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_2 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_2 408.80 lbs/MWh, CH_4 15.59 lbs/GWh, and N_2O 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
Airport Facilities	1,386,054		1,386,040	1,386,040	
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
Solid Waste Facilites	277,720		277,720	277,720	
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	
St Lights & Tfc Signals	38,788		38,788	38,788	
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	
Total	**6,320,485**	**22,508**	**6,503,913**	**6,334,698**	**205,950**

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)
Airport Facilities	63,812
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
Solid Waste Facilities	8,742
Building C	7,306
Emergency Response	6,936
Board of Elections	2,886
Human Services Annex	2,716
DMV	2,618
St Lights & Tfc Signals	0
Total	**295,868**

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
Total	**38,788**

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
Total	**277,720**

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
Total	**8,742**

Airport Facilities

Methodology

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

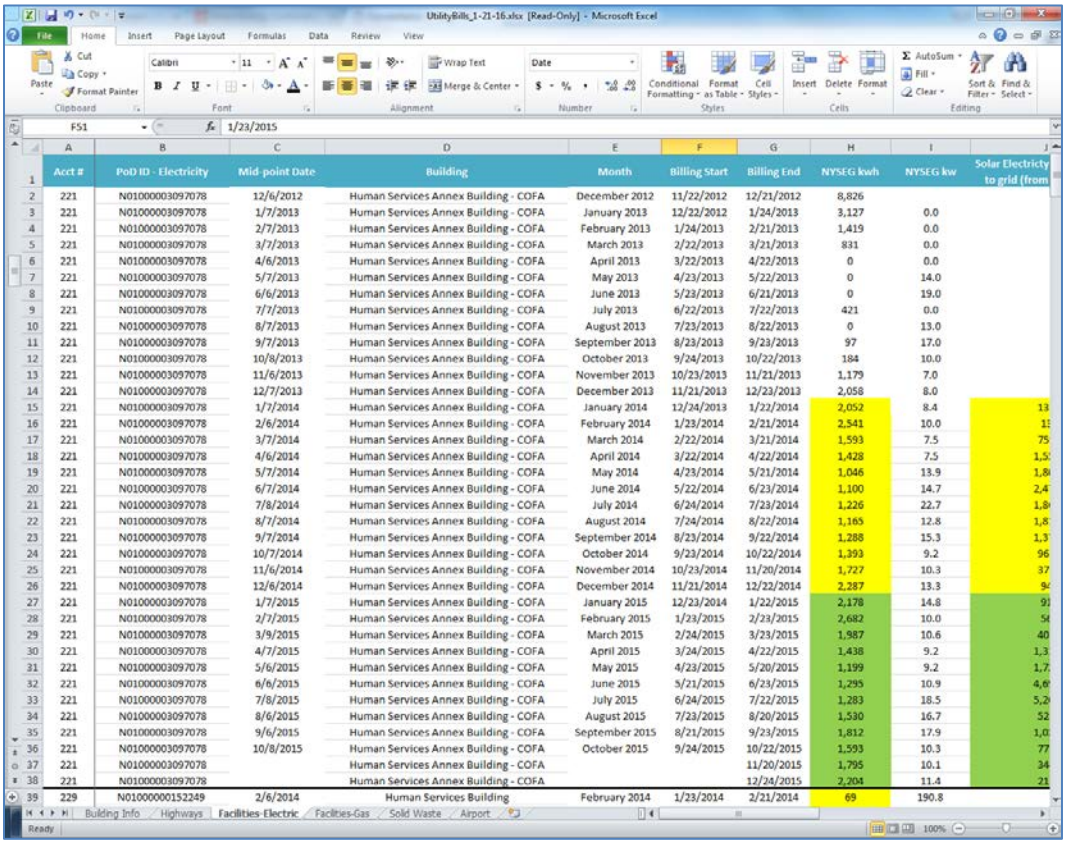
Building Name	Net Usage (kWh, from Grid)
Old IHA Hangar	7,108
Sand Storage Building	10,321
Crash Fire & Rescue	249,520
Airport Terminal	1,092,800
T Hangar I	11,459
T Hangar II	10,737
Airport Parking Lights	1
Total	**1,381,946**

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

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/Integrys bills – Constellation, formerly known as Integrys, is an electricity supplier and the entity through which Green-e RECs are purchased. Therefore, most of the electricity supply for County facilities is purchased through Constellation/Integrys 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 Electricty to grid (from
221	N01000003097078	12/6/2012	Human Services Annex Building - COFA	December 2012	11/22/2012	12/21/2012	8,826		
221	N01000003097078	1/7/2013	Human Services Annex Building - COFA	January 2013	12/22/2012	1/24/2013	3,127	0.0	
221	N01000003097078	2/7/2013	Human Services Annex Building - COFA	February 2013	1/24/2013	2/21/2013	1,419	0.0	
221	N01000003097078	3/7/2013	Human Services Annex Building - COFA	March 2013	2/22/2013	3/21/2013	831	0.0	
221	N01000003097078	4/6/2013	Human Services Annex Building - COFA	April 2013	3/22/2013	4/22/2013	0	0.0	
221	N01000003097078	5/7/2013	Human Services Annex Building - COFA	May 2013	4/23/2013	5/22/2013	0	14.0	
221	N01000003097078	6/6/2013	Human Services Annex Building - COFA	June 2013	5/23/2013	6/21/2013	0	19.0	
221	N01000003097078	7/7/2013	Human Services Annex Building - COFA	July 2013	6/22/2013	7/22/2013	421	0.0	
221	N01000003097078	8/7/2013	Human Services Annex Building - COFA	August 2013	7/23/2013	8/22/2013	0	13.0	
221	N01000003097078	9/7/2013	Human Services Annex Building - COFA	September 2013	8/23/2013	9/23/2013	97	17.0	
221	N01000003097078	10/8/2013	Human Services Annex Building - COFA	October 2013	9/24/2013	10/22/2013	184	10.0	
221	N01000003097078	11/6/2013	Human Services Annex Building - COFA	November 2013	10/23/2013	11/21/2013	1,179	7.0	
221	N01000003097078	12/7/2013	Human Services Annex Building - COFA	December 2013	11/21/2013	12/23/2013	2,058	8.0	
221	N01000003097078	1/7/2014	Human Services Annex Building - COFA	January 2014	12/24/2013	1/22/2014	2,052	8.4	13
221	N01000003097078	2/6/2014	Human Services Annex Building - COFA	February 2014	1/23/2014	2/21/2014	2,541	10.0	1
221	N01000003097078	3/7/2014	Human Services Annex Building - COFA	March 2014	2/22/2014	3/21/2014	1,593	7.5	75
221	N01000003097078	4/6/2014	Human Services Annex Building - COFA	April 2014	3/22/2014	4/22/2014	1,428	7.5	1,5
221	N01000003097078	5/7/2014	Human Services Annex Building - COFA	May 2014	4/23/2014	5/21/2014	1,046	13.9	1,8
221	N01000003097078	6/7/2014	Human Services Annex Building - COFA	June 2014	5/22/2014	6/23/2014	1,100	14.7	2,4
221	N01000003097078	7/8/2014	Human Services Annex Building - COFA	July 2014	6/24/2014	7/23/2014	1,226	22.7	1,8
221	N01000003097078	8/7/2014	Human Services Annex Building - COFA	August 2014	7/24/2014	8/22/2014	1,165	12.8	1,8
221	N01000003097078	9/7/2014	Human Services Annex Building - COFA	September 2014	8/23/2014	9/22/2014	1,288	15.3	1,3
221	N01000003097078	10/7/2014	Human Services Annex Building - COFA	October 2014	9/23/2014	10/22/2014	1,393	9.2	96
221	N01000003097078	11/6/2014	Human Services Annex Building - COFA	November 2014	10/23/2014	11/20/2014	1,727	10.3	87
221	N01000003097078	12/6/2014	Human Services Annex Building - COFA	December 2014	11/21/2014	12/22/2014	2,287	13.3	9
221	N01000003097078	1/7/2015	Human Services Annex Building - COFA	January 2015	12/23/2014	1/22/2015	2,178	14.8	91
221	N01000003097078	2/7/2015	Human Services Annex Building - COFA	February 2015	1/23/2015	2/23/2015	2,682	10.0	5
221	N01000003097078	3/9/2015	Human Services Annex Building - COFA	March 2015	2/24/2015	3/23/2015	1,987	10.6	40
221	N01000003097078	4/7/2015	Human Services Annex Building - COFA	April 2015	3/24/2015	4/22/2015	1,438	9.2	1,3
221	N01000003097078	5/6/2015	Human Services Annex Building - COFA	May 2015	4/23/2015	5/20/2015	1,199	9.2	1,7
221	N01000003097078	6/6/2015	Human Services Annex Building - COFA	June 2015	5/21/2015	6/23/2015	1,295	10.9	4,6
221	N01000003097078	7/8/2015	Human Services Annex Building - COFA	July 2015	6/24/2015	7/22/2015	1,283	18.5	5,2
221	N01000003097078	8/6/2015	Human Services Annex Building - COFA	August 2015	7/23/2015	8/20/2015	1,530	16.7	52
221	N01000003097078	9/6/2015	Human Services Annex Building - COFA	September 2015	8/21/2015	9/23/2015	1,812	17.9	1,0
221	N01000003097078	10/8/2015	Human Services Annex Building - COFA	October 2015	9/24/2015	10/22/2015	1,593	10.3	77
221	N01000003097078		Human Services Annex Building - COFA			11/20/2015	1,795	10.1	34
221	N01000003097078		Human Services Annex Building - COFA			12/24/2015	2,204	11.4	21
229	N01000000152249	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, 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

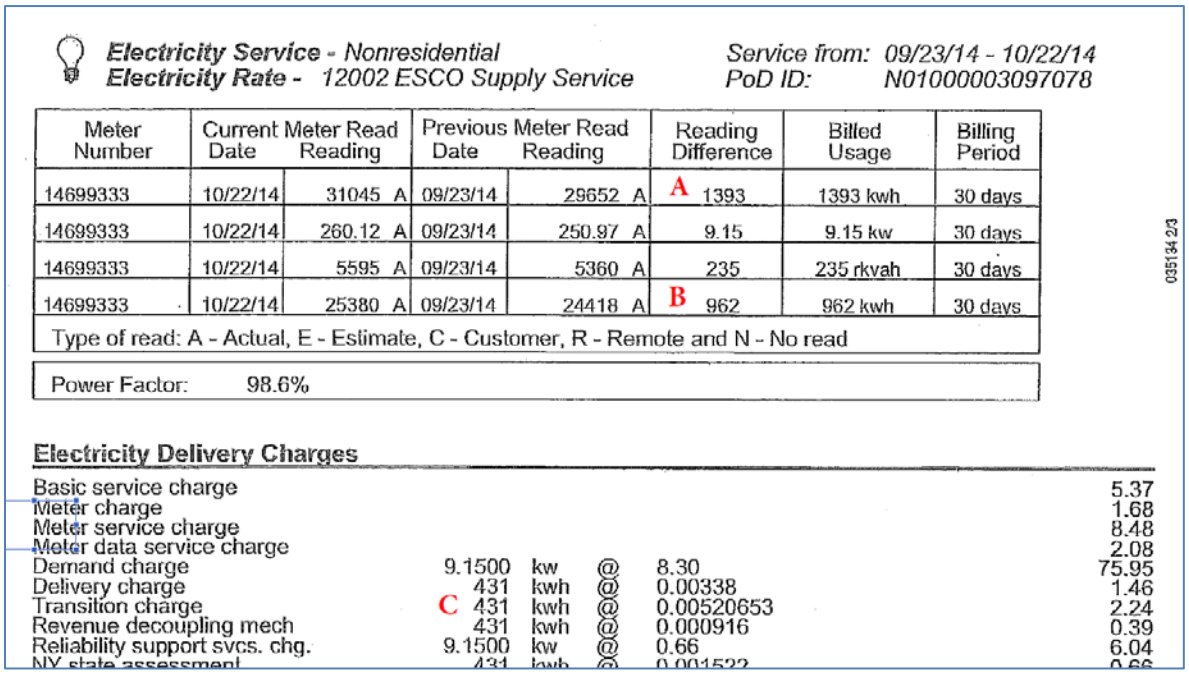
Data for leased panels were obtained from the Solar Liberty website, which records the annual solar electricity generation of PV panels installed on the County's Emergency Response Center, Health Department, Building C, Human Services Annex, Public Safety Building, and Public Works/Bostwick Facility. 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.



Electricity Service *- Nonresidential* — *Service from: 09/23/14 - 10/22/14*
Electricity Rate *- 12002 ESCO Supply Service* — *PoD ID: N01000003097078*

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 rkvah	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%

035134 2/3

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	75.95
Delivery charge	431	kwh	@	0.00338	1.46
Transition charge	C 431	kwh	@	0.00520653	2.24
Revenue decoupling mech	431	kwh	@	0.000916	0.39
Reliability support svcs. chg.	9.1500	kw	@	0.66	6.04
NY state assessment	431	kwh	@	0.001522	0.66

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 $MTCO_2e$ emission of the building/facility.

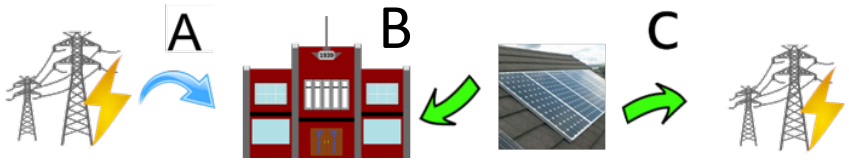
Although the 2010 ICLEI Protocol does not recommend deducting RECs from emissions, preferring they be reported as supplemental information, after consultation with ICLEI staff regarding the County's purchase of Green-e RECs it was agreed that this inventory should account for emissions both with, as 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%202%20Guidance_Final.pdf).

The key metric to consider when finding the correct net electricity use and its CO_2e 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.[20] 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_2e 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
AIRPORT	1959	Dodge	Power Wagon	L8D39586	Light Truck			
	1991	Saab	900	YS3AK36E6M5004445	Passenger Vehicle			
	2003	Chevy	Tahoe	1GNEK13203J302510	Light Truck			
	2003	Sterling	LT9500	2FZHAS93AL86482	Heavy Truck			
	2004	Ford	F-550	1FDAF56564ED25507	Light Truck			
	2007	Ford	Ranger	1FYTR10U38PA39783	Light Truck			
	2009	Ford	F-250	1FTSX21599EB00222	Light Truck			
	2010	Freightliner	M2-106	1FVAC3BS1ADAS9777	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			
							79.52	
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	
							836.16	
COUNTY CLERK	2008	Ford	Escape	1FMCU03118KC90783	Light Truck	18,767	735.96	
HIGHWAY	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	JB504379				
	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	10487SDD				

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

[20] 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***

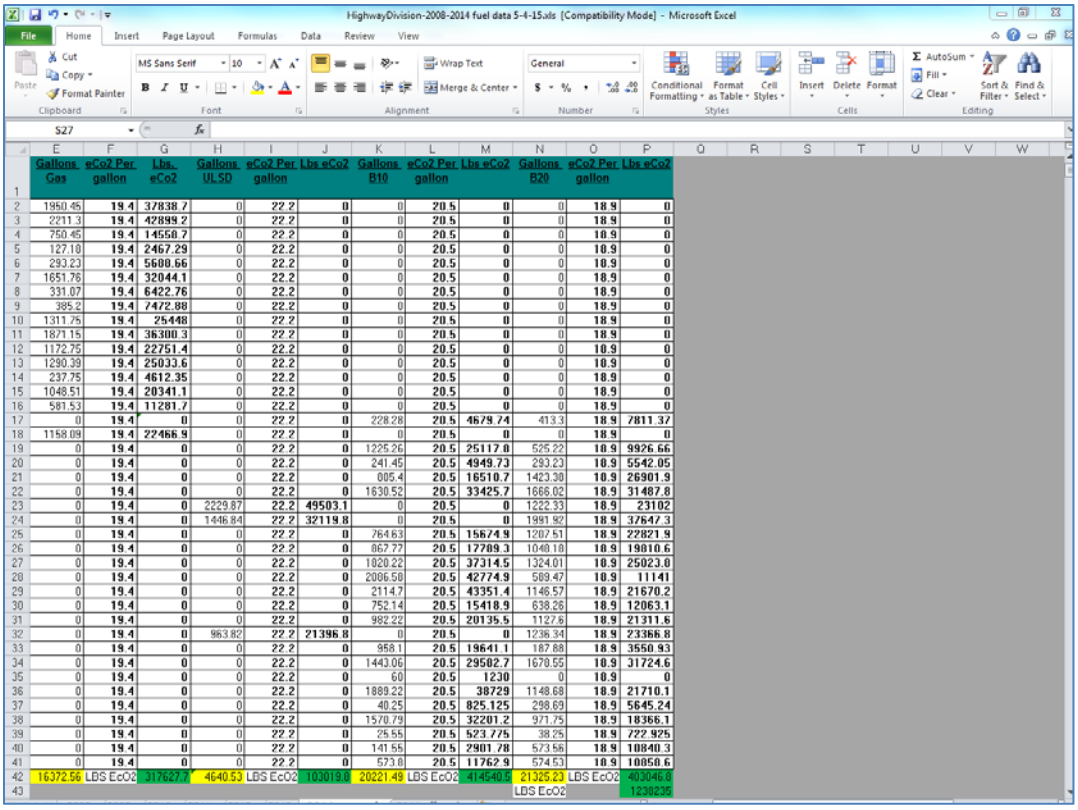
Vehicle miles traveled entered into the WEX database is not accurate. The official fuel economy website above gives a range of MPG for each make and model of vehicle on record. Simple average of MPG for each make and model of vehicle was computed and given their annual fuel consumption, their VMT can therefore be obtained: VMT = miles per gallon (MPG) * 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_4 and N_2O emitted. However, lack of the information only reduces the final CO_2e 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	eCo2 Per gallon	Lbs. eCo2	Gallons ULSD	eCo2 Per gallon	Lbs eCo2	Gallons B10	eCo2 Per gallon	Lbs eCo2	Gallons B20	eCo2 Per gallon	Lbs eCo2
2	1950.45	19.4	37838.7	0	22.2	0	0	20.5	0	0	18.9	0
3	2211.3	19.4	42899.2	0	22.2	0	0	20.5	0	0	18.9	0
4	750.45	19.4	14558.7	0	22.2	0	0	20.5	0	0	18.9	0
5	127.18	19.4	2467.29	0	22.2	0	0	20.5	0	0	18.9	0
6	293.23	19.4	5688.66	0	22.2	0	0	20.5	0	0	18.9	0
7	1651.76	19.4	32044.1	0	22.2	0	0	20.5	0	0	18.9	0
8	331.07	19.4	6422.76	0	22.2	0	0	20.5	0	0	18.9	0
9	385.2	19.4	7472.88	0	22.2	0	0	20.5	0	0	18.9	0
10	1311.75	19.4	25448	0	22.2	0	0	20.5	0	0	18.9	0
11	1871.15	19.4	36300.3	0	22.2	0	0	20.5	0	0	18.9	0
12	1172.75	19.4	22751.4	0	22.2	0	0	20.5	0	0	18.9	0
13	1290.39	19.4	25033.6	0	22.2	0	0	20.5	0	0	18.9	0
14	237.75	19.4	4612.35	0	22.2	0	0	20.5	0	0	18.9	0
15	1048.51	19.4	20341.1	0	22.2	0	0	20.5	0	0	18.9	0
16	581.53	19.4	11281.7	0	22.2	0	0	20.5	0	0	18.9	0
17	0	19.4	0	0	22.2	0	228.28	20.5	4679.74	413.3	18.9	7811.37
18	1158.09	19.4	22466.9	0	22.2	0	0	20.5	0	0	18.9	0
19	0	19.4	0	0	22.2	0	1225.26	20.5	25117.8	525.22	18.9	9926.66
20	0	19.4	0	0	22.2	0	241.45	20.5	4949.73	293.23	18.9	5542.05
21	0	19.4	0	0	22.2	0	805.4	20.5	16510.7	1423.38	18.9	26901.9
22	0	19.4	0	0	22.2	0	1630.52	20.5	33425.7	1666.02	18.9	31487.8
23	0	19.4	0	2229.87	22.2	49503.1	0	20.5	0	1222.33	18.9	23102
24	0	19.4	0	1446.84	22.2	32119.8	0	20.5	0	1991.92	18.9	37647.3
25	0	19.4	0	0	22.2	0	764.63	20.5	15674.9	1207.51	18.9	22821.9
26	0	19.4	0	0	22.2	0	867.77	20.5	17789.3	1048.18	18.9	19810.6
27	0	19.4	0	0	22.2	0	1020.22	20.5	37314.5	1324.01	18.9	25023.8
28	0	19.4	0	0	22.2	0	2006.58	20.5	42774.9	589.47	18.9	11141
29	0	19.4	0	0	22.2	0	2114.7	20.5	43351.4	1146.57	18.9	21670.2
30	0	19.4	0	0	22.2	0	752.14	20.5	15418.9	638.26	18.9	12063.1
31	0	19.4	0	0	22.2	0	982.22	20.5	20135.5	1127.6	18.9	21311.6
32	0	19.4	0	963.82	22.2	21396.8	0	20.5	0	1236.34	18.9	23366.8
33	0	19.4	0	0	22.2	0	958.1	20.5	19641.1	187.88	18.9	3550.93
34	0	19.4	0	0	22.2	0	1443.06	20.5	29502.7	1670.55	18.9	31724.6
35	0	19.4	0	0	22.2	0	60	20.5	1230	0	18.9	0
36	0	19.4	0	0	22.2	0	1889.22	20.5	38729	1148.68	18.9	21710.1
37	0	19.4	0	0	22.2	0	40.25	20.5	825.125	298.69	18.9	5645.24
38	0	19.4	0	0	22.2	0	1570.79	20.5	32201.2	971.75	18.9	18366.1
39	0	19.4	0	0	22.2	0	25.55	20.5	523.775	38.25	18.9	722.925
40	0	19.4	0	0	22.2	0	141.55	20.5	2901.78	573.56	18.9	10840.3
41	0	19.4	0	0	22.2	0	573.0	20.5	11742.9	574.53	18.9	10858.6
42	16372.56	LBS EcO2	317627.7	4640.53	LBS EcO2	103019.8	20221.49	LBS EcO2	414540.5	21325.23	LBS EcO2	403046.8
43										LBS EcO2		1230235

d. Facilities Division

The Highway Division's Joe Stacy also provided data for fuel pumped from Highway tanks for use in Facilities Division vehicles in 2014. The data includes additional gasoline and B20 biodiesel fuel consumption and cost by vehicles owned by the Facilities Division over 2014. The fuel was purchased outside of the WEX vehicle fueling system and therefore was added to any WEX fuel purchases made by the Facilities Division.

e. Ithaca Tompkins Regional Airport

Similar to the Highway Division, the Airport maintains its own fuel tanks that are used to fuel much of its fleet's day to day use. In 2015 it began using a new fueling tracking system to track fuel pumped from these tanks. The system includes the vehicle model, fuel type, annual fuel consumption, and cost. The system's 2015 data were provided by Josh Nalley, the Airport's Fire Chief and Operations Supervisor.

Roxan Noble, the Airport's Administrative Coordinator, provided a list to translate vehicle numbers in the system to particular years, makes, and models of vehicles. Vehicles are classified into on-road and off-road by their vehicle model and fuel type. Passenger cars, pick-up trucks, and fire trucks are counted as on-road vehicles, while equipment such as blowers, mowers, plows, and loaders are counted as off-road vehicles. Actual fuel use information is not available for prior years; therefore 2015 was used as a proxy year for 2014.

Fuel consumption of on-road vehicles is counted in the Vehicle Fleet sector under the Airport. Their annual VMT is estimated from a 2015 list Roxan Noble provided. It includes the odometer of the vehicles several months period. An average MPG is computed for each vehicle by their odometer and fuel consumption over the period. Assuming that 2015 MPG is similar to 2014, the average MPG is applied to the annual fuel consumptions to get the annual VMT of each vehicle. This fuel was purchased outside of the WEX vehicle fueling system and therefore was added to any WEX fuel purchases and related emissions attributed to the Airport.

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: [redacted]	Airport 72 Brown Road Ithaca NY, 14850					
Product Id: 01	Unleaded					
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 → 4	Cans/ MISC	9220	8	$1.000	29.500	$29.50
3	3	5910	9	$1.000	107.000	$107.00
		Totals for Product:		$1.000	1439.000	$1,439.00
Product Id: 06	#2 Diesel					
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 → 4	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
		Totals for Product:		$1.000	3292.600	$3,292.60
		Totals for Account:		$1.000	4731.600	$4,731.60

	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				
	Total		**1,439.0**		**9,355.7**		
		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
	Total		**944.1**		**361**	16	55.5
						17	34.8
						18	4.4
						5	147.2
						6	72.7
						7	86.7
						8	800.6
						9	203.3
						Total	**2348.5**
		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-Tie or More Truck
- Table 4-14 Combination Truck
- Table 4-15 Bus

This information is shown below:

Table 4-11: Light Duty Vehicle, Short Wheel Base and Motorcycle Fuel Consumption and Travel

	2008	2009	2010	2011	2012(R)	2013
Average miles traveled per gallon						
Light duty vehicles, short wheel base[a]	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

Table 4-12: Light Duty Vehicle, Long Wheel Base Fuel Consumption and Travel

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

Table 4-13: Single-Unit 2-Axle 6-Tire or More Truck Fuel Consumption and Travel[a]

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

Table 4-14: Combination Truck Fuel Consumption and Travel

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

Table 4-15: Bus Fuel Consumption and Travel

	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_4/mile and g N_2O/mile

Given the vehicle class, its VMT, and vehicle class percent, CH_4 and N_2O 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, N2O, and Methane, CH4, Emission Factors) http://www3.epa.gov/otaq/models/ngm/420p04016.pdf

- g CO_2/mile

It is specified in ClearPath that there is 8.78 kg CO2 per gallon gasoline and 10.21 kg CO2 per gallon diesel

Off-Road Vehicles Fuel Use

Airport

Methodology

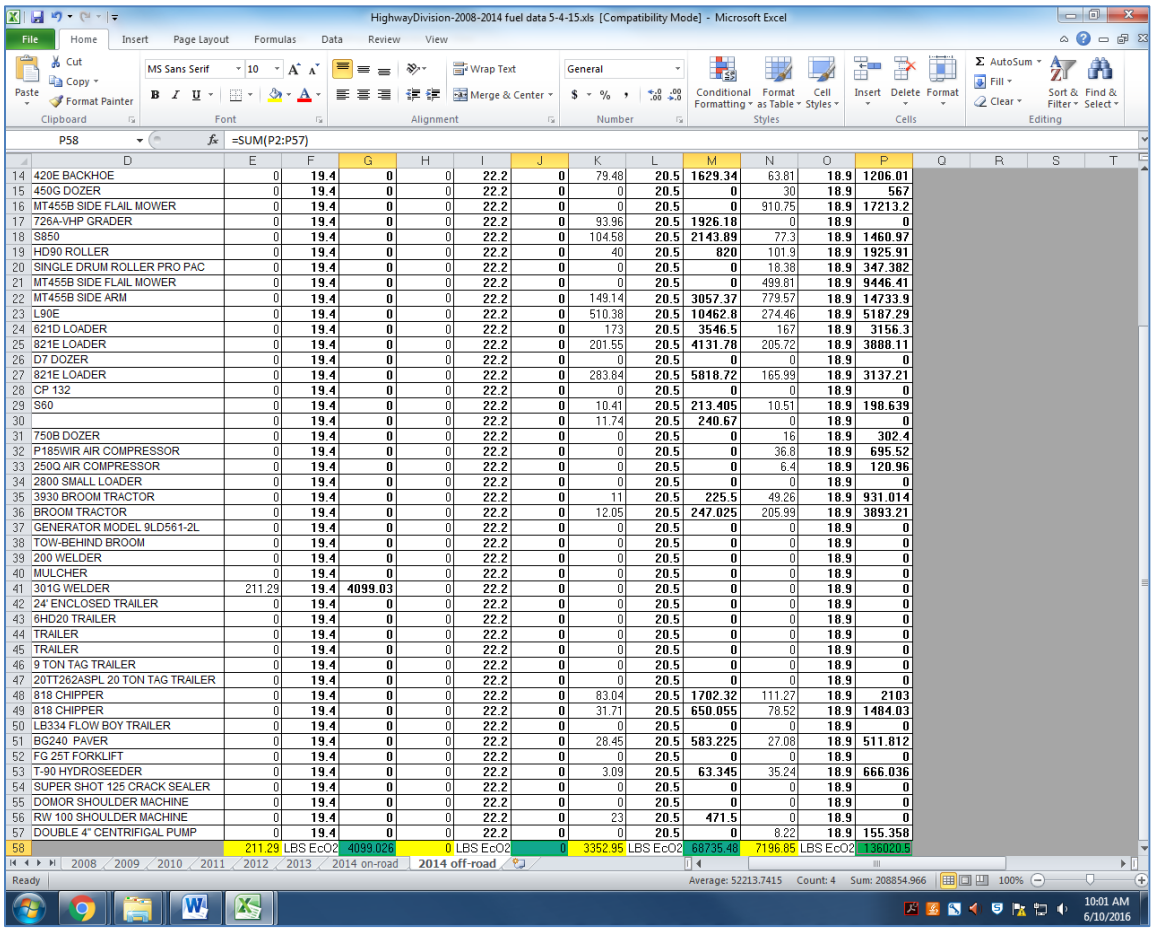
As mentioned above, in the Airport recently began using a fueling tracking system and therefore 2015 was selected as a proxy year for 2014 since 2015 is the first full year with fueling information available. Only equipment such as

blowers, mowers, plows, and loaders are counted as off-road vehicles. Fuel consumption of off-road vehicles is used in the CO_2e 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	621D 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	S60	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	P185WIR 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	DOMOR 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" CENTRIFIGAL PUMP	0	19.4	0	0	22.2	0	0	20.5	0	8.22	18.9	155.358
58		211.29	LBS EcO2	4099.028	0	LBS EcO2	0	3352.95	LBS EcO2	68735.48	7196.85	LBS EcO2	136020.5

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) Aloi, 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_2e 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.