Tompkins County Legislature on December 16, 2008. The Tompkins County Comprehensive Plan was adopted by the Legislature in December 2004. This new element explores the broad range of issues related to energy and greenhouse gas emissions and presents specific policies and actions to address them.

This report tracks the Tompkins County community emissions from 1998-2008, when there was no strategy in place for reducing emissions. With the adoption of the EGGE element, the County has established a community goal of 80 percent greenhouse gas emissions reduction by 2050; the County government is expected to be a leader in achieving this goal. To achieve this goal, the element lays out eight policies with 17 associated action items.

### **2020 Energy Strategy**

In 2010, the County is expected to release a 2020 Energy Strategy to implement specific initiatives that will help the community achieve the first 20 percent reduction in community greenhouse gas emissions by 2020. County government will also be included in this strategy, and will be expected to achieve a 20 percent reduction in emissions from 2008 levels.

Implementing the measures outlined in the EGGE element of the County Comprehensive Plan and the soon to be released 2020 Energy Strategy are seen by Tompkins County government as the best means of achieving emissions reductions in Tompkins County.

**Monitoring Progress**

Future greenhouse gas emissions inventories will be completed to gauge progress toward Tompkins County community emissions reductions, to ensure that the community is achieving its average annual 2 percent reduction of greenhouse gas emissions goal through the year 2050.

Emissions inventories are scheduled in 2013, using 2012 data; in 2017, using 2016 data; and in 2021, using 2020 data.

## APPENDICES

### Appendix A - Glossary

**Carbon Dioxide:** Also called CO<sub>2</sub>, carbon dioxide is essential to living systems and is released by animal respiration, decay of organic matter, and fossil fuel burning. It is removed from the atmosphere by photosynthesis in green plants.

**Cities for Climate Protection (CCP):** The Cities for Climate Protection (CCP) Campaign assists cities to adopt policies and implement quantifiable measures to reduce local greenhouse gas emissions, improve air quality, and enhance urban livability and sustainability. Tompkins County is a signatory to the Cities for Climate Protection (CCP) campaign.

**Cities for Climate Protection Greenhouse Gas Emissions Software (CACP):** Developed by Torrie Smith Associates for the Cities for Climate Protection members, the computer software is an accounting-based program developed to track and measure greenhouse gas emissions for communities and governments. The software translates data on energy use and solid waste information into greenhouse gas emissions and quantifies the greenhouse gas emissions reduction of potential programs and actions.

**eCO<sub>2</sub>:** Equivalent Carbon Dioxide units (eCO<sub>2</sub>) is the factor assigned to each greenhouse gas that reflects its global warming potential (GWP). The GWP is a measure of a compound's ability to trap heat over a given lifetime in the atmosphere, relative to the effects of the same mass of carbon dioxide released over the same time period. Emissions expressed in equivalent terms highlight the contribution of the various gases to overall emissions. Therefore, GWP is a useful statistical weighting tool for comparing the heat trapping potential of various gases. It is sometimes written as CO<sub>2</sub>e, as well.

**ICLEI - Local Governments for Sustainability** is an association of local, regional, national, and international government organizations that have made a commitment to sustainable development. ICLEI provides technical consulting, training, and information services to build capacity, share knowledge, and support local government in the implementation of sustainable development at the local level. Tompkins County has been a member of ICLEI since 2001 when it signed on to participate in the Cities for Climate Protection (CCP) campaign.

**Methane (CH<sub>4</sub>):** A greenhouse gas produced by anaerobic decomposition of solid waste in landfills and sewage treatment facilities, wetlands, outgassing from livestock, and as a byproduct of fossil fuel energy production and transport. It is also the principle constituent of natural gas and can leak from natural gas production and distribution systems and is emitted in the process of coal production. Methane is an extremely potent greenhouse gas, with a global warming potential of 72 times that of carbon dioxide over a period of 20 years.

### Appendix B – Table of Community Emissions 1998-2008

Please see table on next page

Community Greenhouse Gas Emissions Report, by Sector and Energy Source, 1998-2008

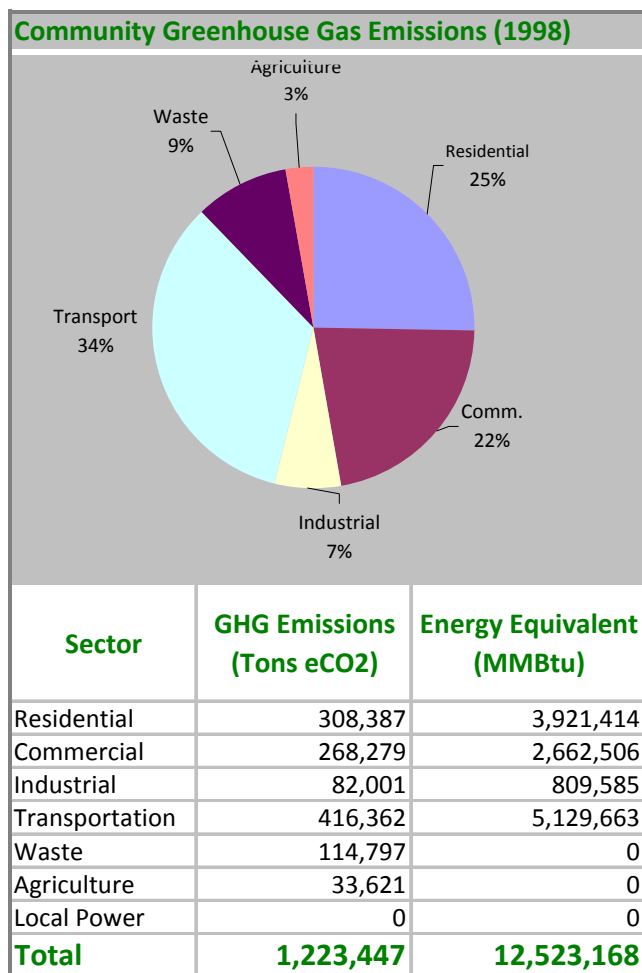
	1998					2006					2008								
	CO2 (tons)	N2O (lbs)	CH4 (lbs)	eCO2 (tons)	eCO2 (%)	Energy (MMBtu)	CO2 (tons)	N2O (lbs)	CH4 (lbs)	eCO2 (tons)	eCO2 (%)	Energy (MMBtu)	CO2 (tons)	N2O (lbs)	CH4 (lbs)	eCO2 (tons)	eCO2 (%)	Energy (MMBtu)	
<b>Residential</b>																			
Electricity	104,142	2,765	6,132	104,635	8.6	843,222	105,852	3,287	7,131	106,436	8.3	1,002,409	105,731	3,283	7,123	106,315	8.2	1,001,266	
Fuel Oil (#1, 2, 4)	41,587	682	12,507	41,824	3.4	515,753	28,225	463	8,489	28,386	2.2	350,044	19,951	327	6,000	20,065	1.6	247,425	
Natural Gas	89,706	338	16,906	89,936	7.4	1,533,730	98,562	372	18,576	98,815	7.8	1,685,148	99,541	375	18,760	99,796	7.7	1,701,883	
Propane	71,519	1,361	24,947	71,992	5.9	1,028,710	17,461	332	6,091	17,577	1.4	251,156	30,976	589	10,805	31,181	2.4	445,549	
<b>Subtotal</b>	<b>306,954</b>	<b>5,146</b>	<b>60,492</b>	<b>308,387</b>	<b>25.3</b>	<b>3,921,415</b>	<b>250,100</b>	<b>4,454</b>	<b>40,287</b>	<b>251,214</b>	<b>19.7</b>	<b>3,288,757</b>	<b>256,199</b>	<b>4,574</b>	<b>42,688</b>	<b>257,357</b>	<b>19.9</b>	<b>3,396,123</b>	
<b>Commercial Sector</b>																			
Electricity	209,608	5,564	12,342	210,600	17.2	1,697,159	125,184	3,887	8,434	125,875	9.9	1,185,484	125,329	3,891	8,443	126,021	9.7	1,186,859	
Fuel Oil (#1, 2, 4)	3,850	63	1,158	3,872	0.3	47,750	4,638	76	1,395	4,664	0.4	57,518	4,750	78	1,429	4,777	0.4	58,913	
Natural Gas	53,669	202	10,115	53,807	4.4	917,597	118,670	447	22,365	118,974	9.3	2,028,937	124,707	470	23,503	125,027	9.7	2,132,161	
<b>Subtotal</b>	<b>267,127</b>	<b>5,829</b>	<b>23,615</b>	<b>268,279</b>	<b>21.9</b>	<b>2,662,506</b>	<b>248,492</b>	<b>4,410</b>	<b>32,194</b>	<b>249,513</b>	<b>19.6</b>	<b>3,271,939</b>	<b>254,786</b>	<b>4,439</b>	<b>33,375</b>	<b>255,825</b>	<b>19.8</b>	<b>3,377,933</b>	
<b>Industrial Sector</b>																			
Electricity	63,884	1,696	3,762	64,186	5.2	517,258	49,315	1,531	3,322	49,587	3.9	467,011	49,804	1,546	3,355	50,079	3.9	471,644	
Fuel Oil (#1, 2, 4)	566	9	46	568	0.0	7,019	360	6	30	362	0.0	4,470	331	5	27	332	0.0	4,106	
Natural Gas	13,862	52	523	13,876	1.1	237,008	27,343	103	1,031	27,370	2.1	467,488	24,747	93	933	24,771	1.9	423,108	
Propane	3,358	64	319	3,371	0.3	48,301	6,243	119	594	6,267	0.5	89,791	6,655	127	633	6,681	0.5	95,718	
<b>Subtotal</b>	<b>81,670</b>	<b>1,821</b>	<b>4,650</b>	<b>82,001</b>	<b>6.6</b>	<b>809,586</b>	<b>83,261</b>	<b>1,759</b>	<b>4,977</b>	<b>83,586</b>	<b>6.5</b>	<b>1,028,760</b>	<b>81,537</b>	<b>1,771</b>	<b>4,948</b>	<b>81,863</b>	<b>6.3</b>	<b>994,576</b>	
<b>Transportation Sector</b>																			
Diesel	58,862	341	351	58,919	4.8	729,989	71,128	425	437	72,198	5.7	894,505	69,576	411	422	69,644	5.4	862,863	
Gasoline	338,139	78,584	63,726	350,989	28.7	4,327,803	382,233	49,619	42,109	390,367	30.6	4,892,160	363,991	47,537	40,682	371,848	28.8	4,658,672	
Motorcycle Gasoline	450	275	258	495	0.0	5,754	550	336	315	605	0.0	7,036	531	325	304	585	0.0	7,998	
Transit Bus Diesel	5,955	25	27	5,959	0.5	66,117	3,552	15	16	3,554	0.3	39,437	7,076	30	32	7,080	0.5	78,559	
<b>Subtotal</b>	<b>403,406</b>	<b>79,225</b>	<b>64,362</b>	<b>416,362</b>	<b>34.0</b>	<b>5,129,663</b>	<b>458,463</b>	<b>50,395</b>	<b>42,877</b>	<b>466,724</b>	<b>36.6</b>	<b>5,833,138</b>	<b>441,174</b>	<b>48,703</b>	<b>41,440</b>	<b>449,157</b>	<b>34.7</b>	<b>5,606,892</b>	
<b>Waste Sector</b>																			
Food Waste	0	0	1,618,784	16,997	1.4		0	0	2,617,303	27,482	2.2		0	0	573,358	6,020	0.5		
Paper Products	0	0	8,359,565	87,775	7.2		0	0	13,516,021	141,918	11.1		0	0	3,448,880	36,213	2.8		
Plant Debris	0	0	705,624	7,409	0.6		0	0	1,140,876	11,979	0.9		0	0	355,257	3,730	0.3		
Wood or Textiles	0	0	249,044	2,615	0.2		0	0	402,662	4,228	0.3		0	0	9,920	104	0.0		
<b>Subtotal</b>	<b>0</b>	<b>0</b>	<b>10,933,017</b>	<b>114,796</b>	<b>9.4</b>		<b>0</b>	<b>0</b>	<b>17,676,862</b>	<b>185,607</b>	<b>14.5</b>		<b>0</b>	<b>0</b>	<b>4,387,415</b>	<b>46,067</b>	<b>3.6</b>		
<b>Other Sector</b>																			
Carbon Dioxide (Power Generation)	0	0	3,202,000	33,621	2.7		0	0	3,627,259	38,086	3.0		153,514	0	0	153,514	11.9		
Methane (Agriculture)	0	0	0	0	0.0		0	0	0	0	0.0		0	0	4,624,147	48,553	3.8		
Nitrous Oxide	0	0	0	0	0.0		0	0	0	0	0.0		0	3,762	0	583	0.0		
<b>Subtotal</b>	<b>0</b>	<b>0</b>	<b>3,202,000</b>	<b>33,621</b>	<b>2.7</b>		<b>0</b>	<b>0</b>	<b>3,627,259</b>	<b>38,086</b>	<b>3.0</b>		<b>153,514</b>	<b>3,762</b>	<b>4,624,147</b>	<b>202,650</b>	<b>15.7</b>		
<b>TOTAL</b>	<b>1,059,157</b>	<b>92,021</b>	<b>14,288,136</b>	<b>1,223,446</b>	<b>99.9</b>	<b>12,523,170</b>	<b>1,040,316</b>	<b>61,018</b>	<b>21,424,456</b>	<b>1,274,730</b>	<b>99.9</b>	<b>13,422,594</b>	<b>1,187,210</b>	<b>63,249</b>	<b>9,134,013</b>	<b>1,292,919</b>	<b>100.0</b>	<b>13,375,524</b>	

## Appendix C - Evolving Inventory Process and Methods

### 1998 Inventory: Data and Methodology

#### *Residential*

To measure emissions from residential homes in Tompkins County in 1998, the consumption of electricity and fuel use by utility customers was calculated. In 2001, the inventory relied upon total electricity and natural gas utilization from May 2000 to June 2001 provided by the primary utility provider in the Tompkins County area, New York State Electric and Gas (NYSEG). This information was updated in 2010 with corrected 1998 data. The original 1998 inventory reported that Tompkins County residential (including residential and residential tax exempt properties) sector used 2,575,366 therms of natural gas in 2000. The correct figure for that sector in 1998 is 15,337,299. Obviously, this significantly changes many of the interpretations of the trends in the emissions inventory that were reported in previous reports.



Approximately 15 different private suppliers provide propane and heating oil to Tompkins County residences and establishments. Rather than collect consumption data from 15 separate companies, propane and heating oil use was estimated using data from the United States Department of Energy (DOE) and the Tompkins County Assessment Department. In 1997, the DOE conducted a study on heating oil use in the mid-Atlantic region (comprised of the states of New York, New Jersey, and Pennsylvania) to find that the average size of households using heating oil was 1,731 square feet and consumed an average 744 gallons of heating oil per year. Thus, the average consumption rate is 0.43 gallons per square foot. Although the Assessment Department maintains data on the utility and fuel type available to a residential property, it does not have information about what is actually used by that household. It was assumed that if natural gas were available to a consumer, they would heat with gas rather than with heating oil. Therefore, all residential properties listed as having gas or gas and electric at their disposal were eliminated. From those properties, all that listed anything but oil as their fuel type were eliminated. Of those that remained, there was a total of 8,649,152 square feet. The total square footage of residential property in Tompkins County using heating oil was then multiplied by the average heating oil use per square foot in the mid-Atlantic region to arrive at the total annual amount of heating oil consumed. Data sets and computations for figures used in calculating

energy and fuel use for the residential sector can be found in Appendix D.

Propane use was derived in a similar manner. The DOE study found that of households using propane in New York State in 1997, the average consumption was 184 gallons. Using the same type of assumptions explained above, information from the Assessment Department determined the number of properties in Tompkins County that use propane to be 17,767. The average annual consumption per household in NYS was multiplied by the total number of households in Tompkins County to arrive at total annual propane use by residential properties.

Projections for 2020 are based on predictions of overall energy use published by the Energy Information



Administration, a division of the DOE. Consumption estimates are given through 2020 for the mid-Atlantic region for each sector by energy type, assuming population growth rates and business-as-usual conditions. For the residential sector in the mid-Atlantic census region, electricity and natural gas is expected to rise by 1.3 percent and 0.6 percent respectively. Heating oil use is expected to decline by 0.8 percent and propane by 2.1 percent .

### ***Commercial***

The process for calculating energy use from the commercial sector is very similar to that of residential housing. NYSEG provided electricity and natural gas consumption for 2000-01. In order to arrive at commercial heating oil and propane use, Department of Energy statistics were again used, from a commercial consumption study conducted in 1995. Data sets and computations for figures used in calculating energy and fuel use for the commercial sector can be found in Appendix E.

NYSEG classifies their electricity customers into five categories: residential, commercial, industrial, public authority, and lighting. Public authority is defined as any publicly owned establishment. As instructed by ICLEI, electricity use for the public authority group is considered a commercial property. According to NYSEG, the lighting category is comprised primarily of streetlights and traffic signals, although a small proportion is the result of outdoor lighting at commercial and industrial properties (e.g., parking lot lighting). Streetlights and traffic signals are considered a part of the commercial sector and were assumed to be 75 percent of the total electricity consumption in the lighting category. Another 10 percent was assumed to be commercial outdoor lighting, while the remaining 5 percent is attributed to industrial outdoor lighting. Therefore, 95 percent of NYSEG's lighting sector is included in the commercial sector of the inventory. It is also important to note that all educational facilities are also classified as commercial property.

NYSEG natural gas consumption is divided into four separate categories: residential, commercial and industrial combined, public authority, and transportation. Since it is impossible to separate commercial natural gas use from industrial natural gas use, it was estimated that 75 percent of the natural gas consumption in the commercial and industrial category is a result of commercial property use. As with the electricity use data, public authority properties are considered commercial property.

Heating oil use was computed in the same manner as natural gas consumption. The Assessment Department supplied a listing of all commercial properties in Tompkins County using heating oil following the same assumptions outlined for the residential sector. The DOE study found that each commercial property in the mid-Atlantic region used an average of 3,608 gallons of heating oil annually. This figure was multiplied by 138, the total number of commercial establishments in Tompkins County using heating oil to arrive at the total amount of heating oil used.

Heating oil use was also estimated using data on consumption per square foot. The 1995 DOE study found that commercial properties in the mid-Atlantic census region used an average of 0.19 gallons of heating oil per square foot. The RPS database was used to gather aggregate square foot data for commercial properties in Tompkins County for a total of 1,003,993. This total was then multiplied by the mid-Atlantic average use per square foot. The mean of results from both methods was then computed.

Propane use in commercial enterprises in Tompkins County is uncommon and the establishments are generally quite small. The Energy Information Administration does not gather information on commercial propane use due to the low numbers of commercial properties listed as using propane heat in a 1998 Department of Labor Statistics study. Therefore, propane use for this sector was not considered.

Forecasting of consumption in the commercial sector was again based on the predictions of overall energy use published by the Energy Information Administration. For the commercial sector in the mid-Atlantic census region, electricity and natural gas is expected to rise by 1.4 percent and 0.9 percent respectively. Heating oil use is expected to decline by 0.2 percent.

### ***Industrial***

Electricity and natural gas information for the industrial sector was obtained from NYSEG. Electricity use was defined as data from the industrial customers category, plus the 5 percent from the lighting sector as described above. Natural gas use was estimated to be 25 percent of the utilization in the commercial and industrial customer category. Heating oil and propane consumption was derived using data from the Assessment Department and 1994 statistics from the Energy Information Administration of the DOE. All estimates were performed using the per establishment method and the per square foot method; the average of the two was used in the inventory. Data sets and computations for figures used in calculating energy and fuel use for the industrial sector can be found in Appendix F.

Heating oil use was computed in a similar manner. The Assessment Department supplied a listing of all industrial properties in Tompkins County using heating oil following the same assumptions outlined in the residential sector methodology. According to the DOE each industrial property in the United States used an average of 17,875 gallons of heating oil annually in 1994. This figure was multiplied by 5, the total number of industrial establishments in Tompkins County using heating oil to arrive at the total amount of heating oil used for this sector.

Heating oil use was also estimated using data on consumption per square foot. The 1994 DOE study found that industrial properties in the United States used an average of 0.36 gallons of heating oil per square foot. The Assessment RPS database was used to gather aggregate square foot data for industrial properties in Tompkins County for a total of 33,059. This total was then multiplied by the average use per square foot. The mean of results from both methods was then computed.

Propane is used at a total of 12 industrial establishments in Tompkins County, according to the RPS database. This figure was multiplied by 78,330, the average number of gallons of propane used per industrial facility in the United States, according to the DOE in 1994. The same study showed the average use per square foot to be 1.57 gallons. When multiplied by the total area of industrial space in Tompkins County, 77,137, an estimate of propane use using the square foot method is arrived at. As done before, the average of the two methods was taken and imputed in the inventory.

Forecasting of consumption in the industrial sector was again based on the predictions of overall energy use published by the Energy Information Administration. For the industrial sector in the mid-Atlantic census region, electricity and natural gas is expected to rise by 1.0 percent and 0.09 percent respectively. Heating oil use is expected to increase by 0.2 percent and propane use by 4.7 percent.

### ***Transportation***

Emissions from vehicles were calculated using annual average daily traffic (AADT) data generated by the Ithaca-Tompkins County Transportation Council, using a transportation system model based on regional mobility studies for 1996. All roads in the County are divided into three categories based on the traffic patterns on a particular road. Collector roads are primarily composed of residential streets. Major arterial streets have heavy traffic, generally found in the commercial or downtown districts. Limited access highways are highways with exit ramps. The total miles of each type of road was multiplied by its respective AADT. This result was then multiplied by 330 days to account for lighter traffic on weekends and holidays in order to arrive at annual vehicle mile traveled (VMT) for all roads in Tompkins County. This VMT data is used in combination with New York State average data for vehicle fuel efficiency and vehicle types provided by the software to calculate total fuel use. This information was updated in 2010 with 1998 data provided by Tom Mank of the Ithaca-Tompkins County Transportation Council. He provided the total VMT for passenger cars and pick-up trucks/SUVs for 1998, reflecting 2000 Census figures for households integrated into the TransCAD model to improve 1998 vehicle miles traveled data. (from 2008 section below, but CACP notes mention that the REGGAE software was used?)

In addition to the fuel estimates embedded in the software, NYSEG provided more specific data regarding natural gas use by vehicles. This data was substituted for the results generated by the software's default values.

The Ithaca-Tompkins County Transportation Council suggested using a transportation model system of peak hour travel (5 to 6 pm on weekdays) as an indicator of growth in the transportation sector. Peak hour VMT for 1996 and a 2020 model were gathered and showed a rise of 7.72 percent by 2020.

### ***Solid Waste***

In 1998, the New York State Department of Environmental Conservation collected waste and recycling data from all Planning units in the State. The Tompkins County Division of Solid Waste submitted information regarding amount of each waste type recycled in the County in 1998 along with the type of recycling program the County has for specific materials. The total amount of waste generated was given as 106,555 tons, with 61,548 tons going to landfill. The remaining 45,007 tons was recycled. This information was updated in 2010 with corrected 1998 data provided by the Tompkins County Solid Waste Division. The correct figures, which were used for the updated 1998 emissions inventory, are: 108,026 tons of community waste, of which 54,944 tons was disposed in a landfill and 53,082 tons was recycled/diverted.

All landfilled waste generated in the County in 1998 was transported by a private hauler to Seneca Meadows Landfill in Waterloo, New York. The landfill site in 1998 was lined with clay on all sides, though was not covered with a plastic cover sheet. Methane recovery is relatively high, as 7 generators operate as a result of methane recovery efforts. Seneca Meadows did not have information available concerning the amount of methane recovery in 1998, though the estimate was that it was around 70 percent. Neither the landfill personnel nor the Division of Solid Waste had specific data regarding the breakdowns of waste going to landfill. Therefore, the default breakdown of waste composition available in the CCP software was used.

In 2001, landfilled waste is not longer transported to Seneca Meadows Landfill, but to a facility in Ontario County. The Ontario County Landfill has is estimated to have the same methane recovery rate as Seneca Meadows did in 1998, at approximately 70 percent. It was assumed that in 2020, waste would continue to be transported to this facility and that methane recovery would remain at 70 percent capacity. The Tompkins County Division of Solid Waste projects waste quantities through 2010. With the help and input of officials there, it was extrapolated that the amount of waste generated from Tompkins County would increase by 1.19 percent. This figure accounts for projected increases in recycling estimated by the Tompkins County Division of Solid Waste.

### ***Agriculture***

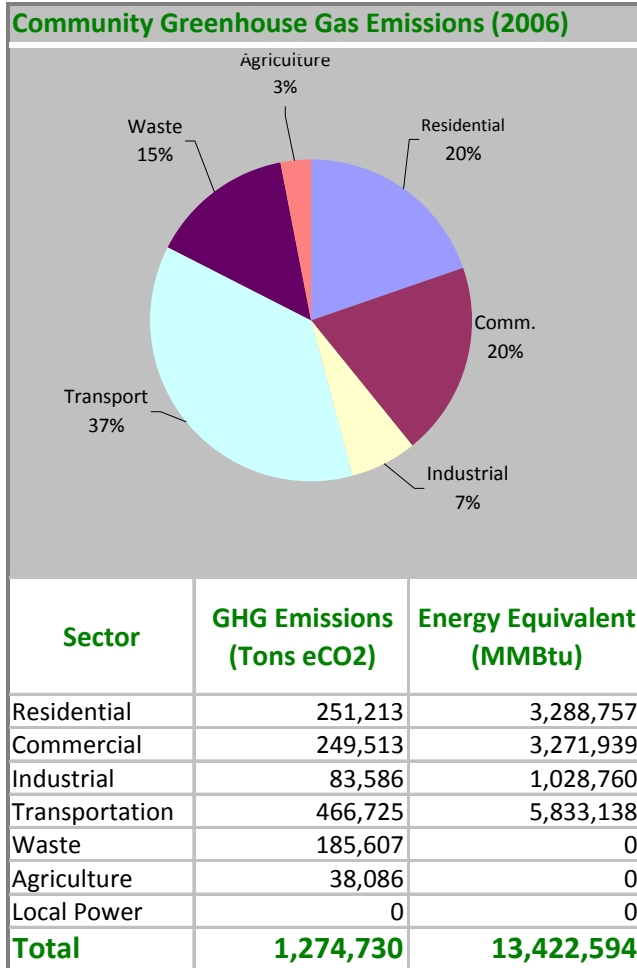
In certain cases, a community may contribute greenhouse gas emissions from other significant sources, depending on the land use in that community. Given the fact that over 30 percent of the land use in Tompkins County is devoted to agriculture, methane from livestock was included in the community emissions inventory. The National Agriculture Statistics Service for the U.S. Department of Agriculture conducted an Agriculture Census in 1997. Data for New York State is broken down by county from which head counts of beef cows, milk cows, goats, horses, sheep and lambs, and swine in Tompkins County was obtained. Torrie Smith Associates suggested obtaining data on methane emissions per livestock type from the United States Environmental Protection Agency's publication on greenhouse gas emissions and sinks. This report detailed methane emissions factors per type of livestock per head per year. The emissions factor for each livestock type was multiplied by the respective number of animals in the County in order to arrive at the total annual amount of methane emitted as a result of livestock.

### **2006 Inventory: Data and Methodology**

This report compared 2006 emissions and energy use data for the County as a whole to the information collected during the baseline year of 1998. Although the original methodology was followed wherever possible, re-examination of that methodology and data sources revealed opportunities to update the baseline inventory based on more sophisticated modeling procedures, more appropriate statistics choices, and the discovery of previously omitted information. In the context of the community emissions portrait, this provided a chance to improve the accuracy of the estimations involved.

**Residential**

Data on electricity and natural gas use for all of Tompkins County was obtained directly from Kirk McAllister at NYSEG. Figures from June 2006 to May 2007 were used, as no earlier data were available. All three residential account types were summed for a residential energy use total.



Rather than obtain information from the many companies that provide heating oil and natural gas throughout the county, the use of these fuels was estimated using statistics from the United States Department of Energy’s Energy Information Administration (EIA). Jay Franklin of the Assessment Department provided a list of size, utility and fuel type for all residential properties in the county. Although fuel type is listed, there is no way to tell which fuel type a property actually uses. It was assumed that consumers would choose to heat with natural gas rather than heating oil or propane if available, however. To determine heating oil use, all properties with natural gas or gas and electric available as utilities were eliminated from the list. Of the remaining properties, all those listing heating oil as their fuel source were selected; they were counted and their square footage aggregated. Information on average heating oil use for space heating per household and per square foot for the Northeast Census Region was taken from the EIA’s 2003 Residential Energy Consumption Survey (RECS), Table CE2-9c. The Northeast region was chosen as more representative of rural, cold Upstate New York than either the Mid-Atlantic census region or New York State alone. Two values for annual heating use were arrived at: one based on per household use and the other per square footage. These two values were then averaged. Propane use was determined in exactly the same manner.

**Commercial**

Data on electricity and natural gas use for commercial properties within Tompkins County were obtained directly from Kirk McAllister of NYSEG for June 2006 to May 2007. NYSEG’s four commercial account types, municipal account type, and 95 percent of the Street Lighting account type were summed for the total commercial use, following the original inventory’s methodology.

For determining heating oil use, a different methodology was used. Unfortunately, the Assessment Department does not keep records on utilities or fuel types for commercial and industrial buildings, and it was unclear how oil-using establishments were identified in the original inventory. As there was no way to estimate changes in establishment heating fuel choices, an adjustment factor for the original baseline total usage figure was therefore created. Average use of heating oil for commercial buildings was compared over time using data from the EIA’s 1995 and 2003 Commercial Building Energy Consumption Survey (CBECS), Tables 1 and C1, respectively. The 1995 CBECS figures were used in the original inventory, and 2003 represents the most current figures available. The percentage change in heating oil use by commercial properties in the Mid-Atlantic census region between these years was calculated and used to adjust the baseline heating oil use figure for Tompkins County accordingly.

Propane use by commercial establishments in Tompkins County is negligible, and the EIA does not collect information on commercial propane use. Therefore, propane use was not considered for this sector.

### ***Industrial***

As above, information on electricity and natural gas use for the industrial sector was obtained directly from Kirk McAllister of NYSEG for June 2006 to May 2007. NYSEG's three industrial account types, plus 5 percent of the Street Lighting account type as per the original methodology, were summed for total industrial use of these energy sources.

Heating oil and propane use were determined in the same manner used for the commercial sector. Data on average industrial use of heating oil and propane for the entire US were taken from the 1994 and 2002 EIA Manufacturing Energy Consumption Survey (MECS), Table 1.1. Again, the 1994 MECS figures were used in the original inventory, and 2002 represents the most current figures available. The percentage change between use in those years was calculated, and the result used to adjust the baseline heating oil and propane values accordingly.

### ***Transportation***

The CACP software's Transport Assistant uses annual Vehicle Miles Traveled (VMT) plus default figures for the average breakdown of VMT by fuel and vehicle type to determine emissions from the transportation sector. Tom Mank of the Ithaca-Tompkins County Transportation Council (ITCTC) provided annual VMT using TransCAD, a standard Travel Demand Forecast Model. Inputs for household locations, the ratio of vehicles to households, and the number of employees were obtained from the Planning Department, Tompkins County Area Development (TCAD), and the 2000 Census.

### ***Solid Waste***

Tompkins County solid waste information was obtained from Tom Richardson of the Solid Waste Department. The Annual Report Form for Recyclables Handling and Recovery Facility tracks this information for the NYS Department of Environmental Conservation. Default values given by the software for composition of landfilled waste were used. Tompkins County waste is sent to Seneca Meadows, a managed landfill with an estimated 70 percent methane recovery rate. The figures used in the 2006 inventory were confirmed with the Tompkins County Solid Waste Division in 2010: 174,660 tons of community waste, with 72,205 tons landfilled and 102,455 tons being recycled/diverted.

### ***Agriculture***

Livestock represent an additional source of greenhouse gas emissions in Tompkins County. To estimate the contribution of this sector to the total inventory, numbers of milk cows, beef cows, "other" cows, goats, horses and ponies, sheep and lambs, and hogs were obtained from the US Department of Agriculture's National Agriculture Statistics Service 2002 Agriculture Census. Emissions factors for all of the above livestock types except "other" cows were taken from the EPA's *Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-1999*, Annex J, Table J-7. In 2002 the USDA stopped distinguishing between the 1997 categories of "heifers and heifer calves" and "steers, steer calves and bulls," instead totaling the numbers of these animals into a new category called "other cows." John Conway, Tompkins County Cornell Cooperative Extension (CCE) dairy specialist, provided advice on estimating the emissions for this group.

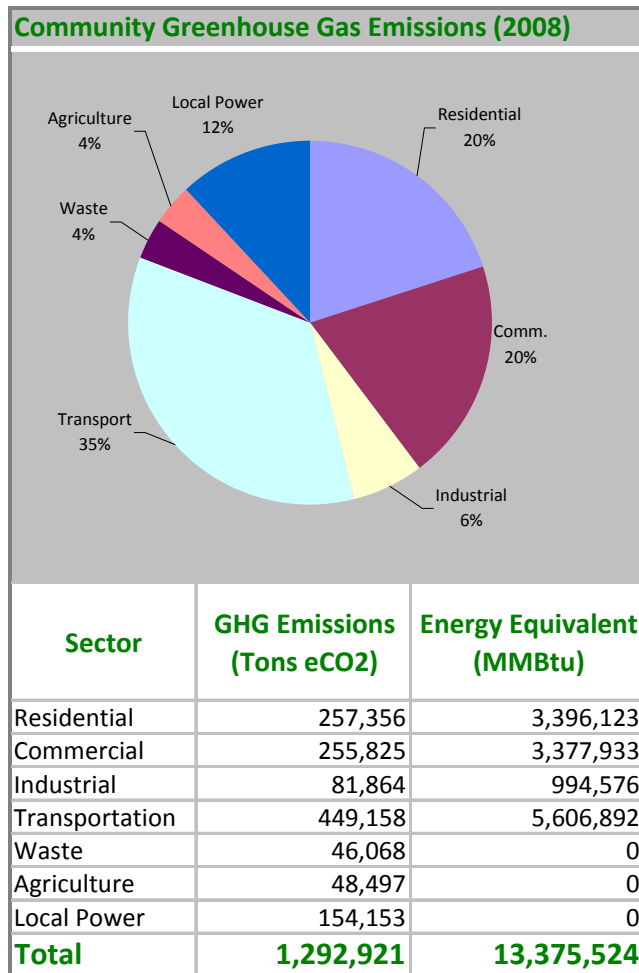
It was assumed that the relative proportions of steers and heifers had not changed since the 1997 census, and so the 1997 proportion of heifers relative to steers and bulls was applied to the 2002 "other" category. Bulls were estimated using the Sonoma County CCP inventory formula of 1 per 100 dairy cows and 4 per 100 beef cows, adjusted downward by 75 percent for this area as suggested by CCE; this number was then subtracted out from the steers and bulls proportion of the "other" cows. Emission factors are given for both dairy and beef calves 0-6 months, 7-11 months, and 12-23. CCE estimated that ¼ of the "other" animals would be 0-6 months old, ¼ would be 7-11 months old, and the remaining ½ would be 12-23 months old. Emissions were calculated accordingly, with dairy calf rates applied to the heifer population and beef calf rates applied to the steer population. Manure was not considered to be a significant source of methane in Tompkins County.

## **2008 Inventory: Data and Methodology**

All methods utilized in the 2006 inventory process were followed in the 2008 emissions inventory process, except where noted below.

### ***Residential***

The data for electricity and natural gas use for the County was received from Kirk McAllister at NYSEG. Fuel oil and propane use was estimated based on the following: average usage per square feet was calculated using the statistics for the Middle Atlantic region from the USA department of Energy website, available at <http://www.eia.doe.gov/emeu/recs/recs2005/c&e/spaceheating/pdf/alltables1-13.pdf>. Average use / square feet = [Total Usage / (no. of households \* Heated square footage per household)].



The data for the square footage and fuel type used for residential buildings was provided by Jay Franklin from the Assessment Department. The buildings using Fuel Oil and Propane were separated and their square footage was added up. This gave the total square footage using Fuel Oil and Propane in the County. The use of Fuel Oil and Propane was calculated by multiplying the Total Square footage by the average use.

Fuel Oil / Propane use in Tompkins County = (Average Use/ square feet) \* (Total square footage using Fuel Oil/Propane)

### ***Commercial***

The data for electricity and natural gas use for the County was received from Kirk McAllister at NYSEG. No data was available to calculate the specific amount of fuel oil utilized by local commercial businesses. Therefore, the numbers from 1998 and 2006 were used to calculate the average change in usage per year, and the equivalent amount was added to the 2006 amount to calculate the usage for 2008.

### ***Industrial***

The data for electricity and natural gas use for the County was received from Kirk McAllister at NYSEG. No data was available to calculate the specific amount of fuel oil and propane. Therefore, the numbers from 1998 and 2006 were used to calculate the average

change in usage per year, and the equivalent amount was added to the 2006 amount to calculate the usage for 2008.

### ***Transportation***

Tom Mank from the Ithaca-Tompkins County Transportation Council provided the total VMT for passenger cars and pick-up trucks/SUVs (say "x"), which was also updated for 1998, reflecting 2000 Census figures for households integrated into the TransCAD model to improve 1998 vehicle miles traveled data. Passenger Cars and Pick-up trucks/SUVs consumed 92.5 percent of the total number of vehicles in Tompkins County. Using the number in 1. and assuming that the number of vehicles directly correlates to the VMT, calculated the total

VMT of all vehicles. (Total VMT =  $x/92.5*100$ ). The Total VMT was broken down to different vehicle types and fuel used according to the distribution percent of VMT used in the previous inventory.

### ***Waste***

Barb Eckstrom from the County Solid Waste Division department provided the required data. Updates to waste methodology recently released from the EPA have drastically altered how emissions were calculated in the CACP software for waste. The new methodology influenced the emissions figures in all three emissions inventories (1998, 2006 and 2008). The EPA previously attributed a negative value to some waste emissions from plant debris, wood based on the premise that some solid waste packed tightly never decays, even after extremely long periods of time. The carbon in this waste is was considered to be “sequestered,” and so a proportion of the carbon in the landfilled waste is thus removed from circulation. However, the EPA has modified this methodology to attribute these types of waste with a neutral emissions factor.

### ***Agricultural Sector***

Ag Emissions: Number of cattle was identified in the 2007 Agricultural Census and the CH<sub>4</sub> emission factors obtained from EPA website. [Ag Census URL](http://www.agcensus.usda.gov/Publications/2007/Full_Report/Volume_1,_Chapter_2_County_Level/New_York/index.asp)  
[http://www.agcensus.usda.gov/Publications/2007/Full\\_Report/Volume\\_1,\\_Chapter\\_2\\_County\\_Level/New\\_York/index.asp](http://www.agcensus.usda.gov/Publications/2007/Full_Report/Volume_1,_Chapter_2_County_Level/New_York/index.asp)

### ***Power Generation Sector***

Cornell Power Plant: The coal usage in the power plant was obtained from the Cornell University Greenhouse Gas Emissions Inventory for the fiscal year 2008 provided by David Frostclapp. Village of Groton: The electricity use data was provided by Ken Thompson, from the Village of Groton at [kthompson@grotonny.org](mailto:kthompson@grotonny.org). Although not included in the total emissions figures, for AES Cayuga Power Plant: The approximate tonnage of emission was provided by Jerry Goodenough, AES Cayuga Power Plant General Manager.

### ***Commercial Air Travel***

Again, although not included in the total emissions figures, the Ithaca-Tompkins Regional Airport provided data for total jet fuel pumped onsite for commercial airplanes from each of the three airline companies operating within the County. Using the flight schedules for each airline available on the airport website, distances traveled within the County’s airspace were determined, for which emissions were calculated. Northwest Airlines operates flights from Ithaca to Detroit. Using the distance tool on Google earth, it was estimated that 5 percent of the flight distance lies within Tompkins County. So the total jet fuel use was multiplied by 5 percent to calculate fuel use within the county. This number was again multiplied by two to factor the round trip. The same methodology was used for Continental Airlines (operates flights between Ithaca and Newark) and US Airways (operates flights to LaGuardia and Philadelphia) and both all of these routes were found to have 10 percent of the flight distances within the county boundaries. The fuel use was calculated using same method that was used for Northwest Airlines. The Climate Registry General Reporting Protocol provided the emission factors for jet fuel. Jet fuel data was provided by the Ithaca-Tompkins Regional Airport General Manager, Bob Nicholas.

## **Appendix D – Conversion to Metric Tons of Emissions**

For 1998-2008 community emissions reports, the County used U.S. short tons eCO<sub>2</sub> as the unit of measure for greenhouse gas emissions. To more closely follow international standards, future reporting of emissions by the County will be in metric tons CO<sub>2</sub>e. The chart below presents the 2008 inventory in both U.S. short tons and metric tons equivalent carbon dioxide units.. The metric figures will be utilized as the 2008 baseline year data for the 2020 Energy Strategy and for all other energy planning initiatives from the County Planning Department. The acronym that will signify equivalent metric tons of equivalent carbon dioxide emissions will be MtCO<sub>2</sub>e.

Metric Tons CO2e	2008 Community Emissions	
	Overall Total = <b>1,172,918</b> MtCO2e	
<i>Community Sector</i>	Total Emissions	Percent of Total
Residential	233,469*	19.9
Commercial	232,081	19.8
Industrial	74,265	6.3
Transportation	407,469	34.7%
Waste	41,792	3.6
Agriculture	43,996	3.8
Local Power Generation**	139,846	11.9
<i>Energy Source</i>		
Electricity	256,202	21.8
Natural Gas	226,428	19.3
Fuel Oil	22,838	1.9
Propane	34,347	2.9
Gasoline	337,866	28.8
Diesel	69,603	5.9
Methane (Ag +Waste)	85,788	7.3
Local Power Generation**	139,846	11.9

\*Buildings include the residential, commercial, and industrial sectors. \*\* Cornell CHP Plant, and Groton Municipal Light and Power Plant

Short Tons CO2e	2008 Community Emissions	
	Overall Total = <b>1,292,920</b> tons eCO2	
<i>Community Sector</i>	Total Emissions	Percent of Total
Residential	257,356*	19.9
Commercial	255,825	19.8
Industrial	81,864	6.3
Transportation	449,158	34.7%
Waste	46,068	3.6
Agriculture	48,497	3.8
Local Power Generation**	154,153	11.9
<i>Energy Source</i>		
Electricity	282,415	21.8
Natural Gas	249,594	19.3
Fuel Oil	25,174	1.9
Propane	37,861	2.9
Gasoline	372,433	28.8
Diesel	76,724	5.9
Methane (Ag +Waste)	94,565	7.3
Local Power Generation**	154,153	11.9

\*Buildings include the residential, commercial, and industrial sectors. \*\* Cornell CHP Plant, and Groton Municipal Light and Power Plant

Year	Short Tons eCO2	Metric Tons eCO2
1998	1,223,446	1,109,891
2006	1,274,730	1,156,416
2008	1,292,920	1,172,918