Village of Fayetteville, New York
Municipal Operations and Community Greenhouse Gas Inventory Update

Compiled by the Central New York
Regional Planning and Development Board

August 15, 2022

425 East Genesee Street

Fayetteville, NY 13066

This GHG inventory update was compiled by the Central New York Regional Planning and Development Board (CNY RPDB) in support of the village's Climate Smart Communities and Clean Energy Communities efforts. Contributors include:

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I. Introduction

Background

The Climate Smart Communities Program represents a partnership between New York State and local governments to reduce energy use and GHG emissions while working to adapt to a changing climate. The required ten elements of the Climate Smart Communities Pledge are:

1. Build a climate-smart community.
2. Inventory emissions, set goals, and plan for climate action.
3. Decrease energy use.
4. Shift to clean, renewable energy.
5. Use climate-smart materials management.
6. Implement climate-smart land use.
7. Enhance community resilience to climate change.
8. Support a green innovation economy.
9. Inform and inspire the public.
10. Engage in an evolving process of climate action.

The Village of Fayetteville adopted the ten-element Climate Smart Communities Pledge as a commitment to greenhouse gas (GHG) emission reduction and climate change adaptation in September 2009, and it is working towards becoming a Bronze Certified Climate Smart Community. The Climate Smart Communities Certification program recognizes communities that have gone beyond the ten pledge elements by completing and documenting mitigation and adaptation actions at the local level. Certified communities are the foremost leaders in the state in terms of climate action. Communities can achieve certification at the Bronze, Silver, or Gold (currently in development) level.

As part of the village's efforts to become a Certified Climate Smart Community, the village decided to compile a community and municipal GHG inventory update using a baseline of 2019. A GHG emissions inventory is an audit of activities that contribute to the release of emissions and acts as a baseline for a Climate Action Plan. The original GHG inventory was completed for the village in April 2013 with a baseline of 2009, and their Climate Action Plan was completed in December 2014.

It is important to note that the information provided in this inventory is not meant to be exhaustive, but rather to provide an estimate of community and municipal emissions data at one snapshot in time, 2019. The inventory information will inform climate action planning efforts in the village moving forward. This inventory will act as a baseline for tracking and understanding trends associated with future GHG mitigation efforts.

For the municipal operations GHG inventory, energy used by buildings and facilities, streetlights, water and sewer facilities, and the vehicle fleet were gathered for the 2019 year, and for the community GHG inventory, residential energy use, commercial/industrial energy use, transportation, waste generation, and wastewater treatment information were gathered for the

2019 year. Methods of calculation explained in the U.S. Community Operations Protocol[1] were utilized to generate emissions figures. Data was entered into the ClearPath[2] tool, outputs were aggregated into metric tons of CO_2 equivalent, and emissions were delineated by sector, source, and scope (for municipal emissions).

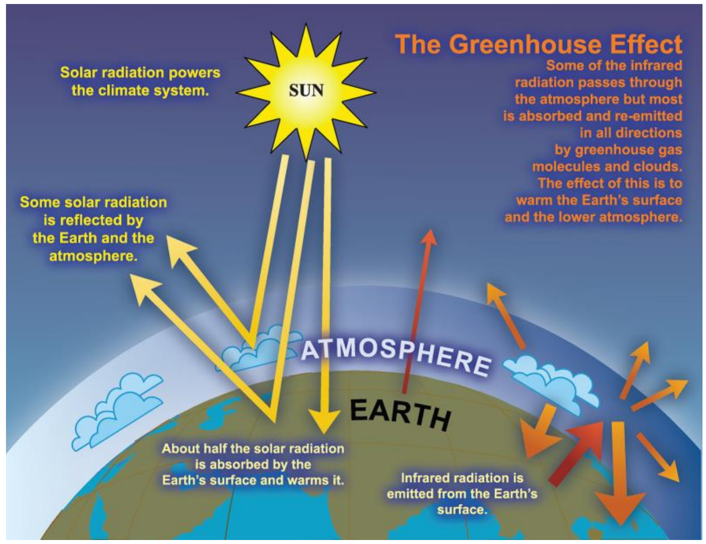

Figure 1: The Greenhouse Effect

Climate Change and Greenhouse Gases

Climate change is recognized as a global concern. Scientists have documented changes to the Earth's climate including the rise in global average temperatures, as well as sea levels, during the last century. An international panel of leading climate scientists, the Intergovernmental Panel on Climate Change (IPCC), was formed in 1988 by the World Meteorological Organization and the United Nations Environment Program to provide objective and up-to-date information regarding the changing climate. In its 2014 Fifth Assessment Report, the IPCC states that there is **a greater than 95 percent chance that rising global average temperatures, observed since the mid-20th century, are primarily due to human activities.**[3] Evidence of observed changes in extremes such as heatwaves, heavy precipitation, droughts, and tropical cyclones, and, in particular, their attribution to human influence, has strengthened since the Fifth Assessment Report, as noted in the Sixth Assessment Report AR6 Climate Change: The Physical Science Basis study published in August 2021.[4]

The rising trend of human-generated GHG emissions is a global threat. The increased presence of these gases affects the warming of the planet by contributing to the natural greenhouse effect, which warms the atmosphere and makes the earth habitable for humans and other species (see Figure 1).[5] Mitigation of GHGs is occurring in all sectors as a means of reducing the impacts of this warming trend. However, scientific models predict that some effects of climate change are inevitable no matter how much mitigative action is taken now. Therefore, climate mitigation actions must be paired with adaptation measures in order to continue efforts to curb emissions

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[1] The Local Government Operations Protocol and U.S. Community Operations Protocol were developed by ICLEI-Local Governments for Sustainability in order to provide "accounting for GHG emissions associated with local government operated buildings, vehicles, and other operations" and "detailed, cutting-edge guidance on completing a GHG emissions inventory at the community scale in the United States — including emissions from businesses, residents, and transportation," according to ICLEI's website.

[2] ClearPath is a proprietary tool developed by ICLEI-Local Governments for Sustainability to assist local governments with conducting greenhouse gas emissions inventories and with the development of local climate action plans.

[3] IPCC. 2014. Fifth Assessment Report. https://www.ipcc.ch/report/ar5/syr/

[4] IPCC. 2021. Sixth Assessment Report Headline Statements from the Summary for Policymakers. https://www.ipcc.ch/report/ar6/wg1/downloads/report/IPCC_AR6_WGI_Headline_Statements.pdf

[5] IPCC Working Group. https://wg1.ipcc.ch/publications/wg1-ar4/faq/wg1_faq-1.3.html

contributions to global warming, while adapting communities so that they are able to withstand climate change impacts and maintain social, economic, and environmental resilience in the face of uncertainty. Climate adaptation can take shape through infrastructure assessments and emergency planning, as well as through educational efforts to raise public awareness about potential climate change impacts.

New York State outlined projected climate impacts and vulnerabilities during the 2011 ClimAid assessment and 2014 supplement (ClimAid Report).[6] The ClimAid Report projects changes to ecosystems (e.g., increased presence of invasive species and shifts in tree composition), while water quality and quantity may also be impacted due to changes in precipitation. Potential beneficial economic impacts were also identified, such as a longer recreation season in the summer, and a longer growing season for the agricultural sector due to rising temperatures. Scientific evidence suggests that the impacts of global climate change will be different in various regions, and will include temperature shifts, more extreme heat events, sea level rise and coastal flooding, more frequent intense precipitation events, and human health risks.

We have already experienced the effects of a changing climate in New York State and abroad, [7] the need for climate action and adaptation is imperative. The goal of building community resilience in order to protect the health and livelihood of residents and natural systems serves as a motivating factor in the assessment of greenhouse gas contributions and effective sustainability planning.

New York State GHG Emissions and Climate Goals

According to the July 2019 *New York State Greenhouse Gas Inventory: 1990-2016* report prepared by the New York State Energy Research and Development Authority (NYSERDA), 2016 state emissions were equal to 206 million metric tons of carbon dioxide equivalent (MMTCO_2e), the majority of which came from energy-related sources (173 MMTCO_2e) compared to non-energy sources (33 MMTCO_2e).[8] Of the energy-related emissions sources, 36% were from transportation, 30% from on-site fuel combustion from buildings, 15% from electricity generation, and 3% from other sources such as fugitive emissions from fossil fuel infrastructure and incineration of municipal waste (see Figure 2).

In July 2019, Governor Cuomo signed the **Climate Leadership and Community Protection Act** (CLCPA) into law. The CLCPA is New York State's ambitious emissions reduction plan with the goal of making electricity 70% renewable by 2030 and 100% carbon neutral by 2040, reducing GHG emissions 40% below 1990 levels by 2030 and 85% below 1990 levels by 2050,

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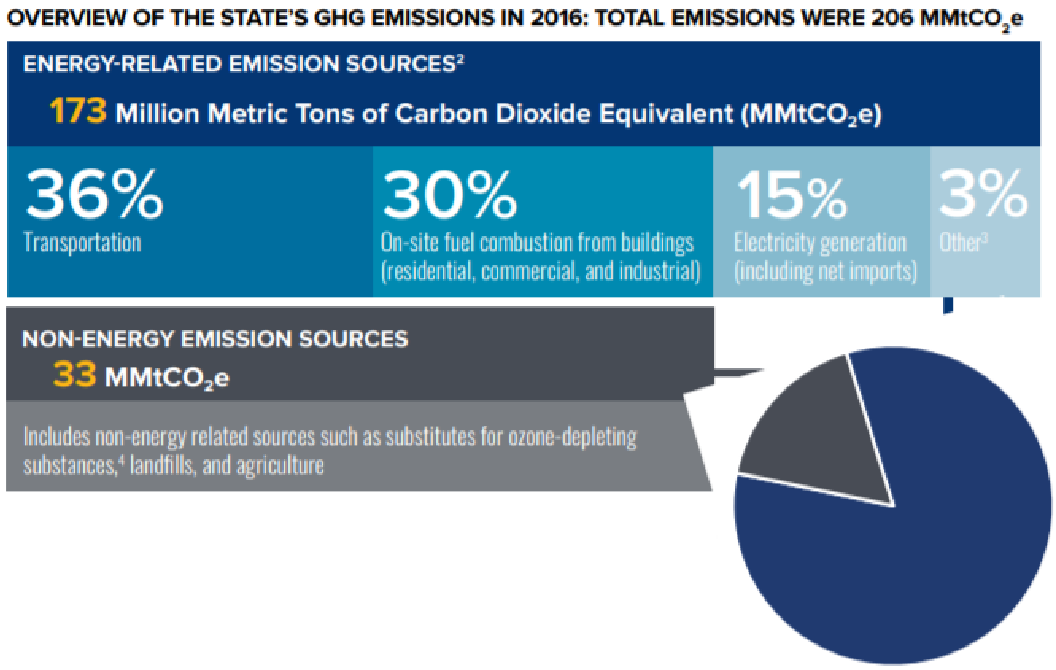
[6] NYSERDA. 2014. Climate Change in New York State: Updating the 2011 ClimAID Climate Risk Information. https://www.nyserda.ny.gov/About/Publications/Research%20and%20Development%20Technical%20Reports/Environmental%20Research%20and%20Development%20Technical%20Reports/Response%20to%20Climate%20Change%20in%20New%20York

[7] NYSERDA. 2014. Climate Change in New York State: Updating the 2011 ClimAID Climate Risk Information. https://www.nyserda.ny.gov/About/Publications/Research%20and%20Development%20Technical%20Reports/Environmental%20Research%20and%20Development%20Technical%20Reports/Response%20to%20Climate%20Change%20in%20New%20York; and National Climate Assessment. 2014. Climate Change Impacts in the United States. https://nca2014.globalchange.gov/.

[8] NYSERDA. Greenhouse Gas Inventory Fact Sheet. https://www.nyserda.ny.gov/About/Publications/EA-Reports-and-Studies/Energy-Statistics.

implementing 6,000 MW of solar by 2025, 3,000 MW of energy storage by 2030, and 9,000 MW of offshore wind by 2035 (see Figure 3).



[1] Based on EIA's state-level estimates of energy-related GHG emissions: www.eia.gov/environment/emissions/state/analysis/.
[2] Combined buildings-related emissions, from onsite fuel combustion and electric generation, contributes 93 MMtCO2e to New York's emissions profile. This is approximately 45% of statewide GHG emissions.
[3] "Other" energy-related emissions include fugitive emissions from fossil fuel infrastructure and incineration of municipal waste.
[4] Hydrofluorocarbon (HFC) emissions result from the consumption of substitutes for ozone-depleting substance (ODS), largely as refrigerants. The most notable HFC substitution is for Chlorofluorocarbons (CFC), which are subject to national and international ozone layer protection policies.

Figure 2: Overview of the State's GHG Emissions in 2016

New York's Nation-Leading Climate Targets

- 85% Reduction in GHG Emissions by 2050
- 100% Carbon-free Electricity by 2040
- 70% Renewable Energy by 2030
- 9,000 MW of Offshore Wind by 2035
- 3,000 MW of Energy Storage by 2030
- 6,000 MW of Solar by 2025
- 22 Million Tons of Carbon Reduction through Energy Efficiency and Electrification

Figure 3: Overview of the CLCPA targets

The Purpose of a Greenhouse Gas Inventory

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

Because local governments typically contribute less than ten percent of the total greenhouse gas emissions generated in a given community, it is recommended that local governments develop both local government operations and community-wide greenhouse gas emissions inventories and reduction strategies[9]. Before concerted management and reduction of greenhouse gas emissions can occur within our local governments and communities, local governments must undertake measurement and analysis of all GHG sources. This report includes a GHG inventory update for both municipal operations and the community-at-large for the 2019 year.

It is important to note that this inventory represents an estimate of emissions for the Village of Fayetteville for the 2019 year, and that the purpose of this inventory is to gain a general baseline of emissions upon which the village can work from for climate action planning purposes. This

[9] ICLEI. 2012. U.S. Community Protocol for Accounting and Reporting of Greenhouse Gas Emissions.

inventory includes a number of assumptions and estimations, and the methods used to establish this baseline will not necessarily be the same methods used to measure progress.

There are several major benefits to compiling emissions inventories:

1. **Fiscal benefits:** Developing climate and energy strategies can help reduce energy costs and save taxpayer dollars. Conducting a GHG emissions inventory will explain exactly how energy is being used and identify opportunities to become more efficient.

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

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

4. **Regulatory preparedness:** Taking action now will help your jurisdiction prepare for any future legislative requirements and position your local government for successful compliance.

Village Profile

The Village of Fayetteville is located in eastern Onondaga County. The village covers an area of approximately 1.7 square miles and is located within the Town of Manlius. According to the 2019 American Community Survey, the village has a population of about 4,095 residents, with 1,742 occupied housing units. This is a 5.84% decrease compared to the 2010 United States Census, where the Village had a population of 4,349 residents. This trend is expected to continue with an estimated 0.67% yearly decrease in population size.

II. Data Collection and Analysis

For the municipal inventory update, information related to building and facilities, streetlights, and vehicle fleet were collected for the Fayetteville municipal operations for the 2019 year following the Local Government Operations Protocol. Specific data collection methods for each sector are explained within each section of this report.

For the community inventory update, information related to residential, commercial/industrial, transportation, waste, and wastewater were collected for the Fayetteville community for the 2019 year following the U.S. Community Protocol. Specific data collection methods for each sector are explained within each section of this report.

The ICLEI ClearPath tool was utilized to convert the information into emissions data measured in metric tons of carbon dioxide equivalent ($MTCO_2e$). The online tool streamlines the process of converting different sources, units, and varieties of emissions into comparable energy use and emissions figures.

Reporting

The three most prevalent greenhouse gases, and therefore the focus of this analysis, are carbon dioxide (CO_2), methane (CH_4) and nitrous oxide (N_2O). The unit used to discuss these gases in aggregate is carbon dioxide equivalent (CO_2e), which is a conversion based on each gas's Global Warming Potential (GWP), or the impact of 1 unit of each gas in the atmosphere compared to 1 unit of CO_2 (see Table 1). This inventory uses the 20-year GWP values published by the IPCC's 5th Assessment Report. A discussion of emissions using the IPCC's 2nd Assessment Report is also included later in this report since these were the GWPs used in the 2013 inventory report.

Greenhouse Gas (GHG)	Global Warming Potential (GWP)
Carbon Dioxide (CO_2)	1
Methane (CH_4)	85
Nitrous Oxide (N_2O)	264

Table 1: IPCC 5th Assessment 20-year Global Warming Potential Values

Emissions are reported by sector and source in the community inventory update and also by scope for the municipal update. Sectors are included or excluded in the boundaries of GHG inventories based on availability of data, relevance to emissions totals, and scale to which they can be changed. The municipal inventory update includes emissions for the buildings and facilities, streetlights, and vehicle fleet sector. The community inventory update includes emissions for the residential, commercial/industrial, transportation, waste, and wastewater sectors. Commercial and industrial sectors are combined due to availability of data from the Utility Energy Registry (UER), which combines commercial/industrial electricity and natural gas use into what it refers to as the "business" sector. Emissions data is also reported by source, including electricity, natural gas, fuel oil, propane, gasoline, and diesel.

III. Municipal Operations Emissions Inventory

Overall Results

In 2019, the Village of Fayetteville's municipal emissions totaled 519 $MTCO_2e$. The vehicle fleet sector contributed to the largest percentage of emissions, accounting for 286 $MTCO_2e$, or 55% of the government's total emissions. Buildings and facilities were the second largest emitting sector, producing 223 $MTCO_2e$, or 43% of total municipal emissions, followed by streetlights and traffic signals which produced 10 $MTCO_2e$, or 2% of total emissions. There were no emissions from wastewater facilities as the Village no longer owns or operates any wastewater facilities or pumps and Onondaga County Department of Water Environment Protection (WEP) provides maintenance services for sewer districts in the Village.. Since the previous GHG inventory was compiled, the Village has replaced electric water pumps with non-electric gravity pumps.

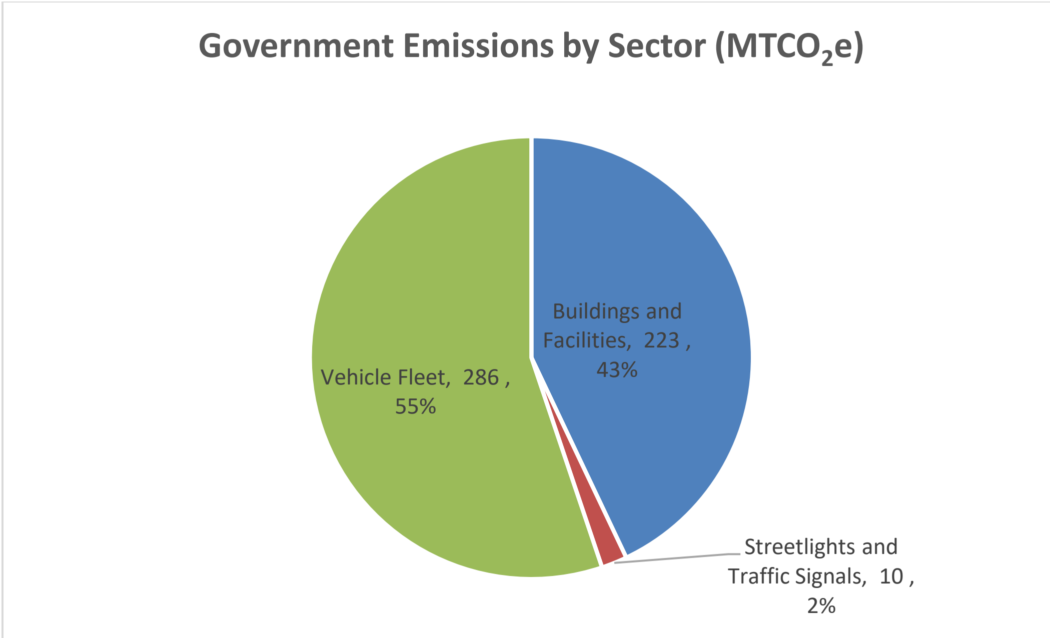


Figure 4: 2019 Municipal Emissions by Sector

The largest source of municipal emissions in the Village of Fayetteville in 2019 was diesel, accounting for 254 $MTCO_2e$, or 49% of all community emissions. Natural gas was also a large emitting source, producing 176 $MTCO_2e$ (34%).

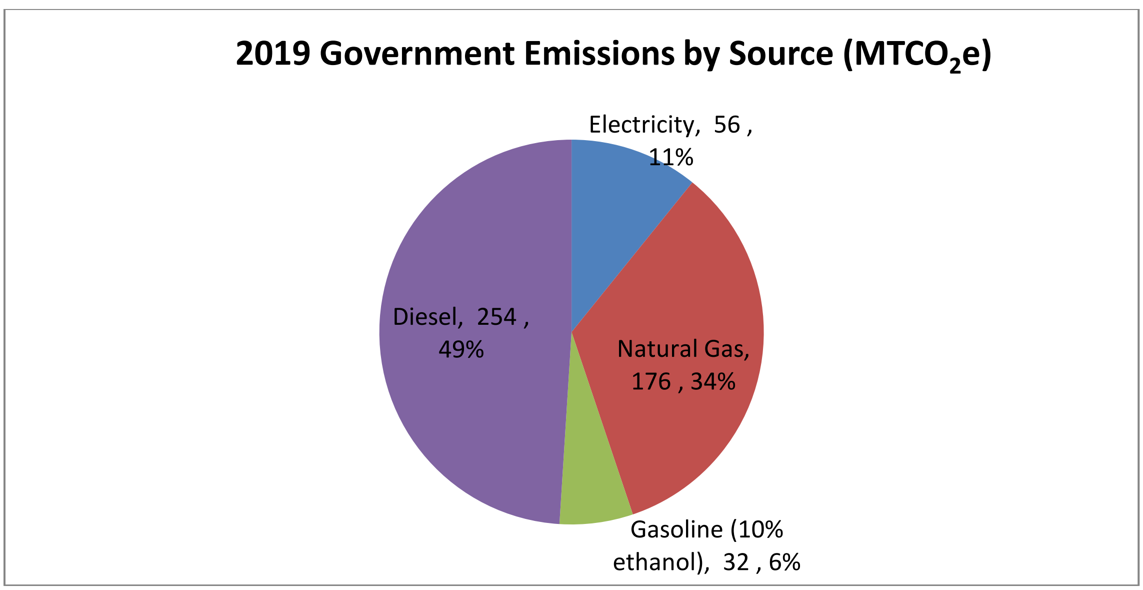


Figure 5: 2019 Municipal Emissions by Source

The majority (89%) of municipal emissions were scope 1 emissions. **Scope 1 emissions** are those that are directly emitted by the government onsite, including stationary combustion and vehicle fleet emissions, as well as wastewater process emissions since the treatment facility is located within the municipality and is under municipal control. **Scope 2 emissions** are those that are indirectly emitted by the government through energy created elsewhere, such as electricity. **Scope 3 emissions** are other indirect emissions not included in scope 2, such as emissions from wastewater, solid waste processes, or employee commute. Scope 3 emissions were not included in this inventory update primarily due to lack of data.

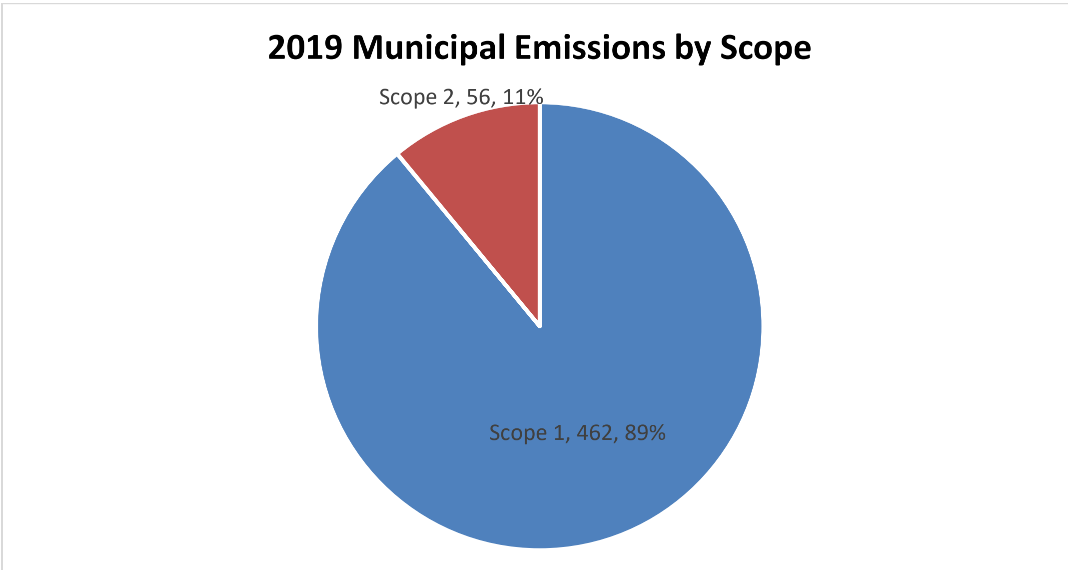


Figure 6: 2019 Municipal Emissions by Scope

Buildings and Facilities

Methods and inputs

Building and facility electricity and natural gas usage for 2019 was collected using National Grid and New York State Municipal Energy Consortium (NYSMEC) bills. This sector includes all municipal accounts that are not streetlights or related to water and sewer facilities. There were no delivered fuels used in this sector in 2019.

Building and facility energy uses were entered into ClearPath using standard emissions factors[10] for natural gas and propane, and the Environmental Protection Agency (EPA)'s Emissions & Generation Resource Integrated Database (eGRID) factors for NPCC Upstate NY from 2019 were used for electricity emissions calculations (see Table 2 below).[11]

[10] The ClearPath tool provides standard emissions factors that were developed by ICLEI and are described in the Local Government Operations Protocol, Appendix G.
[11] US EPA. Emissions & Generation Resource Integrated Database (eGRID). https://www.epa.gov/egrid/summary-data.

1. Subregion Output Emission Rates (eGRID2019)

eGRID subregion acronym	eGRID subregion name	Total output emission rates lb/MWh							Non-baseload output emission rates lb/MWh							Grid Gross Loss (%)
		CO_2	CH_4	N_2O	CO_2e	Annual NO_x	Ozone Season NO_x	SO_2	CO_2	CH_4	N_2O	CO_2e	Annual NO_x	Ozone Season NO_x	SO_2	
AKGD	ASCC Alaska Grid	1,114.4	0.098	0.013	1,120.8	6.2	6.1	0.7	1,333.0	0.123	0.017	1,341.0	6.6	6.7	0.8	5.4%
AKMS	ASCC Miscellaneous	549.3	0.026	0.004	551.3	8.1	7.8	0.7	1,520.2	0.067	0.012	1,525.4	22.6	22.8	2.0	5.4%
AZNM	WECC Southwest	952.3	0.068	0.010	956.9	0.6	0.6	0.2	1,445.3	0.100	0.014	1,451.9	0.9	0.9	0.3	5.1%
CAMX	WECC California	453.2	0.033	0.004	455.3	0.4	0.4	0.0	964.0	0.058	0.007	967.6	0.8	0.8	0.1	5.1%
ERCT	ERCOT All	868.6	0.057	0.008	872.4	0.5	0.5	0.6	1,277.2	0.083	0.012	1,282.7	0.9	0.8	0.9	5.1%
FRCC	FRCC All	861.0	0.055	0.007	864.5	0.3	0.3	0.2	1,029.5	0.054	0.007	1,033.0	0.3	0.3	0.2	5.1%
HIMS	HICC Miscellaneous	1,185.6	0.143	0.022	1,195.6	8.1	8.4	4.1	1,549.5	0.107	0.018	1,557.6	12.3	12.8	5.3	5.5%
HIOA	HICC Oahu	1,694.5	0.185	0.028	1,707.6	3.7	4.1	7.0	1,704.1	0.158	0.025	1,715.6	4.5	4.6	8.1	5.5%
MROE	MRO East	1,502.6	0.147	0.022	1,512.6	0.8	0.9	0.4	1,577.7	0.145	0.021	1,587.4	0.8	0.9	0.4	5.1%
MROW	MRO West	1,098.4	0.119	0.017	1,106.4	0.8	0.8	1.1	1,806.8	0.188	0.027	1,819.6	1.4	1.3	1.7	5.1%
NEWE	NPCC New England	488.9	0.077	0.010	493.8	0.3	0.3	0.1	839.9	0.089	0.012	845.5	0.4	0.4	0.1	5.1%
NWPP	WECC Northwest	715.2	0.068	0.010	719.9	0.6	0.6	0.4	1,617.5	0.156	0.022	1,628.1	1.6	1.5	0.9	5.1%
NYCW	NPCC NYC/Westchester	553.8	0.021	0.002	555.1	0.2	0.2	0.0	1,016.2	0.022	0.002	1,017.5	0.4	0.4	0.0	5.1%
NYLI	NPCC Long Island	1,209.0	0.157	0.020	1,218.9	0.9	0.9	0.2	1,300.6	0.044	0.005	1,303.3	0.8	0.8	0.2	5.1%
NYUP	NPCC Upstate NY	232.3	0.017	0.002	233.0	0.1	0.1	0.0	890.2	0.047	0.006	892.6	0.4	0.4	0.2	5.1%
PRMS	Puerto Rico Miscellaneou	1,537.3	0.084	0.013	1,543.3	3.5	3.9	3.2	1,587.9	0.055	0.010	1,592.3	4.5	5.1	5.0	0.0%
RFCE	RFC East	695.0	0.053	0.007	698.5	0.3	0.3	0.3	1,237.9	0.089	0.012	1,243.8	0.7	0.6	0.7	5.1%
RFCM	RFC Michigan	1,189.3	0.114	0.016	1,197.0	0.7	0.7	1.0	1,766.9	0.177	0.025	1,778.8	1.2	1.2	2.1	5.1%
RFCW	RFC West	1,067.7	0.099	0.014	1,074.4	0.8	0.6	0.7	1,831.6	0.178	0.026	1,843.7	1.5	1.1	1.3	5.1%
RMPA	WECC Rockies	1,242.6	0.117	0.017	1,250.6	0.7	0.6	0.4	1,578.8	0.126	0.018	1,587.3	0.8	0.8	0.4	5.1%
SPNO	SPP North	1,070.0	0.112	0.016	1,077.6	0.6	0.6	0.2	1,958.6	0.200	0.029	1,972.2	1.1	1.2	0.4	5.1%
SPSO	SPP South	1,002.0	0.070	0.010	1,006.7	0.7	0.8	0.8	1,543.7	0.108	0.015	1,550.9	1.2	1.2	1.3	5.1%
SRMV	SERC Mississippi Valley	806.8	0.043	0.006	809.6	0.6	0.6	0.7	1,200.1	0.068	0.010	1,204.7	0.9	1.0	1.4	5.1%
SRMW	SERC Midwest	1,584.4	0.169	0.025	1,595.9	1.0	0.8	2.4	1,960.9	0.216	0.031	1,975.6	1.2	1.1	2.8	5.1%
SRSO	SERC South	969.2	0.071	0.010	974.0	0.4	0.4	0.2	1,389.5	0.101	0.015	1,396.4	0.8	0.7	0.4	5.1%
SRTV	SERC Tennessee Valley	949.7	0.087	0.013	955.6	0.5	0.5	0.6	1,565.2	0.139	0.020	1,574.6	0.7	0.8	0.9	5.1%
SRVC	SERC Virginia/Carolina	675.4	0.058	0.008	679.1	0.3	0.4	0.2	1,349.2	0.118	0.017	1,356.9	0.7	0.8	0.4	5.1%
U.S.		**884.2**	**0.075**	**0.011**	**889.2**	**0.6**	**0.6**	**0.5**	**1,420.2**	**0.114**	**0.016**	**1,427.8**	**1.0**	**0.9**	**0.9**	**5.1%**

Created: 2/23/2021

Table 2: eGRID2019 Summary Table: Subregion Emissions

Results

Building and facilities electricity consumption in 2019 was 435,953 kWh and natural gas consumption was 32,992 therms. Building and facilities emissions from electricity in 2019 were 46 $MTCO_2e$, and emissions from natural gas were 176 $MTCO_2e$. Overall building and facilities emissions in 2019 were 223 $MTCO_2e$.

Streetlights

Methods and inputs

Streetlight electricity for 2019 was estimated using streetlight counts as noted on the few National Grid bills that were available for 2019 and using National Grid's streetlight tariff to estimate kWh based on billable wattage and assumed burn hours. Streetlight energy use was entered into ClearPath using eGRID 2019 factors.

Results

Streetlight electricity consumption in 2019 was 91,806 kWh, a total of 10 $MTCO_2e$.

Vehicle Fleet

Methods and inputs

Gasoline and diesel fuel use for 2019 was collected from the Village of Fayetteville and entered into ClearPath using standard emissions factors for diesel. Gasoline was entered into ClearPath assuming a standard 10% ethanol blend.[12]

Results

Vehicle fleet gasoline consumption in 2019 was 4,050 gallons (32 $MTCO_2e$), and diesel use totaled 24,885 gallons (254 $MTCO_2e$). Vehicle Fleet emissions totaled 286 $MTCO_2e$ in 2019.

Wastewater Facilities

Methods and inputs

The Village no longer operates any wastewater or pumping facilities. Previously electric-powered pumping has been converted to gravity-flow systems. Therefore, this sector is not included in this inventory.

IV. Community Emissions Inventory

Overall Results

In 2019, the Village of Fayetteville's community emissions totaled 25,052 $MTCO_2e$. The residential energy use sector contributed to the largest percentage of emissions, accounting for 11,815 $MTCO_2e$, or 47% of the community's total emissions. Transportation was the next highest emitting sector, producing 7,568 $MTCO_2e$, or 30% of total community emissions, followed by the commercial/industrial energy use sector, which produced 4,411 $MTCO_2e$, or 18% of total emissions. The waste sector emitted 1,170 $MTCO_2e$, or 5% of emissions, followed by the wastewater sector which contributed 88 $MTCO_2e$, or 0.3% of emissions.

[12] The gasoline entry in ClearPath was entered as ethanol with 10% biofuel to account for the typical 10% ethanol blend.

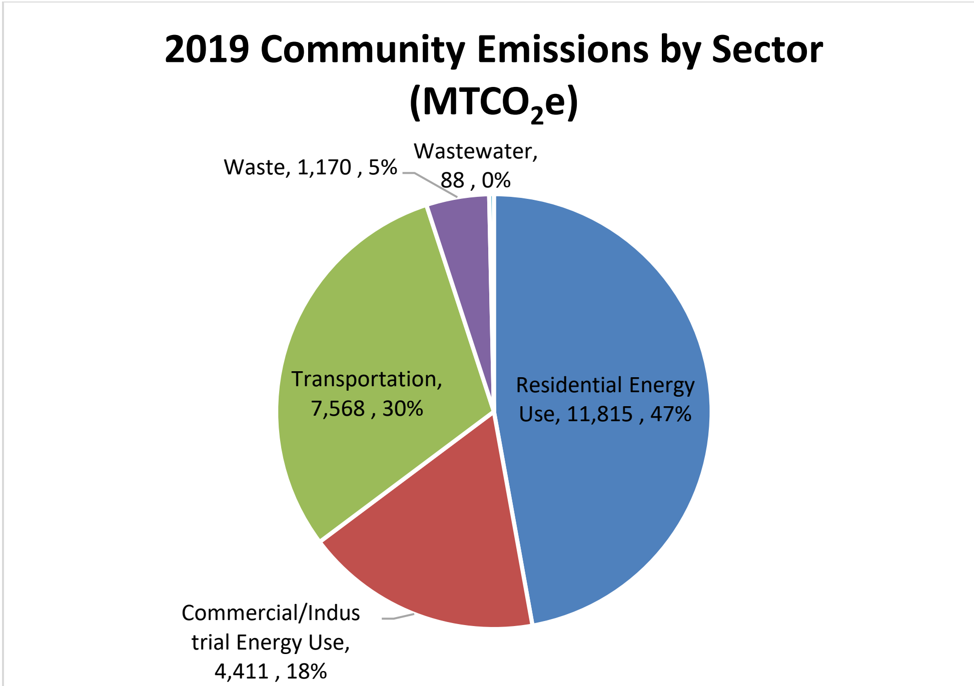


Figure 7: 2019 Community Emissions by Sector

The largest source of community emissions in the Village of Fayetteville in 2019 was natural gas, accounting for 12,407 $MTCO_2e$, or 50% of all community emissions. Gasoline was also a large emitting source, producing 5,348 $MTCO_2e$ (21%).

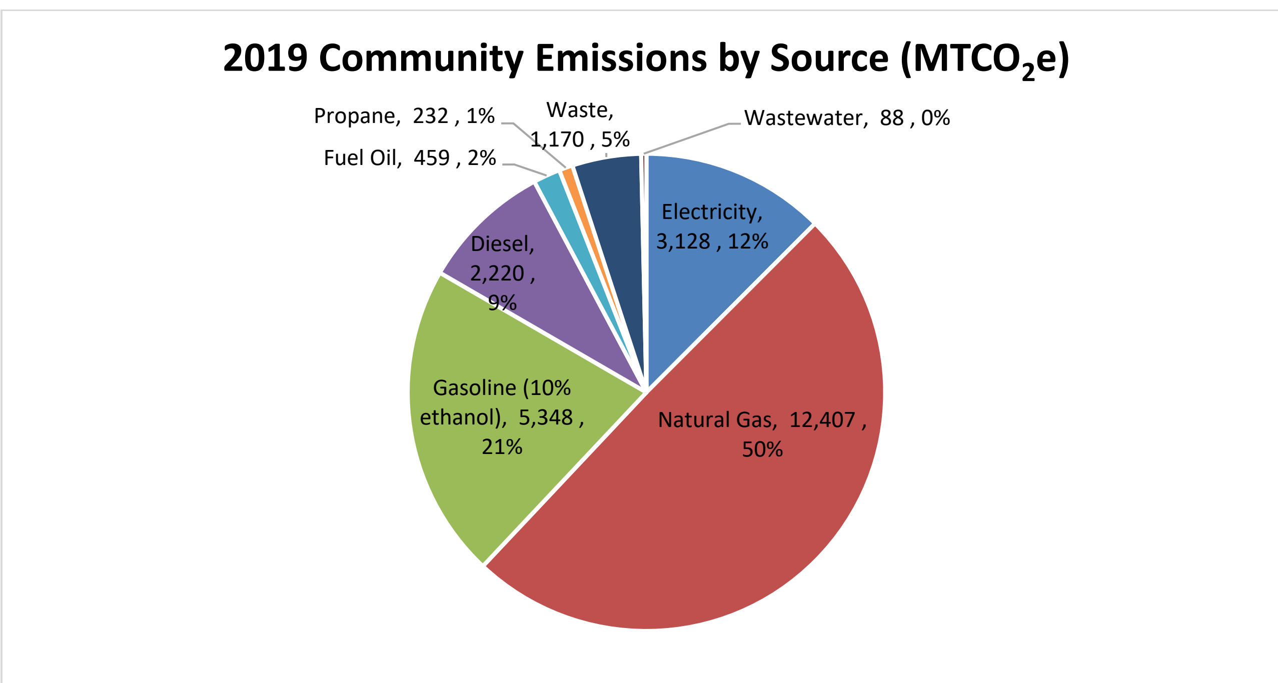


Figure 8: 2019 Community Emissions by Source

Residential Sector

Methods and inputs

Residential electricity and natural gas usage for 2019 was collected using the Utility Energy Registry (UER), which was developed pursuant to the Order Adopting the Utility Energy Registry, issued by the New York State Public Service Commission on April 20, 2018. The UER "standardizes and crowdsources data directly from utilities," and "was developed by NYSERDA to provide local communities data they need to develop greenhouse gas (GHG) inventories and to track progress towards climate goals."[13]

Residential propane and fuel oil use were compiled using the 2019 American Community Survey 5-Year Estimates tables for Selected Housing Characteristics which indicate house heating fuels within the Village of Fayetteville. This information was compared to New York State data for household heating fuel, also from the 2019 American Community Survey 5-Year Estimates tables, and amount/type of fuel consumed within the state (according to the US Energy Information Administration (EIA)'s 2019 Residential Energy Consumption Estimates)[14] to calculate estimated heating fuel use within Village of Fayetteville homes.

Residential energy uses were entered into ClearPath using standard emissions factors[15] for natural gas, propane, and fuel oil. eGRID factors for NPCC Upstate NY from 2019 were used for electricity emissions calculations (as explained above).[16]

Results

Residential electricity consumption in 2019 was 15,912,171 kWh; residential natural gas consumption was 1,800,268 therms; residential propane consumption was estimated at 2,871 MMBtu; and residential fuel oil consumption was estimated at 4,237 MMBtu. Residential emissions from electricity in 2019 were 1,692 $MTCO_2e$; emissions from residential natural gas were 9,626 $MTCO_2e$; emissions from propane were 180 $MTCO_2e$; and emissions from fuel oil were 318 $MTCO_2e$. Overall residential emissions in 2019 were 11,815 $MTCO_2e$.

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[13]NYSERDA. Utility Energy Registry. https://utilityregistry.org/app/#/

[14]US EIA. State Energy Data System (SEDS): 1960-2019. https://www.eia.gov/state/seds/seds-data-complete.php#Consumption

[15] The ClearPath tool provides standard emissions factors that were developed by ICLEI and are described in the Local Government Operations Protocol, Appendix G.

[16] US EPA. Emissions & Generation Resource Integrated Database (eGRID). https://www.epa.gov/energy/emissions-generation-resource-integrated-database-egrid.

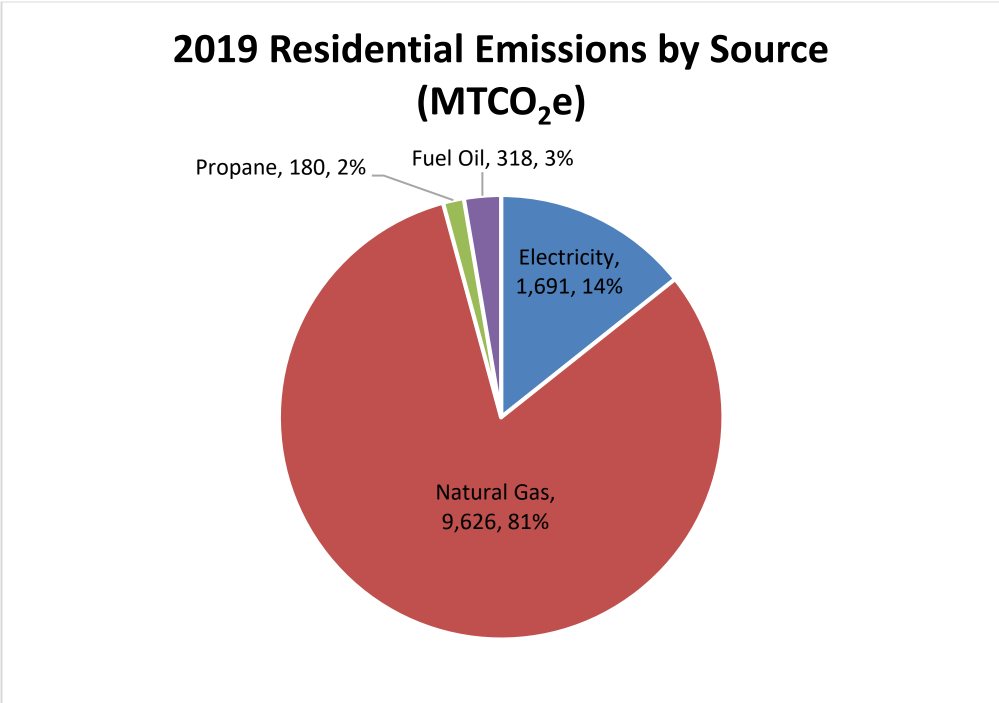

Figure 9: 2019 Residential Emissions by Source

Commercial/Industrial Sector

Methods and inputs

Commercial/industrial electricity and natural gas usage for 2019 were gathered from the National Grid UER data for 2019, under the Business field (which includes non-residential customers).

Commercial/industrial propane and fuel oil use were estimated by assuming the proportion of residential homes using propane and fuel oil within the Village of Fayetteville is equal to the proportion of commercial square footage within the Village of Fayetteville using propane and fuel oil.

The proportion of residential homes using propane and fuel oil was determined from the 2019 American Community Survey 5-Year Estimates tables for Selected Housing Characteristics, which indicate house heating fuels within the Village of Fayetteville, compared to total occupied housing units within the village. These ratios were multiplied by the estimated commercial square footage within the Village of Fayetteville to come up with the estimated commercial/industrial space within the village that uses fuel oil and propane.

Commercial/industrial square footage in the Village of Fayetteville was estimated using commercial floor space per worker from the US EIA's Commercial Buildings Energy Consumption Survey (CBECS) information for 2012 (this was the most recent year with data available),[17] multiplied by the total number of nonfarm workers in the Village of Fayetteville according to the American Community Survey 2019 5-year tables for Occupation by Sex for the Civilian Employed Population 16 Years and Over (including all employed minus natural resources, construction, and maintenance occupations).

Commercial square footage in the Village of Fayetteville using fuel oil and propane were then compared to commercial square footage using fuel oil and propane within New York State. Total commercial floor space within New York was calculated using EIA's Commercial Buildings Energy Consumption Survey (CBECS) for 2012 (this was the most recent year with data available),[18] multiplied by the total number of nonfarm workers as per the American Community Survey 2019 5-year tables for Occupation by Sex for the Civilian Employed Population 16 Years and Over (including all employed minus natural resources, construction, and maintenance occupations) for New York State. Fayetteville commercial/industrial space using fuel oil and propane were then compared to the statewide proportion of households using fuel oil and propane from the statewide American Community Survey. That ratio was then multiplied by the total fuel use within New York State (from the EIA's State Energy Data System (SEDS) 2019 report)[19] to come up with the total commercial/industrial fuel oil and propane use within the Village of Fayetteville. These calculations are explained in detail within the CNY RPDB's data collection and analysis workbooks for this inventory.

Commercial energy uses were entered into ClearPath using the default emissions factors for natural gas, propane, and fuel oil.[20] Similar to the residential electric analysis, the EPA's eGRID factors from 2019 was used for electricity emissions calculations for the commercial/industrial sector.[21]

Results

Commercial/industrial electricity consumption in 2019 was 13,521,470 kWh; commercial/industrial natural gas consumption was 520,006 therms; commercial/industrial propane consumption was estimated at 830 million British Thermal Units (MMBtu); and commercial/industrial fuel oil consumption was 1,881 MMBtu. Commercial/industrial emissions from electricity in 2019 were 1,437 $MTCO_2e$; emissions from commercial/industrial natural gas were 2,781 $MTCO_2e$; emissions from propane were 52 $MTCO_2e$; and emissions from fuel oil were 141 $MTCO_2e$. Total emissions from the commercial/industrial sector in 2019 were 4,411 $MTCO_2e$.

[17] US EIA. Commercial Buildings Energy Consumption Survey (CBECS). https://www.eia.gov/consumption/commercial/data/2012/#b1-b2
[18] US EIA. Commercial Buildings Energy Consumption Survey (CBECS). https://www.eia.gov/consumption/commercial/data/2012/#b1-b2
[19] US EIA. State Energy Data System (SEDS): 1960-2019. https://www.eia.gov/state/seds/seds-data-complete.php#Consumption.
[20] The ClearPath tool provides standard emissions factors that were developed by ICLEI and are described in the Local Government Operations Protocol, Appendix G.
[21] US EPA. Emissions & Generation Resource Integrated Database (eGRID). https://www.epa.gov/energy/emissions-generation-resource-integrated-database-egrid.

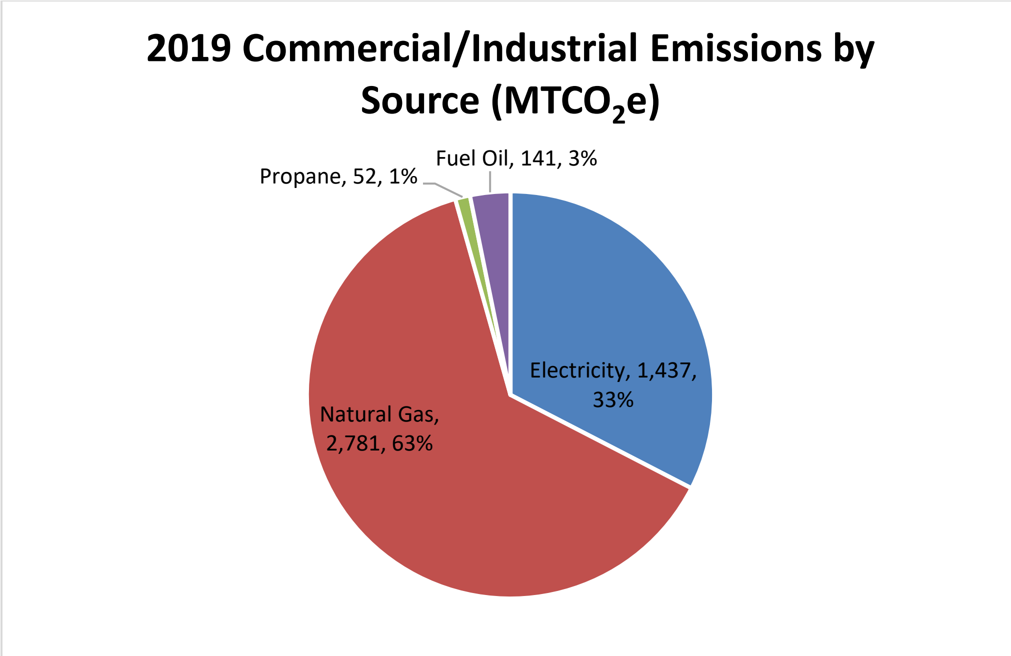

Figure 10: 2019 Commercial/Industrial Emissions by Source

Transportation Sector

Methods and inputs

Transportation emissions were estimated using estimated annual vehicle miles traveled (AVMT), 2019 U.S. National Default emissions factors (updated 2021 – see Table 3 below)[22], and estimates for percentage of vehicle types.[23] Transportation emissions were broken down for diesel and gasoline, assuming a standard 10% ethanol blend in gasoline.[24]

AVMT for 2019 was calculated by multiplying available Annual Average Daily Traffic (AADT) counts from 2019 by road lengths within the Village of Fayetteville and multiplying total daily VMT by 365 days per year.[25]

[22] As per Eli Yewdall at ICLEI, "The default vehicle factor sets are derived from EIA data for fuel economy, and EPA emissions factors for CH4 and N2O. Because EPA publishes factors by model year, we had to convert those to represent the average mix of new and old vehicles on the road in a particular year; we did this using data from the US National GHG inventory."

[23] As provided by Eli Yewdall at ICLEI: Gasoline passenger vehicles: 68.6% Deisel passenger vehicles: 0.3% Gasoline light trucks: 19.7% Deisel light trucks: 0.8% Gasoline heavy trucks: 1.4% Deisel heavy trucks: 8.5%

[24] The gasoline entry in ClearPath was entered as ethanol with 10% biofuel to account for the typical 10% ethanol blend.

[25] AADT and road segment length GIS data provided by the NYSDOT Highway Data Services Bureau. These traffic counts include all traffic within the village, including pass-through traffic where the origin and destination of trips occur outside of the village's boundaries. These trips will be more difficult to address in climate action planning than the trips that begin and/or end within the village.

Name	2019 US National Defaults (updated 2021)
Year	2019
Gas Passenger Vehicle Fuel Economy (MPG)	24.1
Gas Passenger Vehicle g CH4/mi	0.0183
Gas PassengerVehicle g N2O/mi	0.0083
Gas Light Truck Fuel Economy (MPG)	17.6
Gas Light Truck g CH4/mi	0.0193
Gas Light Truck g N2O/mi	0.0148
Gas Heavy Truck Fuel Economy (MPG)	5.371652
Gas Heavy Truck g CH4/mi	0.0785
Gas Heavy Truck g N2O/mi	0.0633
Gas Transit Bus Fuel Economy (MPG)	17.6
Gas Transit Bus g CH4/mi	0.0193
Gas Transit Bus g N2O/mi	0.0148
Gas Para Transit Bus Fuel Economy (MPG)	17.6
Gas Para Transit Bus g CH4/mi	0.0193
Gas Para Transit Bus g N2O/mi	0.0148
Gas Motorcycle Fuel Economy (MPG)	24.1
Gas Motorcycle g CH4/mi	0.0183
Gas Motorcycle g N2O/mi	0.0083
Electric Vehicle Fuel Economy (MPGe)	
Diesel Passenger Vehicle Fuel Economy (MPG)	24.1
Diesel Passenger Vehicle g CH4/mi	0.0005
Diesel PassengerVehicle g N2O/mi	0.001
Diesel Light Truck Fuel Economy (MPG)	17.6
Diesel Light Truck g CH4/mi	0.001
Diesel Light Truck g N2O/mi	0.0015
Diesel Heavy Truck Fuel Economy (MPG)	6.392468
Diesel Heavy Truck g CH4/mi	0.0051
Diesel Heavy Truck g N2O/mi	0.0048
Diesel Transit Bus Fuel Economy (MPG)	17.6
Diesel Transit Bus g CH4/mi	0.001
Diesel Transit Bus g N2O/mi	0.0015
Diesel Para Transit Bus Fuel Economy (MPG)	17.6
Diesel Para Transit Bus g CH4/mi	0.001
Diesel Para Transit Bus g N2O/mi	0.0015
Diesel Motorcycle Fuel Economy (MPG)	24.1
Diesel Motorcycle g CH4/mi	0.0005
Diesel Motorcycle g N2O/mi	0.001

Table 3: 2019 US National Default Transportation Emissions

AADT counts were primarily only available for main arteries; therefore, additional calculations for AADT were needed to estimate AVMT for local/collector roads, as well as some main arteries that do not have AADTs available. The total length of roads in Fayetteville with traffic counts is 6.251 miles, while 18.069 miles of roads do not have AADT counts available.

According to the *Minimum Maintenance Standards Regulation 239/02*, a set of guidelines produced by the Association of Municipalities of Ontario to help local communities estimate traffic volume, while conducting an AADT count, it is possible to estimate the traffic volume for dead-ends and cul-de-sacs to avoid resource intensive counts. This is done by multiplying the number of houses on the roadway by a factor of 6 for rural areas.[26]

This method was applied to the Village of Fayetteville for the roads without AADT counts since most of these roads were local/collector roads. It was determined that there were 1,742 occupied households in the Village of Fayetteville in 2019, according to the American Community Survey. It was assumed that all homes are on roadways that do not have a count, since most houses are on local/collector roads. By multiplying the number of occupied homes by 6, a combined AADT count of 10,452 was calculated for all 18.069 miles of roads without AADT counts available. In order to calculate VMTs, an average AADT value was needed, and derived by dividing the total AADT by the 18.069 miles of uncounted roadway. This gave an average AADT value of 578.4 for 2019, which was applied to all roadways that did not have a count.

Results

AVMT for roads with AADT counts available in 2019 totaled 11,840,073, while AVMT for roads without AADT counts available in 2019 totaled 3,814,980. Total AVMT in 2019 was 15,655,053.

BeginDescr	EndDescrip	RoadwayNam	Calculatio	AADT	RCSTAYearD	Length_Mi	VMT
NY 5	MANLIUS V/L	DUGUID ROAD	2019	1467	331006, 2019, CT	0.230997	338.87
RT 5 FAYETTEVILLE	RT 290 END RT 257		2019	4322	330374, 2019, CT	0.474957	2052.76
TOWN OF MANLIUS VILLAGE OF F	HIGHBRIDGE RD		2019	22698	330109, 2019, CT	0.110000	2496.78
END 5/92 OLAP	TOWN OF MANLIUS VILLAGE OF F		2019	23166	330106, 2019, CT	0.009088	210.53
HIGHBRIDGE RD	SALT SPRINGS RD		2019	21309	330096, 2019, CT	0.440000	9375.96
RT 92 MANLIUS	RT 5 FAYETTEVILLE		2019	6331	330179, 2019, CT	0.547070	3463.50
RT 257	DUGUID RD		2019	8751	330178, 2019, CT	0.861471	7538.73
SALT SPRINGS RD	RT 257		2019	15499	330177, 2019, CT	0.080000	1239.92
VILLAGE LINE S	NY 5	HIGHBRIDGE ST	2019	5044	332102, 2019, CT	0.498994	2516.93

26 http://www.townshipsofheadclaramaria.ca/download.php?dl=YToyOntzOjI6ImlkIjtzOjI6Ijg1IjtzOjM6ImtleSI7aTo0O30=

BeginDescr	EndDescrip	RoadwayNam	Calculatio	AADT	RCSTAYearD	Length_Mi	VMT
GRIFFIN ST	HIGHBRIDGE ST	S BURDICK ST	2019	10	335205, 2019, CT	0.076089	0.76
S MANLIUS ST	WELLWOOD DR	FRANKLIN ST E	2019	352	335204, 2019, CT	0.160880	56.63
GENESEE ST	ELM ST	EDWARDS ST	2019	75	335203, 2019, CT	0.095178	7.14
CLINTON ST	ORCHARD ST	WALNUT ST	2019	200	336072, 2019, CT	0.080143	16.03
SPRING ST	S MANLIUS ST	FRANKLIN ST W	2019	744	336071, 2019, CT	0.229149	170.49
NY5 GENESEE ST	BROOKLEA DR	LIMESTONE PLAZA	2019	3609	336159, 2019, CT	0.130000	469.17
BROOKLEA DR	VILLAGE LINE	FEEDER ST	2019	12	336180, 2019, CT	0.227616	2.73
BRIAR BROOK RUN	CUL-DE-SAC	FRONT ROYAL CT	2019	109	335456, 2019, CT	0.139985	15.26
REDFIELD AVE	BISHOP	FAIRFIELD ST	2019	83	335442, 2019, CT	0.280030	23.24
SALTSPRING RD	END	FIELDSTONE DR	2019	53	335433, 2019, CT	0.087705	4.65
LINCOLN ST	N PARK ST	WARREN ST	2019	540	335427, 2019, CT	0.069981	37.79
CLINTON ST	ORCHARD ST	WARREN ST	2019	551	335426, 2019, CT	0.069986	38.56
BROOKSIDE LA	WOODMANCY LA	VANIDA LA	2019	409	335425, 2019, CT	0.149973	61.34
HIGHBRIDGE ST	END	THOMPSON ST	2019	200	335424, 2019, CT	0.067314	13.46
ORCHARD ST	LINCOLN ST	SPRING ST	2019	161	335423, 2019, CT	0.089965	14.48
WALNUT ST	WARREN ST	SOUTH ST	2019	83	335422, 2019, CT	0.049963	4.15
KENNEDY ST	DEAD END	SIMS PL	2019	16	335421, 2019, CT	0.030434	0.49
WALNUT ST	CHAPEL ST	S PARK ST	2019	98	335420, 2019, CT	0.086618	8.49
GENESEE ST	OAKWOOD ST	REDFIELD AVE	2019	537	335419, 2019, CT	0.129952	69.78
WALNUT ST	CHAPEL ST	ORCHARD ST	2019	645	335418, 2019, CT	0.090018	58.06
LEDYARD AVE	REDFIELD AVE	OAKWOOD ST	2019	138	335417, 2019, CT	0.069652	9.61
WALNUT ST	CHAPEL ST	CLINTON ST	2019	503	335416, 2019, CT	0.089208	44.87
N PARK ST	FRANKLIN ST	CHAPEL ST	2019	316	335415, 2019, CT	0.070056	22.14

BeginDescr	EndDescrip	RoadwayNam	Calculatio	AADT	RCSTAYearD	Length_Mi	VMT
ELM ST	MECHANIC ST	CENTER ST	2019	203	335414, 2019, CT	0.059289	12.04
NY 92	VILLAGE LINE S	HIGHBRIDGE ST	2019	6210	338037, 2019, CT	0.000181	1.13
NY 257	N EAGLE VIL RD	SALT SPRINGS RD	2019	4930	332068, 2019, CT	0.343312	1692.53
NY 5	CEDAR BAY RD	NORTH BURDICK S	2019	13458	331267, 2019, CT	0.025974	349.56
						Daily VMT total	32,438.56
						365 days	365.00
						Annual VMT	11,840,073.37

Table 4: 2019 Village of Fayetteville Traffic Data for Road Segments with Available AADT

# occupied housing units:	1,742
Total AADT for roads not accounted for above:	10,452
Days per year:	365
Average AADT for roads not accounted for above:	578.4
Total Annual VMT for manually calculated roads:	**3,814,980**

Table 5: 2019 Village of Fayetteville Traffic Data for Road Segments without Available AADT

Emissions from transportation in the Village of Fayetteville in 2019 totaled 7,568 $MTCO_2e$, with 5,348 $MTCO_2e$ from gasoline (10% ethanol) and 2,220 $MTCO_2e$ from diesel.

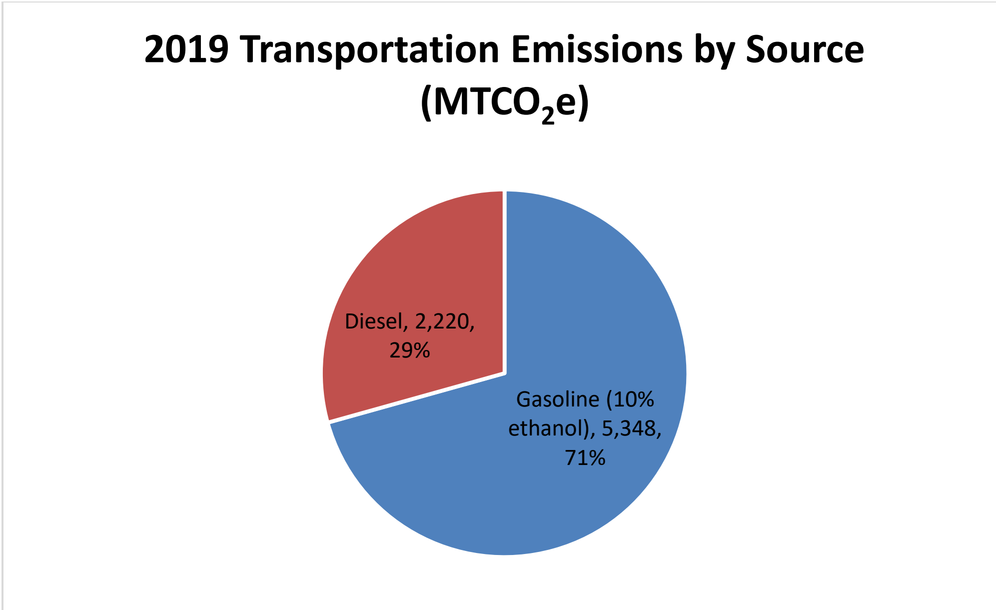

Figure 11: 2019 Transportation Emissions by Source

Waste Sector

Methods and inputs

Waste emissions from the Village of Fayetteville were calculated using total tons of waste from Onondaga County disposed of at the Onondaga County Resource Recovery Agency's Waste to Energy Facility and scaling down to the village based on population. Total waste figures were obtained from OCRRA's 2019 annual report.

County Population	Village of Fayetteville population	Total tons waste from Onondaga County (not including recycling waste)	Tons of waste disposed per person	Tons of waste disposed from Village of Fayetteville
462,872	4,095	362,653.00	0.78	3,208.37

Table 6: 2019 Village of Fayetteville Community Waste Estimate

All waste was entered into the "Combustion of Solid Waste Generated by the Community" calculator and calculated using ICLEI's SW.2.2a methodology.

Results

Waste emissions for the Village of Fayetteville in 2019 totaled 1,170 $MTCO_2e$.

Wastewater Sector

Methods and inputs

According to Lorie Corsette, Village Clerk, all village residents use public wastewater treatment. Wastewater treatment emissions within the Village of Fayetteville were calculated using the Population Based method in ClearPath and assuming the whole residential population of the village was using public wastewater treatment (4,095 people).

Results

Emissions from wastewater treatment in the Village of Fayetteville totaled 88 $MTCO_2e$ in 2019.

V. Municipal Operations Emissions Forecast

Methods and inputs

A municipal operations emissions forecast is included here to provide a sense of what emissions might look like in 2030 for municipal operations under a business-as-usual scenario. The forecast was compiled using ICLEI's protocol for forecasting and entering data into the ClearPath tool online. Data from the 2019 municipal inventory above was used as a baseline for this forecast. Compound Average Growth Rates were used to forecast emissions in all sectors using the inputs noted below.

To forecast emissions from the municipal buildings and facilities sector, population growth rates from 2010 to 2019 as well as mandates of the **Climate Leadership and Community Protection Act** (i.e. 70% electricity from renewables by 2030) were used. It is assumed that as population of the village decreases, energy used by municipal operations at buildings and facilities decreases in a proportional manner.

To forecast emissions from municipal streetlights, mandates of the **Climate Leadership and Community Protection Act** (i.e. 70% electricity from renewables by 2030) were used. For safety reasons, it is assumed that energy used by streetlights in the village remains constant despite decreasing population.

To forecast emissions from the municipal vehicle fleet, population growth rates as well as Federal rules on vehicle fuel mileage standards were used.[27] It is assumed that as population of the village decreases, energy used by the municipal vehicle fleet decreases in a proportional manner.[28]

[27] This forecast uses the December 2021 Final Rule to Revise Existing National GHG Emisisons Standards for Passenger Cars and Light Trucks through MY 2026: https://www.epa.gov/regulations-emissions-vehicles-and-engines/final-rule-revise-existing-national-ghg-emissions/ - CO2 (g/mi) for combined fleet.

[28] Since ClearPath requires VMT inputs for municipal vehicle fleet forecasts, National Default Vehicle Fuel Efficiencies provided by ICLEI at https://docs.google.com/spreadsheets/d/1KXmtHoxI-mPXz0ujidtj76woUcK-RN9ITMRy-gMoUls/edit#gid=1929834944 were utilized to calculate estimated VMT for the village's fleet, using average light trucks for gasoline and heavy duty trucks for diesel.

Results

Assuming a business-as-usual scenario, emissions in the Village of Fayetteville in 2030 are expected to decrease from 519 $MTCO_2e$ in 2019 to 287 $MTCO_2e$ in 2030, a decrease of about 45%. Each sector's forecast is explained further below.

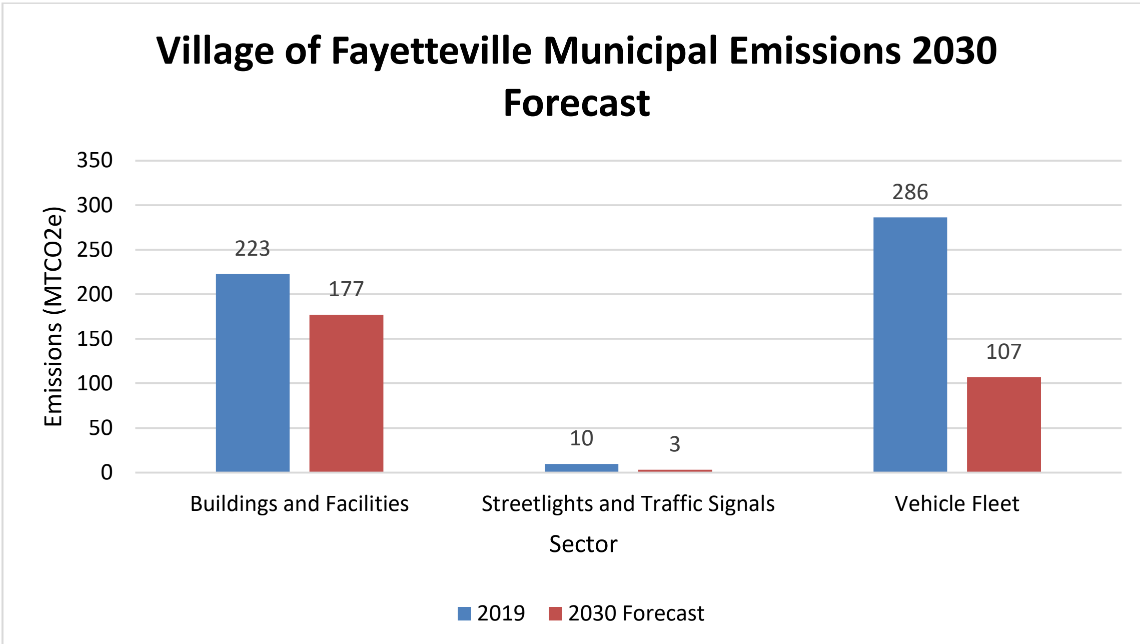

Figure 12: Village of Fayetteville Municipal Operations 2030 Emissions Forecast

Discussion

Electric and natural gas used at municipal buildings and facilities is expected to decline slightly in accordance with the village population growth trend (which has decreased very slightly since 2009), but since the **Climate Leadership and Community Protection Act** requires the state to achieve 70% renewable electricity by 2030, emissions from municipal operations electricity use are expected to drop from 46 $MTCO_2e$ to 13 $MTCO_2e$. Overall emissions from municipal buildings and facilities are therefore expected to decrease from 223 $MTCO_2e$ in 2019 to 177 $MTCO_2e$ by 2030.

Emissions from municipal vehicles are expected to decrease because the carbon intensity of the vehicle miles traveled is expected to decrease as federal transportation policies require vehicle fuel mileage standards to improve over time. Emissions from municipal vehicle fleet at therefore expected to decrease from 286 $MTCO_2e$ in 2019 to 107 $MTCO_2e$ by 2030.

Emissions from streetlights are expected to decrease from 10 $MTCO_2e$ to 3 $MTCO_2e$ in accordance with CLCPA goals of achieving 70% renewable electricity by 2030.

VI. Community Emissions Forecast

Methods and inputs

A community emissions forecast is included here to provide a sense of what emissions might look like in 2030 under a business-as-usual scenario. The forecast was compiled using ClearPath guidance. Compound Average Growth Rates were used to forecast emissions in all sectors, using the inputs noted below.

To forecast emissions from the residential and commercial/industrial sectors, State energy use trends as described in the 2015 **New York State Energy Plan** and mandates of the **Climate Leadership and Community Protection Act** (i.e. 70% electricity from renewables by 2030) were used.

To forecast emissions from the transportation sector, State energy use trends as described in the 2015 **New York State Energy Plan** and Federal rules on vehicle fuel mileage standards were used.[29]

To forecast emissions from the waste sector, population growth rates for the Village of Fayetteville from the American Community Survey from 2010 vs. 2019 were used, assuming population would continue to decline at a similar rate through 2030 and waste production would increase proportionally to population growth.

To forecast emissions from the wastewater sector, population growth rates for the Village of Fayetteville from the American Community Survey from 2010 vs. 2019 were used, assuming population would continue to grow at a similar rate through 2030 and wastewater emissions would increase proportionally to population growth.

Results

Assuming a business-as-usual scenario, emissions in the Village of Fayetteville in 2030 are expected to decrease from 25,052 MTCO_2e in 2019 to 18,481 MTCO_2e in 2030, a decrease of about 26%. Emissions are expected to decrease in the residential, commercial/industrial, and transportation sectors, and increase in the waste and wastewater sectors. Each sector's forecast is explained further below.

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[29] This forecast uses the March 2020 Safer Affordable Fuel Efficient (SAFE) Vehicles Rule, which projects combined passenger and light duty vehicle fuel efficiency to be 40.4 mpg by 2026, according to https://www.c2es.org/content/regulating-transportation-sector-carbon-emissions/ accessed 10/19/21.

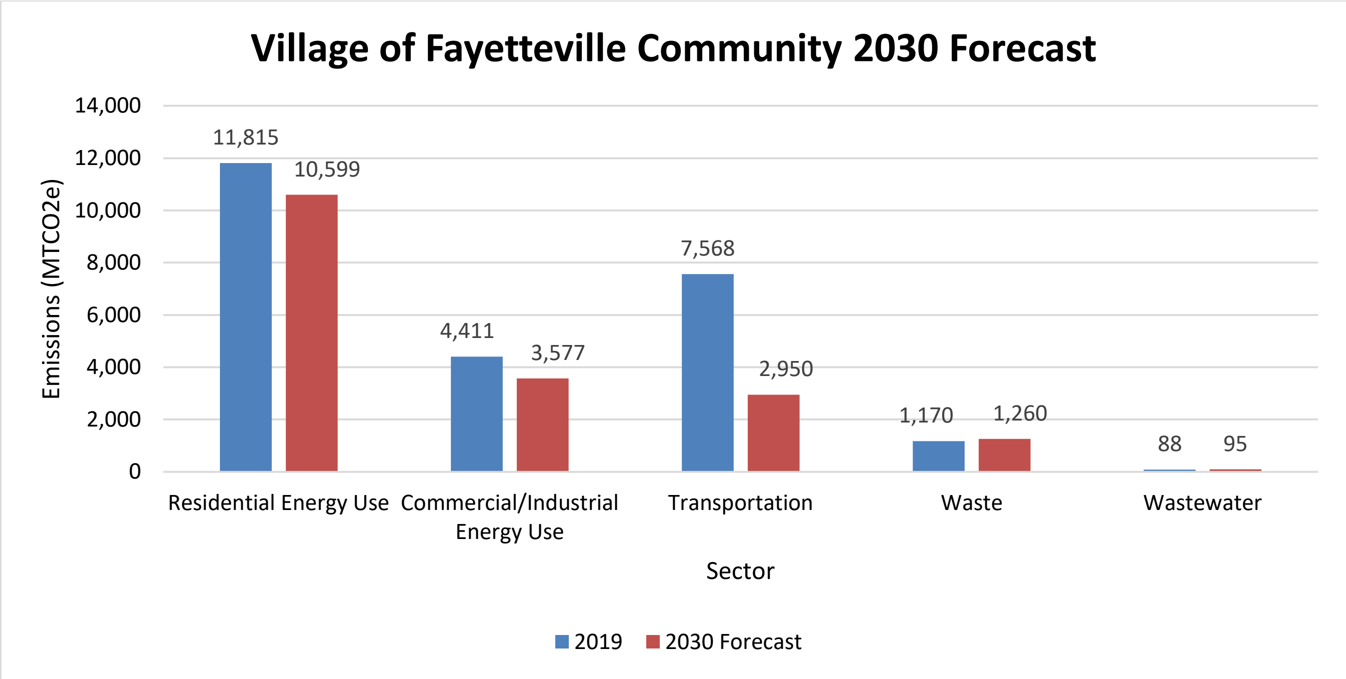

Figure 13: Village of Fayetteville Community 2030 Emissions Forecast

Discussion

Emissions from the residential sector are expected to decrease from 11,815 $MTCO_2e$ in 2019 to 10,599 $MTCO_2e$ by 2030.

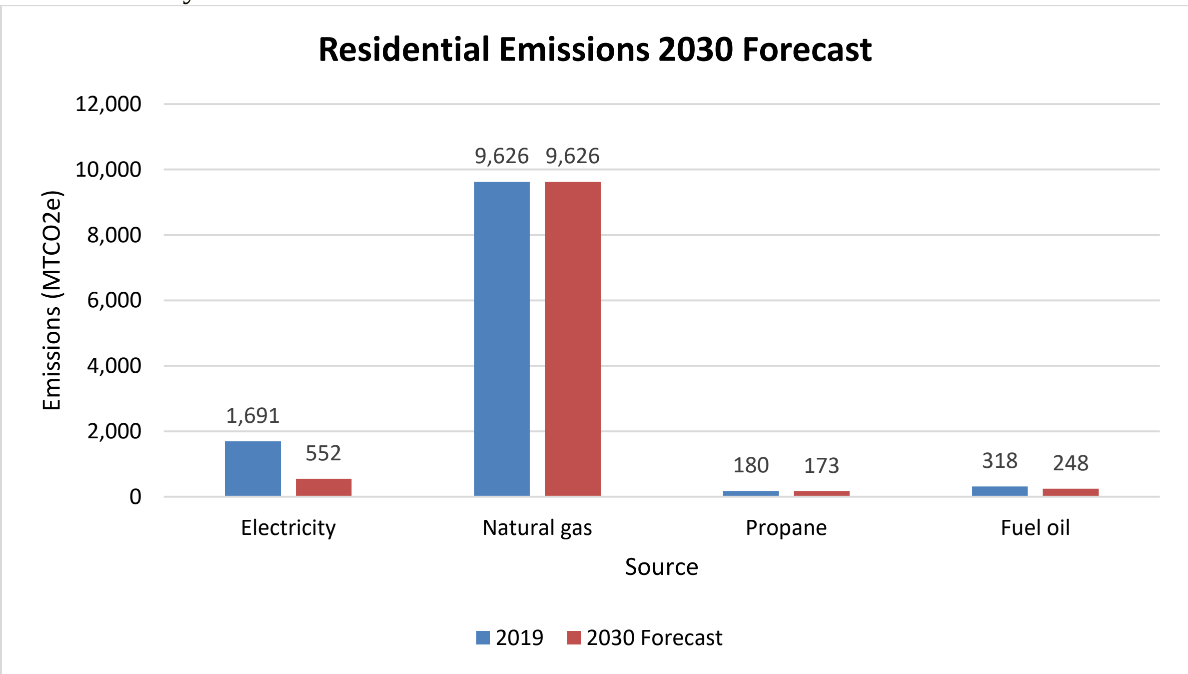

Figure 14: Forecasted Residential Emissions in the Village of Fayetteville for 2030

Since the **Climate Leadership and Community Protection Act** has set a goal of 70% electricity coming from renewables by 2030, emissions from residential electricity use are expected to drop significantly. Residential propane and fuel oil use are projected to decrease as well, with natural gas use staying about the same, according to the 2015 **New York State Energy Plan**.

Emissions from the commercial/industrial sector are expected to decrease overall, from 4,411 $MTCO_2e$ in 2019 to 3,577 $MTCO_2e$ by 2030.

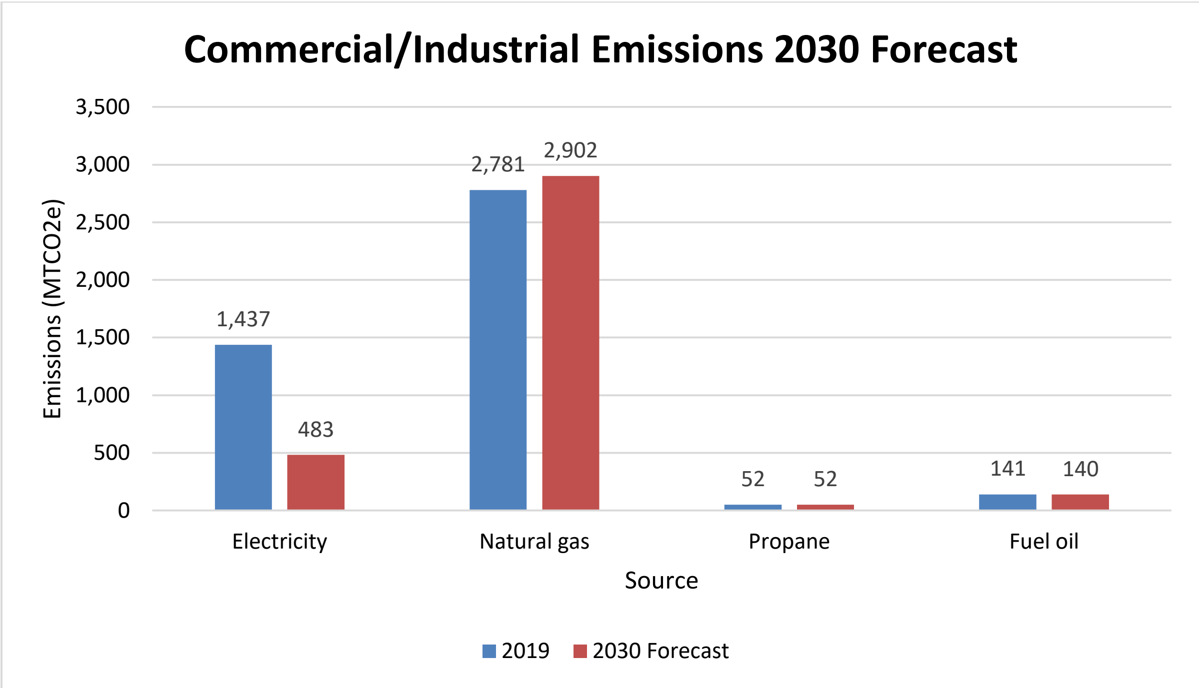

Figure 15: Forecasted Commercial/Industrial Emissions in the Village of Fayetteville for 2030

Since the **Climate Leadership and Community Protection Act** has set a goal of 70% electricity coming from renewables by 2030, emissions from commercial/industrial electricity use are expected to drop significantly. Commercial/industrial fuel oil use is projected to decrease as well, with propane use staying about the same and natural gas use increasing slightly over time, according to the 2015 **New York State Energy Plan**.

Emissions from the transportation sector are expected to decrease overall as well, from 7,568 $MTCO_2e$ in 2019 to 2,950 $MTCO_2e$ by 2030.

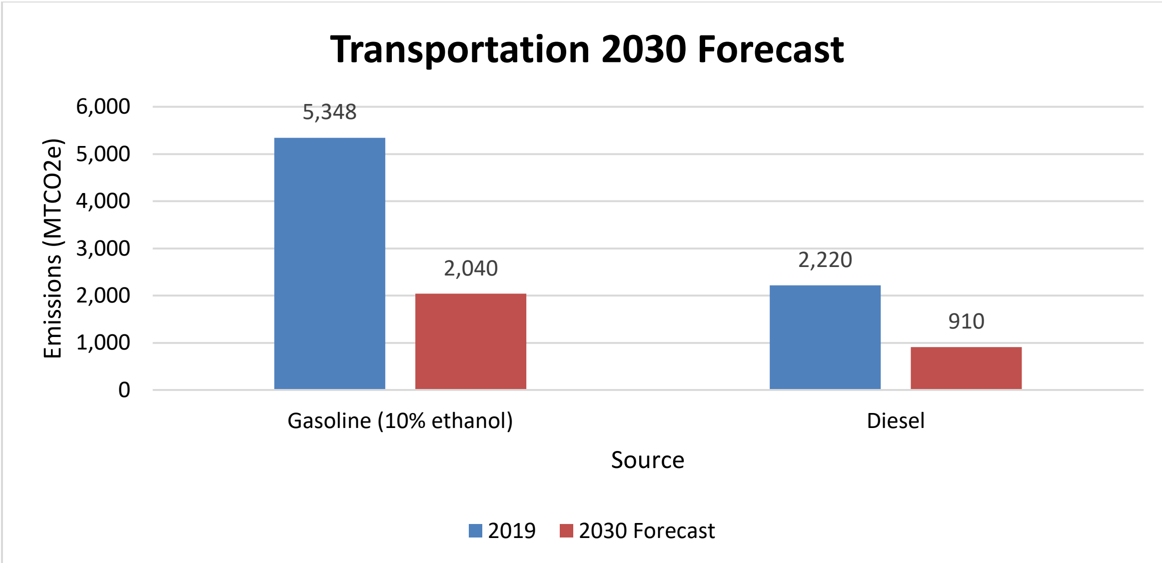

Figure 16: Forecasted Transportation Emissions in the Village of Fayetteville for 2030

According to the 2015 **New York State Energy Plan**, gasoline and vehicle miles traveled are expected to decrease over time, with diesel use and vehicle miles traveled increasing. However, the carbon intensity of the vehicle miles traveled for all fuel types is expected to decrease as federal transportation policies require vehicle fuel mileage standards to improve over time, so emissions from all fuel sources are expected to decrease.

Emissions from the waste sector are expected to increase slightly, from 1,170 $MTCO_2e$ in 2019 to 21,260 $MTCO_2e$ by 2030. This forecast is directly related to estimated population growth rate in the village.

Emissions from the wastewater sector are expected to increase, from 88 $MTCO_2e$ in 2019 to 95 $MTCO_2e$ in 2030. This forecast is directly related to estimated population growth rate in the village.

VII. Discussion: 2009 vs 2019 Inventory

As noted above, the Village of Fayetteville compiled a greenhouse gas inventory in 2013 with a baseline year of 2009. Below is a discussion comparing emissions for both the municipal operations and the community as reported in 2009 vs this report.

It should be noted that the 2009 inventory was compiled using the current standards at the time, which meant using Global Warming Potentials (GWPs) from the IPCC's 2nd Assessment Report compared to the current standard of using the 20-year GWPs in IPCC's 5th Assessment Report. Therefore, Figures 17 and 18 below shows what emissions totals would be for 2019 using the same GWPs as were used to calculate 2009 emissions (noted as "2019 IPCC 2nd").

The IPCC 2nd assessment report assumes a GWP of 21 for methane over a 100-year period, meaning that the impact of 1 unit of methane in the atmosphere creates 21 times more warming potential than 1 unit of CO_2 over a 100-year time period. However, methane typically remains in the atmosphere for closer to 12 years as opposed to CO_2 which can remain in the atmosphere for over 100 years, meaning that methane's impact while it remains in the atmosphere is much stronger than that of CO_2. Therefore, the IPCC 5th assessment report includes both a 100 year and 20-year GWP for methane of 28 and 84, respectively.[30] The IPCC 5th assessment report's 20-year GWP for nitrous oxide is 264 as compared to 310 from the IPCC 4th assessment report, 100-year GWP.

As illustrated in Figures 17 and 18, there is not much difference between the two GWP scenarios for most sectors, but there is a more noticeable increase in emissions for waste and wastewater using the IPCC 5th assessment 20-year GWPs. Therefore, it is important to consider the methodology used in creating this and future inventory updates, as well as when comparing data from this inventory to inventories from other communities.

Municipal Comparison

Table 7 below compares municipal energy use from 2009 to municipal energy use from 2019.

Municipal Energy Use	Source	2009	2019	Difference	
Buildings and Facilities	Electricity (kWh)	130,273	435,953	305,680	235%
	Natural gas (therms)	53,556	32,992	-20,564	-38%
Streetlights and Traffic Signals	Electricity (kWh)	229,602	91,806	-137,796	-60%
Vehicle Fleet	Gasoline (gallons)	5,423	4,050	-1,373	-25%
	Diesel (gallons)	25,656	24,885	-772	-3%
Wastewater Facilities	Electricity (kWh)	4,485	0	-4,485	-100%

Table 7: Village of Fayetteville Municipal Energy Use 2009 v 2019

In 2009, emissions from the Village of Fayetteville municipal operations totaled 670 $MTCO_2e$, compared to 519 $MTCO_2e$ in 2019.

[30] IPCC. Climate Change 2014 Synthesis Report. https://ar5-syr.ipcc.ch/ipcc/ipcc/resources/pdf/IPCC_SynthesisReport.pdf

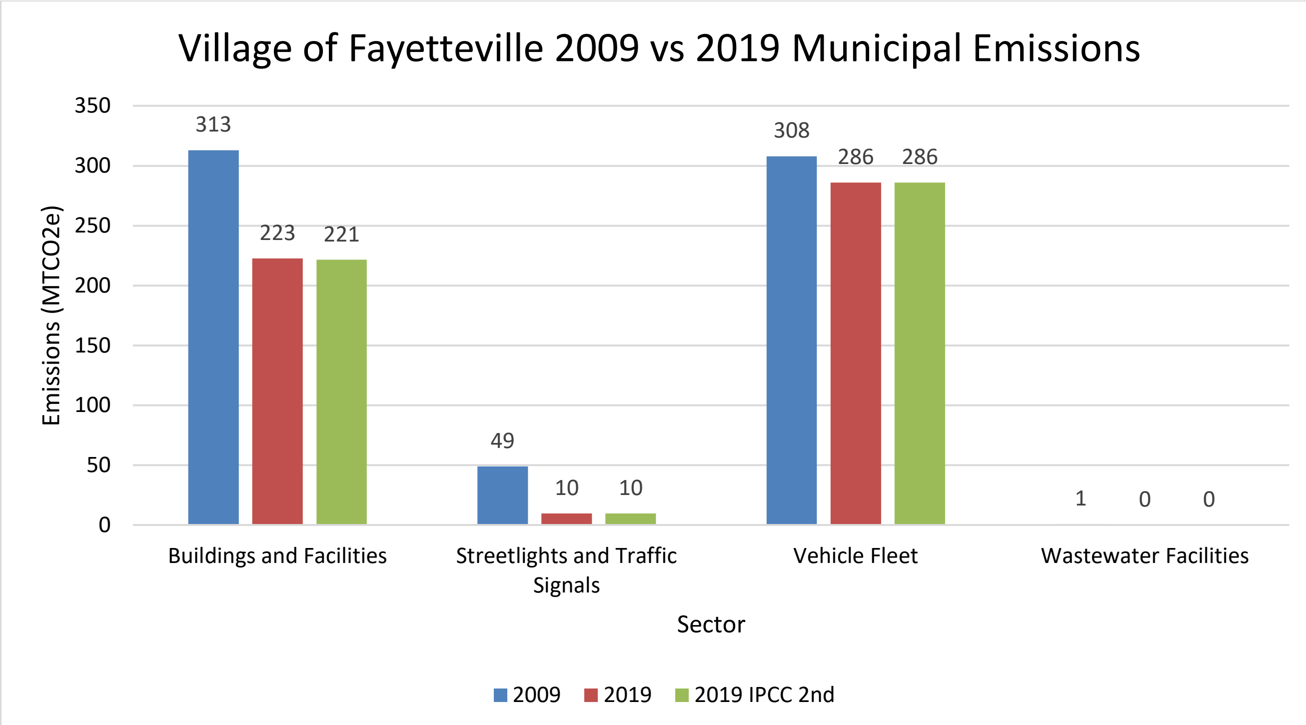

Figure 17: Village of Fayetteville 2009 vs 2019 Municipal Emissions

As illustrated in Figure 17, the largest difference in emissions from 2009 to 2019 is in the buildings and facilities sector. The increase in electricity use from 139,273 kWh in 2009 to 435,953 kWh in 2019 can likely be attributed to a significant addition made to the Fire Department, the creation of a bunk-in student program, and addition of overnight shifts. Despite the increase in electricity use, there was still a 30% decrease in emissions from the Buildings and Facilities sector over the ten-year period which can be explained by decreases in emissions factors for electricity as a result of less carbon-intensive sources of electricity being supplied by the state's utilities. Additionally, natural gas use decreased by 38% during that time. Upgrades to the DPW building, such as air curtains and a new roof, improved the building's energy efficiency and likely reduced the amount of natural gas needed to heat the building. Another potential cause for this reduction in natural gas use is fewer heating degree days in 2019 compared to 2009. A degree day compares the mean temperature recorded for a location to a standard temperature, usually 65°F.[31] More heating degree days implies greater energy use to heat spaces. In 2009, there were 6,687 heating degree days and in 2019 there were 6,601 heating degree days, so the village likely required less natural gas for building heating.[32]

Emissions from streetlights significantly decreased between 2009 and 2019 because of the reduced energy use since the Village converted all cobra head streetlights to LEDs. The Village is currently in the process of converting decorative streetlights to LEDs as well.

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[31] U.S. Energy Information Administration. 2022. https://www.eia.gov/energyexplained/units-and-calculators/degree-days.php
[32] National Weather Service. https://www.cpc.ncep.noaa.gov/products/analysis_monitoring/cdus/degree_days/

Vehicle fleet emissions decreased slightly in between 2009 and 2019. This could be attributed to a reduction in the vehicle fleet, distance traveled, and improvements in fuel efficiency with newer vehicles.

Community Comparison

Table 8 below compares community energy in 2009 to community energy use in 2019.

Community Energy Use	Source	2009	2019	Difference	
Residential Energy Use	Electricity (kWh)	15,169,694	15,912,171	742,477	5%
	Natural gas (therms)	1,590,582	1,800,268	209,686	13%
	Propane (MMBtu)	1,300	2,871	1,571	121%
	Fuel oil (MMBtu)	607	4,237	3,630	598%
Commercial/Industrial Energy Use	Electricity (kWh)	13,193,041	13,521,470	328,429	2%
	Natural gas (therms)	555,657	520,006	-35,651	-6%
	Propane (MMBtu)	2,165	830	-1,335	-62%
	Fuel oil (MMBtu)	8,821	1,881	-6,939	-79%
Transportation	Vehicle Miles Traveled	22,139,799	15,655,053	-6,484,746	-29%
Waste	Total tons	2,953	3,208	255	9%

Table 7: Village of Fayetteville Municipal Energy Use 2009 v 2019

In 2009, emissions from the Village of Fayetteville community totaled 31,389 $MTCO_2e$, compared to 25,052 $MTCO_2e$ in 2019. It should be noted that the 2015 report was able to separate out Commercial and Industrial emissions due to availability of data at the time, but the two sectors are included in the Commercial/Industrial Use sector in Figure 18 below.

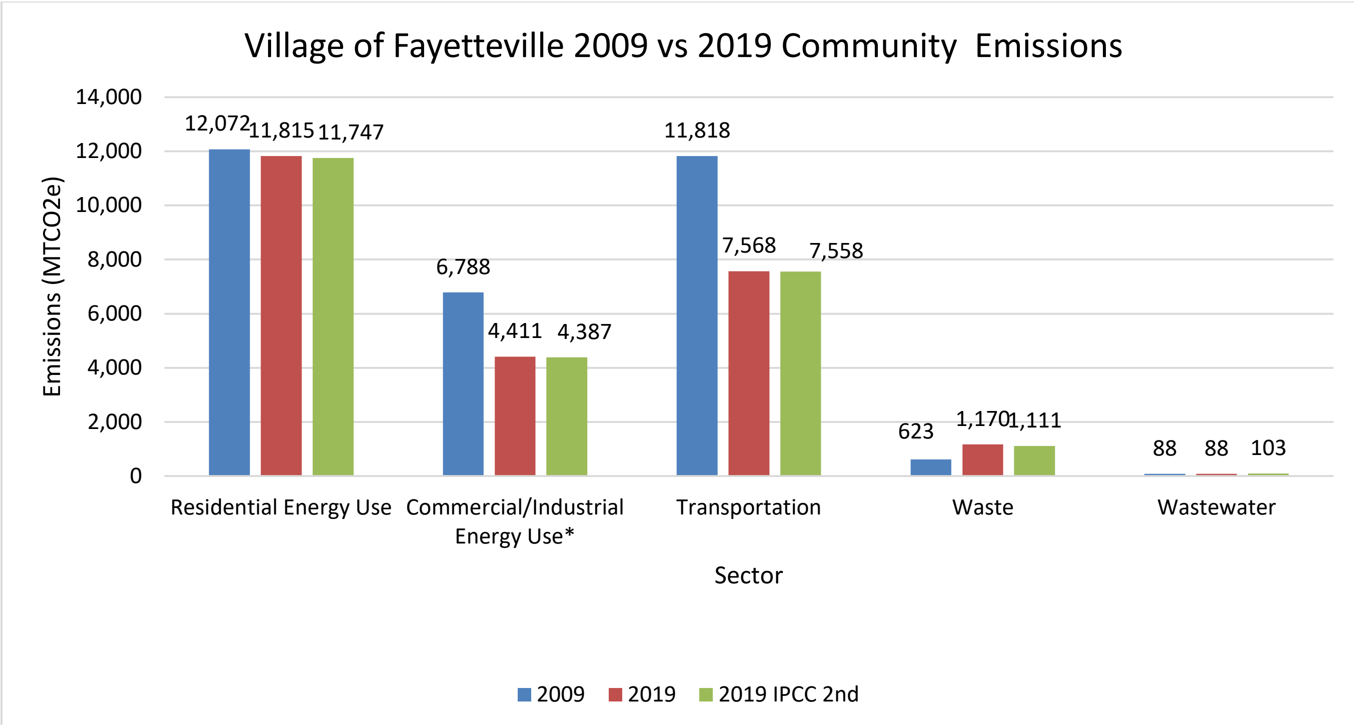

Figure 18: Village of Fayetteville 2009 vs 2019 Community Emissions

As illustrated in Figure 18, emissions in the Residential, Waste, and Wastewater sectors were relatively similar in 2009 and 2019, whereas emissions for Commercial/Industrial and Transportation sectors appear to have decreased. This could be due to a difference in methodology, as Commercial/Industrial energy use for all sources had to be estimated in 2019 and Industrial energy use was not available separately. It could also be due to a decrease in emissions factors for electricity, and for vehicle miles traveled, as vehicles have become more efficient per mile traveled over time.

VIII. Conclusion

This greenhouse gas inventory update can help inform a Climate Action Plan update, which can help the village to better understand energy use and emissions from both municipal operations and the community-at-large.

The results of this study indicate that the largest percentage of municipal emissions came from the vehicle fleet and the largest percentage of community emissions came from the residential sector for 2019. Municipal vehicle fleet emissions should be targeted in the village's future Climate Action Plan Update so that energy use from this sector can be reduced, therefore lowering both energy costs and GHG emissions. Through the Department of Environmental Conservation (DEC) Municipal Zero-emission Vehicle (ZEV) program, municipalities can earn rebates for purchasing zero-emission vehicles for fleet use, as well as grant funding for charging station infrastructure.

It should be noted that buildings continue to be the largest source of emissions for the community, as it is for the state, and that efforts could be directed towards cleaner sources of heating and cooling, including implementing local community campaigns for clean heating and cooling and energy efficiency, which could be completed in coordination with HeatSmart CNY and with the assistance of the CNY RPDB.

It is recommended that the village participate further in the Clean Energy Communities program and other state and utility incentive programs to help achieve additional energy and emissions savings. The CNY RPDB is available to provide technical assistance to implement projects and to secure grants and other financial support for projects.

As a Climate Smart Community, the Village of Fayetteville has partnered with state and local agencies to combat climate change and pledge to reduce greenhouse gas emissions. Conducting an emissions inventory update is an important step in climate action planning, mitigation, and adaptation. This inventory will provide a benchmark for planning purposes with the goal of setting an emissions reduction target and updating the Village's Climate Action Plan.

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