

# 2014 TOMPKINS COUNTY GOVERNMENT OPERATIONS

## GREENHOUSE GAS EMISSIONS AND ENERGY USE INVENTORY

TOMPKINS COUNTY PLANNING DEPARTMENT

SEPTEMBER 2016



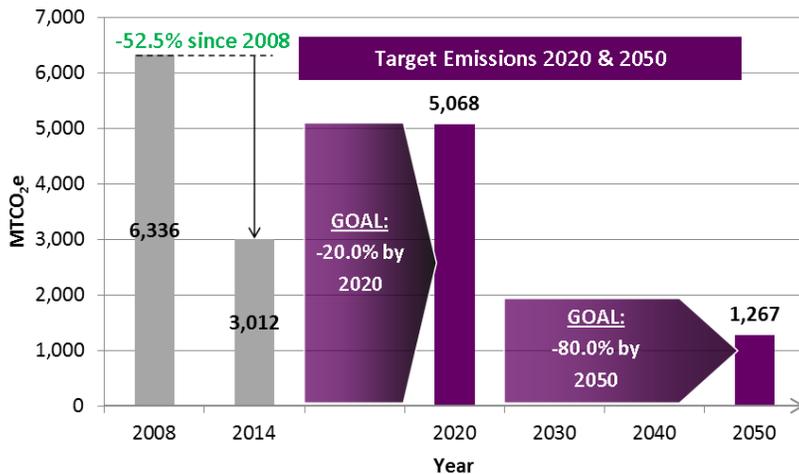
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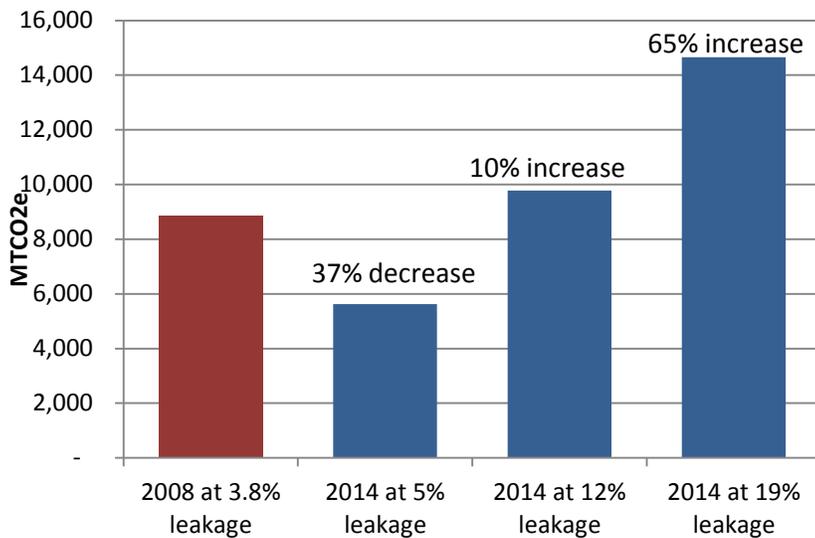
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# County Government Inventory Executive Summary



GHG Emissions Goals and Progress – Currently Accepted Accounting



GHG Emissions – New Shale Gas Accounting

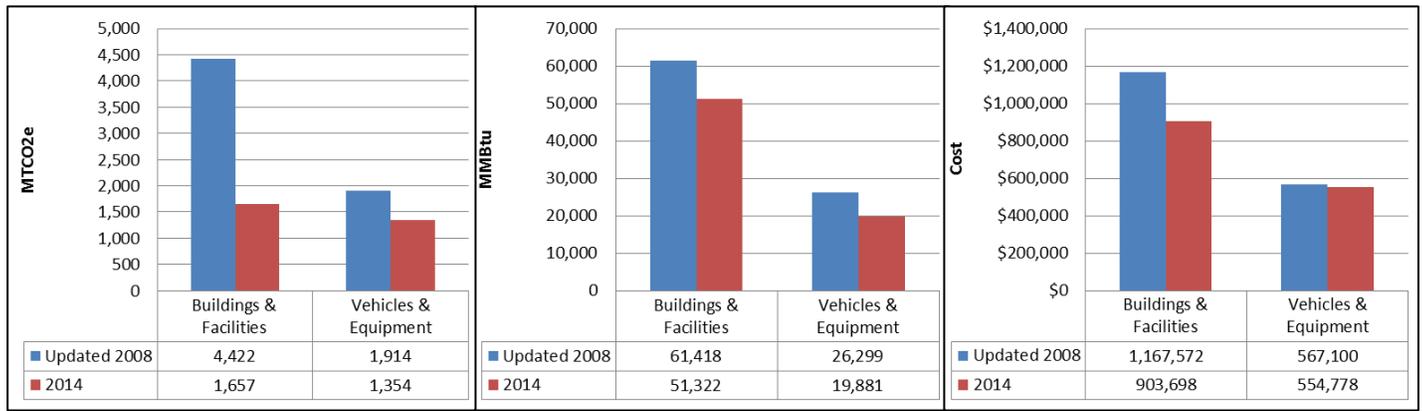
Tompkins County reduced the greenhouse gas (GHG) emissions from its government operations 53 percent from 2008 levels by 2014. This reduction far surpassed the target goal of a 20 percent reduction by 2020, and means that County government is nearly two-thirds of the way to achieving its goal of at least an 80 percent reduction from 2008 levels by 2050. Although this is encouraging news and reflects the positive results of the County's concerted efforts to reduce its emissions, this is tempered by the fact that a considerable amount of this reduction has been achieved through a major shift from coal to natural gas to power the electric grid, and there are growing concerns about the impact of natural gas extracted using high-volume hydrofracking techniques on total GHG emissions, including methane.

Between 2008 and 2014 the source of the gas used in the community, including by the Tompkins County government, transitioned from wells drilled through conventional methods to fracked gas, primarily coming from the Marcellus Shale in Pennsylvania. Emissions associated with fracked shale gas are calculated extremely differently depending on whether current accounting methods or evolving climate science accounting methods are applied. **If the new science is applied, the County government has not seen a remarkable 53 percent reduction in emissions, but instead has increased total GHG emissions by 10 percent between 2008-2014 if the 20-year global warming potential and mid-range overall leakage rate of 12% are applied for methane**

emissions. The higher leakage range of 19% would result in a 65% increase in emissions. While all recent local studies have pointed to the need to transition away from natural gas regardless of accounting methods, the conclusion that emissions are sharply increasing due to reliance on fracked gas calls for making that transition to renewable energy much more quickly. Applying this conclusion to the Inventory calls for rapidly adding more renewable electricity generation in the County and developing strategies to dramatically reduce reliance on natural gas.

While this tension between two GHG accounting methods runs throughout this document, the main focus is on presenting the results using generally accepted GHG accounting methodologies and calling out differences with new climate science accounting in separate sections of the report.

## Results: Comparison of Emissions, Energy Use, and Energy Costs 2008-2014



GHG Emissions (MTCO<sub>2</sub>e)

Energy Use (MMBtu)

Energy Costs (\$)

The County government has two overarching sectors (1) Buildings & Facilities, which include electricity and thermal heating for all County buildings and facilities, including the Airport, Solid Waste Facilities, and County-owned Street Lights & Traffic Signals, and (2) Vehicles & Equipment, which includes both on- and off-road vehicles and equipment powered by vehicle fuels. Both sectors saw a decrease in GHG emissions, energy use, and energy costs between 2008 and 2014, although the decrease in costs for the Vehicle & Equipment Sector was relatively small at \$12,322.

The Buildings & Facilities Sector saw a significant reduction in emissions, largely due to the County's purchase of Green-e Energy Certified Renewable Energy Certificates, which allowed it to claim the environmental benefits of renewably-generated electricity for nearly all of its 2014 electricity use. The influence of these Renewable Energy Certificates means that emissions are less closely correlated with energy use for the Building & Facilities Sector.

### Results: 2014 Emissions and Energy Use

**GHG Emissions.** The total County government GHG emissions 2014 were approximately 3,000 metric tons of carbon dioxide equivalent (MTCO<sub>2</sub>e), with 52 percent of those emissions from natural gas consumption and 45 percent of emissions from County vehicles and equipment fueled by gasoline, biodiesel, diesel, and ethanol fuels.<sup>1</sup>

**Electricity.** The total electricity consumed by County government operations in 2014 was 6,503,913 kWh. 6,100,000 kWh, or 94 percent, of that electricity was offset by the purchase of Green-e Energy Certified Renewable Energy Certificates, which allow the County to claim the environmental benefits of this renewably generated electricity rather than the party generating it.

**Thermal Energy.** The total amount of natural gas consumed for County government operations in 2014 was 295,868 therms. A small amount of propane and waste oil, 100 and 700 gallons respectively, was used for additional heating.

**Vehicle and Equipment Fuel.** In 2014, County government consumed 19,881 MMBtus of energy to fuel its vehicles and off-road equipment such as mowers and forklifts. Vehicles and equipment consumed 153,467 gallons of fuel.<sup>2</sup>

**Next Steps.** The results of this Inventory will be used to inform development of the update to the 2020 Energy Strategy, as well as future efforts to reduce GHG emissions and to reduce consumption of energy by Tompkins County government operations. In particular, this Inventory can better inform the nearer-term efforts by the County to: update its policies; pursue additional opportunities for renewable energy and improved energy efficiency; begin transitioning towards the use of electric vehicles in its fleet; and to continually monitor progress towards meeting the County's emissions reduction goals.

<sup>1</sup> MTCO<sub>2</sub>e – a measure of the combined ability of emitted GHGs to trap heat.

<sup>2</sup> MMBtu – a measure of the energy content in fuel; used as a basis for comparing the energy content of various fuels.

# 2014 Tompkins County Government Operations GHG Emissions and Energy Use Inventory

## Introduction

In 2008 the Tompkins County Legislature committed to reducing greenhouse gas emissions by at minimum two percent a year to achieve at least a 20 percent reduction from 2008 levels by 2020 and at least an 80 percent reduction by 2050. In the spring and summer of 2016, the Tompkins County Planning Department completed a 2014 greenhouse gas emissions inventory to measure County government progress towards meeting this commitment. Greenhouse gas emissions inventories provide an accounting of emissions during a particular time period, and when repeated over time they enable an organization to track changes in emissions and progress towards reduction goals, such as those set by the Tompkins County Legislature.

This report summarizes the greenhouse gas emissions produced by Tompkins County government operations for the 2014 calendar year, while also providing information regarding the County government's energy use and energy costs, and comparing 2014 to 2008 findings. This inventory is based upon the *Local Government Operations Protocol for the Quantification and Reporting of Greenhouse Gas Emissions Inventory, Version 1.1*.<sup>3</sup> ClearPath, an online application for the calculation and tracking of greenhouse gas emissions at the government operations and community scales, was used to calculate 2014 emissions. ClearPath is the most widely-used software tool for managing local climate mitigation efforts and is available to members of the International Council for Local Environmental Initiatives (ICLEI), including Tompkins County.

The Inventory uses Intergovernmental Panel on Climate Change (IPCC) 5th Assessment Report's 100 year Global Warming Potential (GWP) values and the 2008 inventory, which originally used the IPCC 2<sup>nd</sup> Assessment Report values, has been updated to the 5<sup>th</sup> Assessment 100 year values to allow direct comparison to the 2014 inventory. In addition, calculations using the latest climate science information on shale gas leakage and GWP were included as a separate analysis in this Inventory, to better inform actions to combat climate change. Additional details regarding the methodology used in this inventory and the updated 2008 inventory may be found in Appendix E.

## Inclusion of RECs in 2014 Findings

A significant change between this 2014 inventory and previous inventories of Tompkins County government emissions is the inclusion of Renewable Energy Certificates (RECs). A REC is a tradable commodity that is created when harnessing energy from the wind, sun, water, plants, and other renewable sources. The owner of a REC is able to claim the environmental attributes, including reduced emissions, associated with the amount of renewably generated electricity the particular REC represents. Therefore, the entity producing the renewable energy cannot claim the environmental attributes of the energy generated if it does not retain ownership of the RECs for that energy.

In November 2012 Tompkins County, began purchasing Green-e Energy Certified Renewable Energy Certificates (Green-e RECs) to offset 100 percent of the County government's electricity usage.<sup>4</sup> As a result of this purchase, the County is able to claim the environmental attributes of this renewably generated electricity even though the renewable energy is not generated by the County itself. The original producer of the energy cannot claim these

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<sup>3</sup> Developed in partnership and adopted by the California Air Resources Board, the California Climate Action Registry, ICLEI-Local Governments for Sustainability, and The Climate Registry.

<sup>4</sup> Tompkins County Resolution 2012-241, adopted November 20, 2012 and authorizing purchase of electricity for the period ending December 31, 2014,

[https://tompkinscountyny.iqm2.com/Citizens/Detail\\_LegFile.aspx?ID=3681&highlightTerms=renewable%20energy%20credits](https://tompkinscountyny.iqm2.com/Citizens/Detail_LegFile.aspx?ID=3681&highlightTerms=renewable%20energy%20credits).

attributes. Therefore, the zero emissions attributed to the Green-e RECs purchased by the County are used in this inventory's calculations.

These Green-e RECs represent 6,100,000 kWh of zero-emission electricity for calendar year 2014, and therefore eliminate most of the emissions that would otherwise be attributed to electricity use by the County government. In reality, the County's electricity use exceeded 6,100,000 kWh in 2014, so there are some remaining emissions associated with County government electricity consumption. Protocols for the treatment of RECs in emissions inventories is evolving, therefore Appendix C presents an alternative inventory of the 2014 Tompkins County government emissions *without* Green-e RECs included in emissions calculations.

## Overview of Natural Gas Impacts

In conducting this analysis it has become clear that the biggest change in our energy system since 2008 has been the increased use of natural gas to generate electricity, largely replacing generation using coal and fuel oil, and the change in the source of that gas from wells drilled through conventional methods to fracked gas, primarily from the Marcellus Shale in Pennsylvania. Our methodology, using the protocols relied on by the International Council for Local Environmental Initiatives (ICLEI) in developing the ClearPath software tool, does not account for the impact of the change in the source of the natural gas or the increased focus internationally on the significance of methane as a greenhouse gas. Two factors are at play here: first, an international consensus is developing that methane should be accounted for at its 20 year warming impact (80 to 100 times that of carbon dioxide) rather than the 100 year impact (20 times CO<sub>2</sub>) reflected in the methodology that has been applied to date; and second, evidence suggests that more methane escapes to the atmosphere in the fracking process than from conventional natural gas production and this can have a profound impact on the effect of gas production on the climate. These factors fundamentally alter our understanding of the impacts of use of natural gas in Tompkins County and in drawing electricity from a more natural gas intensive grid.

We are thus faced with the dilemma of trying to use consistent methodology to measure change across time while recognizing that the science is rapidly evolving and methods of calculating emissions will likely change to reflect increasing concern regarding the impacts of methane as a greenhouse gas. So while the ICLEI methodology shows a 52.5 percent reduction in emissions from 2008 to 2014, a remarkable accomplishment that would put us ahead of schedule to reach our goal of a 20 percent reduction by 2020, the real impact on climate change may be a different story. We have tried to accurately portray both stories in this report, one that shows progress toward our goal based on what we knew in 2008 and another that shows a significant increase in greenhouse gas emissions resulting from the transition to fracked gas. Going forward it is clear that we must rapidly build on our progress by adding more renewable electricity generation in the County and develop strategies to dramatically reduce reliance on natural gas.

## Findings from the 2014 Inventory<sup>5</sup>

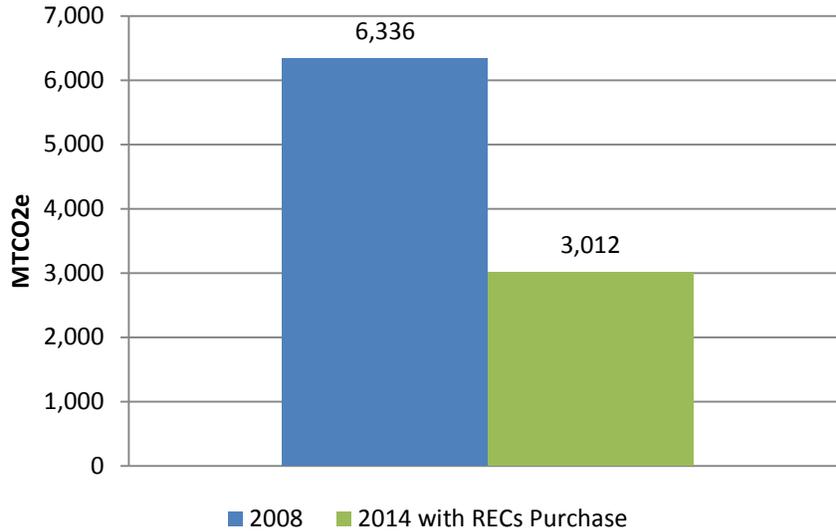
### Overview

The total emissions from Tompkins County government operations in 2014 were 3,012 metric tons of carbon dioxide equivalent (MTCO<sub>2e</sub>).<sup>6</sup> Given that County government operations emitted 6,336 MTCO<sub>2e</sub> in 2008. **This is a 52.5 percent reduction in Tompkins County government emissions between 2008 and 2014** (Figure 1).

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<sup>5</sup> Please note that all findings include the reduction in emissions from purchased Green-e RECs as discussed above.

<sup>6</sup> MTCO<sub>2e</sub> is a measure that aggregates different greenhouse gases into a single measure, using global warming potentials.

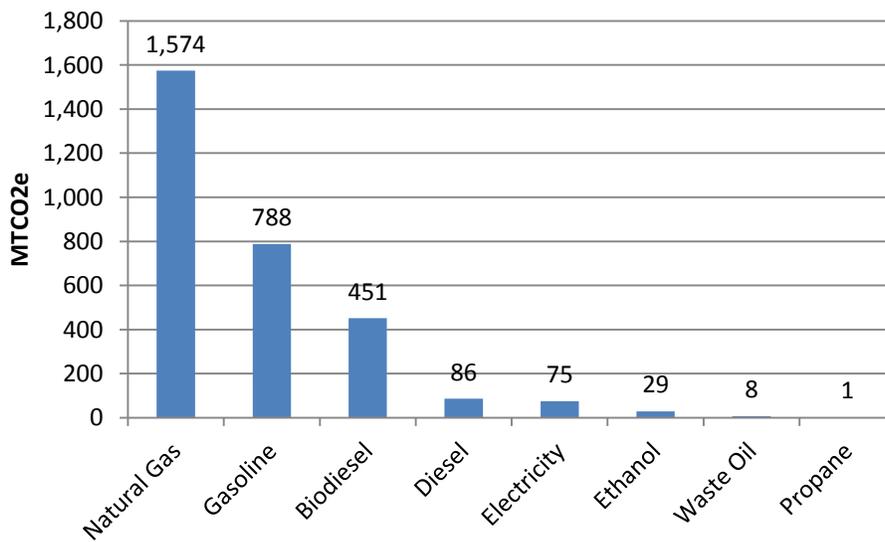


**Figure 1. Total MTCO<sub>2</sub>e emissions in 2008 and 2014**

By this measure, County government emissions reductions have already exceeded the goal of 20 percent emissions reductions by 2020. If the County government can continue a similar pace of reductions moving forward, these reductions should meet or exceed the goal of 80 percent emissions reductions by 2050. Although the County’s reduction goals are community-wide and its government operations are a small portion of the entire community’s emissions, the County has most direct control over its own government emissions and its efforts to reduce them provide the opportunity to lead by example.

### Emissions by Fuel Type and Sector

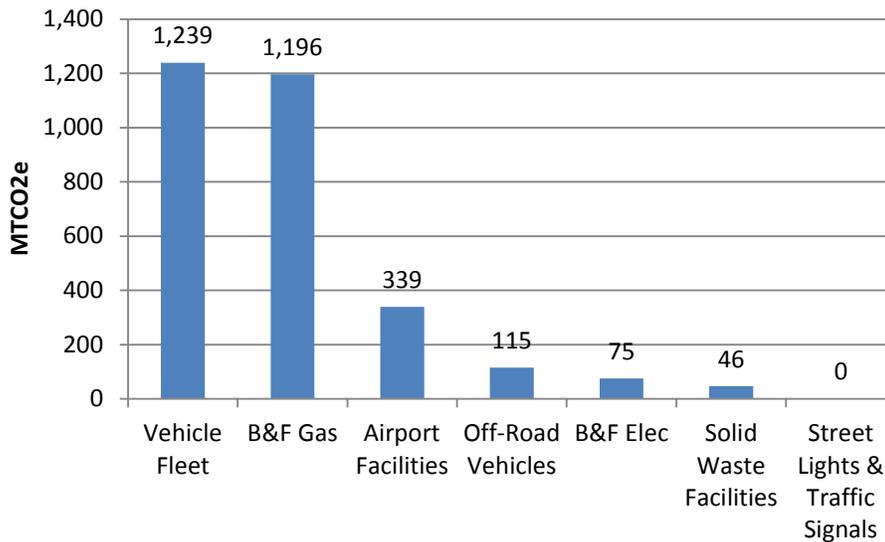
In 2014, natural gas used for heat and hot water produced 52.3 percent of the County government’s emissions – the most of any single fuel source (Figure 2). Vehicle fuels including gasoline, biodiesel, diesel, and ethanol fuels for the County fleet together represent 45.0 percent of total emissions. Waste oil and propane used to heat the Highway Satellite Facility together contribute 0.3 percent of emissions. Due to the purchase of Green-e RECs, electricity accounted for just 2.5 percent of emissions.



**Figure 2. Breakdown of total MTCO<sub>2</sub>e emission by fuel type, including Green-e RECs**

The *Local Government Operations Protocol* uses the following local government sectors to categorize emissions:<sup>7</sup>

- Buildings and other facilities
- Streetlights and traffic signals
- Airport facilities
- Vehicle fleet<sup>8</sup>
- Solid waste facilities



**Figure 3. Breakdown of total MTCO<sub>2</sub>e emission by sector, including Green-e- RECs<sup>9</sup>**

### Vehicle Fleet

The County vehicle fleet included 225 vehicles in 2014 and was the second largest source of emissions, as it has been in previous inventories. The fleet used 18,092 MMBtu of energy, and generated 1,239 MTCO<sub>2</sub>e, representing 41.1 percent of County government emissions.

### Buildings and Facilities<sup>10</sup>

Buildings and facilities operated by the County used 38,255 MMBtu of energy, including natural gas and electricity, and generated 1,271 MTCO<sub>2</sub>e in 2014.<sup>11</sup> Although the Green-e RECs significantly reduced the electricity portion of this sector's emissions, at 38 percent of its total emissions, buildings and facilities continue to be the largest emitters as they have been in the three previous County government emissions inventories.

<sup>7</sup> Note that additional sectors include transit fleet as well as water delivery, port, power generation, and wastewater facilities. However these sectors are not part of Tompkins County government operations.

<sup>8</sup> Note that Vehicle Fleet includes on and off-road vehicles, which are calculated differently and shown separately in the following charts since the off-road vehicles include equipment such as mowers and forklifts which are not necessarily used for transportation purposes.

<sup>9</sup> Note that B&F (Buildings & Facilities) Gas includes emissions from waste oil and propane use at the Highway Satellite Facility.

<sup>10</sup> Note that per the Protocol, Airport and Solid Waste buildings and facilities are not included in this sector.

<sup>11</sup> MMBtu stands for one million British Thermal Units, a measure of the energy content in fuel. One Btu is the amount of work needed to raise the temperature of one pound of water by one degree Fahrenheit. MMBtu is used as a basis for comparing the energy content of various grades of natural gas and other fuels.

### Airport Facilities

The County’s airport facilities include the Airport Terminal and its outdoor lights, T Hangar I, T Hangar II, the Old IHA Hangar, the Crash Fire and Rescue Building, and the Sand Storage Building. These facilities used 11,112 MMBtu of energy and generated 339 MTCO<sub>2</sub>e in 2014, representing 11.3 percent of County government emissions.

### Off-Road Vehicles

The County’s off-road vehicles include equipment such as forklifts, loaders, and mowers. Both the Airport and the Highway Division use these types of vehicles and equipment, which in total used 1,789 MMBtu of energy and generated 115 MTCO<sub>2</sub>e in 2014, representing 3.8 percent of County government emissions.

### Solid Waste Facilities

The County’s solid waste facilities include the Solid Waste Office, the Recycling Center, and the Solid Waste - Household Hazardous Waste Building. These facilities used 1,822 MMBtu of energy and generated 46 MTCO<sub>2</sub>e in 2014, representing 1.5 percent of County government emissions.

### Street Lights and Traffic Signals

The County’s Highway Division operates six traffic signals and one set of street lights. These lights and signals used 132 MMBtu of energy and generated 0 MTCO<sub>2</sub>e in 2014, representing 0.0 percent of County government emissions.

## Energy Use

In 2014 Tompkins County government operations used a total of 71,203 MMBtu. This use represents the actual energy required by County facilities, vehicles, and equipment for their operation in 2014.

### Electricity

County government operations used 6,503,913 kWh of electricity in 2014. The Airport Facilities, Tompkins County Public Library, and Human Services Building were the three biggest consumers (Figure 4). They used 1,386,040 kWh, 869,808 kWh, and 735,738 kWh of electricity respectively in 2014.

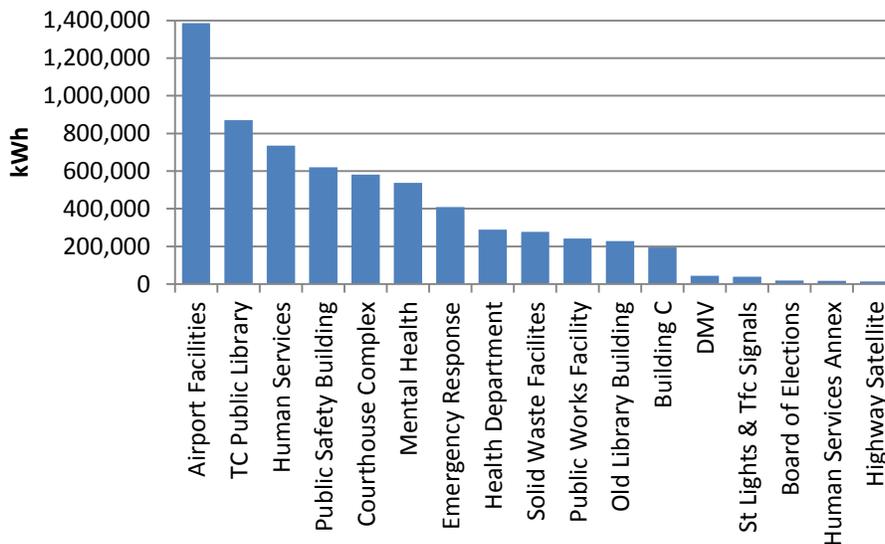
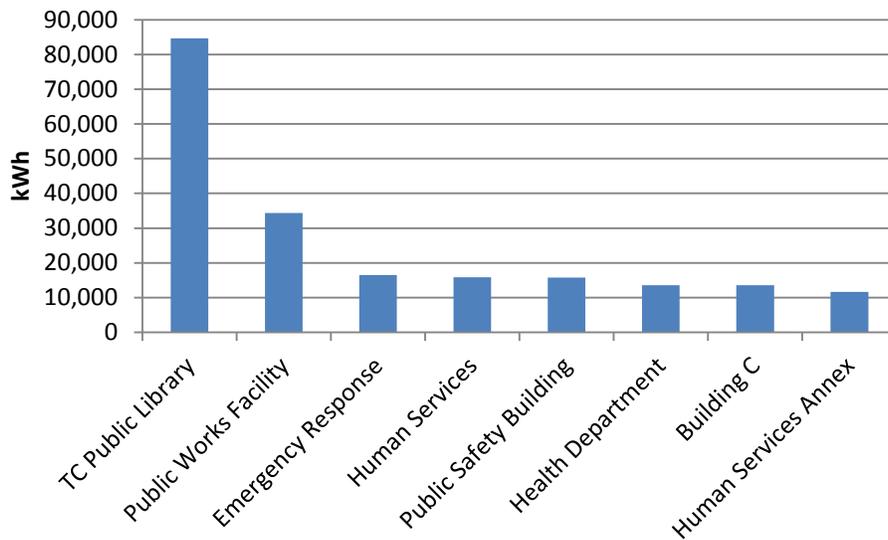


Figure 4. Electricity use by County facilities

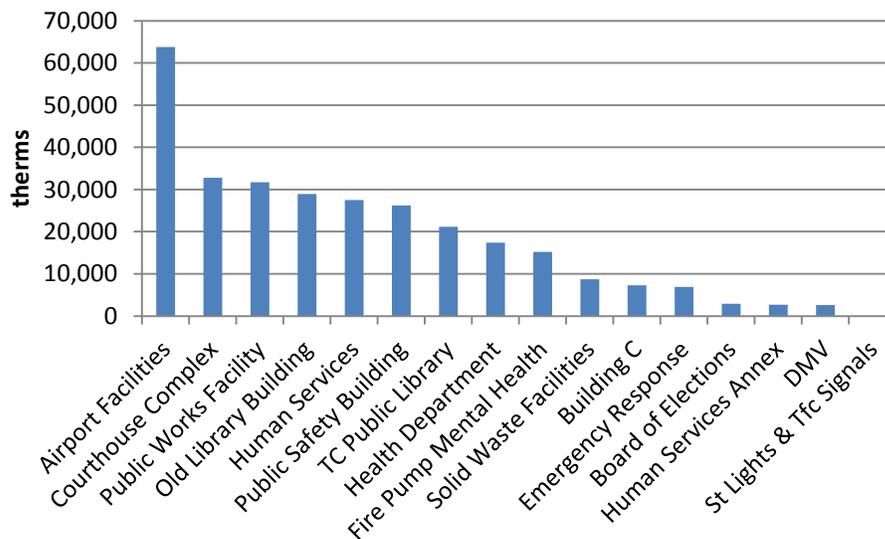
The facilities' electricity use includes electricity delivered by the grid as well as any solar electricity generated and used on site by photovoltaic (PV) panels installed on County facilities. Figure 5 indicates the facilities whose PV panel(s) started operating by the end of 2014 and their annual solar electricity generation over 2014.



**Figure 5. Solar electricity generated at County facilities in 2014**

**Natural Gas**

The total natural gas used for County government operations in 2014 was 295,868 therms. The Airport Facilities, Courthouse Complex, and Public Works Facility were the three biggest consumers (Figure 6). They used 63,812 therms, 32,744 therms, and 31,722 therms of natural gas respectively in 2014.



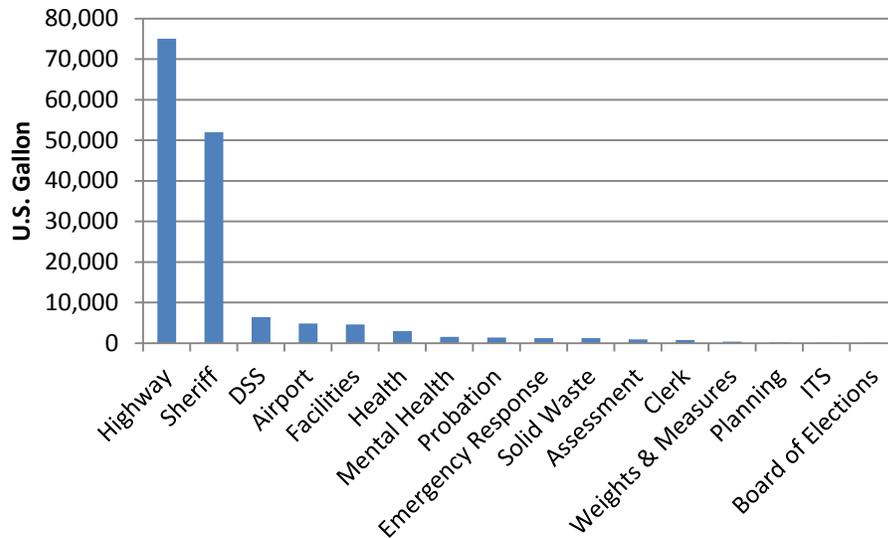
**Figure 6. Natural gas uses of the facilities**

**Propane and Fuel Oil**

The Highway Satellite Facility used 100 gallons of propane and 700 gallons of waste oil to run a heater in 2014. This waste oil most closely resembles No. 6 fuel oil, and is treated as such in calculating emissions.

## Vehicle Fuel<sup>12</sup>

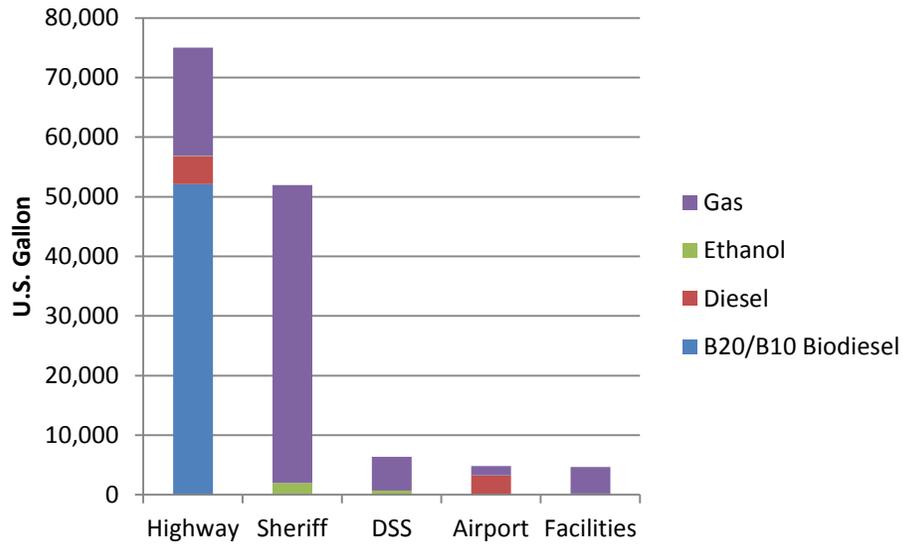
The total vehicle fuel used for County government operations in 2014 was 153,467 gallons. Figure 7 presents the annual vehicle fuel use by each department in a descending order. The Highway Division, Sheriff's Office, Social Services (noted as DSS in the figures), Airport, and Facilities Division were the five biggest consumers. They used 75,003 gallons, 51,962 gallons, 6,373 gallons, 4,811 gallons, and 4,633 gallons of fuel respectively in 2014.



**Figure 7. Annual vehicle fuel uses of the departments**

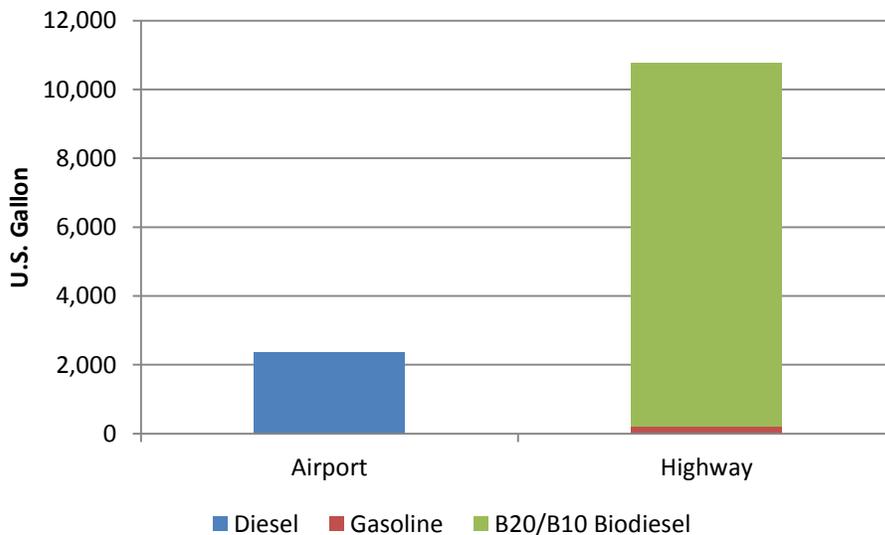
The County departments with the highest annual vehicle fuel use are Highway, Sheriff's Office, Social Services, Airport, and Facilities (Figure 7). Gasoline was the major fuel for the Sheriff's Office, Department of Social Services, and Facilities Division. For the Highway Division, the major fuel was biodiesel (Figure 8). The Sheriff's Office and Highway Division consumed 98 gallons and 74 gallons of kerosene respectively in 2014, which is too small a quantity to appear in Figure 8. Kerosene was mixed in with diesel when it was purchased by the Sheriff's Office, and some suppliers classified this diesel as kerosene. At the Highway Division, kerosene was used for a pressure washer to wash trucks. The pressure washer burns kerosene to produce heat for hot water. As the consumption was minimal and they were not used directly by vehicles, kerosene is not shown in the breakdown of fuel below.

<sup>12</sup> Note that vehicle fuel includes fuel used by off-road vehicles and equipment as well as on-road vehicles.



**Figure 8. Breakdown of annual vehicle fuel use by fuel type among the largest users**

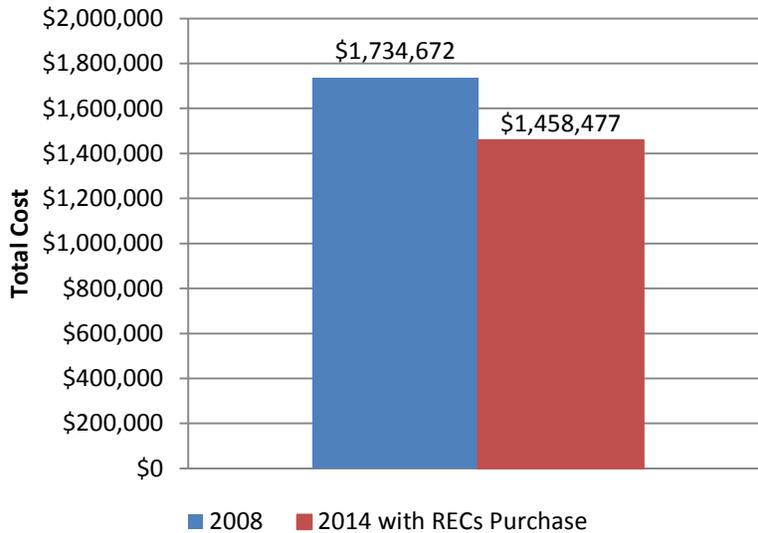
Both the Highway Division and Airport have equipment not intended for regular on-road uses that are classified as off-road vehicles, such as front loaders and lawn mowers. The total fuel consumed for running off-road vehicles was 13,110 gallons. All 2,349 gallons used for Airport off-road vehicles was diesel. Of the 10,761 gallons consumed by Highway off-road vehicles, 98 percent was B20/B10 biodiesel, while the remainder was gasoline. Jet fuel consumed by planes using the Airport facilities is not used for government operations, and therefore is included in the Community GHG Emissions Inventory.



**Figure 9. Annual fuel use of off-road vehicles**

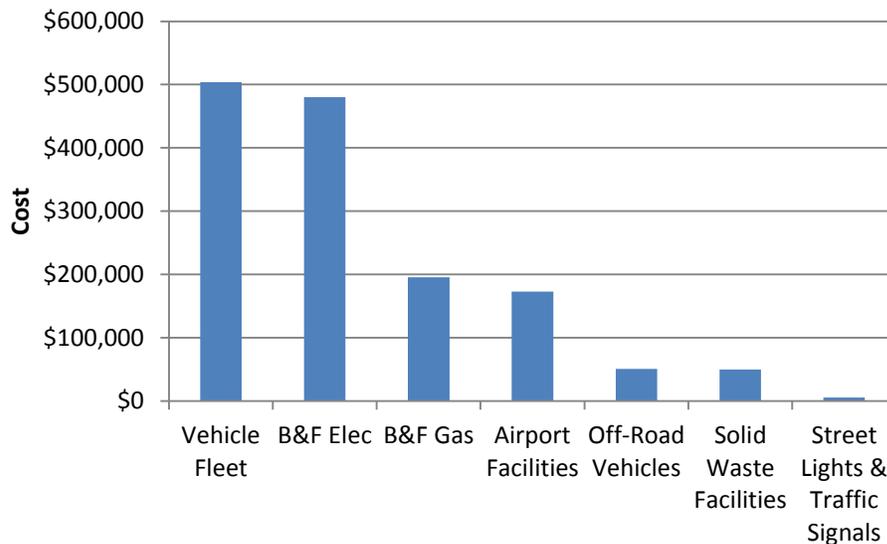
### Energy Costs

The energy required for Tompkins County government operations in 2014 cost \$1,458,477, with the purchase of Green-e RECs included. Tompkins County spent \$276,195, or 15.9% less than it did on energy costs in 2008 (Figure 10).



**Figure 10. Total costs for energy consumed in 2008 and 2014**

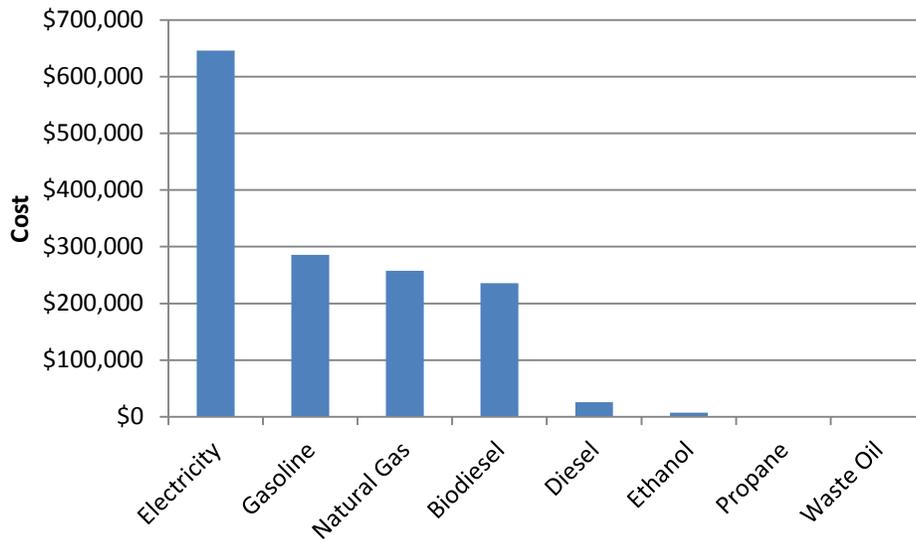
Energy costs were greatest for the vehicle fleet at \$503,853, or 34.5 percent of total energy costs. These costs were followed closely by electricity for buildings and facilities, which at \$479,926 accounts for 32.9 percent of total energy costs (Figure 11).<sup>13</sup>



**Figure 11. Breakdown of total cost by sector**

In terms of costs by fuel type, at \$645,875 or 44.3 percent of total energy costs, electricity is the largest expense (Figure 12). Fuels used for the vehicle fleet and off-road vehicles, including gasoline, biodiesel, diesel, and ethanol, together cost \$554,778, or 38 percent of the total County government energy costs.

<sup>13</sup> Note that the Airport and Solid Waste Facilities costs include both electricity and natural gas used at those facilities.



**Figure 12. Breakdown of total cost by fuel type**

### Applying Latest Climate Science on Shale Gas to Results

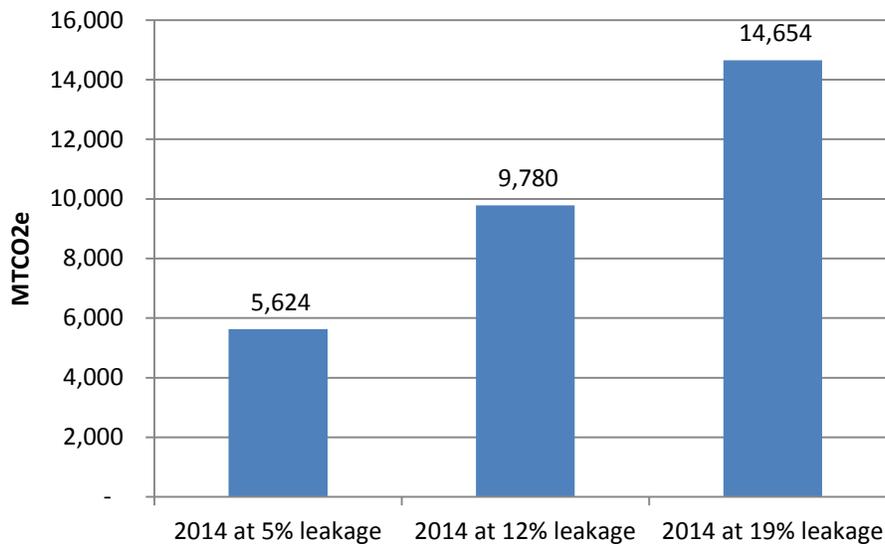
In addition to the GHG Emissions Inventory based on internationally recognized protocols and software tools, the GHG Emissions Inventory for 2014 for the first time includes a separate section and accounting that looks ahead at what may soon be modifications to those protocols to better understand the impacts to the climate of burning shale gas in the County. Between 2008 and 2014, there was a profound shift in how the natural gas consumed in the community, including by County government was extracted from the ground, as well as new international recommendations on the time horizon and global warming potential (GWP) that should be used to calculate the GHG emissions for methane.

Studies conducted by local internationally-renowned experts, including Dr. Bob Howarth and Dr. Tony Ingraffea, have informed this section of the Inventory, with Dr. Howarth providing appropriate figures to include in these calculations. It is estimated that 5-19 percent of unburned methane leaks from production well to combustion in the home or business due in large part to the techniques employed by the shale gas industry. The analysis applies leakage rates of 5, 12, and 19 percent to all natural gas consumed by County government, including the portion used to generate electricity (Table 1). Leakage not only increases emissions from direct use of natural gas, but also increases emissions from electricity use due to the increasing use of natural gas to generate electricity (Figure 13).

In addition to the leakage of methane due to shale gas development and distribution, is the consideration of the appropriate timescale for GWP of methane. Methane is an extremely impactful GHG in the short-term, with a greenhouse warming effect of >100-fold more than carbon dioxide in the short-term. Given the current state of the Earth's climate, the Earth is predicted to warm by 1.5° C above the preindustrial baseline within the next 15 years and by 2° C within the next 35 years giving new urgency to the role of methane in the short-term. Standard GHG accounting principles call for the use of the 100-year GWP for greenhouse gases, which is appropriate for the other GHGs, however this analysis applies the 20-year GWP for methane of 86 to all methane emissions in 2014.

	2014 with 100-yr GWP and without Leakage	2014 New Accounting 5th IPCC 20-yr GWP for Methane with 5% Leakage	2014 New Accounting 5th IPCC 20-yr GWP for Methane with 12% Leakage	2014 New Accounting 5th IPCC 20-yr GWP for Methane with 19% Leakage
MTCO <sub>2</sub> e from Leaked Methane	n/a	2,612	6,768	11,642
Total Government MTCO <sub>2</sub> e with Leakage	3,012	5,624	9,780	14,654

**Table 1. 2014 Emissions as 5%, 12% and 19% Methane Leakage and GWP of 86**



**Figure 13: 2014 Emissions at 5%. 12% and 19% Methane Leakage and GWP of 86**

### Weather Conditions in 2014

In 2014, there were 7,403 Heating Degree Days (HDD) where the average temperature was below 65° Fahrenheit, the temperature below which buildings are considered to need to be heated (Table 2). There were 342 Cooling Degree Days (CDD) where the average temperature is above 65° Fahrenheit and people start to use air conditioning to cool their buildings. During the past 45 years (1970-2015), there were an average of 7,091 Heating Degree Days and 432 Cooling Degree Days. This indicates that 2014 was cooler in the summer and colder in the winter than past years. Therefore, one would expect that less electricity would be needed in 2014 compared to the past 45 years for air conditioning, and more natural gas and other thermal fuels for space heating.

	<b>HDD</b> Higher number = colder winter	<b>CDD</b> Higher number = hotter summer
<b>2008</b>	6975	387
<b>2009</b>	7031	272
<b>2010</b>	6641	622
<b>2011</b>	6615	526
<b>2012</b>	6202	543
<b>2013</b>	7106	479
<b>2014</b>	7403	342
<b>2015</b>	6954	445
<b>Average 1970-2015</b>	7,091	432

**Table 2. Heating and Cooling Degree Days, 2008-2015**

## 2008 and 2014 Inventories: Comparison and Findings

Between 2008 and 2014, County government emissions decreased by 52.5 percent. Although alterations to particular buildings and facilities are detailed in Appendix D, the following changes since 2008 have been critical in reducing emissions:

### **Transforming the Electric Grid**

According to the U.S. EPA's Emissions & Generation Resource Integrated Database for 2012 (eGRID 2012), the CO<sub>2</sub> emissions factor of electricity generation in the New York Upstate Subregion declined from 720.8 lbs/MWh to 408.8 lbs/MWh since 2008 due to the shift of fuel use from coal to natural gas and renewable energy. A changing grid reduces emissions for users of the electricity, including County government. This reduction, however, would be largely offset if applying the methane emissions factors outlined in the "Applying the Latest Climate Science" section of this report to electricity produced with natural gas.

### **Renewable Energy Credits (RECs)**

#### *RECs Purchased (Green-e RECs)*

As previously mentioned, in November 2012 Tompkins County began purchasing Green-e Energy Certified Renewable Energy Credits (Green-e RECs) to offset 100 percent of the County's electricity usage. These Green-e RECs reduced the County's 2014 electricity-related emissions, however, they do not represent actual reductions in energy use by County government.

#### *RECs Generated but not Retained*

In 2011, Tompkins County entered into a 15-year lease agreement with Solar Liberty to install solar panels on the following seven County government buildings: Building C; Emergency Response Center; Health Department; Human Services Annex; Human Services Building; Public Safety Building; and the Public Works Building. All panels were producing electricity in 2014, however the panels on the Public Safety Building were not operational until September 3, 2014. Under the terms of the agreement, Solar Liberty retains ownership of the RECs generated by these panels and can sell them to other parties wishing to reduce their emissions. Therefore, although the solar panels on County government buildings generate these RECs, Tompkins County does not own the panels or retain ownership of these RECs and they do not reduce the County government's emissions.

#### *RECs Generated and Retained*

One County building, the Tompkins County Public Library, has solar panels installed which are owned by Tompkins County. Installed by SunPower in 2000, the County retains the RECs from the electricity they generate. As a result, these RECs do reduce the County government's emissions.

### **Energy Performance Contract**

Tompkins County and Johnson Controls, Inc. entered into an Energy Performance Contract (EPC) in December 2005. The contract guarantees that Tompkins County will realize \$4,154,367 of energy cost avoidance between February 2007 and January 2022. Although most improvements to County buildings occurred before 2008, an additional EPC was executed in January 2013 for the purpose of upgrading energy equipment and systems within the Public Safety Building. Although these additional improvements were not fully completed until September 2015, a number of improvements were completed prior to or during the early months of 2014 and therefore provided reductions in energy use and associated emissions.

## **Green Fleet Policy**

In 2009 the Tompkins County Legislature adopted a green fleet policy for the County which requires each department to reduce its fleet emissions by 2 percent annually in order to help the County reach its emissions reduction goals. By 2014, nine hybrid vehicles and one electric vehicle had been added to the County fleet, and car sharing between the Planning and Assessment Departments had increased.<sup>14</sup>

As departments replaced vehicles between 2008 and 2014, newer vehicles typically provided greater fuel efficiency, further reducing the County government's emissions. U.S. gas prices experienced a high spike in the second half of 2008, and in 2009 major changes began in the Corporate Average Fuel Economy (CAFE) standards for new vehicles sold in the U.S. to encourage greater fuel efficiency. These changes have resulted in manufacturers producing vehicles with lower CO<sub>2</sub> emissions and record fuel economy.<sup>15</sup>

While the 2008 inventory found that increasing fuel consumption by the County's fleet was contributing to increased County emissions between 1998 and 2008, the 2014 inventory finds a successful reversal of this trend. In addition to the green fleet policy, improved fuel economy of newer vehicles, and car sharing to slightly lessen the need for additional vehicles, technology may also be playing a role. Webinars and web-based meetings have become more common, and County facilities and technology have been improved to encourage participation in online meetings. Although vehicle miles traveled (VMT) was not tracked in 2008, there is anecdotal evidence that travel for in-person meetings both within the County and to more distant destinations, such as Albany, has been declining and resulting in less fuel consumption and associated vehicle emissions.

## **Changing Vehicle Fuels**

In 2014, 3,566 gallons of fuel purchased for vehicles using gasoline were blended with ethanol (5.7% or 10%), resulting in lower emissions than unblended gasoline. Although ethanol blended gasoline was not tracked separately in 2008 and all gasoline was considered to be unblended, increasing oil prices and changing energy regulations in 2008 helped to increase the proportion of ethanol blended gasoline used in vehicles by 2014, including the County's fleet.

In 2009 the Tompkins County Highway Department began transitioning its diesel vehicles, which account for more than three-quarters of its fleet, to B10 and B20 biodiesel. Biodiesel emits less CO<sub>2</sub>e than conventional diesel, and this change accounts for 59.4 percent of the reduced vehicle fleet emissions between 2008 and 2014.

Although it does not reduce emissions in the context of the software used in this inventory, County vehicles used 4,641 gallons of ultra-low-sulfur diesel (ULSD) in 2014, whereas in 2008 all diesel vehicles were using traditional diesel fuel. Diesel fuel use is the primary source of black carbon emissions in the U.S., and the combination of ULSD and newer diesel vehicles designed for ULSD use has greatly reduced this component of particulate matter (soot).<sup>16</sup> The U.S. Environmental Protection Agency expects reduced black carbon emissions to provide climate benefits within the next several decades due to its short atmospheric lifetime and strong warming potential.

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<sup>14</sup> Although the electric vehicle was in use in 2014, it has since been removed from the County fleet, so the County currently does not have any electric vehicles.

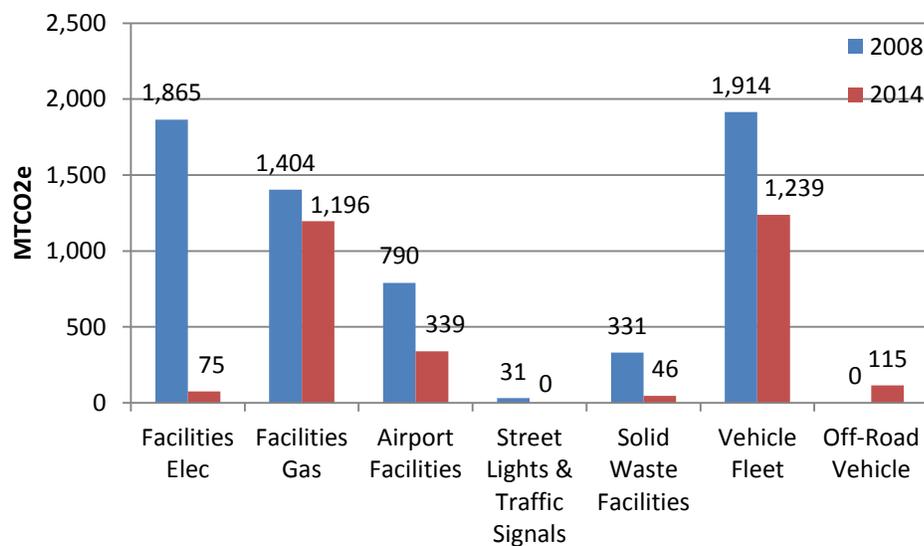
<sup>15</sup> Light-Duty Automotive Technology, Carbon Dioxide Emissions, and Fuel Economy Trends:1975-2015, <https://www3.epa.gov/otaq/fetrends.htm>

<sup>16</sup> [https://www.eia.gov/environment/emissions/ghg\\_report/ghg\\_overview.cfm](https://www.eia.gov/environment/emissions/ghg_report/ghg_overview.cfm), <https://www3.epa.gov/blackcarbon/mitigation.html>

## Breakdown of Total Emissions by Sector and Fuel Type

As previously discussed, the purchase of Green-e RECs substantially reduced emissions from the Buildings & Facilities electricity consumption. After this reduction, Solid Waste Facilities experienced the second largest emissions reduction from 2008 to 2014 among all the sectors at 86.0 percent (Figure 14).<sup>17</sup> Possible reasons for the significant reduction of CO<sub>2</sub>e emission are:

- 1) The recycling process changed from a dual stream sorting process to a single stream transfer in 2011. Prior to 2011, a lot of sorting equipment was operated at the Recycling Center and Solid Waste Transfer Station. In 2011, the majority of that equipment was taken out and most of the recyclables have been transferred to a facility in Ontario County for processing ever since.
- 2) Changing grid. According to EPA eGRID 2012, the CO<sub>2</sub> emission factor of electricity generation went down from 720.8 lbs/MWh to 408.8 lbs/MWh since 2008 due to the shift of fuel use from coal to natural gas and renewable energy. A changing grid may explain ~43.4 percent of the emission reduction from electricity use.



**Figure 13. Comparison of emissions by sector**

The changing grid may also explain the emissions reduction from Street Lights & Traffic Signals, Airport Facilities, and electricity use at the other County-operated facilities (noted as B&F Elec in the figure). Besides, solar generation and net-metering offset some electricity provided by the grid. The sale of the Biggs Building in 2010 and the K-House in 2013 also contributed to the County government’s reduced electricity and natural gas use.

Figure 15 provides the breakdown of the total CO<sub>2</sub>e emissions in 2008 and 2014 by fuel type. There was a significant 90.0% drop of emissions from the use of diesel. Tompkins County began switching some of its vehicle and equipment from diesel to biodiesel in 2009. In 2014, 23,547 gallons of B10<sup>18</sup> biodiesel and 28,522 gallons of B20 biodiesel were purchased, representing a reduction of approximately 67 MT of CO<sub>2</sub>e emissions over the equivalent

<sup>17</sup> Solid waste facilities include the Solid Waste Office, the Recycling Center and Solid Waste Transfer Station, and the Solid Waste – Household Hazardous Waste Building.

<sup>18</sup> Biodiesel is a diesel fuel produced from plant oils or animal fats. It is commonly sold blended with diesel derived from petroleum. Common blends include “B2” (2% biodiesel), “B5” (5% biodiesel), “B10” (10% biodiesel), and “B100” (100% biodiesel) (<http://www.bioenergywiki.net/Biodiesel>).

amount of ultra-low sulfur diesel fuel. Other types of alternative fuels such as ethanol and kerosene were also used in 2014.

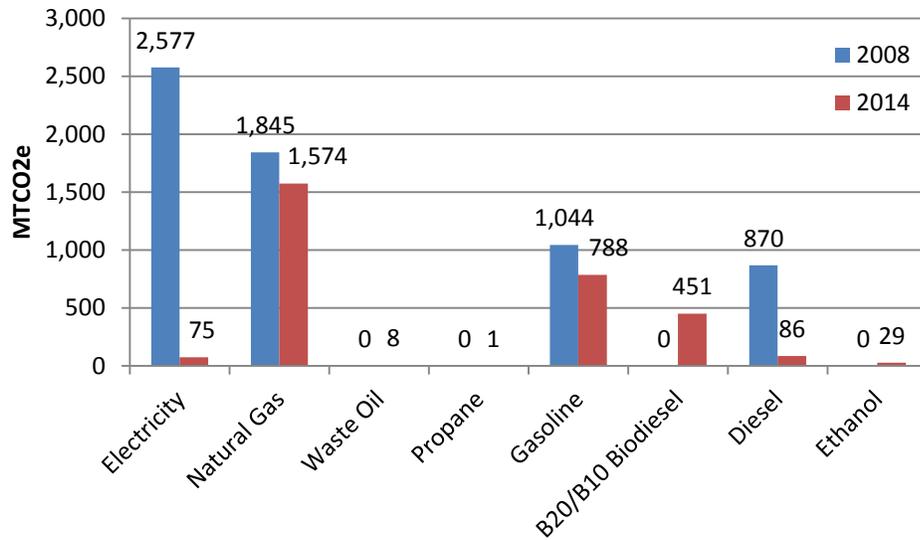


Figure 15. Comparison of emissions by fuel type

### Breakdown of Energy Use by Facility

Although the purchase of Green-e RECs reduces emissions from facilities’ electricity use, it does not necessarily equate to a reduction in actual energy use. Figure 16 provides the breakdown of energy use (MMBtu) by County facility, including electricity consumption as well as any natural gas consumption.

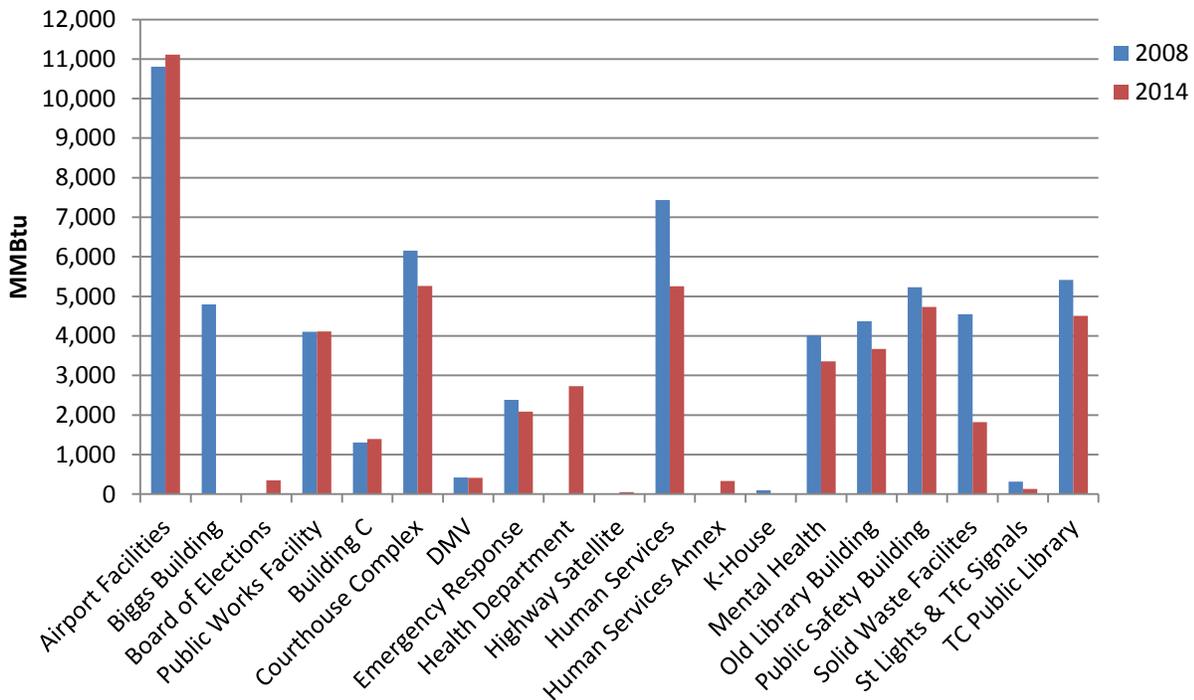


Figure 16. Comparison of energy use by facility

## Breakdown of Emissions from Vehicle Fuel Use by Department

Figure 17 provides the breakdown of the total CO<sub>2</sub>e emissions in 2008 and 2014 from vehicle fuel use by department. Additional information about changes within specific departments that affected vehicle fuel use changes between 2008 and 2014 may be found in Appendix D.

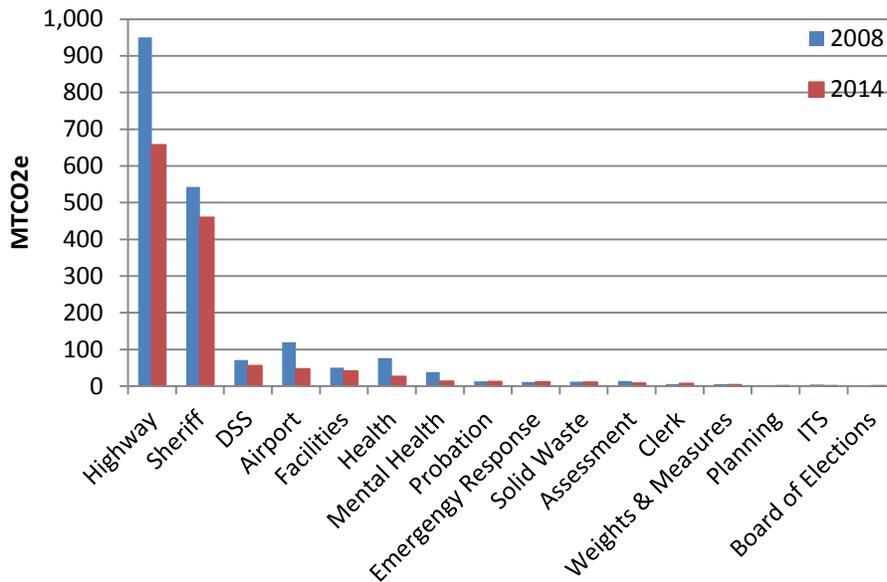


Figure 17. Comparison of emissions from vehicle fuel use by department

## Applying Latest Climate Science on Shale Gas to Results: 2008-2014

Between 2008 and 2014, there was a profound shift in how the natural gas consumed in the County was extracted from the ground, as well as new international recommendations on the time horizon and global warming potential (GWP) that should be used to calculate the GHG emissions for methane. While the results presented above are calculated using widely-accepted international protocols, it is important to look ahead at what may soon be modifications to those protocols to better understand the impacts to the climate of burning shale gas in the County and better inform near-term actions.

Studies conducted by local internationally-renowned experts, including Dr. Bob Howarth and Dr. Tony Ingraffea, have informed this section of the Inventory, with Dr. Howarth providing appropriate figures to include in these calculations. It is estimated that 5-19 percent of unburned methane leaks from production well to combustion in the home or business due to the techniques employed by the shale gas industry. The analysis below applies an average leakage factor of 12 percent to all natural gas consumed by County government operations. In 2008, the natural gas consumed in the County came from traditionally drilled vertical wells. Dr. Howarth advises that traditional extraction methods experience a 3.8 percent leakage rate. Therefore, a leakage factor of 3.8 percent was applied to methane consumed in 2008, as well.

In addition to the leakage of methane due to shale gas development and distribution, is the consideration of the appropriate timescale for GWP of methane. Methane is an extremely impactful GHG in the short-term, with a greenhouse warming effect of >100-fold more than carbon dioxide in the short-term. Given the current state of the Earth's climate, the Earth is predicted to warm by 1.5° C above the preindustrial baseline within the next 15 years and by 2° C within the next 35 years, giving new urgency to the role of methane in the short-term. Standard GHG accounting principles call for the use of the 100-year GWP for greenhouse gases, which is appropriate for the other

GHGs, however this analysis applies the 20-year GWP for methane of 86 to all methane emissions in both 2008 and 2014.

Using the results below, the County government has actually seen a 10 percent increase in its GHG emissions since 2008 (Table 3). Applying this conclusion to the Inventory calls for substantial and significant actions to reduce the community’s use of natural gas coming from hydro-fracked shale formations.

	2008 New Accounting 5th IPCC 20-yr GWP for Methane with 3.8% Leakage	2014 New Accounting 5th IPCC 20-yr GWP for Methane with 5% Leakage	2014 New Accounting 5th IPCC 20-yr GWP for Methane with 12% Leakage	2014 New Accounting 5th IPCC 20-yr GWP for Methane with 19% Leakage
MTCO <sub>2</sub> e from Leaked Methane	2,551	2,612	6,768	11,642
Total Government MTCO <sub>2</sub> e w/o Leakage	6,336	3,012	3,012	3,012
Total Government MTCO <sub>2</sub> e with Leakage	8,887	5,624	9,780	14,654
Percent Change from 2008 at 3.8% Leakage	n/a	-37%	10%	65%

**Table 3. Comparison of Emissions, Shale Gas Leakage 3.8% and 5-19% & 20-Year GWP for Methane 86**

## Next Steps for Reducing Greenhouse Gas Emissions from County Government Operations

Although Tompkins County has made significant reductions in its government emissions since 2008, plans are underway that will further reduce energy use and emissions.

### Energy Roadmap

The Tompkins County Energy Roadmap was identified as a priority of the 2020 Energy Strategy to implement specific initiatives to help the County and its community to achieve the first 20 percent reduction in emissions by 2020. Published in 2016, the Energy Roadmap evaluated local energy resources and developed scenarios to meet the 80 percent greenhouse gas emission reduction goal while meeting energy needs projected through 2050. The energy planning guidance provided in the Energy Roadmap, which is applicable to County government operations as well as the community, includes a short-term goal of achieving efficiency potential averaging 35 percent in existing buildings, and the following intermediate goals:

- Reduce natural gas use by 50 percent and grid electricity generated outside of Tompkins County by 24 percent from current levels.
- Develop 50 percent of solar potential, 20 percent of wind potential and 20 percent of micro-hydro potential and track progress.
- Develop 50 percent of biomass potential, and install significant numbers of ground and air source heat pumps particularly in new construction; buildings that use fuel oil, propane, or electric resistance heat; or when existing heating systems have surpassed their useful life
- Transition 50 percent of light vehicles from gasoline to electric and avoiding any growth in vehicle miles traveled are appropriate intermediate planning goals.

This guidance should inform the next steps the County takes to reduce emissions within its own operations and facilities.

### **Renewable Energy and Improved Efficiencies**

In March 2016, the Tompkins County Legislature authorized execution of a 20-year hydroelectric remote net metering agreement between the County and Gravity Renewables, Inc., which is renovating a hydroelectric plant in Waterloo, NY. The County will pay Gravity Renewables a fee to operate based on a kWh basis and in return will receive a credit on its electric bills for the electricity produced, which is expected to be approximately 63 percent of the County's electricity consumption.<sup>19</sup> The agreement provides the County with predictable electricity costs for this portion of its consumption, and assigns the environmental attributes of this renewable energy to the County to reduce its emissions.

Additionally, the County's recently completed New York Prize Microgrid Study (Stage I) and planned energy improvements to the Airport Terminal indicate that significant potential remains to improve energy efficiency and increase renewable energy generation. This could make up the balance of electricity needed for County government operations that will not be supplied through the agreement with Gravity Renewables. Given the great strides made in reducing emissions associated with electricity consumption, the Terminal improvements will also dramatically reduce natural gas use

### **Updating County Policies**

Tompkins County has a number of policies in place that encourage reduction in County government emissions including:

- Facilities Management and Workplace Environment Policy (Policy 06-09, adopted 1993 and modified 2009): addressing topics such as energy reduction, thermostat settings, and use of appliances in County buildings.
- Waste Reduction and Resource Management Policy (Policy 06-15, 2007): adopts procedures to reduce waste and to increase reuse, recycling, composting, and environmentally preferable purchasing programs; states additional goal of educating employees.
- Green Fleet Policy (Policy 01-44, 2009): calls for measuring performance of County-owned motor vehicles, having departments submit plans for reducing GHG, inventorying vehicles, and establishing a Fleet Management Team.
- Green Building Policy (Policy 01-47, 2013): adopts a minimum of the equivalent of LEED Silver green building standards for all new construction and major renovation of County-owned buildings.

Given the significant emissions and costs associated with the County vehicle fleet, plans are underway to update the Green Fleet Policy in 2016 and the County's first purchase of electric vehicles are also planned this year. This should result in better planning, purchasing, and monitoring of individual department fleets while further reducing emissions associated with the fleet. Once completed, additional policies can be reviewed to determine whether they are being implemented effectively and are adequate to assist the County in meeting its emissions goals.

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<sup>19</sup> Tompkins County Resolution 2016-53, adopted March 15, 2016, [https://tompkinscountyny.iqm2.com/Citizens/Detail\\_Legifile.aspx?ID=6202&highlightTerms=hydroelectric](https://tompkinscountyny.iqm2.com/Citizens/Detail_Legifile.aspx?ID=6202&highlightTerms=hydroelectric).

## **Electric Vehicles**

2014, Tompkins County received a grant to develop an electric vehicle infrastructure plan for Tompkins County, which included a review of charging stations and what would be needed to install them and where charging stations should be located. Recently, New York State has been making an effort to reduce the cost of electric vehicles and as part of the process has asked municipalities how many vehicles they might consider purchasing if costs were lower. Tompkins County is currently planning to purchase five electric vehicles for its fleet. As County parking lot projects are planned, the infrastructure needed underneath parking surfaces for charging stations will be installed to prepare for these vehicle purchases and the charging stations that they, and the growing fleet of privately-owned electric vehicles, will require.

## **EPA Green Power Partnership**

In September 2015, Tompkins County joined the U.S. EPA Green Power Partnership Program, which commits an organization to report its green power use annually and, given Tompkins County's electricity use, to procure at least 10 percent of the organization's electricity through green power.

## **Monitoring Progress**

The results of this Inventory will be used to inform the County's future efforts to reduce its GHG emissions and reduce consumption of energy in its government operations. In order to ensure these efforts achieve the desired results, additional monitoring will be needed. For example, future contracts to collect waste and recyclables from County facilities could include reporting of the weight of materials collected to calculate Scope 3 emissions from waste generated at County facilities, and a system for tracking employee commuting emissions could be established to track information that was not available for the purposes of this Inventory. Also, as the County investigates more efficient ways to track energy and vehicle fuel use, there are opportunities to more frequently monitor such data to track progress between larger full inventory efforts such as this one.

**Appendix A – 2014 Tompkins County Government Operations GHG Emissions Inventory Facilities Utility Use**

Department		MTCO2e	MTCO2e (%)	Energy (MMBtu)	Energy (%)	Cost	Cost (%)
TC Public Library	Electricity	130		2,391		\$81,165.67	
	Natural Gas	113		2,115		\$18,476.59	
<b>Subtotal TC Public Library</b>		<b>243</b>	<b>8.8%</b>	<b>4,506</b>	<b>8.8%</b>	<b>\$99,642.26</b>	<b>11.0%</b>
Human Services	Electricity	137		2,511		\$81,777.91	
	Natural Gas	146		2,746		\$23,859.31	
<b>Subtotal Human Services</b>		<b>283</b>	<b>10.2%</b>	<b>5,257</b>	<b>10.2%</b>	<b>\$105,637.22</b>	<b>11.7%</b>
Public Safety Building	Electricity	115		2,117		\$58,267.96	
	Natural Gas	139		2,619		\$23,360.12	
<b>Subtotal Public Safety Building</b>		<b>255</b>	<b>9.2%</b>	<b>4,736</b>	<b>9.2%</b>	<b>\$81,628.08</b>	<b>9.0%</b>
Courthouse Complex	Electricity	108		1,986		\$55,909.51	
	Natural Gas	174		3,274		\$27,709.86	
<b>Subtotal Courthouse Complex</b>		<b>282</b>	<b>10.2%</b>	<b>5,261</b>	<b>10.3%</b>	<b>\$83,619.37</b>	<b>9.3%</b>
Mental Health	Electricity	100		1,834		\$56,756.38	
	Natural Gas	81		1,523		\$13,322.43	
<b>Subtotal Mental Health</b>		<b>181</b>	<b>6.6%</b>	<b>3,356</b>	<b>6.5%</b>	<b>\$70,078.81</b>	<b>7.8%</b>
Emergency Response	Electricity	76		1,396		\$37,394.10	
	Natural Gas	37		694		\$6,628.13	
<b>Subtotal Emergency Response</b>		<b>113</b>	<b>4.1%</b>	<b>2,090</b>	<b>4.1%</b>	<b>\$44,022.23</b>	<b>4.9%</b>
Health Department	Electricity	54		988		\$29,582.27	
	Natural Gas	93		1,740		\$15,277.48	
<b>Subtotal Health Department</b>		<b>146</b>	<b>5.3%</b>	<b>2,728</b>	<b>5.3%</b>	<b>\$44,859.75</b>	<b>5.0%</b>
Old Library Building	Electricity	42		777		\$23,426.69	
	Natural Gas	154		2,896		\$24,111.46	
<b>Subtotal Old Library Building</b>		<b>196</b>	<b>7.1%</b>	<b>3,673</b>	<b>7.2%</b>	<b>\$47,538.15</b>	<b>5.3%</b>
Public Works Facility	Electricity	45		826		\$24,152.89	
	Natural Gas	169		3,172		\$27,222.74	
	Waste Oil	8		105		\$0.00	
	Propane	1		9		\$154.00	
<b>Subtotal Public Works Facility</b>		<b>222</b>	<b>8.0%</b>	<b>4,112</b>	<b>8.0%</b>	<b>\$51,529.63</b>	<b>5.7%</b>
Building C	Electricity	36		662		\$18,113.72	
	Natural Gas	39		731		\$6,771.75	
<b>Subtotal Building C</b>		<b>75</b>	<b>2.7%</b>	<b>1,393</b>	<b>2.7%</b>	<b>\$24,885.47</b>	<b>2.8%</b>
DMV	Electricity	8		150		\$5,188.67	
	Natural Gas	14		262		\$2,742.07	
<b>Subtotal DMV</b>		<b>22</b>	<b>0.8%</b>	<b>412</b>	<b>0.8%</b>	<b>\$7,930.74</b>	<b>0.9%</b>
Board of Elections	Electricity	4		65		\$2,567.24	
	Natural Gas	15		289		\$2,877.37	
<b>Subtotal Board of Elections</b>		<b>19</b>	<b>0.7%</b>	<b>353</b>	<b>0.7%</b>	<b>\$5,444.61</b>	<b>0.6%</b>
Highway Sallite	Electricity	3		48		\$3,673.09	
	Natural Gas	0		0		\$0.00	
<b>Subtotal Highway Sallite</b>		<b>3</b>	<b>0.1%</b>	<b>48</b>	<b>0.1%</b>	<b>\$3,673.09</b>	<b>0.4%</b>
Human Services Annex	Electricity	3		59		\$1,949.65	
	Natural Gas	14		272		\$3,028.70	
<b>Subtotal Human Services Annex</b>		<b>18</b>	<b>0.6%</b>	<b>330</b>	<b>0.6%</b>	<b>\$4,978.35</b>	<b>0.6%</b>
Airport Facilities	Electricity	258		4,731		\$119,960.56	
	Natural Gas	339		6,381		\$52,991.07	
<b>Subtotal Airport Facilities</b>		<b>597</b>	<b>21.6%</b>	<b>11,112</b>	<b>21.7%</b>	<b>\$172,951.63</b>	<b>19.1%</b>
Street Lights & Traffic Signals	Electricity	7		132		\$5,493.49	
	Natural Gas	0		0		\$0.00	
<b>total Street Lights &amp; Traffic Signals</b>		<b>7</b>	<b>0.3%</b>	<b>132</b>	<b>0.3%</b>	<b>\$5,493.49</b>	<b>0.6%</b>
Solid Waste Facilities	Electricity	52		948		\$40,495.38	
	Natural Gas	46		874		\$9,290.11	
<b>Subtotal Solid Waste Facilities</b>		<b>98</b>	<b>3.6%</b>	<b>1,822</b>	<b>3.6%</b>	<b>\$49,785.49</b>	<b>5.5%</b>
<b>Total</b>		<b>2,761</b>	<b>100.0%</b>	<b>51,322</b>	<b>100.0%</b>	<b>\$903,698.37</b>	<b>100.0%</b>

- Fuel use of the vehicle fleet and off-road vehicles

Department		Annual Fuel Use (U.S. Gallon)	Annual Fuel Use (%)	MTCO2e	MTCO2e (%)	Energy (MMBtu)	Energy (%)	Cost	Cost (%)
Sheriff	Diesel	136	0.1%	1	0.1%	19	0.1%	\$131.89	0.0%
	Ethanol (5.7% blend)	1,592	1.0%	13	1.0%	195	1.0%	\$693.26	0.1%
	Ethanol (10% blend)	244.27	0.2%	2	0.1%	30	0.1%	\$582.20	0.1%
	Gas	49,990	32.6%	443	32.7%	6,246	31.4%	\$149,466.36	26.9%
<b>Subtotal Sheriff</b>		<b>51,962</b>	<b>33.9%</b>	<b>459</b>	<b>33.9%</b>	<b>6,490</b>	<b>32.6%</b>	<b>\$150,873.71</b>	<b>27.2%</b>
DSS	Ethanol (5.7% blend)	12	0.0%	0	0.0%	1	0.0%	\$2,460.99	0.4%
	Ethanol (10% blend)	679	0.4%	5	0.4%	82	0.4%	\$91.45	0.0%
	Gas	5,681	3.7%	50	3.7%	710	3.6%	\$20,591.71	3.7%
<b>Subtotal DSS</b>		<b>6,373</b>	<b>4.2%</b>	<b>56</b>	<b>4.1%</b>	<b>793</b>	<b>4.0%</b>	<b>\$23,144.15</b>	<b>4.2%</b>
Health	Ethanol (5.7% blend)	17	0.0%	0	0.0%	2	0.0%	\$231.84	0.0%
	Ethanol (10% blend)	90	0.1%	1	0.1%	11	0.1%	\$52.58	0.0%
	Gas	2,867	1.9%	25	1.9%	358	1.8%	\$2,833.04	0.5%
<b>Subtotal Health</b>		<b>2,974</b>	<b>1.9%</b>	<b>26</b>	<b>1.9%</b>	<b>371</b>	<b>1.9%</b>	<b>\$3,117.46</b>	<b>0.6%</b>
Highway	Diesel	4,715	3.1%	48	3.6%	651	3.3%	\$21,265.50	3.8%
	B10	23,574	15.4%	217	16.0%	3,232	16.3%	\$106,661.40	19.2%
	B20	28,522	18.6%	233	17.2%	3,881	19.5%	\$129,046.75	23.3%
	Ethanol (5.7% blend)	72	0.0%	1	0.0%	9	0.0%	\$857.87	0.2%
	Gas	18,119	11.8%	159	11.8%	2,264	11.4%	\$70,737.00	12.8%
<b>Subtotal Highway</b>		<b>75,003</b>	<b>48.9%</b>	<b>657</b>	<b>48.5%</b>	<b>10,037</b>	<b>50.5%</b>	<b>\$328,568.52</b>	<b>59.2%</b>
Probation	Ethanol (10% blend)	196	0.1%	2	0.1%	24	0.1%	\$13.15	0.0%
	Gas	1,192	0.8%	11	0.8%	149	0.7%	\$3,611.21	0.7%
<b>Subtotal Probation</b>		<b>1,388</b>	<b>0.9%</b>	<b>12</b>	<b>0.9%</b>	<b>173</b>	<b>0.9%</b>	<b>\$3,624.36</b>	<b>0.7%</b>
Emergency Response	Diesel	278	0.2%	3	0.2%	38	0.2%	\$950.67	0.2%
	Gas	973	0.6%	9	0.6%	122	0.6%	\$2,196.53	0.4%
<b>Subtotal Emergency Response</b>		<b>1,252</b>	<b>0.8%</b>	<b>11</b>	<b>0.8%</b>	<b>160</b>	<b>0.8%</b>	<b>\$3,147.20</b>	<b>0.6%</b>
Mental Health	Ethanol (5.7% blend)	16	0.0%	0	0.0%	2	0.0%	\$1,531.06	0.3%
	Ethanol (10% blend)	518	0.3%	4	0.3%	63	0.3%	\$41.49	0.0%
	Gas	1,029	0.7%	9	0.7%	129	0.6%	\$3,120.84	0.6%
<b>Subtotal Mental Health</b>		<b>1,563</b>	<b>1.0%</b>	<b>13</b>	<b>1.0%</b>	<b>193</b>	<b>1.0%</b>	<b>\$4,693.39</b>	<b>0.8%</b>
Solid Waste	Gas	1,224	0.8%	11	0.8%	153	0.8%	\$3,683.21	0.7%
<b>Subtotal Solid Waste</b>		<b>1,224</b>	<b>0.8%</b>	<b>11</b>	<b>0.8%</b>	<b>153</b>	<b>0.8%</b>	<b>\$3,683.21</b>	<b>0.7%</b>
Assessment	Ethanol (5.7% blend)	13	0.0%	0	0.0%	2	0.0%	\$176.73	0.0%
	Ethanol (10% blend)	60	0.0%	0	0.0%	7	0.0%	\$82.98	0.0%
	Gas	831	0.5%	7	0.5%	104	0.5%	\$2,514.68	0.5%
<b>Subtotal Assessment</b>		<b>905</b>	<b>0.6%</b>	<b>8</b>	<b>0.6%</b>	<b>113</b>	<b>0.6%</b>	<b>\$2,774.39</b>	<b>0.5%</b>
Clerk	Ethanol (10% blend)	27	0.0%	0	0.0%	3	0.0%	\$223.72	0.0%
	Gas	736	0.5%	7	0.5%	92	0.5%	\$4,862.08	0.9%
<b>Subtotal Clerk</b>		<b>763</b>	<b>0.5%</b>	<b>7</b>	<b>0.5%</b>	<b>95</b>	<b>0.5%</b>	<b>\$5,085.80</b>	<b>0.9%</b>
Weights & Measures	Gas	396	0.3%	3	0.3%	49	0.2%	\$1,201.57	0.2%
<b>Subtotal Weights &amp; Measures</b>		<b>396</b>	<b>0.3%</b>	<b>3</b>	<b>0.3%</b>	<b>49</b>	<b>0.2%</b>	<b>\$1,201.57</b>	<b>0.2%</b>
Planning	Ethanol (5.7% blend)	5	0.0%	0	0.0%	1	0.0%	\$71.88	0.0%
	Ethanol (10% blend)	24	0.0%	0	0.0%	3	0.0%	\$45.00	0.0%
	Gas	102	0.1%	1	0.1%	13	0.1%	\$318.17	0.1%
<b>Subtotal Planning</b>		<b>131</b>	<b>0.1%</b>	<b>1</b>	<b>0.1%</b>	<b>16</b>	<b>0.1%</b>	<b>\$435.05</b>	<b>0.1%</b>
ITS	Gas	86	0.1%	1	0.1%	11	0.1%	\$255.21	0.0%
<b>Subtotal ITS</b>		<b>86</b>	<b>0.1%</b>	<b>1</b>	<b>0.1%</b>	<b>11</b>	<b>0.1%</b>	<b>\$255.21</b>	<b>0.0%</b>
Airport	Diesel	3,293	2.1%	34	2.5%	455	2.3%	\$2,702.94	0.5%
	Gas	1,519	1.0%	13	1.0%	190	1.0%	\$1,701.11	0.3%
<b>Subtotal Airport</b>		<b>4,811</b>	<b>3.1%</b>	<b>47</b>	<b>3.5%</b>	<b>644</b>	<b>3.2%</b>	<b>\$4,404.05</b>	<b>0.8%</b>
Facilities	Diesel	19	0.0%	0	0.0%	3	0.0%	\$944.10	0.2%
	B20	230	0.1%	2	0.1%	31	0.2%	\$66.35	0.0%
	Gas	4,385	2.9%	39	2.8%	548	2.8%	\$18,744.38	3.4%
<b>Subtotal Facilities</b>		<b>4,633</b>	<b>3.0%</b>	<b>41</b>	<b>3.0%</b>	<b>582</b>	<b>2.9%</b>	<b>\$19,754.83</b>	<b>3.6%</b>
Board of Elections	Gas	5	0.0%	0	0.0%	1	0.0%	\$15.38	0.0%
<b>Subtotal Board of Elections</b>		<b>5</b>	<b>0.0%</b>	<b>0</b>	<b>0.0%</b>	<b>1</b>	<b>0.0%</b>	<b>\$15.38</b>	<b>0.0%</b>
<b>Total</b>		<b>153,467</b>	<b>100.0%</b>	<b>1,354</b>	<b>100.0%</b>	<b>19,881</b>	<b>100.0%</b>	<b>\$554,778.28</b>	<b>100.0%</b>

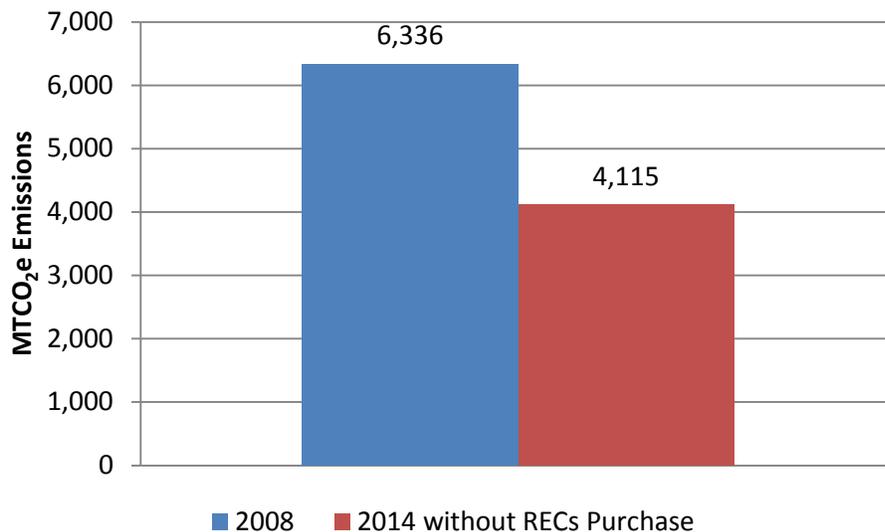
## Appendix B – Updated 2008 Tompkins County Government Operations GHG Emissions Inventory

Buildings & Facilities		MTCO2e	MTCO2e (%)	Energy (MMBtu)	Cost
Biggs B	Electricity	121	1.9%	1,255	\$44,328
	Natural Gas	189	3.0%	3,546	\$46,544
Subtotal Biggs B		309	4.9%	4,801	\$90,872
Building C	Electricity	71	1.1%	740	\$26,130
	Natural Gas	30	0.5%	567	\$7,436
Subtotal Building C		101	1.6%	1,307	\$33,566
Public Works Facility	Electricity	89	1.4%	928	\$32,771
	Natural Gas	169	2.7%	3,176	\$41,679
Subtotal Public Works Facility		258	4.1%	4,104	\$74,450
Courthouse Complex	Electricity	223	3.5%	2,318	\$81,892
	Natural Gas	204	3.2%	3,837	\$50,367
Subtotal Courthouse Complex		427	6.7%	6,155	\$132,259
DMV	Electricity	14	0.2%	150	\$5,303
	Natural Gas	14	0.2%	271	\$3,553
Subtotal DMV		29	0.5%	421	\$8,856
Emergency Response	Electricity	145	2.3%	1,509	\$53,299
	Natural Gas	47	0.7%	876	\$11,491
Subtotal Emergency Response		192	3.0%	2,385	\$64,790
Human Services Building	Electricity	388	6.1%	4,033	\$142,458
	Natural Gas	181	2.9%	3,399	\$44,613
Subtotal Human Services Building		569	9.0%	7,432	\$187,071
K-House	Electricity	1	0.0%	12	\$427
	Fuel Oil (#1 2 4)	6	0.1%	87	\$2,179
Subtotal K-House		8	0.1%	99	\$2,606
TC Public Library	Electricity	283	4.5%	2,943	\$103,981
	Natural Gas	132	2.1%	2,473	\$32,457
Subtotal TC Public Library		415	6.5%	5,416	\$136,438
Mental Health	Electricity	194	3.1%	2,013	\$71,113
	Natural Gas	106	1.7%	2,000	\$26,252
Subtotal Mental Health		300	4.7%	4,013	\$97,365
Old Library Building	Electricity	94	1.5%	975	\$34,435
	Natural Gas	181	2.9%	3,400	\$44,630
Subtotal Old Library Building		275	4.3%	4,375	\$79,065
Public Safety Building	Electricity	240	3.8%	2,497	\$88,229
	Natural Gas	145	2.3%	2,734	\$35,880
Subtotal Public Safety Building		386	6.1%	5,231	\$124,109
<b>SUBTOTAL</b>		<b>3,269</b>	<b>51.6%</b>	<b>45,739</b>	<b>\$1,031,447</b>
Street Lights & Traffic Signals		MTCO2e	MTCO2e (%)	Energy (MMBtu)	Cost
Integry	Electricity	15	0.2%	160	\$4,132
	Subtotal Integry		15	0.2%	160
NYSEG	Electricity	15	0.2%	159	\$2,685
	Subtotal NYSEG		15	0.2%	159
<b>SUBTOTAL</b>		<b>31</b>	<b>0.5%</b>	<b>319</b>	<b>\$6,817</b>
Airport Facilities		MTCO2e	MTCO2e (%)	Energy (MMBtu)	Cost
Terminal	Electricity	372	5.9%	3,865	\$29,225
	Natural Gas	233	3.7%	4,374	\$9,896
Subtotal Terminal		605	9.5%	8,239	\$39,121
Crash Fire & Rescue	Electricity	99	1.6%	1,031	\$10,585
	Natural Gas	76	1.2%	1,438	\$17,954
Subtotal Crash Fire & Rescue		176	2.8%	2,469	\$28,539
Outdoor Lighting (Poles)	Electricity	1	0.0%	14	\$646
	Subtotal Outdoor Lighting (Poles)		1	0.0%	14
T-Hangar 1	Electricity	5	0.1%	49	\$687
	Subtotal T-Hangar 1		5	0.1%	49
T-Hangar 2	Electricity	4	0.1%	38	\$688
	Subtotal T-Hangar 2		4	0.1%	38
<b>SUBTOTAL</b>		<b>790</b>	<b>12.5%</b>	<b>10,809</b>	<b>\$69,681</b>

Solid Waste Facilities		MTCO2e	MTCO2e (%)	Energy (MMBtu)	Cost
160 Commercial Avenue	Electricity	157	2.5%	1,628	\$34,102
	Natural Gas	110	1.7%	2,062	\$14,393
Subtotal 160 Commercial Avenue		266	4.2%	3,690	\$48,495
Hillview Landfill - NYSEG	Electricity	0	0.0%	0	\$186
		0	0.0%	0	\$186
Subtotal Hillview Landfill - NYSEG		0	0.0%	0	\$186
Solid Waste Office-Hess Corporation	Natural Gas	10	0.2%	190	\$1,990
		10	0.2%	190	\$1,990
Subtotal Hess Corporation		10	0.2%	190	\$1,990
Solid Waste Office-Integry	Electricity	22	0.3%	224	\$5,784
		22	0.3%	224	\$5,784
Subtotal Integry		22	0.3%	224	\$5,784
Solid Waste Office-NYSEG	Electricity	22	0.3%	224	\$2,220
	Natural Gas	12	0.2%	223	\$952
Subtotal NYSEG		33	0.5%	447	\$3,172
<b>SUBTOTAL</b>		<b>331</b>	<b>5.2%</b>	<b>4,551</b>	<b>\$59,627</b>
On-Road Vehicle Fleet		MTCO2e	MTCO2e (%)	Energy (MMBtu)	Cost
Airport	Diesel	86	1.4%	1,171	\$0
	Gasoline	33	0.5%	461	\$47
Subtotal Airport		119	1.9%	1,632	\$47
Central Services	Gasoline	5	0.1%	69	\$1,526
		5	0.1%	69	\$1,526
Subtotal Central Services		5	0.1%	69	\$1,526
Assessment	Gasoline	14	0.2%	189	\$4,175
		14	0.2%	189	\$4,175
Subtotal Assessment		14	0.2%	189	\$4,175
DSS	Gasoline	71	1.1%	985	\$21,084
		71	1.1%	985	\$21,084
Subtotal DSS		71	1.1%	985	\$21,084
Emergency Response	Gasoline	12	0.2%	161	\$3,666
		12	0.2%	161	\$3,666
Subtotal Emergency Response		12	0.2%	161	\$3,666
Facilities	Gasoline	50	0.8%	698	\$15,154
		50	0.8%	698	\$15,154
Subtotal Facilities		50	0.8%	698	\$15,154
Health	Gasoline	76	1.2%	1,056	\$24,065
		76	1.2%	1,056	\$24,065
Subtotal Health		76	1.2%	1,056	\$24,065
Highway	Diesel	783	12.4%	10,630	\$257,773
	Gasoline	167	2.6%	2,315	\$50,701
Subtotal Highway		950	15.0%	12,945	\$308,474
ITS	Gasoline	4	0.1%	56	\$1,228
		4	0.1%	56	\$1,228
Subtotal ITS		4	0.1%	56	\$1,228
Mental Health	Gasoline	38	0.6%	527	\$11,844
		38	0.6%	527	\$11,844
Subtotal Mental Health		38	0.6%	527	\$11,844
Planning	Gasoline	2	0.0%	32	\$719
		2	0.0%	32	\$719
Subtotal Planning		2	0.0%	32	\$719
Probation	Gasoline	13	0.2%	177	\$3,955
		13	0.2%	177	\$3,955
Subtotal Probation		13	0.2%	177	\$3,955
Sheriff	Transit Bus Diesel	543	8.6%	7,534	\$165,824
		543	8.6%	7,534	\$165,824
Subtotal Sheriff		543	8.6%	7,534	\$165,824
Solid Waste	Gasoline	12	0.2%	171	\$3,838
		12	0.2%	171	\$3,838
Subtotal Solid Waste		12	0.2%	171	\$3,838
Weights and Measures	Gasoline	5	0.1%	67	\$1,501
		5	0.1%	67	\$1,501
Subtotal Weights and Measures		5	0.1%	67	\$1,501
<b>SUBTOTAL</b>		<b>1,914</b>	<b>30.2%</b>	<b>26,299</b>	<b>\$567,100</b>
<b>TOTAL</b>		<b>6,336</b>	<b>100.0%</b>	<b>87,717</b>	<b>\$1,734,672</b>

## Results: 2014 Government GHG Emissions Inventory and Energy Flow Without Green-e RECs

Tompkins County has been purchasing Green-e Energy Certified Renewable Energy Credits (Green-e RECs) to offset 100 percent of the County’s electricity usage since November 2012.<sup>1</sup> Purchased RECs allow the purchaser, as opposed to the generation source, to claim the environmental attributes for the renewable electricity consumed. Although Tompkins County can claim the renewable energy use for the Green-e RECs it purchases for its government operations, it is important to consider the County government’s emissions without the RECs to gain a clearer understanding of total emissions if the County were not able to take credit for renewable energy generated by other parties. The information below provides a second version of the inventory calculations without the emissions reductions attributed to the purchase of Green-e RECs.

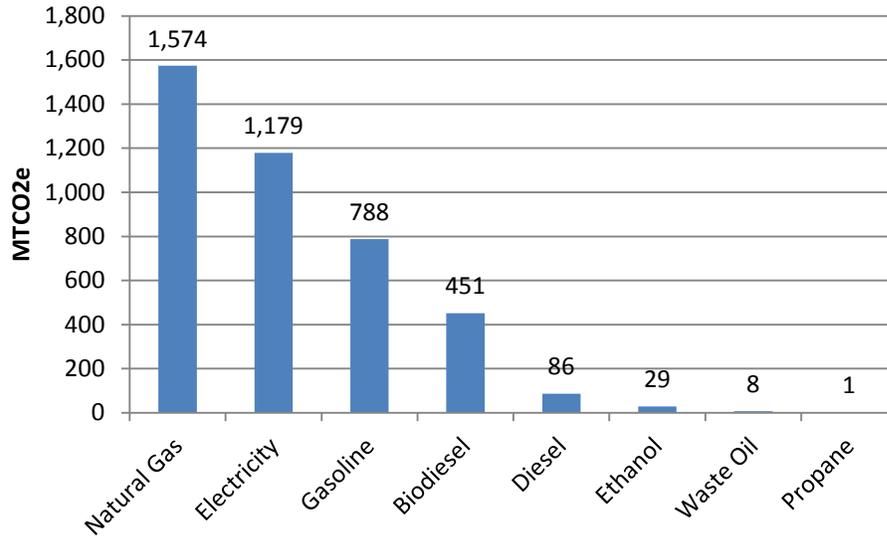


**Figure 18. Total MTCO<sub>2</sub>e emissions in 2008 and 2014 without RECs purchase**

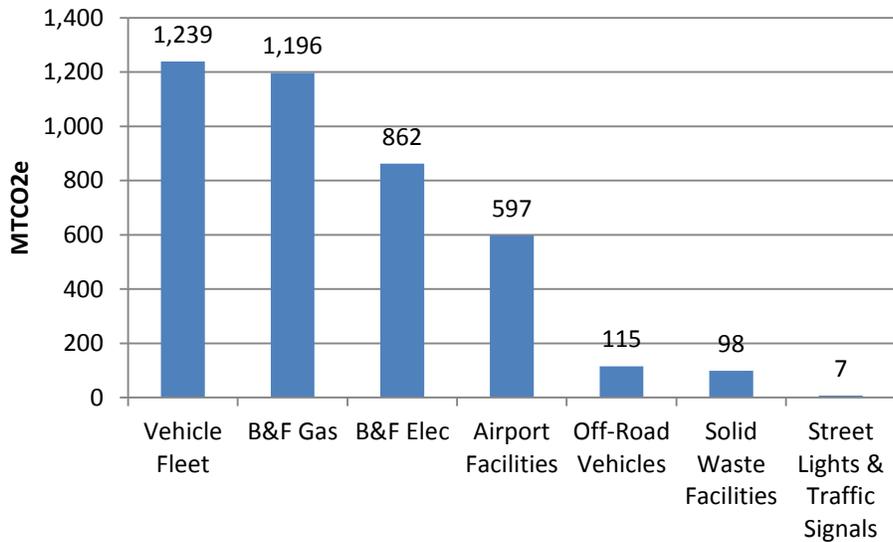
The total MTCO<sub>2</sub>e emissions from Tompkins County government operations in 2014 were 4,115 MTCO<sub>2</sub>e when RECs are excluded. In 2008, County government operations emitted 6,336 MTCO<sub>2</sub>e. Tompkins County government emissions decreased by 35.0% between 2008 and 2014 when emissions reductions from purchased RECs are excluded (Figure 18). Even without the emissions reduction benefits of the RECs, County government emissions reductions have already exceeded the goal of 20 percent emissions reductions by 2020, and are well ahead of schedule to meet the 80 percent emissions reduction goal by 2050.

As shown in Figures 19 and 20, without the Green-e RECs, electricity moves ahead of vehicle fuels to become the second highest emissions fuel type, and Buildings & Facilities electricity moves to become the third highest sector for emissions.

<sup>1</sup> In reality, the County used 403,913 kWh more electricity than anticipated in the purchase agreement, so emissions from this additional electricity are included in the main body of the report, which otherwise assigns no emissions to the 6,100,000 kWh of electricity covered by the Green-e RECs purchase.



**Figure 19. Breakdown of total CO<sub>2</sub>e emission by fuel type without accounting for Green-e-Certified RECs purchase**



**Figure 20. Breakdown of total CO<sub>2</sub>e emission by sector without accounting for Green-e-Certified RECs purchase**

**Buildings and Facilities**

Buildings and facilities operated by the County used 38,255 MMBtu of energy and generated 2,058 MTCO<sub>2</sub>e in 2014. Producing 50.0% of all emissions, buildings and facilities continue to be the largest emitters as they have been in the three previous County government emissions inventories.

**Vehicle Fleet**

The County vehicle fleet included 255 vehicles in 2014 and was the second largest source of emissions, as it has been in previous inventories. The fleet used 18,092 MMBtu of energy, and generating 1,239 MTCO<sub>2</sub>e, representing 30.1% of County government emissions.

### Airport Facilities

The County’s airport facilities include the airport terminal and its parking lot lights, three hangars, the Crash Fire and Rescue Building, and the Sand Storage Building. These facilities used 11,112 MMBtu of energy and generated 597 MTCO<sub>2</sub>e in 2014, representing 14.5% of County government emissions.

### Off-Road Vehicles

The County’s off-road vehicles include pick-up trucks, dump trucks, fire trucks, and equipment such as forklift, loader, and mower at both the Airport and Highway Division. These facilities used 1,789 MMBtu of energy and generated 115 MTCO<sub>2</sub>e in 2014, representing 2.8% of County government emissions.

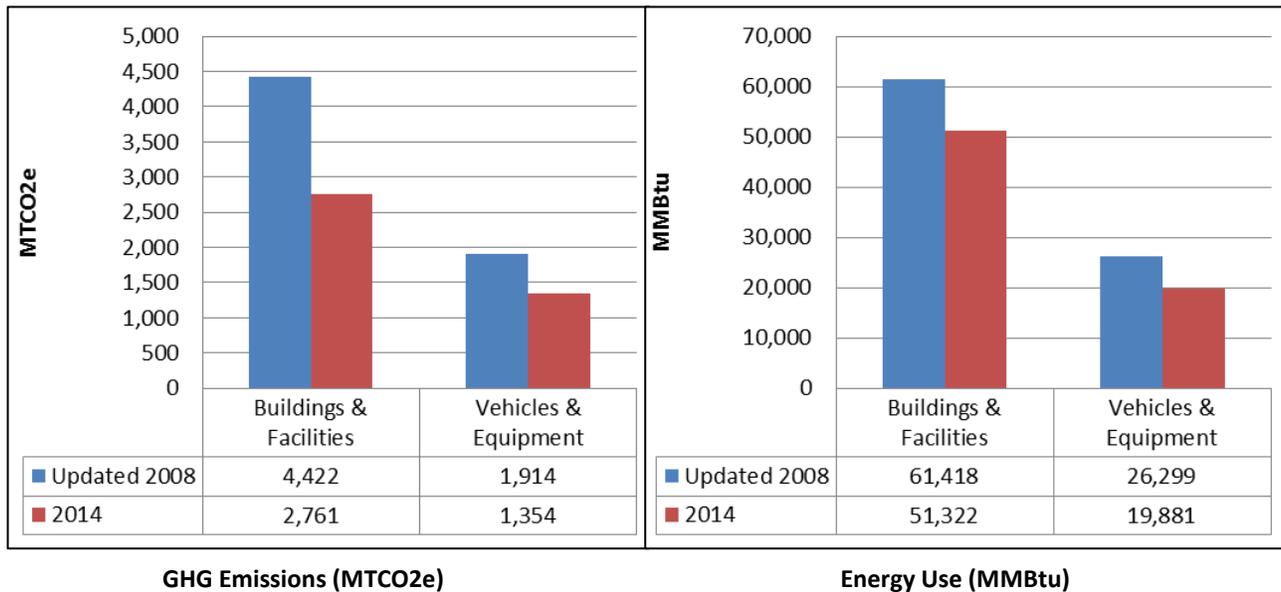
### Solid Waste Facilities

The County’s solid waste facilities include the Solid Waste Office, the Recycling Center, and the Solid Waste - Household Hazardous Waste Building. These facilities used 1,822 MMBtu of energy and generated 98 MTCO<sub>2</sub>e in 2014, representing 2.4% of County government emissions.

### Street Lights and Traffic Signals

The County’s airport facilities include the airport terminal and its parking lot lights, three hangars, the Crash Fire and Rescue Building, and the Sand Storage Building. These facilities used 132 MMBtu of energy and generated 7 MTCO<sub>2</sub>e in 2014, representing 0.2 percent of County government emissions.

## Comparison of Emissions and Energy Use 2008-2014 Without Green-e RECs

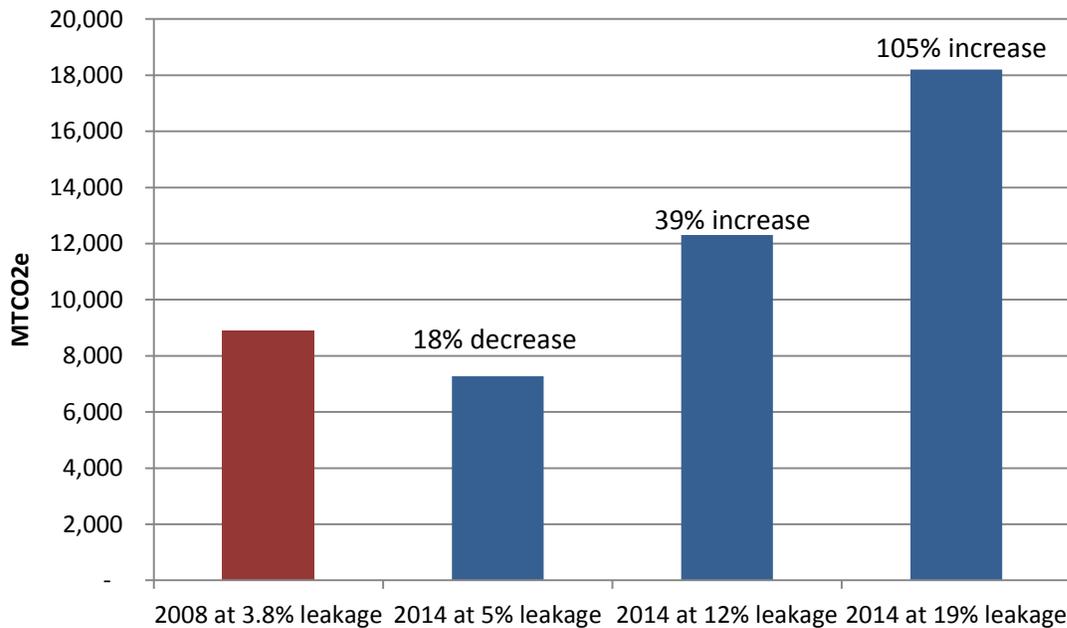


**Figure 21. 2014 GHG Emissions and Energy Use without RECs purchase**

The County government has two overarching sectors (1) Buildings & Facilities, which include electricity and thermal heating for all County buildings and facilities, including the Airport, Solid Waste Facilities, and (2) Vehicles & Equipment, which includes both on- and off-road vehicles and equipment powered by vehicle fuels. Without the emissions reduction benefits of the Green-e RECs, the increase in conventionally generated electricity results in a closer correlation between energy use and emissions.

## Applying Latest Climate Science on Shale Gas to Results: 2008-2014

Between 2008 and 2014 the source of the gas used in the community, including by County government, transitioned from wells drilled through conventional methods to fracked gas, primarily coming from the Marcellus Shale in Pennsylvania. Emissions associated with fracked shale gas are calculated extremely differently depending on whether current accounting methods or evolving climate science accounting methods are applied. If the new accounting is applied to natural gas extracted from shale using fracking, the County government has not seen a remarkable 35 percent reduction in emissions without its purchase of Green-e RECs, but instead has *increased* emissions by 39 percent between 2008-2014 if the 20-year global warming potential and mid-range overall leakage rate of 12% are applied for methane emissions (Figure 18, Table 4. This is due to direct natural gas use as well as the use of electricity generated using natural gas. Applying this conclusion to the Inventory calls for rapidly replacing all County electricity use with renewably generated electricity and developing strategies to dramatically reduce reliance on natural gas.



**Figure 22. GHG Emissions - New Shale Gas Accounting**

	2014 with 100-yr GWP and without Leakage	2014 New Accounting 5th IPCC 20-yr GWP for Methane with 5% Leakage	2014 New Accounting 5th IPCC 20-yr GWP for Methane with 12% Leakage	2014 New Accounting 5th IPCC 20-yr GWP for Methane with 19% Leakage
MTCO2e from Leaked Methane	n/a	3,612	8,192	14,092
Total Government MTCO2e with Leakage	4,115	7,277	12,307	18,207

**Table 4. 2014 Emissions as 5%, 12% and 19% Methane Leakage and GWP of 86**

## 2014 Greenhouse Gas Emissions Inventory Findings for Individual County Facilities<sup>19</sup>

In addition to changes specific to individual County facilities and department fleets between 2008 and 2014, several factors more generally affect electricity, natural gas, and fuel use across numerous County facilities and department fleets.

**Solar PV Systems.** The County has six leased solar PV systems installed on the following buildings: Building C; Emergency Response Center; Health Department; Human Services Annex; Human Services Building; Public Safety Building; and the Public Works Building. Together with the system the County owns at the Tompkins County Public Library, these solar panels can provide some shading and insulation benefits that slightly reduce the need for cooling in summer.

**Heating and cooling degree days.** The winter and summer of 2014 were cooler than 2008, resulting in the need for more natural gas heating in the winter and less electricity to cool in the summer.

**Building use.** Changes in occupancy, occupant behavior, and electronics/equipment used inside the building may affect both a building’s need for climate control and electricity use. Known changes are noted in the individual building profiles.

**Fuel efficiency improvements.** Vehicle fuel efficiency standards have improved since 2008, meaning that vehicles purchased since the 2008 are generally more fuel efficient than older vehicles of a similar class.

### Airport Facilities

#### Energy Use

Airport Facilities include the Terminal, Crash Fire & Rescue, and Sand Storage buildings, along with the Airport parking lot lights, T Hangar I, T Hangar II, and the Old IHA Hangar. Between 2008 and 2014, Airport Facilities reduced electricity use by 74,074 kWh and increased natural gas use by 5,694 therms. However, neither the Old IHA (Ithaca Hangar Association) Hangar nor the Sand Storage Building’s energy use was included in the 2008 inventory. Without these new additions, the Airport Facilities’ electricity use would have decreased by 6.3% and natural gas use would have decreased by 3.3%.

Facility	Electricity Use (kWh)			Natural Gas Use (therms)		
	2008	2014	% Change	2008	2014	% Change
Airport Facilities	1,460,128	1,386,054	-5.1%	58,118	63,812	9.8%
County Average*	574,675	474,137	-17.5%	25,848	22,739	-12.0%

*\*Note: Excludes facilities added or subtracted between 2008-2014*

<sup>19</sup> Note that the emissions listed below do not include Green-e RECs, since the emissions reduction from these RECs are applied to the overall County emissions rather than to specific facilities.

## Vehicle Fuel Use

Since 2008 a new tracking system for fuel pumping has been implemented. The Airport's vehicle/equipment fuel use decreased by 7,329 gallons, but some of this reduction may be due to the greater accuracy of fuel data available in the new system.

Vehicle Fuel Use (gallons)			
Department	2008	2014	% Change
Airport	12,140	4,811	-60.4%
County Average	12,639	9,592	-24.1%

\* 2014 data was not available, so 2015 fueling information has been used as a proxy for 2014.

## Emissions

Airport Facilities' emissions decreased by 24.4%, or 193 MTCO<sub>2e</sub>, between 2008 and 2014. The associated changes in emissions from vehicle use between 2008 and 2014 are also detailed below. On average, County facilities reduced emissions by 44.9% and vehicle emissions declined by 29.2%.

Facility Emissions (MTCO <sub>2e</sub> )				Vehicle Emissions (MTCO <sub>2e</sub> )			
Facility	2008	2014	% Change	Department	2008	2014	% Change
Airport Facilities	790	597	-24.4%	Airport	119	47	-60.7%

\* Note: Facility emissions do not include Green-e RECs

## Reasons for Changes

- 1) *Energy Performance Contract with Johnson Controls, Inc.* The facility improvement measures (FIMs) that took place in the Airport Terminal include a lighting upgrade for the Terminal and Crash Fire & Rescue Building.
- 2) *Changes in fuel tracking.* In 2008 the filling of fuel tanks used by the Airport was used in calculating total fuel use, even though all of that fuel may not have been consumed by Airport vehicles and equipment during that calendar year. The data used for 2014 benefit from a new tracking system that indicates the actual fuel from those tanks consumed by Airport vehicles and equipment. Therefore, the 2015 data, used as a proxy for 2014, more accurately represents the actual fuel pumped from these tanks for use in on- and off-road vehicles/equipment.
- 3) *Changes in vehicle and equipment use.* Since 2008, the frequency of grass mowing has been reduced, and the vehicles and equipment used for snow removal are no longer left outside idling during storms when not in active use.
- 4) *Vehicle and fuel improvements.* The Airport replaced some vehicles and equipment after the 2008 inventory, benefiting from improvements to fuel efficiency standards and the addition of an all-electric vehicle.
- 5) *Additional buildings.* The Airport took over the Old IHA Hangar from the Ithaca Hangar Association in January 2009. In 2012, the Sand Storage Building was constructed for the Airport's use. Therefore, neither building was part of the 2008 inventory.

## Board of Elections Training and Storage Facility

### Energy Use

The County did not begin leasing the Board of Election’s Training and Storage Facility space until late 2008, therefore a comparison of energy use between the two inventories is not possible. In addition to its use as storage for electronic voting machines and as a training site for election inspectors of the machines, until late 2013 it also housed the office of the Tompkins County Soil and Water Conservation District. The County rents rather than owns the building, but is responsible for the energy used at the facility.

Facility	Electricity Use (kWh)			Natural Gas Use (therms)		
	2008	2014	% Change	2008	2014	% Change
Board of Elections T&S	0	18,912	NA	0	2,886	NA

### Vehicle Fuel Use

There is no vehicle fuel use for this facility because the Board of Election’s vehicle fuel use is provided in information regarding Building C, its primary office.

### Emissions

There are no associated emissions from vehicle use since vehicle fuel use is associated with Building C, the primary home of the Board of Elections.

Facility Emissions (MTCO <sub>2</sub> e)			
Facility	2008	2014	% Change
Board of Elections T&S	0	19	NA

\* Note: Facility emissions do not include Green-e RECs

## Building C

### Energy Use

Building C houses the Assessment and Information Technology Services (ITS) Departments along with the Board of Elections. Between 2008 and 2014, Building C reduced its electricity use by 22,762 kWh and increased its natural gas use by 1,640 therms.

Facility	Electricity Use (kWh)			Natural Gas Use (therms)		
	2008	2014	% Change	2008	2014	% Change
Building C	216,720	193,958	-10.5%	5,666	7,306	28.9%
County Average*	574,675	474,137	-17.5%	25,848	22,739	-12.0%

\*Note: Excludes facilities added or subtracted between 2008-2014

## Vehicle Fuel Use

In 2010 both the Assessment and ITS Departments added a hybrid car to their fleets and the ITS fleet was cut from two vehicles to one hybrid car. The Board of Elections maintains a fuel card, but not its own vehicle, so much of its reduction comes from the ability to borrow a hybrid vehicle from the Assessment Department.

Vehicle Fuel Use (gallons)			
Department	2008	2014	% Change
Assessment	1,518	905	-40.4%
Board of Elections	14	5	-66.0%
ITS	450	86	-80.9%
<i>County Average</i>	<i>12,639</i>	<i>9,592</i>	<i>-24.1%</i>

## Emissions

Building C's facility emissions decreased by 26.0%, or 26 MTCO<sub>2</sub>e, between 2008 and 2014. The associated changes in emissions from vehicle use between 2008 and 2014 are also detailed below. On average, County facilities reduced emissions by 44.9% and vehicle emissions declined by 29.2%.

Facility Emissions (MTCO <sub>2</sub> e)				Vehicle Emissions (MTCO <sub>2</sub> e)			
Facility	2008	2014	% Change	Department	2008	2014	% Change
Building C	101	75	-26.0%	Assessment	14	8	-41.5%
				Board of Elections	0	0	NA
				ITS	4	1	-80.9%

\* Note: Facility emissions do not include Green-e RECs

## Reasons for Changes

- 1) *Energy Performance Contract with Johnson Controls, Inc.* The facility improvement measures (FIMs) that took place at Building C include lighting upgrades and improvements to the building envelope, and installation of plug load controls. Johnson controls suspects that adjustments of space set points and schedules for heating may be contributing to increased use of natural gas.
- 2) *Generator.* A natural gas-powered generator provides back-up power to the building and its computer servers and other equipment. Although there are no records of generator use between 2008 and 2014 beyond normal testing, it is possible that some undocumented generator use would contribute to spikes in natural gas use.
- 3) *HVAC.* Occupants in Building C report wide discrepancies in heating and cooling throughout the building, likely resulting in increased energy use, particularly as heating systems consuming natural gas are turned on or thermostats raised to offset cold offices.
- 4) *Vehicle and fuel improvements.* Fuel use reductions stem from the ITS fleet replacing two conventional vehicles with a single hybrid car, and the addition of one hybrid car to the Assessment Department fleet which the Board of Elections borrows as needed. The Assessment Department had two fewer field staff positions in 2014 than it did in 2008, which reduces the number of staff members driving department vehicles. Also, 2008 was a full revaluation year so Assessment staff members were out in the field much more than in 2014, which was a more typical year.
- 5) *Staff reductions.* The Assessment Department decreased by 6 Full Time Equivalent (FTE) staff members between 2008 and 2014. This reduced the computers, monitors, office lights, and other appliances used by staff.

## Courthouse Complex

### Energy Use

The Courthouse Complex includes the Main Courthouse, Daniel D. Tompkins Building (or Old Courthouse), and the Old Jail. The Courthouse Complex houses the State Court System, District Attorney's Office, County Clerk's Office, and County Legislature, as well as the County Administration, Finance, Personnel, and Planning Departments. Between 2008 and 2014, the Courthouse Complex reduced its electricity use by 97,200 kWh and reduced its natural gas use by 5,629 therms.

Facility	Electricity Use (kWh)			Natural Gas Use (therms)		
	2008	2014	% Change	2008	2014	% Change
Courthouse Complex	679,200	582,000	-14.3%	38,373	32,744	-14.7%
<i>County Average*</i>	<i>574,675</i>	<i>474,137</i>	<i>-17.5%</i>	<i>25,848</i>	<i>22,739</i>	<i>-12.0%</i>

*\*Note: Excludes facilities added or subtracted between 2008-2014*

### Vehicle Fuel Use

The Planning Department and County Clerk each had a single vehicle in 2014, but the Planning Department replaced its car with a hybrid in 2010.

Vehicle Fuel Use (gallons)			
Department	2008	2014	% Change
Clerk	976	763	-21.8%
Planning	261	131	-49.9%
<i>County Average</i>	<i>12,639</i>	<i>9,592</i>	<i>-24.1%</i>

### Emissions

The Courthouse Complex reduced its facility emissions by 33.9%, or 145 MTCO<sub>2</sub>e. The increase in the County Clerk's Office vehicle emissions and decrease in Planning Department vehicle emissions between 2008 and 2014 are also detailed below. On average, County facilities reduced emissions by 44.9% and vehicle emissions declined by 29.2%.

Facility Emissions (MTCO <sub>2</sub> e)				Vehicle Emissions (MTCO <sub>2</sub> e)			
Facility	2008	2014	% Change	Department	2008	2014	% Change
Courthouse Complex	427	282	-33.9%	Clerk	5	7	35.3%
				Planning	2	1	-50.6%

\* Note: Facility emissions do not include Green-e RECs

### Reasons for Changes

- 1) *Energy Performance Contract with Johnson Controls, Inc.* The facility improvement measures (FIMs) that took place include installing facility management systems and making building envelope improvements to all three buildings. Both the Main Courthouse and Old Jail benefited from boiler replacements and installation of plug load controls. An old rooftop air handling system was replaced at the Main Courthouse.
- 2) *Renovation of Daniel D. Tompkins Building for County Legislature.* The second floor of the Daniel D. Tompkins Building was renovated for the new Legislature chambers in 2013, and the first floor also received lighting upgrades during the project.

- 3) *Vehicle and fuel improvements.* The Planning Department replaced its car in 2010 with a hybrid vehicle, and by 2014 was sharing vehicles with the Assessment Department when needed. The County Clerk’s Office was using the same vehicle in 2014 as it did in 2008 and experienced some benefit from using ethanol blended gasoline.

## Department of Motor Vehicles

### Energy Use

The Department of Motor Vehicles is rented by the County rather than owned, but the County is responsible for the energy used at the facility. Its electricity use decreased by 0.2%, or 100 kWh, between 2008 and 2014 and reduced its natural gas use by 3.3%, or 89 therms. This department does not have vehicles or fuel cards.

Facility	Electricity Use (kWh)			Natural Gas Use (therms)		
	2008	2014	% Change	2008	2014	% Change
DMV	43,980	43,880	-0.2%	2,707	2,618	-3.3%

### Emissions

The Department of Motor Vehicle’s facility emissions decreased by 23.4%, or 7 MTCO<sub>2</sub>e, between 2008 and 2014.

Facility Emissions (MTCO <sub>2</sub> e)			
Facility	2008	2014	% Change
DMV	29	22	-23.4%

\* Note: Facility emissions do not include Green-e RECs

### Reasons for Changes

- 1) *Rented space.* As a tenant rather than a building owner, the County has not made the types of energy efficiency improvements that have reduced energy use in many County-owned facilities.

## Emergency Response Center

### Energy Use

Between 2008 and 2014, the Emergency Response Center reduced its electricity use by 32,897 kWh and reduced its natural gas use by 1,819 therms.

Facility	Electricity Use (kWh)			Natural Gas Use (therms)		
	2008	2014	% Change	2008	2014	% Change
Emergency Response	442,054	409,157	-7.4%	8,755	6,936	-20.8%
County Average*	574,675	474,137	-17.5%	25,848	22,739	-12.0%

\*Note: Excludes facilities added or subtracted between 2008-2014

## Vehicle Fuel Use

Although the Department of Emergency Response's two vehicles date to after the 2008 inventory and benefit from improvements in fuel efficiency, the SUV and pickup truck are less fuel efficient than cars, and the Department only reduced its consumption by 47 gallons.

Vehicle Fuel Use (gallons)			
Department	2008	2014	% Change
Emergency Response	1,299	1,252	-3.6%
<i>County Average</i>	<i>12,639</i>	<i>9,592</i>	<i>-24.1%</i>

## Emissions

The Emergency Response Center's facility emissions decreased by 41.1%, or 79 MTCO<sub>2</sub>e, between 2008 and 2014. The Department of Emergency Response vehicle emissions decreased by 1.4%, or 0.2 MTCO<sub>2</sub>e. On average, County facilities reduced emissions by 44.9% and vehicle emissions declined by 29.2%.

Facility Emissions (MTCO <sub>2</sub> e)				Vehicle Emissions (MTCO <sub>2</sub> e)			
Facility	2008	2014	% Change	Department	2008	2014	% Change
Emergency Response	192	113	-41.1%	Emergency Response	12	11	-1.4%

\* Note: Facility emissions do not include Green-e RECs

## Reasons for Changes

- 1) *Vehicle and fuel improvements.* Although the Department's vehicles have been replaced since the 2008 inventory, the SUV and pickup truck tend to be less fuel efficient than department fleets with a higher proportion of sedans and/or hybrid vehicles. The Department's pickup truck is a heavy-duty fire scene support unit that carries an air compressor and breathing air cascade system. It should be noted that several fire departments have retired from service duplicate systems (and vehicles) because the County can share with them a single, safer and more efficient unit. The SUV is necessitated by response expectations that occur in all weather conditions and frequently "off-road." The reduction in fuel usage by the department has occurred despite increased response demands and the addition of several County-maintained remote radios transmission sites since 2008.
- 2) *Boiler replacement.* A new boiler system was installed in 2014.
- 3) Continued efforts to consolidate computerized equipment and demobilize legacy communications systems within the Center since 2014 are expected to further reduce utility usage.

## Health Department

### Energy Use

The Health Department's new building constructed in 2010 means that comparisons between 2008 and 2014 are not available. However, as compared to its electricity use in the Biggs Building it occupied in 2008, the Health Department reduced its electricity use by 78,043 kWh and reduced its natural gas use by 18,063 therms.

Facility	Electricity Use (kWh)			Natural Gas Use (therms)		
	2008	2014	% Change	2008	2014	% Change
Biggs Building	367,649	0	NA	35,461	0	NA
Health Department	0	289,606	NA	0	17,398	NA

## Vehicle Fuel Use

Programmatic changes, vehicle replacements, and a gradual decline in out of County travel reduced vehicle miles and fuel consumption by the Health Department.

Vehicle Fuel Use (gallons)			
Department	2008	2014	% Change
Health	8,502	2,974	-65.0%
County Average	12,639	9,592	-24.1%

## Emissions

Again, direct comparisons between 2008 and 2014 are not possible, however as compared to its former home in the Biggs Building, facility emissions decreased by 52.7%, or 163 MTCO<sub>2</sub>e. The associated changes in emissions from vehicle use between 2008 and 2014 are also detailed below.

Facility Emissions (MTCO <sub>2</sub> e)				Vehicle Emissions (MTCO <sub>2</sub> e)			
Facility	2008	2014	% Change	Department	2008	2014	% Change
Biggs B	309	0	-100.0%	Health	76	26	-65.4%
Health Department	0	146	NA				

\* Note: Facility emissions do not include Green-e RECs

## Reasons for Changes

- 1) *Renovation.* The renovation of the existing Health Department building in 2010 to become the County's first LEED Silver Certified building provided a much more energy efficient facility than the c.1920 Biggs Building occupied by the department in 2008.
- 2) *Changes to vehicles, vehicle use, and fuel improvements.* In 2012 the Health Department's Home Care Unit eliminated its vehicle fleet and stopped making home visits, which significantly reduced both mileage and fuel consumption between 2008 and 2014. Thirteen of the Health Department's 19 vehicles date to after the 2008 inventory, benefiting from improving fuel standards. Department vehicle use for out of County travel has also been declining over the past several years, and ethanol fuel use since 2008 further reduces emissions.

## Highway Satellite Facility

### Energy Use

The Highway Satellite Facility is located at the Caswell Landfill in the Town of Dryden. Although the Highway Division has been using the facility since 2006 as an eastern satellite of its main facility at Bostwick Road, it was not included in the 2008 inventory and data are not available to adjust 2008 inventory results to include the facility. The building uses electricity but no natural gas. Its heater used approximately 40 gallons of propane and 700 gallons of waste oil in 2014, according to Highway staff estimates.

Facility	Electricity Use (kWh)		
	2008	2014	% Change
Highway Satellite	0	14,060	NA

## Emissions

Although no comparison can be made to 2008, the 2014 emissions were 3 MTCO<sub>2</sub>e.

Facility Emissions (MTCO <sub>2</sub> e)			
Facility	2008	2014	% Change
Highway Satellite	0	3	NA

\* Note: Facility emissions do not include Green-e RECs

## Human Services Annex

### Energy Use

The Human Services Annex building houses the Office for the Aging. This building was purchased for the County's use in 2011; therefore a comparison to 2008 is not possible. However, it should be noted that the County renovated the building to LEED standards, a rating system devised by the U.S. Green Building Council to evaluate the environmental performance of a building and encourage sustainable design which reduces the use of energy and water while reducing greenhouse gas emissions.

Facility	Electricity Use (kWh)			Natural Gas Use (therms)		
	2008	2014	% Change	2008	2014	% Change
Human Services Annex	0	17,229	NA	0	2,716	NA

### Vehicle Fuel Use

The Office for the Aging does not own a vehicle or have a WEX fuel card with which it could fuel a vehicle. It takes advantage of shared fleet vehicles with Planning and DSS.

## Emissions

The Office for the Aging does not own a vehicle or have a WEX fuel card with which it could fuel a vehicle. As noted above, 2014 emissions cannot be compared with the 2008 inventory.

After acquiring the Human Services Annex, the County renovated the building to LEED standards. LEED, or Leadership in Energy and Environmental Design, is a rating system devised by the U.S. Green Building Council to evaluate the environmental performance of a building and encourage sustainable design which reduces the use of energy and water while reducing greenhouse gas emissions.

Facility Emissions (MTCO <sub>2</sub> e)			
Facility	2008	2014	% Change
Human Services Annex	0	18	NA

\* Note: Facility emissions do not include Green-e RECs

## Human Services Building

### Energy Use

The Human Services Building houses the Department of Social Services (DSS), the Probation Department, and Youth Services. Between 2008 and 2014, the Human Services Building reduced its electricity use by 445,789 kWh and its natural gas use by 6,529 therms.

Facility	Electricity Use (kWh)			Natural Gas Use (therms)		
	2008	2014	% Change	2008	2014	% Change
Human Services	1,181,527	735,738	-37.7%	33,989	27,460	-19.2%
County Average*	574,675	474,137	-17.5%	25,848	22,739	-12.0%

*\*Note: Excludes facilities added or subtracted between 2008-2014*

### Vehicle Fuel Use

The Probation Department's vehicle fuel consumption from its two large SUVs held fairly steady between 2008 and 2014. DSS reduced its consumption by 1,557 gallons. All but one of the DSS cars in its fleet is post-2008 models, including five hybrid cars.

Vehicle Fuel Use (gallons)			
Department	2008	2014	% Change
DSS	7,930	6,373	-19.6%
Probation	1,427	1,388	-2.8%
County Average	12,639	9,592	-24.1%

*\*Note that Youth Services does not have a vehicle*

### Emissions

The Human Services Building's facility emissions decreased by 50.3%, or 286 MTCO<sub>2</sub>e, between 2008 and 2014. The Human Services Building houses the Department of Social Services (DSS), the Probation Department, and Youth Services. The associated changes in emissions from vehicle use between 2008 and 2014 are also detailed below. On average, County facilities reduced emissions by 44.9% and vehicle emissions declined by 29.2%.

Facility Emissions (MTCO <sub>2</sub> e)				Vehicle Emissions (MTCO <sub>2</sub> e)			
Facility	2008	2014	% Change	Department	2008	2014	% Change
Human Services	569	283	-50.3%	DSS	71	56	-21.1%
				Probation	13	12	-5.4%

\* Note: Facility emissions do not include Green-e RECs

### Reasons for Changes

- 1) *Energy Performance Contract with Johnson Controls, Inc.* The facility improvement measures (FIMs) that took place at the Human Services Building include installing a facility management system, a separate A/C unit for the computer room, plug load controls, and a water flow monitoring system.

- 2) *Vehicle and fuel improvements.* DSS replaced nearly all of its vehicles with more efficient models between 2008 and 2014, including five hybrid models. DSS also began operating satellite offices in 2014. This may have further reduced the need to travel to individual clients.
- 3) *Boiler replacement.* One of the building's three c. 1997 boilers was replaced in 2015.

## Mental Health Building

### Energy Use

Between 2008 and 2014, the Mental Health Building reduced its electricity use by 52,790 kWh. Its natural gas use decreased by 4,773 therms.

Facility	Electricity Use (kWh)			Natural Gas Use (therms)		
	2008	2014	% Change	2008	2014	% Change
Mental Health	589,800	537,010	-9.0%	20,001	15,228	-23.9%
County Average*	574,675	474,137	-17.5%	25,848	22,739	-12.0%

*\*Note: Excludes facilities added or subtracted between 2008-2014*

### Vehicle Fuel Use

Program changes in 2014 significantly decreased the miles driven by Mental Health Department vehicles, and helped reduce vehicle fuel consumption by 3,014 gallons. Also, three fuel efficient cars and one hybrid car were purchased after the 2008 inventory.

Vehicle Fuel Use (gallons)			
Department	2008	2014	% Change
Mental Health	4,240	1,563	-63.1%
County Average	12,639	9,592	-24.1%

### Emissions

The Mental Health Building, constructed in 2004, decreased its facility emissions by 39.7%, or 119 MTCO<sub>2</sub>e, between 2008 and 2014. The associated changes in emissions from vehicle use between 2008 and 2014 are also detailed below. On average, County facilities reduced emissions by 44.9% and vehicle emissions declined by 29.2%.

Facility Emissions (MTCO <sub>2</sub> e)				Vehicle Emissions (MTCO <sub>2</sub> e)			
Facility	2008	2014	% Change	Department	2008	2014	% Change
Mental Health	300	181	-39.7%	Mental Health	38	13	-64.6%

\* Note: Facility emissions do not include Green-e RECs

## Reasons for Changes

- 1) *Energy Performance Contract with Johnson Controls, Inc.* The facility improvement measures (FIMs) that took place at the Mental Health Building include a lighting upgrade, installation of a facility management system, improvements to the building envelope, and installation of plug load controls as well as a water flow monitoring system.
- 2) *Changes to vehicles and usage.* In addition to replacing several vehicles with more efficient models, in 2014 program changes required the Mental Health department to start connecting clients with Medicaid-assisted transportation (bus passes, Gadabout, etc.) instead of using County vehicles to provide transportation both in and out of town for appointments and daily necessities.
- 3) *Building use.* Changes in occupancy, occupant behavior, and electronics/equipment used inside the building may affect both a building's need for climate control and electricity use.
- 4) *Boiler replacement.* A new boiler system was installed in 2012.

## Old Library Building

### Energy Use

The Old Library was previously used for County archives and the Alternatives to Incarceration Program offices. By 2014, only the Day Reporting Program remained in the building. Between 2008 and 2014, the Old Library Building reduced its electricity use by 57,900 kWh and reduced its natural gas use by 5,041 therms.

Facility	Electricity Use (kWh)			Natural Gas Use (therms)		
	2008	2014	% Change	2008	2014	% Change
Old Library Building	285,600	227,700	-20.3%	34,003	28,962	-14.8%
County Average*	574,675	474,137	-17.5%	25,848	22,739	-12.0%

\*Note: Excludes facilities added or subtracted between 2008-2014

### Emissions

The facility emissions decreased by 28.5%, or 78 MTCO<sub>2</sub>e, between 2008 and 2014, and no vehicle emissions are associated with the building. On average, County facilities reduced emissions by 44.9%.

Facility Emissions (MTCO <sub>2</sub> e)			
Facility	2008	2014	% Change
Old Library Building	275	196	-28.5%

\* Note: Facility emissions do not include Green-e RECs

## Reasons for Changes

- 1) *Occupancy changes.* The reduced occupancy of the building between 2008 and 2014 likely decreased the amount of electricity needed for lighting, computers, etc. The need for natural gas decreased at a slower rate, possibly due to fewer people and less equipment generating heat.

## Public Safety Building

### Energy Use

Between 2008 and 2014, the Public Safety Building reduced its electricity use by 111,426 kWh and reduced its natural gas use by 1,151 therms.

Facility	Electricity Use (kWh)			Natural Gas Use (therms)		
	2008	2014	% Change	2008	2014	% Change
Public Safety Building	731,760	620,334	-15.2%	27,336	26,185	-4.2%
County Average*	574,675	474,137	-17.5%	25,848	22,739	-12.0%

\*Note: Excludes facilities added or subtracted between 2008-2014

### Vehicle Fuel Use

With the majority of the Sheriff's Office fleet in 2014 consisting of more fuel efficient vehicles purchased after the 2008 inventory, vehicle fuel use decreased by 8,682 gallons.

Vehicle Fuel Use (gallons)			
Department	2008	2014	% Change
Sheriff	60,644	51,962	-14.3%
County Average	12,639	9,592	-24.1%

### Emissions

The Public Safety Building's facility emissions decreased by 34.0%, or 131 MTCO<sub>2</sub>e, between 2008 and 2014. The associated changes in emissions from vehicle use between 2008 and 2014 are also detailed below.

Facility Emissions (MTCO <sub>2</sub> e)				Vehicle Emissions (MTCO <sub>2</sub> e)			
Facility	2008	2014	% Change	Department	2008	2014	% Change
Public Safety Building	386	255	-34.0%	Sheriff	543	459	-15.4%

\* Note: Facility emissions do not include Green-e RECs

### Reasons for Changes

- 1) *Energy Performance Contract with Johnson Controls, Inc.* The facility improvement measures (FIMs) that took place at the Public Safety Building include a lighting upgrade, installation of a facility management system, improvements to the building envelope, and installation of plug load controls as well as a water flow monitoring system. An additional EPC executed in 2013 resulted in replacing exterior lighting with more efficient LEDs, replacing windows, and replacing a failing roof with a new roof that includes improved insulation. By February 2014, a more efficient boiler system had been installed and initial heat pump replacements occurred throughout 2014.
- 2) *Vehicle and fuel improvements.* Some ethanol consumption in 2014 reduced emissions slightly, and most of the fleet was replaced between 2008 and 2014, benefitting from improved fuel efficiency standards.

## Public Works Facility

### Energy Use

The Public Works Facility, also known as the Bostwick Road or Highway Facility, houses the Facilities, Highway, and Weights and Measures Departments. Between 2008 and 2014, the Public Works Facility reduced its electricity use by 29,826 kWh and its natural gas use by 33 therms.

Facility	Electricity Use (kWh)			Natural Gas Use (therms)		
	2008	2014	% Change	2008	2014	% Change
Public Works	271,800	241,974	-11.0%	31,755	31,722	-0.1%
<i>County Average*</i>	<i>574,675</i>	<i>474,137</i>	<i>-17.5%</i>	<i>25,848</i>	<i>22,739</i>	<i>-12.0%</i>

*\*Note: Excludes facilities added or subtracted between 2008-2014*

### Vehicle Fuel Use

Vehicle Fuel Use (gallons)			
Department	2008	2014	% Change
Facilities	5,616	4,633	-17.5%
Highway	95,287	75,003	-21.3%
Weights & Measures	536	396	-26.1%
<i>County Average</i>	<i>12,639</i>	<i>9,592</i>	<i>-24.1%</i>

### Emissions

The facility's emissions increased by 13.9%, or 36 MTCO<sub>2</sub>e, between 2008 and 2014. The associated changes in emissions from vehicle use between 2008 and 2014 are also detailed below. On average, County facilities reduced emissions by 44.9% and vehicle emissions declined by 29.2%.

Facility Emissions (MTCO <sub>2</sub> e)				Vehicle Emissions (MTCO <sub>2</sub> e)			
Facility	2008	2014	% Change	Department	2008	2014	% Change
Public Works Facility	258	222	-13.9%	Facilities	50	41	-19.3%
				Highway	950	657	-30.8%
				Weights & Measures	5	3	-27.0%

\* Note: Facility emissions do not include Green-e RECs

### Reasons for Changes

- 1) *Energy Performance Contract with Johnson Controls, Inc.* The facility improvement measures (FIMs) that took place at the Public Works Facility include a lighting upgrade, improvements to the building envelope, boiler replacement, and installation of plug load controls. The lighting upgrade reduced heat generated by lighting, so would slightly increase the need for natural gas for heating in winter.
- 2) *Vehicle and fuel improvements.* The Highway Department began converting its vehicles to B10/B20 biodiesel in 2009 and had converted most diesel vehicles by 2014, which significantly reduced emissions. Nearly a third of its 2014 on-road and off-road vehicles and equipment were purchased after 2008, benefiting from improvements in fuel standards and particularly to the efficiency of diesel engines. In 2014, the Facilities Division was

purchasing B20 biodiesel from the Highway Division, helping to reduce its emissions in addition to a reduction in its overall fuel use. Also travel schedules have been rearranged to reduce mileage.

- 3) *Occupancy changes.* In November 2013 the Tompkins County Soil and Water Conservation District moved from its space in the Board of Elections Training and Storage Facility into the second floor of the Public Works Facility.

## Solid Waste Facilities

### Energy Use

Solid Waste facilities include the Solid Waste Office, the Recycling Center, and the Solid Waste - Household Hazardous Waste Building. Between 2008 and 2014, Solid Waste facilities reduced electricity use by 330,485 kWh. Natural gas use decreased by 16,008 therms.

Facility	Electricity Use (kWh)			Natural Gas Use (therms)		
	2008	2014	% Change	2008	2014	% Change
Solid Waste Facilities	608,205	277,720	-54.3%	24,750	8,742	-64.7%
<i>County Average*</i>	<i>574,675</i>	<i>474,137</i>	<i>-17.5%</i>	<i>25,848</i>	<i>22,739</i>	<i>-12.0%</i>

*\*Note: Excludes facilities added or subtracted between 2008-2014*

### Vehicle Fuel Use

The Solid Waste Division reduced its vehicle fuel consumption by 156 gallons.

Vehicle Fuel Use (gallons)			
Department	2008	2014	% Change
Solid Waste	1,380	1,224	-11.3%
<i>County Average</i>	<i>12,639</i>	<i>9,592</i>	<i>-24.1%</i>

### Emissions

The Solid Waste Division's facility emissions decreased by 70.4%, or 233 MTCO<sub>2</sub>e, between 2008 and 2014. The Solid Waste Division's vehicle emissions decreased by 12.4%, or 2 MTCO<sub>2</sub>e.

Facility Emissions (MTCO <sub>2</sub> e)				Vehicle Emissions (MTCO <sub>2</sub> e)			
Facility	2008	2014	% Change	Department	2008	2014	% Change
Solid Waste Facilities	331	98	-70.4%	Solid Waste	12	11	-12.4%

\* Note: Facility emissions do not include Green-e RECs

### Reasons for Changes

- 1) *Single stream transfer.* In 2011, processes changed at the Recycling Center as dual stream sorting was replaced with a single stream process. A lot of sorting equipment was removed from operation as materials no longer needed sorting before transfer to a facility in Ontario County.
- 2) *2011 Recycling Center upgrades.* During the upgrades, 32 high intensity discharge light fixture were replaced with fluorescent fixtures that are 68% more efficient. Multiple overhead doors were added to reduce the need to use rooftop exhaust fans. A number of overhead heaters using natural gas were removed and replaced with

two infrared heaters over the sorting platform. Also, the maintenance and break room HVAC units were replaced with more efficient units.

- 3) *2013-2014 facility improvements.* In 2013 electric heaters in the sprinkler and electric room were replaced with more efficient units. In 2014 the duct work from the HVAC unit to the Solid Waste Office was replaced and insulated.
- 4) *Vehicle and fuel improvements.* Two of the Department’s three vehicles have been replaced since the 2008 inventory, and therefore benefit from improved fuel efficiency in newer vehicles.
- 5) *Boiler replacement.* A new boiler system was installed in 2013.

## Tompkins County Public Library

### Energy Use

Between 2008 and 2014, the Tompkins County Public Library increased its electricity use by 7,065 kWh and reduced its natural gas use by 3,576 therms. The Library does not have a County vehicle or fuel card.

Facility	Electricity Use (kWh)			Natural Gas Use (therms)		
	2008	2014	% Change	2008	2014	% Change
TC Public Library	862,400	869,465	0.8%	24,728	21,152	-14.5%
<i>County Average*</i>	<i>574,675</i>	<i>474,137</i>	<i>-17.5%</i>	<i>25,848</i>	<i>22,739</i>	<i>-12.0%</i>

*\*Note: Excludes facilities added or subtracted between 2008-2014*

### Emissions

The Tompkins County Public Library reduced its emissions by 41.5%, or 172 MTCO<sub>2</sub>e.

Facility Emissions (MTCO <sub>2</sub> e)			
Facility	2008	2014	% Change
TC Public Library	415	243	-41.5%

\* Note: Facility emissions do not include Green-e RECs

### Reasons for Changes

- 1) *Not Included in Energy Performance Contract with Johnson Controls, Inc.* The Tompkins County Public Library was not one of the facilities improved under the contract with Johnson Controls, so the building has not benefited from efficiency measures to reduce electricity use. The solar panels on the Library’s roof are owned by the County and reduce the amount of electricity provided through the grid, but solar electricity has been included in the total electricity use.
- 2) *Building Use.* Although winter was colder in 2014 than it was in 2008, increased occupancy may have helped reduced the demands on the heating system.

## **Appendix E**

### **Detailed Methodology**

**2014 Tompkins County**

## **Government Operations**

### **Greenhouse Gas Emissions and Energy Use Inventory**

September 2016

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## Methodology for 2014 Government GHG Emissions Inventory and Energy Flow

This methodology provides sources used, the sources of particular data and information about why these data were selected, other factors or conversions used to manipulate the data for this report, and the sources of these factors and conversions.

### ICLEI and ClearPath Software

This inventory is based upon Local Government Operations Protocol for the Quantification and Reporting of Greenhouse Gas Emissions Inventory, Version 1.1. ClearPath version 2014, an online application for the calculation and tracking of greenhouse gas emissions at the government operations and community scales, was used to calculate 2014 emissions in June 2016. ClearPath is the most widely-used software tool for managing local climate mitigation efforts and is available to members of the International Council on Local Environmental Initiatives (ICLEI), including Tompkins County.

The Protocol requires that emissions be reported by the following sectors. Notation below indicates why sectors that were not included in the 2014 inventory have been excluded:

- *Buildings and Other Facilities* – included in the 2014 inventory.
- *Streetlights and Traffic Signals* – included in the 2014 inventory. It should be noted that only a small proportion of the streetlights and traffic signals in the county are operated by the Tompkins County government.
- *Water Delivery Facilities Wastewater Facilities* – excluded because the County does not own or operate such facilities.
- *Port Facilities* – excluded because the County does not own or operate such facilities.
- *Airport Facilities* – included in the 2014 inventory.
- *Vehicle Fleet* – included in the 2014 inventory.
- *Transit Fleet* – excluded. Tompkins County provides a portion of the funding for the Tompkins Consolidated Area Transit, Inc. (TCAT), the not-for-profit corporation that provides public transportation for Tompkins County. However, TCAT is not part of County government operations.
- *Power Generation Facilities* – excluded because the County does not own or operate such facilities.
- *Solid Waste Facilities* – included in the 2014 inventory, although County-government-generated waste is not included.
- *Other Process and Fugitive Emissions* – excluded because the County does not own or operate the types of production and manufacturing facilities which releases these emissions.

The Protocol also breaks emissions out by scope:

- Scope 1 - All direct GHG emissions from sources owned or controlled by the organization (with the exception of direct CO<sub>2</sub> emissions from biogenic sources). This inventory includes these emissions, primarily in the form of fuel used in vehicles.
- Scope 2 - Indirect GHG emissions associated with the consumption of purchased or acquired electricity, steam, heating, or cooling. This inventory includes these emissions.
- Scope 3 – Other indirect emissions, such as the extraction and production of purchased materials and fuels that are a consequence of an organization's operations. These emissions are not included in this inventory, nor have they been part of past inventories. The County does not currently have systems in place to track sources of these emissions.

This inventory focuses on Scope 1 and 2 emissions, which have are combined to provide total emissions calculations. Although the Protocol particularly encourages reporting of Scope 3 employee commute data on the commuting habits by County government employees, it has not been included in this inventory. Employee commuting has not been included in previous inventories, and reliable data was not available at the time of this inventory’s preparation. However, the County is working to reduce emissions from employee commuting, as demonstrated by its longtime free bus pass program for employees. The establishment of a system to track emissions associated with employee commutes is a “next step” for future County emissions reduction efforts.

The Protocol also encourages reporting of Scope 3 emissions from solid waste, such as emissions from waste generated by local government operations if a government does not own the landfill where waste is sent, as is the case for Tompkins County. However, data is not available for the waste collected from County facilities in 2014, or for 2008, so these emissions have not been included in the emissions from Solid Waste Facilities. Technology is changing, with more trucks now equipped with scales to measure materials collected at each stop. For an additional fee, the County could request data regarding the collection of solid waste from County facilities as part of its future contracts with waste and recycling haulers.

## General Inputs for GHG Emissions and Energy Use

### What grid mix was used?

EPA eGRID 2012 (<https://www.epa.gov/energy/egrid>, eGRID 2012 Data File, Sheet 6 Sub-region Data), which is the latest emissions & generation resource database released in Oct. 2015.

Fuel Mix of Upstate New York	%
Gas	30.4
Hydro	29.2
Nuclear	28.9
Coal	5.5
Wind	3.6
Biomass	1.8
Other Fossil	0.4
Oil	0.2
Solar	0.0
Geothermal	0.0
Other Unknown/Purchased Fuel	0.0

Grid emission factors used in ICLEI ClearPath: CO<sub>2</sub> 408.80 lbs/MWh, CH<sub>4</sub> 15.59 lbs/GWh, and N<sub>2</sub>O 3.83 lbs/GWh (also obtained from the EPA eGRID 2012 file Sheet 6 Sub-region Upstate New York).

Using the NYSEG fuel mix and emissions factors, if attainable, is more accurate than those of the general eGrid Sub-region Upstate New York. However, Tompkins County was not able to obtain the grid emission factors by greenhouse gas from NYSEG that is required to determine emissions.

### Conversion factors used throughout

1 kWh = 0.0034095106405145 MMBtu

1 therm = 0.10 MMBtu

1 barrel = 42 US gallon

### What Global Warming Potential was used?

Global Warming Potential refers to multipliers that are applied to all non-CO2 greenhouse gases in order to present them in a common term that indicates their relative strength of the greenhouse effect they have in the atmosphere. In the U.S., standard practice for a number of years now has been to maintain alignment with federal agencies, which are now using the values published in the Intergovernmental Panel on Climate Change (IPCC) 5th Assessment Report. Therefore, this 2014 inventory uses IPCC 5th Assessment Report 100 year values and the 2008 inventory, which originally used the IPCC 2nd Assessment Report values, has been updated to the 5th Assessment 100 year values to allow direct comparison to the 2014 inventory.

## Applying Latest Climate Science on Shale Gas to Results

Guidance was provided in May 2016 from Dr. Robert Howarth, Cornell University, on the methodology to use in making these calculations, based on his most recent scholarly articles on the topic. For detailed explanations of the calculations involved, please refer to the Detailed Methodology section of the 2014 Tompkins County Community Greenhouse Gas Emissions and Energy Use Inventory (September 2016). Details are provided below regarding inputs specific to Tompkins County government operations.

County Government	2008	2014 (with RECs)	2014 (without RECs)
Electricity (MMBtu)	26,765	800	21,598
Natural Gas (MTCO2e)	1,838	1,574	1,574
Total Emissions (MTCO2e)	6,336	3,012	4,115

## Electricity and Natural Gas (Including Buildings and Facilities, as well as Airport Facilities, Solid Waste Facilities, and Street Lights & Traffic Signals)

Beginning in the 2008 inventory and continuing into this inventory, ICLEI protocols require separate reporting of airport facilities and solid waste facilities from general buildings and facilities. These airport and solid waste facilities also function as enterprise operations. The most recent protocol also requires separate reporting of street lights and traffic signals. However airport, solid waste, buildings and facilities, and street lights and traffic signals all largely use the same methodology, with differences noted below.

### Electricity Used

#### Methodology

Both New York State Electric and Gas (NYSEG) and Constellation (formerly known as Integrys) provide electricity supply to County facilities, although NYSEG provides the delivery of electricity no matter which company provides the supply. Monthly electricity use for each account billed to the County was obtained from online NYSEG and Constellation account web portals. These bills were used to provide the kWh and associated costs for both supply and delivery to each facility, including any exterior lighting attributed to the facility. Solar PV electricity generation for 2014 from the Tompkins County Public Library solar PV systems was added to the Library's kWh total, since this

electricity is generated and used on site, so does not appear on utility bills. This electricity had no associated costs since there were no supply or delivery charges to the Library. NYSEG bills for facilities with solar panels leased from Solar Liberty provided information about excess electricity generated and fed back to the grid, and this excess was not counted towards the County’s electricity use or electricity costs since it was not used by County facilities.

Building Name	Electricity Used (kWh, from NYSEG Bills)	Electricity Fed Back to Grid (kWh, from NYSEG Bills)	Electricity Use (kWh)	Electricity Use Counted toward Emission (kWh)	Solar Electricity Generated
<b>Airport Facilities</b>	<b>1,386,054</b>		<b>1,386,040</b>	<b>1,386,040</b>	
TC Public Library	785,200	0	869,808	700,592	84,608
Human Services	719,827	0	735,738	735,738	15,911
Public Safety Building	604,560	0	620,334	620,334	15,774
Courthouse Complex	582,000		582,000	582,000	
Mental Health	537,010		537,010	537,010	
Emergency Response	392,648	0	409,157	409,157	16,509
Health Department	276,000	0	289,606	289,606	13,606
<b>Solid Waste Facilities</b>	<b>277,720</b>		<b>277,720</b>	<b>277,720</b>	
Public Works Facility	216,800	9,200	241,974	241,974	34,374
Old Library Building	227,700		227,700	227,700	
Building C	180,480	80	193,958	193,958	13,558
DMV	43,880		43,880	43,880	
<b>St Lights &amp; Tfc Signals</b>	<b>38,788</b>		<b>38,788</b>	<b>38,788</b>	
Board of Elections	18,912		18,912	18,912	
Human Services Annex	18,846	13,228	17,229	17,229	11,611
Highway Satellite	14,060	0	14,060	14,060	
<b>Total</b>	<b>6,320,485</b>	<b>22,508</b>	<b>6,503,913</b>	<b>6,334,698</b>	<b>205,950</b>

## Natural Gas Used

### Methodology

Both NYSEG and Direct Energy provide natural gas supply to County facilities, although NYSEG provides the delivery of natural gas no matter which company provides the supply. Monthly natural gas use for each account billed to the County was obtained from online NYSEG and Direct Energy account web portals. The bills were used to provide therms used, and the associated costs for both supply and delivery to each facility.

Building Name	Fuel Use (Therms)
<b>Airport Facilities</b>	<b>63,812</b>
Courthouse Complex	32,744
Bostwick/Highway	31,722
Old Library Building	28,962
Human Services	27,460
Public Safety Building	26,185
TC Public Library	21,152
Health Department	17,398
Fire Pump Mental Health	15,228
<b>Solid Waste Facilities</b>	<b>8,742</b>
Building C	7,306
Emergency Response	6,936
Board of Elections	2,886
Human Services Annex	2,716
DMV	2,618
<b>St Lights &amp; Tfc Signals</b>	<b>0</b>
<b>Total</b>	<b>295,868</b>

## Street Lights and Traffic Signals

### Methodology

As stated in the description of electricity use above.

Name	Electricity Used (kWh)
Signal - Judd Falls Rd	825
Signal - Warren Rd & Bro Rd	1,925
Street Lights - Brown Rd	30,159
Signal - Brown/Warren Rd	1,134
Signal - Near 747 Warren Rd	1,366
Signal - Halseyville Rd, Trumansburg	3,150
Signal - Hanshaw & Warren Rd	229
<b>Total</b>	<b>38,788</b>

## Solid Waste Facilities

### Methodology

As stated in the description of electricity and natural gas use above, with one addition. By 2014, Solid Waste's third party contractor, Casella, was paying the utilities at the Recycling and Solid Waste Center. Since this remains a County facility regardless of the shift in utility billing to a contractor, the utility use and costs from the Recycling and Solid Waste Center were included in this inventory.

Building Name	Electricity Used (kWh)
Solid Waste Office	66,520
Hillview Landfill	0
Recycling Center and Solid Waste Transfer Station	211,200
<b>Total</b>	<b>277,720</b>

Building Name	Fuel Use (Therms)
Solid Waste Office	2,189
Solid Waste - Household Hazardous Waste Building	1,995
Recycling Center and Solid Waste Transfer Station	4,558
<b>Total</b>	<b>8,742</b>

## Airport Facilities

### Methodology

As stated in the description of electricity and natural gas use above.

Building Name	Net Usage (kWh, from Grid)
Old IHA Hangar	7,108
Sand Storage Building	10,321
Crash Fire & Rescue	249,520
Airport Terminal	1,092,800
T Hangar I	11,459
T Hangar II	10,737
Airport Parking Lights	1
<b>Total</b>	<b>1,381,946</b>

Building Name	Fuel Use (Therms)
Sand Storage Building	7,604
Crash Fire & Rescue	12,454
Airport Terminal	43,755
<b>Total</b>	<b>63,812</b>

### Data & Sources

#### a. Utility bills from the County departments

- NYSEG bills – As the electricity and natural gas utility for County facilities, NYSEG provides at minimum delivery of electricity and/or natural gas to these facilities, and in many cases the electricity and/or natural gas supply as well.
- Constellation/Integrays bills – Constellation, formerly known as Integrays, is an electricity supplier and the entity through which Green-e REC's are purchased. Therefore, most of the electricity supply for County facilities is purchased through Constellation/Integrays even though it is delivered by NYSEG.
- Direct Energy bills – Direct Energy is a natural gas supplier which provides the supply of natural gas to many County facilities even though it is delivered by NYSEG.

Acct #	POD ID - Electricity	Mid-point Date	Building	Month	Billing Start	Billing End	NYSEG kWh	NYSEG kw	Solar Electricity to grid (from)
2	N0100003097078	12/6/2012	Human Services Annex Building - COFA	December 2012	11/22/2012	12/21/2012	8,826		
3	N0100003097078	1/7/2013	Human Services Annex Building - COFA	January 2013	12/22/2012	1/24/2013	3,127	0.0	
4	N0100003097078	2/7/2013	Human Services Annex Building - COFA	February 2013	1/24/2013	2/21/2013	1,419	0.0	
5	N0100003097078	3/7/2013	Human Services Annex Building - COFA	March 2013	2/22/2013	3/21/2013	831	0.0	
6	N0100003097078	4/6/2013	Human Services Annex Building - COFA	April 2013	3/22/2013	4/22/2013	0	0.0	
7	N0100003097078	5/7/2013	Human Services Annex Building - COFA	May 2013	4/23/2013	5/22/2013	0	14.0	
8	N0100003097078	6/6/2013	Human Services Annex Building - COFA	June 2013	5/23/2013	6/21/2013	0	19.0	
9	N0100003097078	7/7/2013	Human Services Annex Building - COFA	July 2013	6/22/2013	7/22/2013	421	0.0	
10	N0100003097078	8/7/2013	Human Services Annex Building - COFA	August 2013	7/23/2013	8/22/2013	0	13.0	
11	N0100003097078	9/7/2013	Human Services Annex Building - COFA	September 2013	8/23/2013	9/23/2013	97	17.0	
12	N0100003097078	10/8/2013	Human Services Annex Building - COFA	October 2013	9/24/2013	10/22/2013	184	10.0	
13	N0100003097078	11/6/2013	Human Services Annex Building - COFA	November 2013	10/23/2013	11/21/2013	1,179	7.0	
14	N0100003097078	12/7/2013	Human Services Annex Building - COFA	December 2013	11/24/2013	12/23/2013	2,058	8.0	
15	N0100003097078	1/7/2014	Human Services Annex Building - COFA	January 2014	12/24/2013	1/22/2014	2,052	8.4	13
16	N0100003097078	2/6/2014	Human Services Annex Building - COFA	February 2014	1/23/2014	2/21/2014	2,541	10.0	11
17	N0100003097078	3/7/2014	Human Services Annex Building - COFA	March 2014	2/22/2014	3/21/2014	1,593	7.5	75
18	N0100003097078	4/6/2014	Human Services Annex Building - COFA	April 2014	3/22/2014	4/22/2014	1,428	7.5	1.5
19	N0100003097078	5/7/2014	Human Services Annex Building - COFA	May 2014	4/23/2014	5/21/2014	1,046	13.9	1.9
20	N0100003097078	6/7/2014	Human Services Annex Building - COFA	June 2014	5/22/2014	6/23/2014	1,100	14.7	2.4
21	N0100003097078	7/8/2014	Human Services Annex Building - COFA	July 2014	6/24/2014	7/23/2014	1,226	22.7	1.9
22	N0100003097078	8/7/2014	Human Services Annex Building - COFA	August 2014	7/24/2014	8/22/2014	1,165	12.8	1.8
23	N0100003097078	9/7/2014	Human Services Annex Building - COFA	September 2014	8/23/2014	9/22/2014	1,288	15.3	1.3
24	N0100003097078	10/7/2014	Human Services Annex Building - COFA	October 2014	9/23/2014	10/22/2014	1,393	9.2	96
25	N0100003097078	11/6/2014	Human Services Annex Building - COFA	November 2014	10/23/2014	11/20/2014	1,727	10.3	37
26	N0100003097078	12/6/2014	Human Services Annex Building - COFA	December 2014	11/21/2014	12/22/2014	2,287	13.3	9
27	N0100003097078	1/7/2015	Human Services Annex Building - COFA	January 2015	12/23/2014	1/22/2015	2,176	14.8	91
28	N0100003097078	2/7/2015	Human Services Annex Building - COFA	February 2015	1/23/2015	2/23/2015	2,682	10.0	54
29	N0100003097078	3/9/2015	Human Services Annex Building - COFA	March 2015	2/24/2015	3/23/2015	1,987	10.6	40
30	N0100003097078	4/7/2015	Human Services Annex Building - COFA	April 2015	3/24/2015	4/22/2015	1,438	9.2	1.3
31	N0100003097078	5/6/2015	Human Services Annex Building - COFA	May 2015	4/23/2015	5/20/2015	1,199	9.2	1.7
32	N0100003097078	6/6/2015	Human Services Annex Building - COFA	June 2015	5/21/2015	6/23/2015	1,295	10.9	4.8
33	N0100003097078	7/8/2015	Human Services Annex Building - COFA	July 2015	6/24/2015	7/22/2015	1,283	18.5	5.2
34	N0100003097078	8/6/2015	Human Services Annex Building - COFA	August 2015	7/23/2015	8/20/2015	1,530	16.7	52
35	N0100003097078	9/6/2015	Human Services Annex Building - COFA	September 2015	8/21/2015	9/23/2015	1,812	17.9	1.0
36	N0100003097078	10/8/2015	Human Services Annex Building - COFA	October 2015	9/24/2015	10/22/2015	1,593	10.3	77
37	N0100003097078		Human Services Annex Building - COFA			11/20/2015	1,795	10.1	34
38	N0100003097078		Human Services Annex Building - COFA			12/24/2015	2,204	11.4	21
39	N0100000152249	2/6/2014	Human Services Building	February 2014	1/23/2014	2/21/2014	69	190.8	

*Airport Facilities Contact* – Cheryl Dean provided copies of utility bills for the Airport. Facilities with electricity bills include the Terminal, Airport Parking Lights, T Hangar I, T Hangar II, Crash Fire & Rescue Building, Sand Storage Building, and Old IHA Hangar. Buildings with natural gas use include the Terminal, Crash Fire & Rescue Building, and Sand Storage Building.

*Solid Waste Facilities Contact* – Jackie Maloney and Mike Armstrong provided copies of utility bills for Solid Waste facilities. Facilities with electricity bills include the Solid Waste Office, Recycling Center and Solid Waste Transfer Station, and Hillview Landfill (although it has service charges but used no electricity during 2014). Facilities with natural gas bills include the Solid Waste Office, Solid Waste – Household Hazardous Waste Building, and Recycling Center and Solid Waste Transfer Station. Leo Riley, Assistant Solid Waste Manager provided electric and natural gas use data for the Recycling and Solid Waste Center, and contacted Angelo Porfirio ([angelo.porfirio@casella.com](mailto:angelo.porfirio@casella.com), 607-273-2307), General Manager of Casella Recycling, who provided the electric and natural gas costs.

*Highway Contact* – Patricia (Trish) Hardy provided copies of electric bills for the Highway Satellite Facility as well as Highway signals and lights. Signals (as named by NYSEG) include those at Judd Falls Road, Warren and Brown Roads, Brown/Warren Roads, near 747 Warren Road, Halseyville Road (Trumansburg), and Hanshaw and Warren Road. The streetlights billed to the Highway Department are labeled “Brown Road.” Highway Director Jeff Smith provided information regarding LED upgrades to traffic signals.

*Facilities Contact*– Suzanne Phillips provided utility bills for the following facilities: Board of Elections Training and Storage Building, Public Works (Bostwick/Highway), Building C, Courthouse Complex, Department of Motor Vehicles, Emergency Response Center, Health Department, Human Services Annex, Mental Health Building, Old Library, Public Safety Building, and Tompkins County Public Library.

- b. Online County NYSEG accounts: <http://www.nyseg.com/default.html>
- c. Online County Constellation accounts: <https://energymanager.constellation.com/>
- d. Online Direct Energy accounts: <https://myaccount.directenergy.com/>

## Solar Electricity Generation

### Methodology

Data for leased panels were obtained from the Solar Liberty website, which records the annual solar electricity generation of PV panels installed on the County’s Emergency Response Center, Health Department, Building C, Human Services Annex, Public Safety Building, and Public Works/Bostwick Facility. As mentioned above, NYSEG bills provide data regarding excess electricity generated and fed back to the grid. For the PV panels installed at the Tompkins County Public Library, 84,607kWh of solar electricity is generated and used on-site each year per its Green Power Partnership Agreement with EPA, and data is recorded through Sun Power Performance Monitoring.

### Data & Sources

- a. Solar Liberty - <http://monitoring.solarliberty.com/Account/Login?ReturnUrl=%2f>
- b. Sun Power - <http://commercial.sunpowermonitor.com/Commercial/Default.aspx>

- c. NYSEG Bill Excess Generation – On the snapshot of a NYSEG bill below, A=total electricity coming from the grid (1,393 kWh) and B=excess electricity generated by solar PV and returned to grid because it was not used on site (962 kWh), so the total electricity used by this particular building is A-B=C (431 kWh), with C being the amount entered in ClearPath.

Meter Number	Current Meter Read Date	Current Meter Read Reading	Previous Meter Read Date	Previous Meter Read Reading	Reading Difference	Billed Usage	Billing Period
14699333	10/22/14	31045 A	09/23/14	29652 A	A 1393	1393 kwh	30 days
14699333	10/22/14	260.12 A	09/23/14	250.97 A	9.15	9.15 kw	30 days
14699333	10/22/14	5595 A	09/23/14	5360 A	235	235 kvah	30 days
14699333	10/22/14	25380 A	09/23/14	24418 A	B 962	962 kwh	30 days

Type of read: A - Actual, E - Estimate, C - Customer, R - Remote and N - No read

Power Factor: 98.6%

**Electricity Delivery Charges**

Basic service charge		5.37
Meter charge		1.68
Meter service charge		8.48
Meter data service charge		2.08
Demand charge	9.1500 kw @	8.30
Delivery charge	431 kwh @	0.00338
Transition charge	C 431 kwh @	0.00520653
Revenue decoupling mech	431 kwh @	0.000916
Reliability support svcs. chg.	9.1500 kw @	0.66
NY state assessment	431 kwh @	0.001522

## Net Electricity Use and Accounting of Renewable Energy Certificates (RECs) in Emissions

### Methodology

Net electricity use of a building/facility takes into account its electricity use according to utility bills, solar electricity generated by solar PV systems, as well as the amount of electricity fed back to the transmission grid. Net electricity use affects the MTCO<sub>2e</sub> emission of the building/facility.

Although the 2010 ICLEI Protocol does not recommend deducting RECs from emissions, preferring they be reported as supplemental information, after consultation with ICLEI staff regarding the County’s purchase of Green-e RECs it was agreed that this inventory should account for emissions both with, as well as without, the emissions reductions the RECs provide. RECs have become an important market-based tool in the growth of renewable energy generation, so attributing no emissions benefits to organizations purchasing RECs undermines a strong incentive to continue investing in renewable energy generation through RECs. The County’s Green-e Certified RECs and RECs generated by the solar PV system at the Tompkins County Public Library satisfy the requirements of the 2015 GHG Protocol Scope 2 Guidance to ensure that the GHG emissions rate claims from purchased RECs are reliable ([http://ghgprotocol.org/files/ghgp/Scope%20%20Guidance\\_Final.pdf](http://ghgprotocol.org/files/ghgp/Scope%20%20Guidance_Final.pdf)).

The key metric to consider when finding the correct net electricity use and its CO<sub>2e</sub> emissions is the number of RECs a building/facility holds. The Tompkins County Public Library holds the RECs for the solar electricity its PVs generate. So the solar electricity generated and used on site can be counted as zero-emission. The other seven County facilities with leased solar PV systems do not own the RECs for the solar electricity their PVs generate. In this case,

the solar electricity can no longer be counted as zero-emission for their use, but is rather treated as conventional electricity since the ultimate owner of RECs will claim its environmental benefits.

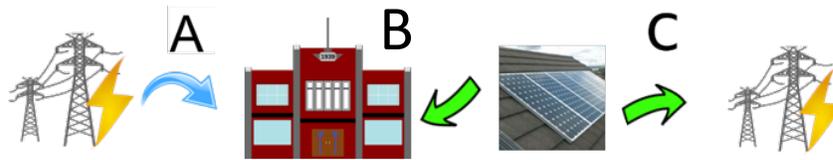
“A” represents the amount of electricity supplied to the building from the electric grid.

“B” represents the total amount of electricity generated by the PV array.

“C” represents the amount of electricity sold back to the grid from the PV array.

If the County owns the RECs, then we account for the GHG emissions from the amount of electricity used in the building based on this equation:  $A - (B - C)$ .

If the County does not own the RECs, then we account for the GHG emissions from the amount of electricity used in the building based on this equation:  $A + (B - C)$ .



RECs held by TC	Facility	A	B	C	D	Illustration, D =
		Electricity Used (kWh, from NYSEG Bills)	Solar Electricity Generated (kWh)	Electricity Fed Back to Grid (kWh, from NYSEG Bills)	Net Electricity Use (kWh)	
Yes	TC Public Library	785,200	84,608	0	700,592	$A - (B - C)$
No	Public Works Facility	216,800	34,374	9,200	241,974	$A + (B - C)$
No	Emergency Response	392,648	16,509	0	409,157	$A + (B - C)$
No	Human Services	719,827	15,911	0	735,738	$A + (B - C)$
No	Public Safety Building	604,560	15,774	0	620,334	$A + (B - C)$
No	Health Department	276,000	13,606	0	289,606	$A + (B - C)$
No	Building C	180,480	13,558	80	193,958	$A + (B - C)$
No	Human Services Annex	18,846	11,611	13,228	17,229	$A + (B - C)$

**Table 1 Net electricity use and RECs accounting for emissions**

### Propane and Waste oil Used

Waste oil and propane are used for space heating in the Highway Satellite Facility. Trish Carey of the Highway Division provided the Ferrell Gas invoices for propane used at the Highway Satellite Facility; however this information is for the filling of the tank and does not directly represent use in 2014. Tom Jacobs, Crew Supervisor of the Highway Satellite Facility, estimated 100 gallons of propane and 700 gallons of waste oil use.

It was assumed that waste oil is heavy with lighter hydrocarbons distilled away after previous use (<http://www.eia.gov/tools/glossary/index.cfm?id=residual%20fuel%20oil>). Residual fuel oil is a general classification for heavier oils, known as No.5 and No.6 fuel oils. No.6 fuel oil is used for space heating, while No.5 is not. Therefore, waste oil is treated as No.6 fuel oil in ClearPath.

# Vehicle Fleet Fuel Use and Emissions

## Methodology

Annual fuel use of on-road vehicles were grouped by the departments that the vehicles belong to and by types of vehicle classes.<sup>20</sup> The county fleet included the following vehicle classes: passenger vehicles, light-duty trucks, and heavy trucks, based on the ICLEI Protocol. In addition, five types of vehicle fuels were considered in the inventory. They are gasoline, biodiesel (B10 & B20), ultra-low sulfur diesel, ethanol (5.7% blend & 10% blend), and kerosene. In ClearPath, when calculating CO<sub>2</sub>e emissions from biodiesel and ethanol uses, a percent of biofuel in blend is needed as input.

GHG emissions were calculated by ClearPath based on these inputs:

- 1) Type of fuel consumed by department
- 2) Annual fuel consumption by department
- 3) Annual vehicle miles travelled (VMT) by vehicle class within the department

## Data & Sources

- a. Vehicle Fleet Information – The inventory of County-owned vehicles maintained by Jackie Kippola in County Administration was updated in 2015 by the Planning Department with the assistance of Lisa Hall in the Purchasing Division of the Finance Department. This list provides details about the year, make, and model of vehicles owned by County departments.

Tompkins County Vehicle Inventory as of 8/28/15									
DEPARTMENT	YR	MAKE	MODEL	VIN	Classification (ClearPath)	Gas	Gas (gallons)	Ethanol	
A I R P O R T	1959	Dodge	Power Wagon	L8D39586	Light Truck				
	1991	Saab	900	YS3AK36E6M5004445	Passenger Vehicle				
	2003	Chevy	Tahoe	1GNEK13203J302510	Light Truck				
	2003	Sterling	LT9500	2FZHA593AL86482	Heavy Truck				
	2004	Ford	F-550	1FDAP56564ED25507	Light Truck				
	2007	Ford	Ranger	1FYTR10U38PA39783	Light Truck				
	2009	Ford	F-250	1FTSX21599EB00222	Light Truck				
	2010	Freightliner	M2-106	1FVAC3BS1ADA59777	Heavy Truck				
	2012	Ford	F-250	1FTBF2B6XCEB82110	Light Truck				
	2013	Chevy	Volt (lease)	1G1RE6E41DU115687	Passenger Vehicle	2,942	79.52		
	2004	E-One	HPR Titan Crash Truck	128090	Heavy Truck				
1996	Oshkosh	T-1500 Crash Truck	10T9L5BH1V1053950	Heavy Truck					
ASSESSMENT	2006	Jeep	Liberty	1J4GL48K57W686755	Light Truck	5,068	266.76	247	
	2006	Ford	Taurus	1FAFP53U76A19824	Passenger Vehicle	3,873	193.63		
	2007	Jeep	Liberty	1J4GL48K76W269325	Light Truck	4,022	236.60		
	2010	Toyota	Prius	JTDKN3DU4A0147769	Passenger Vehicle	6,959	139.17		
COUNTY CLERK	2008	Ford	Escape	1FMCU03118KC90783	Light Truck	18,767	735.96		
H I G H W A Y	1967	GRACE	TOW-BEHIND BROOM	W4-1770					
	1969	GINDY	BRIDGE TRAILER	48878					
	1973	CATERPILLAR	D7 DOZER	94N5479					
	1978	RIVINIUS	DOMOR SHOULDER MACHINE						
	1986	OVER-LOWE TPME-3A4DC	GENERATOR MODEL 9LD561-2L	647318/95					
	1986	BARBER GREEN	BG240 PAVER	BG240X560					
	1987	BAME	9 TON TAG TRAILER	1B9500938HS026002					
	1988	REINCO W4-1770	MULCHER	6204493					
	1988	GORMAN RUPP	DOUBLE 4" CENTRIFIGAL PUMP	101009					
	1989	JOHN DEERE	750B DOZER	760277					
	1990	HAMM	HD90 ROLLER	5279					
	1990	MILLER	200 WELDER	J8504379					
	1993	FORD	3930 BROOM TRACTOR	BD51525					
	1993	KOMATSU	FG 25T FORKLIFT	456286A					
	1994	STOW	WALK-BEHIND ROLLER	8903790					
	1994	IR SD100D	SINGLE DRUM ROLLER PRO PAC	104875DD					

- b. WEX fuel card website – WEXOnline (<https://go.wexonline.com/online/>)

<sup>20</sup>Note that the methodology of off-road vehicles and equipment is described below in section 7.

The County began using WEX fuel cards for fuel purchases in 2013. Transaction Management Reports provided the information needed for 2014: Vehicle Year, Make, and Model, Product Description (tells what type of fuel a vehicle uses), Net Cost, and fuel consumption over the desired time period. This online data portal was not available in 2008.

- **Fuel Type and Annual Consumption**

By matching the WEX data with the vehicle inventory above, fuel type and annual fuel consumption by each model and make of vehicle can be obtained. Subtotals of annual consumption by fuel type were found for each department.

- **Vehicle Class**

ClearPath only allows classification by passenger vehicle, light truck, or heavy truck. This does not match with any standard vehicle classification system, such as the Federal Highway Administration Vehicle Classes or the vehicle classes used in the U.S. EPA's emissions standards. It was assumed that SUVs, vans, and pick-up trucks are counted as light truck in ClearPath. Based on this assumption and fuel economy information from U.S. Department of Energy (<https://www.fueleconomy.gov/feg/bymodel/bymakemodelNF.shtml>), passenger vehicles and light trucks can be identified. The rest of the vehicles are either heavy trucks or off-road vehicles.

- **Vehicle Miles Traveled**

Vehicle miles traveled entered into the WEX database is not accurate. The official fuel economy website above gives a range of MPG for each make and model of vehicle on record. Simple average of MPG for each make and model of vehicle was computed and given their annual fuel consumption, their VMT can therefore be obtained:  $VMT = \text{miles per gallon (MPG)} * \text{fuel consumption}$ . Subtotal of VMT by department was found. Within each department, VMT % by vehicle class was also found.

Some vehicles' class and/or VMT are not available, specifically fueling data from Highway tanks for Highway and Facilities vehicles does not provide mileage of vehicles being fueled. They affect the CH<sub>4</sub> and N<sub>2</sub>O emitted. However, lack of the information only reduces the final CO<sub>2</sub>e result by 0.1%-1.8%. So an inability to enter these two ClearPath inputs when the vehicle class and/or VMT data are not attainable does not significantly alter results.

WEX data showed a marked decrease in fuel use between 2008 and 2014 for the Mental Health and Health Departments. Mental Health Department staff member Maria Andrews provided information about 2014 programmatic changes which helped to explain her department's reduction in vehicle and fuel use. Health Department staff member Karen Johnson provided information about the 2012 elimination of the Home Care Unit fleet and significant reduction in her department's fuel use.

Although the Airport, Highway Division, and Facilities Division all purchase some fuel through the WEX system, much of their vehicle fuel is purchased outside of the system, as detailed below.

- c. Highway Division – The Highway Division maintains its own fuel tanks that are used to fuel many of its vehicles. Data regarding this fuel use in vehicles at the Highway Division was provided by Jeff Lucas and Joe Stacy, past and present Equipment Service Manager of the Highway Division. The data includes additional gasoline, diesel, B10 biodiesel, and B20 biodiesel fuel consumption by various vehicles owned by the Highway Division over 2014, and costs of the fuel pumped. The fuel was purchased outside of the WEX vehicle fueling system and therefore was added to any WEX fuel purchases made by the Highway Division.

	Gallons Gas	Per gallon	Lbs. ULSD	Gallons ULSD	Per gallon	Lbs. B10	Gallons B10	Per gallon	Lbs. B20	Gallons B20	Per gallon
2008	1950.46	19.4	37838.7	0	22.2	0	0	20.5	0	0	18.9
2009	2211.3	19.4	42899.2	0	22.2	0	0	20.5	0	0	18.9
2010	750.45	19.4	14550.7	0	22.2	0	0	20.5	0	0	18.9
2011	127.10	19.4	2467.29	0	22.2	0	0	20.5	0	0	18.9
2012	293.23	19.4	5688.66	0	22.2	0	0	20.5	0	0	18.9
2013	1651.76	19.4	32044.1	0	22.2	0	0	20.5	0	0	18.9
2014	331.07	19.4	6422.76	0	22.2	0	0	20.5	0	0	18.9
2015	385.2	19.4	7472.88	0	22.2	0	0	20.5	0	0	18.9
2016	1311.75	19.4	25448	0	22.2	0	0	20.5	0	0	18.9
2017	1871.15	19.4	36300.3	0	22.2	0	0	20.5	0	0	18.9
2018	1172.75	19.4	22751.4	0	22.2	0	0	20.5	0	0	18.9
2019	1290.39	19.4	25033.6	0	22.2	0	0	20.5	0	0	18.9
2020	237.75	19.4	4612.35	0	22.2	0	0	20.5	0	0	18.9
2021	1048.51	19.4	20341.1	0	22.2	0	0	20.5	0	0	18.9
2022	581.53	19.4	11281.7	0	22.2	0	0	20.5	0	0	18.9
2023	0	19.4	0	0	22.2	0	228.28	20.5	4679.74	413.3	18.9
2024	1158.09	19.4	22466.9	0	22.2	0	0	20.5	0	0	18.9
2025	0	19.4	0	0	22.2	0	1225.26	20.5	25117.0	625.22	18.9
2026	0	19.4	0	0	22.2	0	241.45	20.5	4949.73	293.23	18.9
2027	0	19.4	0	0	22.2	0	805.4	20.5	16510.7	1423.39	18.9
2028	0	19.4	0	0	22.2	0	1630.52	20.5	33425.7	1666.02	18.9
2029	0	19.4	0	2229.87	22.2	49503.1	0	20.5	0	1222.33	18.9
2030	0	19.4	0	1446.84	22.2	32119.8	0	20.5	0	1991.92	18.9
2031	0	19.4	0	0	22.2	0	764.63	20.5	15674.9	1207.51	18.9
2032	0	19.4	0	0	22.2	0	867.77	20.5	17789.3	1040.18	18.9
2033	0	19.4	0	0	22.2	0	1820.22	20.5	37314.5	1324.01	18.9
2034	0	19.4	0	0	22.2	0	2086.59	20.5	42774.9	593.47	18.9
2035	0	19.4	0	0	22.2	0	2114.7	20.5	43351.4	1146.57	18.9
2036	0	19.4	0	0	22.2	0	752.14	20.5	15418.9	638.26	18.9
2037	0	19.4	0	0	22.2	0	982.22	20.5	20135.5	1127.6	18.9
2038	0	19.4	0	963.82	22.2	21396.8	0	20.5	0	1236.34	18.9
2039	0	19.4	0	0	22.2	0	958.1	20.5	19641.1	167.88	18.9
2040	0	19.4	0	0	22.2	0	1443.06	20.5	29502.7	1678.55	18.9
2041	0	19.4	0	0	22.2	0	60	20.5	1230	0	18.9
2042	0	19.4	0	0	22.2	0	1889.22	20.5	38729	1148.68	18.9
2043	0	19.4	0	0	22.2	0	40.25	20.5	825.125	298.69	18.9
2044	0	19.4	0	0	22.2	0	1570.79	20.5	32201.2	971.75	18.9
2045	0	19.4	0	0	22.2	0	25.55	20.5	523.775	38.25	18.9
2046	0	19.4	0	0	22.2	0	141.55	20.5	2901.78	573.58	18.9
2047	0	19.4	0	0	22.2	0	573.8	20.5	11762.9	574.53	18.9
2048	16372.56	LBS Eco2	317827.7	4640.53	LBS Eco2	103019.0	20221.49	LBS Eco2	4145.05	21325.23	LBS Eco2
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### Ithaca Tompkins Regional Airport

#### Simple Invoice By Account For Vehicle

Date Range From: 1/1/2015 12:00:00 AM To: 12/31/2015 11:59:59 PM

Vehicle	Vehicle Name	Driver	# of Trans	Avg Price	Total Quantity	Total Amount
Account: 01 Airport 72 Brown Road Ithaca NY, 14850						
<b>Product Id: 01 Unleaded</b>						
1	1	2989	44	\$1,000	495.600	\$495.60
14	14	5910	13	\$1,000	154.300	\$154.30
16	16	2468	2	\$1,000	11.600	\$11.60
2	2	5910	23	\$1,000	177.300	\$177.30
20	20	1817	6	\$1,000	33.600	\$33.60
2201	2201 fire truck	5910	1	\$1,000	0.300	\$0.30
2202	2202 Fire Truck	2468	3	\$1,000	15.500	\$15.50
2241	2241 Fire Truck	5910	2	\$1,000	42.600	\$42.60
2242	2242 Fire Truck	9060	44	\$1,000	371.700	\$371.70
25	Cans/ MISC	9220	8	\$1,000	29.500	\$29.50
3	3	5910	9	\$1,000	107.000	\$107.00
<b>Totals for Product:</b>				<b>\$1,000</b>	<b>1439.000</b>	<b>\$1,439.00</b>
<b>Product Id: 06 #2 Diesel</b>						
1	1	5308	1	\$1,000	25.500	\$25.50
10	10	8424	4	\$1,000	165.500	\$165.50
11	11	5910	1	\$1,000	51.600	\$51.60
12	12	5910	5	\$1,000	121.500	\$121.50
13	13	2989	8	\$1,000	139.800	\$139.80
15	15	2989	5	\$1,000	464.900	\$464.90
16	16	5308	2	\$1,000	55.500	\$55.50
17	17	5308	2	\$1,000	34.800	\$34.80
18	18	9060	1	\$1,000	4.400	\$4.40
2201	2201 fire truck	6181	27	\$1,000	595.600	\$595.60
2202	2202 Fire Truck	2468	24	\$1,000	265.000	\$265.00
2242	2242 Fire Truck	2468	2	\$1,000	18.400	\$18.40
25	Cans/ MISC	6181	8	\$1,000	39.600	\$39.60
5	5	2468	5	\$1,000	147.200	\$147.20
6	6	5910	6	\$1,000	72.700	\$72.70
7	7	6181	14	\$1,000	86.700	\$86.70
8	8	5910	62	\$1,000	800.600	\$800.60
9	9	9060	21	\$1,000	203.300	\$203.30
<b>Totals for Product:</b>				<b>\$1,000</b>	<b>3292.600</b>	<b>\$3,292.60</b>
<b>Totals for Account:</b>				<b>\$1,000</b>	<b>4731.600</b>	<b>\$4,731.60</b>

	On-Road #		Fuel Consumption	Approximate MPG	VMT	Off-Road	Fuel Consumption	
Gas	1	Light Truck	495.6	6.4	3,162.7			
	14	Light Truck	154.3	14.8	2,290.7			
	16	Light Truck	11.6					
	2	Light Truck	177.3	5.8	1,021.8			
	2201	Heavy Truck	0.3					
	2202	Heavy Truck	15.5					
	2241	Light Truck	42.6					
	2242	Light Truck	371.7	6.8	2,541.2			
	3	Light Truck	107.0	1.8	191.9			
	20	Passenger Car	33.6	4.4	147.4			
	4	Heavy Truck	29.5					
	<b>Total</b>			<b>1,439.0</b>		<b>9,355.7</b>		
			Passenger Car	1	9.1%			
			Light Truck	7	63.6%			
		Heavy Truck	3	27.3%				
			11					
	On-Road #		Fuel Consumption	Approximate MPG	VMT	Off-Road	Fuel Consumption	
Diesel	1	Light Truck	25.5			10	165.5	
	2201	Heavy Truck	595.6	0.1	78	11	51.6	
	2202	Heavy Truck	265.0	0.1	20	12	121.5	
	2242	Light Truck	18.4			13	139.8	
	4	Heavy Truck	39.6	6.7	264	15	464.9	
	<b>Total</b>		<b>944.1</b>		<b>361</b>	<b>16</b>	<b>55.5</b>	
						17	34.8	
						18	4.4	
						5	147.2	
						6	72.7	
						7	86.7	
					8	800.6		
					9	203.3		
					<b>Total</b>	<b>2348.5</b>		
		Sum	3292.6					

**f. Fuel Economy and Emission Rates**

Entered into ClearPath under "Factor Sets" as "2014 Govt Transportation Factor Set". No default values are available.

- Miles per Gallon (MPG)

The fuel economy data was obtained from the 2013 National Transportation Statistics - Average miles traveled per gallon (2013 statistics is the most recent data available) <http://www.rita.dot.gov/bts/publications>

- Table 4-11 Light Duty Vehicle, Short Wheel Base and Motorcycle
- Table 4-12 Light Duty Vehicle, Long Wheel Base
- Table 4-13 Single-Unit 2-Axle 6-Tire or More Truck
- Table 4-14 Combination Truck
- Table 4-15 Bus

This information is shown below:

	2008	2009	2010	2011	2012(R)	2013
Average miles traveled per gallon						
Light duty vehicles, short wheel base <sup>a</sup>	23.7	23.5	23.3	23.2	23.3	23.4
Motorcycles	42.5	43.2	43.4	43.5	43.5	43.5

	2008	2009	2010	2011	2012(R)	2013
Average miles traveled per gallon	17.3	17.3	17.2	17.1	17.1	17.2

	2008	2009	2010	2011	(R) 2012	2013
Average miles traveled per gallon	7.4	7.4	7.3	7.3	7.3	7.3

	2008	2009	2010	2011	2012(R)	2013
Average miles traveled per gallon	6.0	6.0	5.9	5.8	5.8	5.8

	2008	2009	2010	2011	2012(R)	2013
Average miles traveled per gallon	7.2	7.2	7.2	7.1	7.2	7.2

**- g CH<sub>4</sub>/mile and g N<sub>2</sub>O/mile**

Given the vehicle class, its VMT, and vehicle class percent, CH<sub>4</sub> and N<sub>2</sub>O emissions can be obtained.

Update of Methane and Nitrous Oxide Emission Factors for On-Highway Vehicles (Page 22, Table 28.

“Recommended Emission Factors for On-Highway Vehicles” where values are given for Nitrous Oxide, N<sub>2</sub>O, and Methane, CH<sub>4</sub>, Emission Factors) <http://www3.epa.gov/otag/models/ngm/420p04016.pdf>

**- g CO<sub>2</sub>/mile**

It is specified in ClearPath that there is 8.78 kg CO<sub>2</sub> per gallon gasoline and 10.21 kg CO<sub>2</sub> per gallon diesel

## Off-Road Vehicles Fuel Use

### Airport

**Methodology**

As mentioned above, in the Airport recently began using a fueling tracking system and therefore 2015 was selected as a proxy year for 2014 since 2015 is the first full year with fueling information available. Only equipment such as

blowers, mowers, plows, and loaders are counted as off-road vehicles. Fuel consumption of off-road vehicles is used in the CO<sub>2</sub>e emissions by using ClearPath.

## Highway

### Methodology

A detailed list of vehicles used by the Highway Division in 2014 was provided by Jeff Lucas and Joe Stacy, past and present Equipment Service Managers of the Highway Division. The list includes the vehicle model, fuel type, and annual fuel consumption. Equipment such as that described above for the Airport was classified as similar off-road vehicles. Those from off-road vehicles are counted under this sector while those from on-road vehicles are counted in the Vehicle Fleet sector under the Highway Division.

	D	E	F	G	H	I	J	K	L	M	N	O	P
14	420E BACKHOE	0	19.4	0	0	22.2	0	79.48	20.5	1629.34	63.81	18.9	1206.01
15	450G DOZER	0	19.4	0	0	22.2	0	0	20.5	0	30	18.9	567
16	MT455B SIDE FLAIL MOWER	0	19.4	0	0	22.2	0	0	20.5	0	910.75	18.9	17213.2
17	726A-VHP GRADER	0	19.4	0	0	22.2	0	93.96	20.5	1926.18	0	18.9	0
18	S850	0	19.4	0	0	22.2	0	104.58	20.5	2143.89	77.3	18.9	1460.97
19	HD90 ROLLER	0	19.4	0	0	22.2	0	40	20.5	820	101.9	18.9	1925.91
20	SINGLE DRUM ROLLER PRO PAC	0	19.4	0	0	22.2	0	0	20.5	0	18.38	18.9	347.382
21	MT455B SIDE FLAIL MOWER	0	19.4	0	0	22.2	0	0	20.5	0	499.81	18.9	9446.41
22	MT455B SIDE ARM	0	19.4	0	0	22.2	0	149.14	20.5	3057.37	779.57	18.9	14733.9
23	L90E	0	19.4	0	0	22.2	0	510.38	20.5	10462.8	274.46	18.9	5187.29
24	821D LOADER	0	19.4	0	0	22.2	0	173	20.5	3546.5	167	18.9	3156.3
25	821E LOADER	0	19.4	0	0	22.2	0	201.55	20.5	4131.78	205.72	18.9	3888.11
26	D7 DOZER	0	19.4	0	0	22.2	0	0	20.5	0	0	18.9	0
27	821E LOADER	0	19.4	0	0	22.2	0	283.84	20.5	5818.72	165.99	18.9	3137.21
28	CP 132	0	19.4	0	0	22.2	0	0	20.5	0	0	18.9	0
29	S80	0	19.4	0	0	22.2	0	10.41	20.5	213.405	10.51	18.9	198.639
30		0	19.4	0	0	22.2	0	11.74	20.5	240.67	0	18.9	0
31	750B DOZER	0	19.4	0	0	22.2	0	0	20.5	0	16	18.9	302.4
32	P185MIR AIR COMPRESSOR	0	19.4	0	0	22.2	0	0	20.5	0	36.8	18.9	695.52
33	250Q AIR COMPRESSOR	0	19.4	0	0	22.2	0	0	20.5	0	6.4	18.9	120.96
34	2800 SMALL LOADER	0	19.4	0	0	22.2	0	0	20.5	0	0	18.9	0
35	3930 BROOM TRACTOR	0	19.4	0	0	22.2	0	11	20.5	225.5	49.26	18.9	931.014
36	BROOM TRACTOR	0	19.4	0	0	22.2	0	12.05	20.5	247.025	205.99	18.9	3893.21
37	GENERATOR MODEL 9LD561-2L	0	19.4	0	0	22.2	0	0	20.5	0	0	18.9	0
38	TOW-BEHIND BROOM	0	19.4	0	0	22.2	0	0	20.5	0	0	18.9	0
39	200 WELDER	0	19.4	0	0	22.2	0	0	20.5	0	0	18.9	0
40	MULCHER	0	19.4	0	0	22.2	0	0	20.5	0	0	18.9	0
41	301G WELDER	211.29	19.4	4099.03	0	22.2	0	0	20.5	0	0	18.9	0
42	24' ENCLOSED TRAILER	0	19.4	0	0	22.2	0	0	20.5	0	0	18.9	0
43	6HD20 TRAILER	0	19.4	0	0	22.2	0	0	20.5	0	0	18.9	0
44	TRAILER	0	19.4	0	0	22.2	0	0	20.5	0	0	18.9	0
45	TRAILER	0	19.4	0	0	22.2	0	0	20.5	0	0	18.9	0
46	9 TON TAG TRAILER	0	19.4	0	0	22.2	0	0	20.5	0	0	18.9	0
47	20TT262ASPL 20 TON TAG TRAILER	0	19.4	0	0	22.2	0	0	20.5	0	0	18.9	0
48	818 CHIPPER	0	19.4	0	0	22.2	0	83.04	20.5	1702.32	111.27	18.9	2103
49	818 CHIPPER	0	19.4	0	0	22.2	0	31.71	20.5	650.055	78.52	18.9	1484.03
50	LB334 FLOW BOY TRAILER	0	19.4	0	0	22.2	0	0	20.5	0	0	18.9	0
51	BG240 PAVER	0	19.4	0	0	22.2	0	28.45	20.5	583.225	27.08	18.9	511.812
52	FG 25T FORKLIFT	0	19.4	0	0	22.2	0	0	20.5	0	0	18.9	0
53	T-90 HYDROSEEDER	0	19.4	0	0	22.2	0	3.09	20.5	63.345	35.24	18.9	666.036
54	SUPER SHOT 125 CRACK SEALER	0	19.4	0	0	22.2	0	0	20.5	0	0	18.9	0
55	SUMOR SHOULDER MACHINE	0	19.4	0	0	22.2	0	0	20.5	0	0	18.9	0
56	RW 100 SHOULDER MACHINE	0	19.4	0	0	22.2	0	23	20.5	471.5	0	18.9	0
57	DOUBLE 4" CENTRIFUGAL PUMP	0	19.4	0	0	22.2	0	0	20.5	0	8.22	18.9	155.358
58		211.29	LBS Eco2	4099.026	0	LBS Eco2	0	3352.95	LBS Eco2	68735.48	7196.85	LBS Eco2	136120.5

Note that in 2008, off-road vehicles were not separated from the overall fuel use of the Airport or Highway Division.

## Changes to Facilities

### Johnson Controls Energy Performance Contract

Tompkins County and Johnson Controls, Inc. entered into an Energy Performance Contract (EPC) in December 2005, with a number of Facility Improvement Measures (FIMs) implemented to increase the energy efficiency of buildings. An additional EPC was executed in January 2013 for the purpose of upgrading energy equipment and systems within the Public Safety Building. Arel LeMaro and Alan Lockett of the Facilities Division, together with Johnson Controls Energy Consultant Gerold (Jerry) Aloji, provided copies of the Tompkins County Performance Contract Cost

Avoidance Report for 2014 and a hard copy of the Public Safety Building Energy Performance Contract Cost Avoidance Report dated March 30, 2016. Improvements made during or before 2014 have been noted in this inventory. The 2014 report is available at

### **Solid Waste Facilities**

Leo Riley, Assistant Solid Waste Manager at the Solid Waste Division, provided additional information regarding upgrades to Solid Waste facilities and operational changes which affected electricity and natural gas use.

### **Airport Facilities**

Airport Administrative Coordinator Roxan Noble provided the dates for the Airport taking over the Old IHA Hangar from the Ithaca Hangar Association, and for construction of the Sand Storage Building.

### **County Staff Insights**

Information regarding each department's building and fleet energy use and known factors that contributed to changes in this use between 2008 and 2014 was shared with County department heads to discuss with their staff and to provide additional input regarding changes within their departments and buildings between 2008 and 2014 that may have affected energy use. This information has been incorporated into the explanations provided in Appendix D – Individual Facility Data.

### **Sale of Former County Properties**

Tompkins County Legislature minutes and County Tax Assessment records were used to confirm dates of sale for former County properties disposed of since 2008.

## **Limitations of Data**

The results of GHG emissions inventories, including this 2014 inventory, are impacted by the quality of the data available as inputs to the calculations. The data used in preparing this inventory was the best available at the time.

- Electricity and natural gas utility data – Billing cycles are often inconsistent and utility companies sometimes make billing mistakes or poor estimations for a particular month that are corrected at a later date. For this reason, energy use from utility websites was prioritized over printed bills, which are sometimes amended at later dates.
- Vehicle fleet – differences in records available for fuel pumped at public gas stations vs. fuel pumped from Highway or Airport tanks means that fleet data is not consistent, resulting in slightly different inputs and assumptions as described in the fleet section below. Also, WEX fuel data requires drivers to input their odometer readings, which are prone to both accidental and intentional (ex. entering "0") user error, so VMT calculations rely on average mileage for the vehicles fueled. However, if a vehicle's year, make, and model are not specified in fueling data, as is the case with fueling of Highway and Facilities vehicles from Highway tanks, its MPG cannot be known and VMT cannot be estimated. Its VMT is left blank in ClearPath and the estimated CO<sub>2</sub>e emission would be slightly off compared to those of vehicles where VMT is known.
- Highway Satellite Facility heating – Without formal utility bills for heating, personal staff estimates for heating fuel use were used and are subjective.