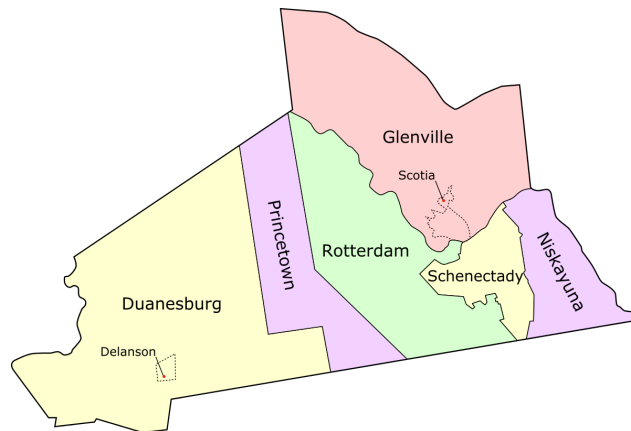


Inventory of Community Greenhouse Gas Emissions County of Schenectady April 2023



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TABLE OF CONTENTS

Introduction	3
Data Source	4
Greenhouse Gas Inventory for the County of Schenectady (2010)	5
Community GHG Framework	5
Scopes Based GHG Accounting	6
Emission Source and Quantity	8
Schenectady County Total GHG Emissions, by Sector (MTCDE)	8
Schenectady County Total GHG Emissions, by Source (MTCDE)	10
Schenectady County Total GHG Emissions, by Community (MTCDE)	13
GHG Emissions per Capita Comparison	13
Overview of Schenectady County GHG Emissions 2010 by Scope	14
About Greenhouse Gases	16
GHG Inventory Analysis	16
Appendix	17
Emission Source Definitions	17

INTRODUCTION

Understanding the sources of greenhouse gas (GHG) emissions and establishing a GHG baseline are critical first steps in the local climate action process. A Greenhouse Gas Inventory identifies activities that are responsible for GHG emissions, quantifies the level of each activity, and then calculates the associated emissions resulting from transportation fuels, waste, energy usage in buildings, and other sources within the community.

An essential way to understand how many greenhouse gasses are being emitted into the atmosphere is by measuring them and converting all gasses into a metric ton of CO₂ (Carbon Dioxide) equivalent (MTCO₂e). Each of these steps, defining the activities, measuring the level of the activity, and determining the consequent emissions, is carefully calculated in order to build a credible, transparent, and easily replicable inventory.

Government operations typically account for less than three percent of a community's emissions. It is therefore important to understand how the industries, businesses, schools, homes, and vehicles in the entire community are contributing to climate change. Community GHG inventories provide the data needed to set realistic goals and track progress toward reducing costs, energy use, and emissions. By identifying the largest sources of emissions in the community, GHG inventories help local governments focus policies and incentives on the most important sectors.

DATA SOURCE

Data for this GHG inventory was obtained from the Capital District Regional GHG Inventory which contains emissions data for the region from the year 2010.¹ Published in 2013 by The Capital District Regional Planning Commission (CDRPC) for The New York Energy Development and Research Authority (NYSERDA), local data was identified to create the County of Schenectady baseline inventory. Refer to the regional report for a comparison of GHG emissions across Capital Districts and methodology used to calculate emissions.

¹ https://climatesmart.ny.gov/fileadmin/csc/documents/GHG_Inventories/capdistghginven.pdf

GREENHOUSE GAS INVENTORY FOR THE COUNTY OF SCHENECTADY

The three highest sectors contributing to greenhouse gas emissions in the County of Schenectady are Transportation, Residential, and Commercial. Data recorded for the County of Schenectady shows that roughly 40% of emissions measured came from mobile energy (transportation). Following transportation is residential energy at 23%, which includes the use of electricity, fuel oil, and gas in residential homes. All emissions are reported in metric tons of carbon dioxide equivalent (MTCO₂e). See Appendix for Emission Source Descriptions.

COMMUNITY GHG FRAMEWORK

With support from the New York State Energy Research and Development Agency (NYSERDA), Schenectady County developed a community-wide greenhouse gas (GHG) emission inventory for the year 2010 as part of a grant to evaluate GHG emissions from all sectors in the County. In this inventory, the County accounts for all major GHGs including carbon dioxide (CO₂), methane (CH₄), nitrous oxide (N₂O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulfur hexafluoride (SF₆).

The inventory described here is for the community as a whole, meaning that it accounts for all residential and business activity in the County and within each municipality separately. The emissions from County and municipally-owned operations are treated like any other business and are considered to be a subset of these inventories. The inventory includes “direct” emissions from burning fuels like natural gas, fuel oil, and propane in buildings, to emissions from burning fuels in on-road and off-road vehicles. It also includes “indirect” emissions that don’t occur physically in the County but that which can easily be attributed to County residents and businesses. For example, these include

emissions attributed to electricity consumption and waste generation because these emissions occur at power plants and waste disposal sites outside of the County.

Overall, the Schenectady County community wide GHG inventory includes emissions from the following sources:

Figure 1: Schenectady County Community GHG Framework

Sector / Source	Description of the Source	Scope
Energy (Residential, Commercial, Industrial)		
Natural gas consumption	Direct emissions from burning natural gas in county residences and businesses	1
Electricity consumption	Indirect emissions at regional power plants caused by using electricity in the county	2
Fuel oil, propane, and wood consumption	Direct emissions from burning typical fuels consumed that are not supplied by the utility	1
Transportation		
On road vehicles	Direct emissions from gasoline and diesel used in on-road vehicles	1
Off-road vehicles / equipment	Direct emissions from off-road fuels (e.g., from construction and agriculture, lawn care, etc.)	1
Waste		
Solid waste	Indirect emissions at regional landfills and waste-to-energy plants caused by waste generation	3
Sewage waste	Indirect emissions from waste water treatment plants and private septic systems	2
Agricultural Fugitive		
Livestock / manure	Direct emissions from livestock	1
Fertilizer and soils	Direct emissions from cropland management and fertilizer application	1
Process Fugitive		
Industrial processes (cement, steel, etc.)	Direct emissions (non-energy related) from chemical, cement, and metal industries	1
Refrigerant leakage	Direct emissions from refrigerants used in vehicles and buildings throughout the county	1

SCOPES BASED GHG ACCOUNTING

Within the regional or any community inventory, GHG sources are organized by what is known as “Scopes” based accounting that assign sources as either:

- Scope 1 (direct) emissions that physically occur within the regional or community boundary such as those emitted by burning natural gas or fuel oil in homes and businesses.
- Scope 2 is a special category of emissions to attribute a share of regional power plant emissions to individual communities based on how much electricity they use.

-
- Scope 3 (indirect) emissions attributed to region or community activities that cause emissions whether the emissions physically occur in-boundary or not.

Scopes based accounting allows a community to have both Scope 1 and 3 emissions for what is essentially the same source. For example, communities with electric power stations have very large Scope 1 sources from fuel burned by the power plants inside the community. Power plants, however, do not supply electricity to communities directly. They supply the electricity grid. Therefore, communities will also have separate Scope 2 emissions based on (1) the amount of electricity they consume and (2) on the average carbon intensity of all the plants supplying the regional grid.

Scopes accounting can inherently double count, so they are never added together. The point of organizing inventories by scopes is to empower stakeholders to reduce emissions they influence. Therefore power plant and landfill operators can record GHG reductions against community Scope 1 footprints, whereas municipalities can tie community-wide energy and waste reduction efforts against their Scope 2 and 3 footprints.

All GHG emissions in this report are reported in units of **Metric Tons Carbon Dioxide Equivalent (MTCDE)** which is the convention for reporting regional GHG inventories. One MTCDE is equal to 1000 kgs of CO₂. Non-CO₂ GHGs are first converted to an equivalent amount of CO₂ using a global warming potential (GWP) unique to each gas as defined in the Intergovernmental Panel on Climate Change (IPCC) Second Assessment Report.

EMISSION SOURCE AND QUANTITY

Schenectady County Total GHG Emissions, by Sector (MTCDE)

Figure 2, By Sector Bar Graph:

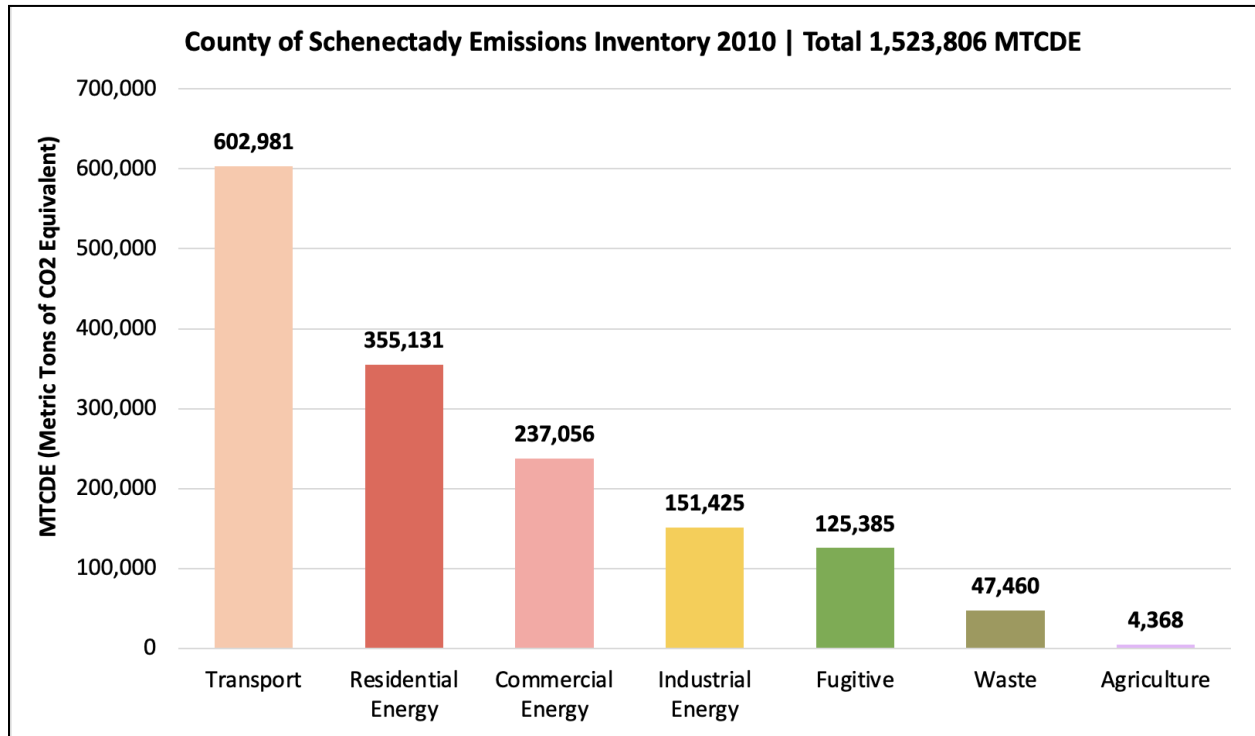
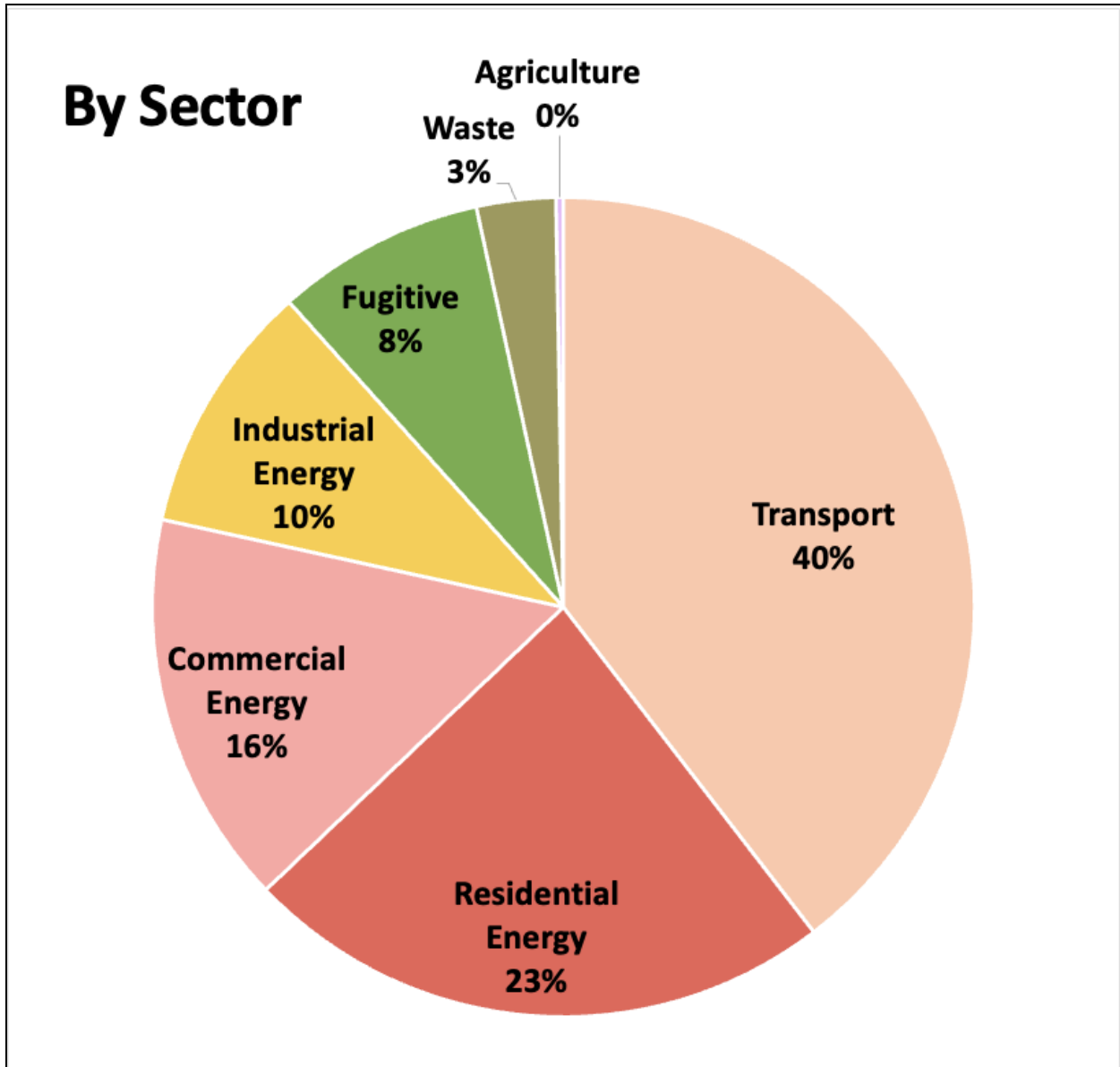


Figure 3, By Sector Table:

Sector	Metric Tons CO ₂ e	% of Total
Transport	602,981	39.6%
Residential Energy	355,131	23.3%
Commercial Energy	237,056	15.6%
Industrial Energy	151,425	9.9%
Fugitive	125,385	8.2%
Waste	47,460	3.1%
Agriculture	4,368	0.3%
Total	1,523,806	100.0%

Figure 4, By Sector Pie Chart:



Schenectady County Total GHG Emissions, by Source (MTCDE)

Figure 5, By Source Bar Graph:

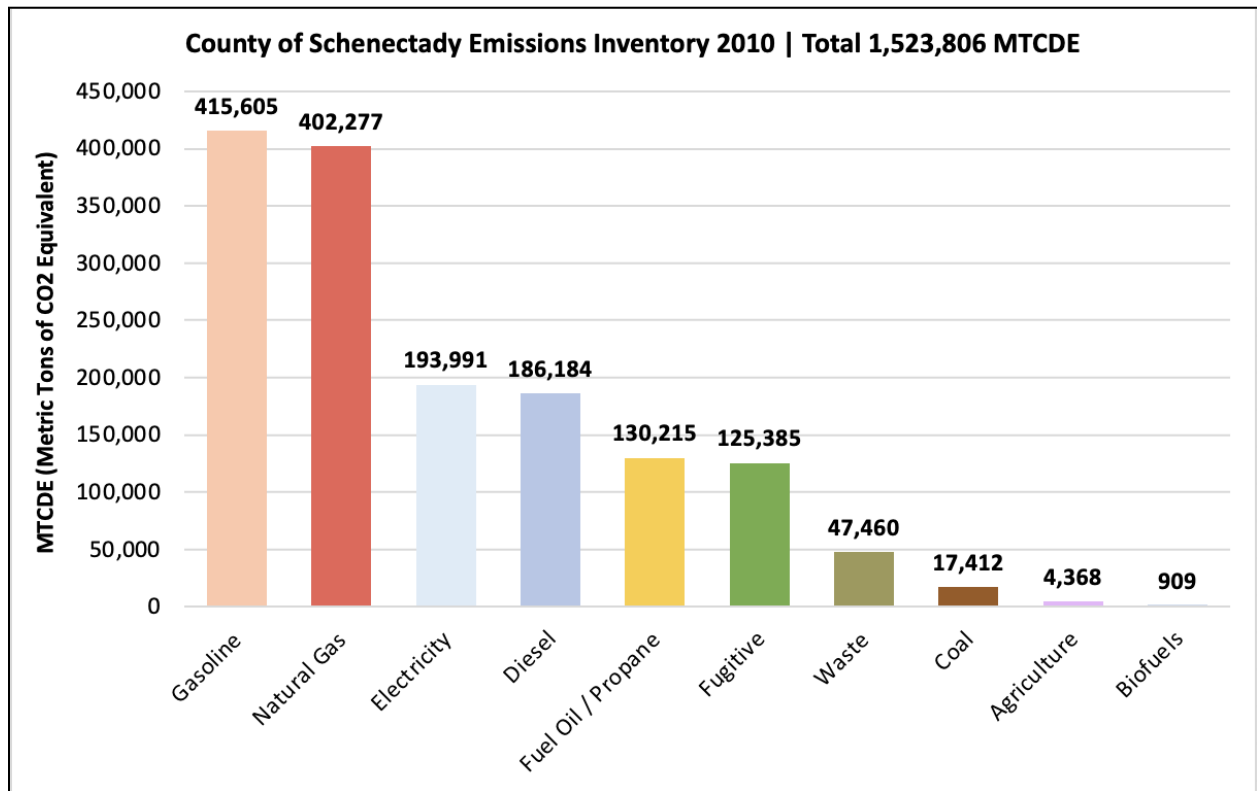
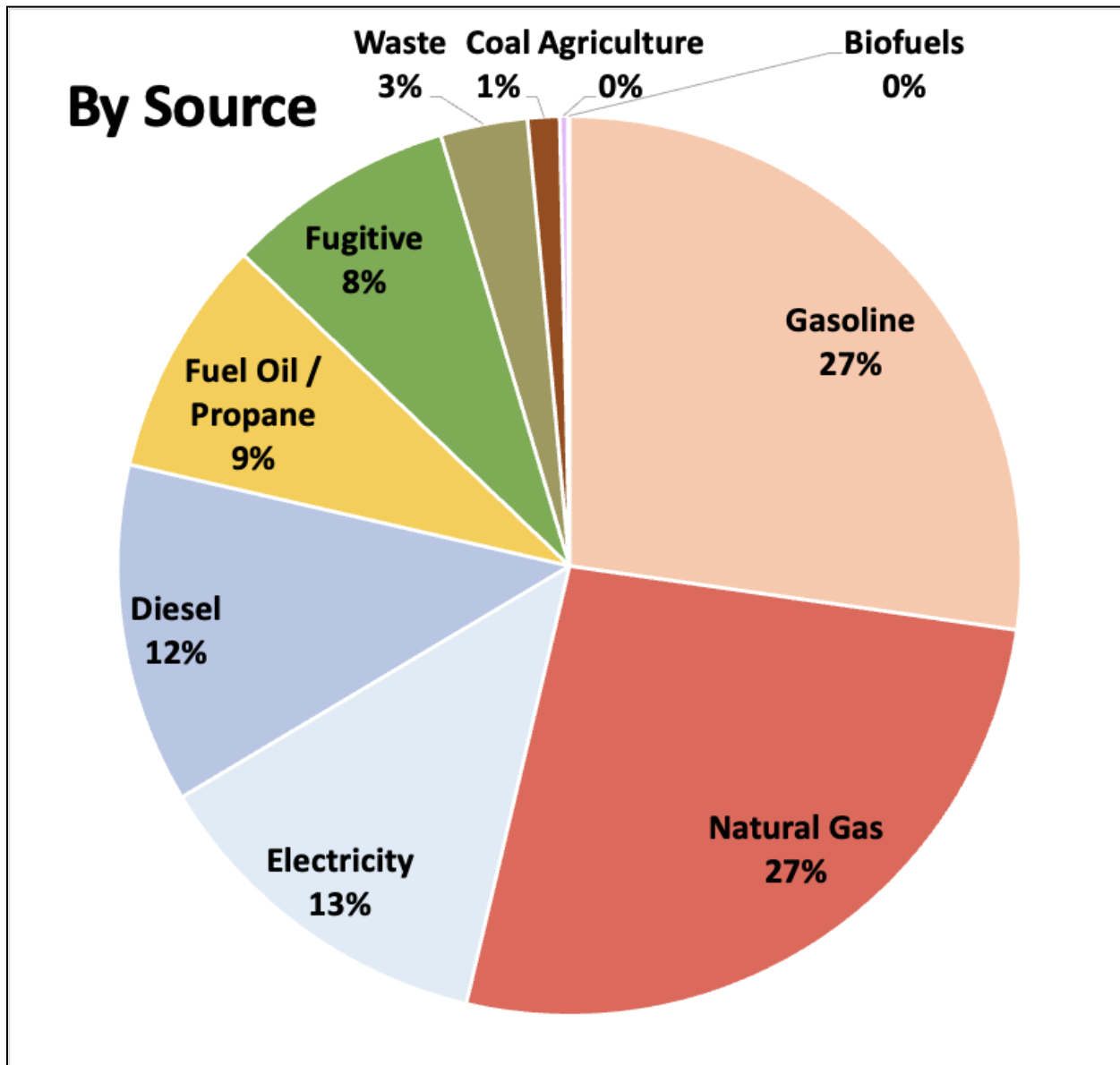


Figure 6, By Source Table:

Source	Metric Tons CO2e	% of Total
Gasoline	415,605	27.3%
Natural Gas	402,277	26.4%
Electricity	193,991	12.7%
Diesel	186,184	12.2%
Fuel Oil / Propane	130,215	8.5%
Fugitive	125,385	8.2%
Waste	47,460	3.1%
Coal	17,412	1.1%
Agriculture	4,368	0.3%
Biofuels	909	0.1%
Total	1,523,806	100.0%

Figure 7, By Source Pie Chart:



Schenectady County Total GHG Emissions, by Community (MTCDE)

Figure 8, By Community Table:

Community	Type	County	GHG Emissions By Sector (MTCDE)							Totals
			Res	Com	Industry	Process	Transport	Waste	Ag	
Schenectady	City	Schenectady	131,239	98,774	66,283	25,492	103,742	20,286	0	445,816
Rotterdam	Town	Schenectady	82,610	58,602	39,815	11,402	157,432	8,924	805	359,589
Glenville	Town	Schenectady	80,632	53,892	0	11,515	121,384	9,042	1,109	277,575
Niskayuna	Town	Schenectady	64,000	38,754	29,468	8,500	69,284	6,681	319	217,006
Duanesburg	Town	Schenectady	20,694	6,026	29,276	2,362	48,338	1,878	1,596	110,170
Scotia	Village	Schenectady	19,715	5,876	0	2,962	15,883	2,371	0	46,806
Princetown	Town	Schenectady	6,925	1,920	0	817	26,440	649	539	37,289
Delanson	Village	Schenectady	1,206	689	30,693	149	992	116	0	33,845

GHG Emissions per Capita Comparison

Figure 9, Per Capita Table Comparison

County	Emissions	Emissions per Capita (MTCDE/person)			
	(MTCDE)	Total	res / com	Industrial*	Transport
Albany	5,146,057	16.9	4.8	5.5	6.1
Saratoga	3,035,995	13.8	4.3	2.4	6.5
Rensselaer	1,687,291	10.6	4.1	1.0	4.9
Warren	1,558,953	23.7	5.8	10.0	7.5
Schenectady	1,523,806	9.8	4.2	1.5	3.9
Greene	1,074,747	21.8	5.7	7.6	7.9
Washington	917,143	14.5	4.4	2.4	4.9
Columbia	887,247	14.1	5.3	1.2	6.2
REDC	15,831,238	14.7	4.6	3.6	5.8

Note: In 2010, the County of Schenectady had the lowest emissions per capita among Capital District counties at 9.8 metric tons of CO₂e per person.

Overview of Schenectady County GHG Emissions 2010 by Scope

Sector / Source	GHG Emissions (MTCDE)			Energy
	Scope 1	Scope 2	Scope 3	(MMBT)
Residential Energy Consumption				
Electricity / Steam		92,594		1,376,289
Natural Gas	196,551			3,703,470
Propane / LPG	10,940			177,280
Distillate Fuel Oil	54,271			731,325
Coal	188			1,998
Wood	587			297,433
Total	262,537	92,594	0	6,287,795
Commercial Energy Consumption				
Electricity / Steam		97,570		1,450,255
Natural Gas	107,925			2,033,554
Propane / LPG	2,741			44,418
Distillate Fuel Oil	14,475			195,052
Residual Fuel Oil	14,217			188,678
Coal	18			196
Wood	110			55,710
Total	139,486	97,570	0	3,967,863
Industrial Energy Consumption				
Electricity / Steam		3,827		56,886
Natural Gas	97,388			1,835,014
Propane / LPG	779			12,319
Distillate Fuel Oil	8,492			114,428
Residual Fuel Oil	7,676			101,874
Coal	17,206			182,795
Petroleum Coke	0			0
Motor Gasoline (E-10)	5,102			72,401
Other Oils	10,743			144,690
Wood	212			107,526
Total	147,598	3,827	0	2,627,933
Energy Generation and Supply				
Natural Gas	0			104,780,116
Distillate Fuel Oil	0			25,004
MSW	0			1,592,624
Landfill Gas	0			553,480
Electricity T/D Losses	10,076			152,245
Natural Gas T/D Losses	55,222			136,297
Total	65,298	0	0	107,239,766

Product Use (HFC, ODS)				
Use of SF6 in the Utility Industry	2,656			
All Refrigerants - except SF6	57,431			
Total	60,087	0	0	0
Transport: On-Road				
Motor Gasoline (E-10)	398,331			6,074,267
Diesel	60,727			804,874
Ethanol (E-85)	N/A			
Biodiesel	N/A			
Total	459,058	0	0	6,879,141
Transport: Rail, Marine, Off-Road, Air				
Motor Gasoline (E-10)	12,172			191,896
Diesel	49,096			650,722
Residual Fuel Oil	1			10
Natural Gas	413			7,789
Propane / LPG	5,880			93,001
Jet Kerosene (Air)			76,361	1,012,091
Total	67,562	0	76,361	1,955,509
Waste Management				
Landfill Methane	0		32,428	
MSW Incineration			0	
Sewage Treatment	15,032			
Total	15,032	0	32,428	0
Agriculture				
Enteric Fermentation / Manure	2,384			
Soils / Fertilizer	1,984			
Total	4,368	0	0	0
Totals by Scope	1,221,026	193,991	108,789	128,958,007

ABOUT GREENHOUSE GASSES

Humans are rapidly moving long-stored carbon into the atmosphere and changing the global carbon budget. Since the start of the Industrial Revolution in the late 1700s, humans have been emitting more and more greenhouse gasses through activities like burning fossil fuels and cement production. At the same time, land use changes that clear forests and fill wetlands for agriculture and development decrease the ability for natural processes to absorb GHG from the atmosphere.

Types of Greenhouse Gasses

- Carbon dioxide (CO₂);
- Methane (CH₄);
- Nitrous oxide (N₂O) from agricultural loss of soil, and wetlands
- Hydrofluorocarbons (HFCs), Perfluorocarbons (PFCs); Sulfur hexa-fluoride (SF₆): these are all man-made chemicals, typically used for refrigeration and cooling, and do not occur in nature;
- Water Vapor (H₂O), often evidenced as clouds, is also a GHG, but is not measured in these studies as these vapors are a component of the water cycle⁵. The aggregate of water in all forms on our planet, ice, liquid and gas, does not change.

GHG INVENTORY ANALYSIS

The County of Schenectady emitted an estimated **1,523,806 Metric Tons Carbon Dioxide Equivalent (MTCDE)** greenhouse gas emissions in 2010. Energy use by homes and businesses combined for 49% across residential, commercial, and industrial sectors. Of this, residential energy use is the single largest source of emissions (23%), followed by

commercial (16%), and industrial (10%). Transportation is the single largest sector in the County of Schenectady coming in at 40% of all GHG emissions. Climate Actions Plans should target these high-emission sectors. For residential and commercial buildings, possible solutions include expanding renewable energy projects, installing electric heat pumps, or retrofitting buildings to become more energy efficient. For transportation, solutions include incentivizing residents to purchase electric or hybrid vehicles, expanding public transportation initiatives, or increasing the walkability of downtown areas. A PE2 Climate Action Plan will serve as a strategy document that sets these goals and outlines a set of initiatives to reduce greenhouse gas (GHG) emissions, by using GHG emissions inventories as its foundation.

APPENDIX

EMISSION SOURCE DEFINITIONS

Mobile Energy: Use of energy in transportation, including on-road transportation, passenger and freight rail, aviation, marine transportation, and off-road vehicles.

Residential Energy Consumption: Use of energy in homes, businesses, and other non-mobile uses.

Industrial Processes: Non-energy emissions associated with industrial activity (e.g., carbon dioxide emissions associated with cement production or emissions associated with coolants for air conditioners) and fugitive emissions from fuel systems (leakages in the production, distribution, and transmission of fossil fuels).

Commercial Energy Consumption: Direct emissions from the combustion of natural gas, coal, kerosene, distillate, motor gasoline and other fuels, as well as indirect emissions from electricity consumption.

Solid Waste: Non-energy emissions related to managing solid waste, including trash and wastewater (e.g., methane emissions associated with the anaerobic decay of waste disposed of in landfills).

Wastewater Treatment: When organic waste material in wastewater degrades during the wastewater treatment processes, it emits both methane and nitrous oxide.

Energy Supply: Fugitive emissions and energy losses due to the transmission and distribution of electricity and natural gas.

Agriculture: Non-energy emissions from agriculture, including both crops and livestock (e.g., methane emissions associated with livestock and nitrous oxide emissions associated with fertilizer application).

Industrial (Stationary) Energy Consumption: Direct emissions from power plants, landfills, metals manufacturing, mineral production, petroleum refineries, pulp and paper manufacturing, chemicals manufacturing, government and commercial facilities, and other industrial facilities.