



City of Littleton

2023 Inventory of Community and Government Operations Greenhouse Gas Emissions

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Produced by the City of Littleton with Assistance from ICLEI – Local
Governments for Sustainability USA

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Executive Summary

The City of Littleton (“Littleton”) recognizes that greenhouse gas (GHG) emissions from human activity are catalyzing profound climate change, the consequences of which pose substantial risks to the future health, well-being, and prosperity of our community. In 2024, Littleton adopted its first ever [Environmental Stewardship Action Plan](#). This plan contains six key focus areas: air quality/emissions, built environment, consumption and waste diversion, natural environment, water, and community. Step one to tracking the reduction of emissions is to first know where we are starting from. Step two would then be to create reduction targets for the community of Littleton to work towards.

This report provides estimates of greenhouse gas emissions resulting from activities in Littleton as a whole in 2023, as well as emissions specifically from the city’s government operations. This report only accounts for the actual incorporated Littleton city limits of 13.75 square miles. The data found within this report is meant to equip city decision makers as well as residents with the knowledge they need to take the best steps forward. Steps taken to reduce the city’s GHG emissions will also help accomplish other city goals, such as increasing urban tree canopy, as outlined in Littleton’s [2023 Urban Forestry Management Plan](#).

Seeing the reductions needed will be a community effort. This inventory marks the completion of Milestone One of the Five ICLEI Climate Mitigation Milestones. The next steps are to forecast emissions, set an emissions-reduction target, and build upon the existing Environmental Stewardship Action Plan with a more robust resilience and adaptation plan that identifies specific, quantified strategies that can cumulatively meet that target. To keep engaged with sustainability work within the city, please reference the [Sustainability pages](#) on Littletonco.gov, where you can learn more about sustainability programs, policies, and efforts you’d like to see here in Littleton.

Key Findings

Figure 1 shows community-wide emissions by sector. The largest contributor is Commercial Energy with 33.05% of emissions. The next largest contributors are Transportation & Mobile Sources (31.84%) and Residential Energy (27.35%). Actions to reduce emissions in all of these sectors will be a key part of a resilience and adaptation plan. Solid Waste, Water & Wastewater, and Process & Fugitive Emissions were responsible for the remaining (less than 7.74%) emissions.

Figure 2 shows local government operations emissions. The Water & Wastewater Treatment Facilities sector accounts for a vast majority (81.06%) of these emissions. The next largest contributor is Building & Facilities (10.71%), followed by Vehicle Fleet (4.52%). Actions to reduce emissions from these sectors will be a key part of any future resilience and adaptation plan developed by Littleton. Employee Commute, Solid Waste Facilities, Street Lights & Traffic Signals, and Transit Fleet were responsible for the remainder (less than 3.71%) of local government operations emissions.

The Inventory Results section of this report provides a detailed profile of emissions sources within Littleton; information that is key to guiding local reduction efforts. These data will also provide a baseline against which the city will be able to compare future performance and demonstrate progress in reducing emissions.

Figure 1: Community-wide Emissions

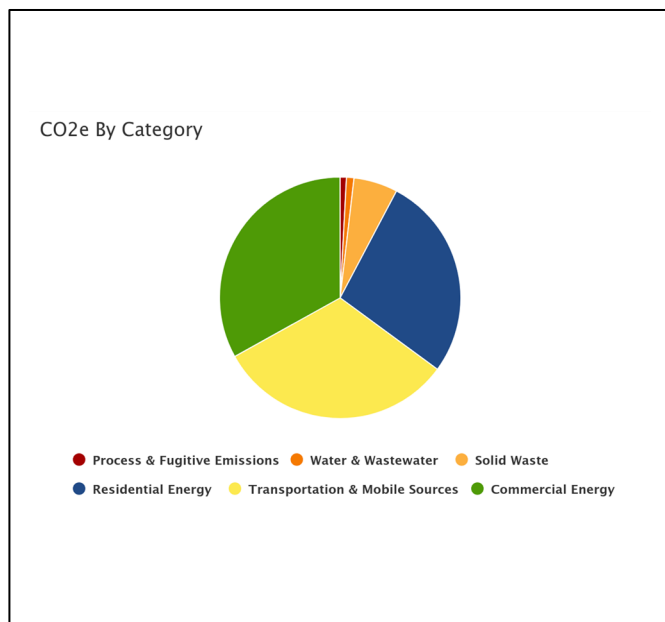
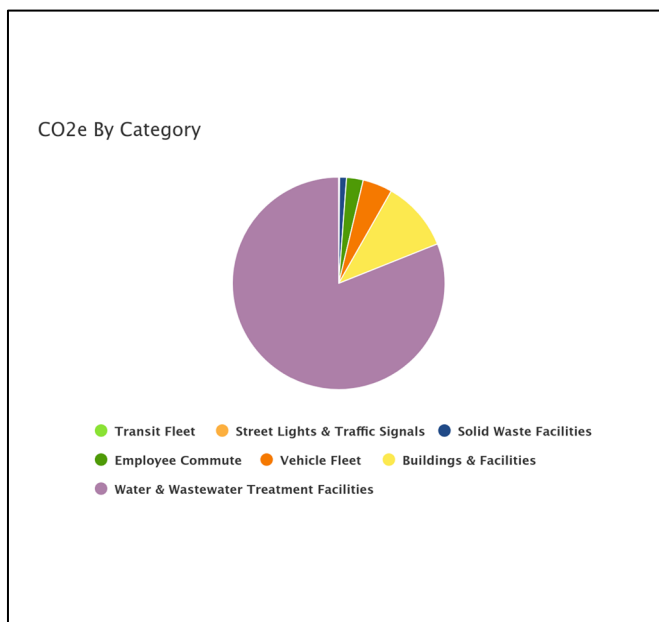


Figure 2: Local Government Operations Emissions



Introduction to Climate Change

Naturally occurring gases dispersed in the atmosphere determine the Earth's climate by trapping solar radiation, a phenomenon known as the greenhouse effect. Overwhelming evidence shows that human activities are increasing the concentration of greenhouse gases and changing the global climate. The most significant contributor is the burning of fossil fuels for transportation, electricity generation and other purposes, which introduces large amounts of carbon dioxide and other greenhouse gases into the atmosphere. Collectively, these gases intensify the natural greenhouse effect, causing global average surface and lower atmospheric temperatures to rise, threatening the safety, quality of life, and economic prosperity of global communities. Although the natural greenhouse effect is needed to keep the earth warm, a human enhanced greenhouse effect with the rapid accumulation of GHG in the atmosphere leads to too much heat and radiation being trapped. The Intergovernmental Panel on Climate Change (IPCC) Sixth Assessment Report confirms that human activities have unequivocally caused an increase in carbon emissions¹. Many regions are already experiencing the consequences of global climate change, and Littleton is no exception.

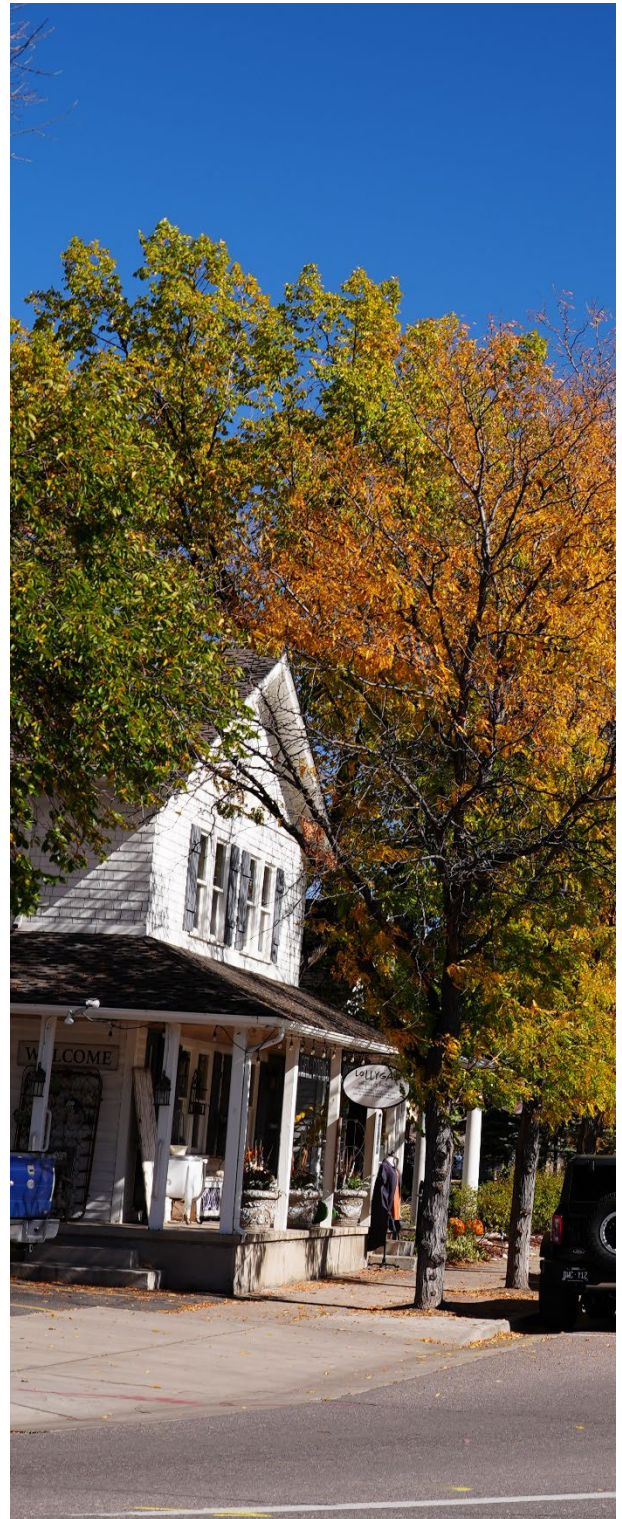
Human activities are estimated to have caused approximately 1.0°C of global warming above pre-industrial levels, with a likely range of 0.8°C to 1.2°C. Global warming is likely to reach 1.5°C between 2030 and 2052 if it continues to increase at the current rate. (high confidence) Warming from anthropogenic emissions from the pre-industrial period to the present will persist for centuries to millennia and will continue to cause further long-term changes in the climate system, such as sea level rise, with associated impacts (high confidence), but these emissions alone are unlikely to cause global warming of 1.5°C (medium confidence). Climate-related risks for natural and human systems are higher for global warming of 1.5°C than at present, but lower than at 2°C (high confidence). These risks depend on the magnitude and rate of warming, geographic location, levels of development and vulnerability, and on the choices and implementation of adaptation and mitigation options (high confidence)².

¹IPCC, 2021: Summary for Policymakers. In: Climate Change 2021: The Physical Science Basis. Contribution of Working Group I to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change [Masson-Delmotte, V., P. Zhai, A. Pirani, S. L. Connors, C. Péan, S. Berger, N. Caud, Y. Chen, L. Goldfarb, M. I. Gomis, M. Huang, K. Leitzell, E. Lonnoy, J. B. R. Matthews, T. K. Maycock, T. Waterfield, O. Yelekçi, R. Yu and B. Zhou (eds.)]. Cambridge University Press. In Press.

²IPCC, 2018: Summary for Policymakers. In: Global Warming of 1.5°C. An IPCC Special Report on the impacts of global warming of 1.5°C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty [Masson-Delmotte, V., P. Zhai, H.-O. Pörtner, D. Roberts, J. Skea, P.R. Shukla, A. Pirani, W. Moufouma-Okia, C. Péan, R. Pidcock, S. Connors, J.B.R. Matthews, Y. Chen, X. Zhou, M.I. Gomis, E. Lonnoy, T. Maycock, M. Tignor, and T. Waterfield (eds.)]. World Meteorological Organization, Geneva, Switzerland, 32 pp.

According to the 2023 National Climate Assessment, the effects of climate change are many, including (but not limited to) increased wildfires, drought, extreme heat, air pollution, and more. In Colorado, climate change has already led to reductions in seasonal maximum snowpack, resulting in less available surface water for irrigation downstream and, consequently, crop production losses and food security risks. To learn more about how climate change will directly impact communities within the Southwest specifically, visit <https://nca2023.globalchange.gov/chapter/28/>³.

Many communities in the United States have started to take responsibility for addressing climate change at the local level. Reducing fossil fuel use in the community can have many benefits in addition to reducing greenhouse gas emissions. More efficient use of energy decreases utility and transportation costs for residents and businesses. Retrofitting homes and businesses to be more efficient creates local jobs. In addition, when residents save on energy costs, they are more likely to spend at local businesses and add to the local economy. Reducing fossil fuel use improves air quality and increasing opportunities for walking and bicycling improve residents' health.



³ White, D.D., E.H. Elias, K.A. Thomas, C.E. Bradatan, M.W. Brunson, A.M. Chischilly, C.A.F. Enquist, L.R. Fisher, H.E. Froehlich, E.A. Koebele, M. Méndez, S.M. Ostoja, C. Steele, and J.K. Vanos, 2023: Ch. 28. Southwest. In: Fifth National Climate Assessment. Crimmins, A.R., C.W. Avery, D.R. Easterling, K.E. Kunkel, B.C. Stewart, and T.K. Maycock, Eds. U.S. Global Change Research Program, Washington, DC, USA. <https://doi.org/10.7930/NCA5.2023.CH28>.

Greenhouse Gas Inventory as a Step Toward Carbon Neutrality

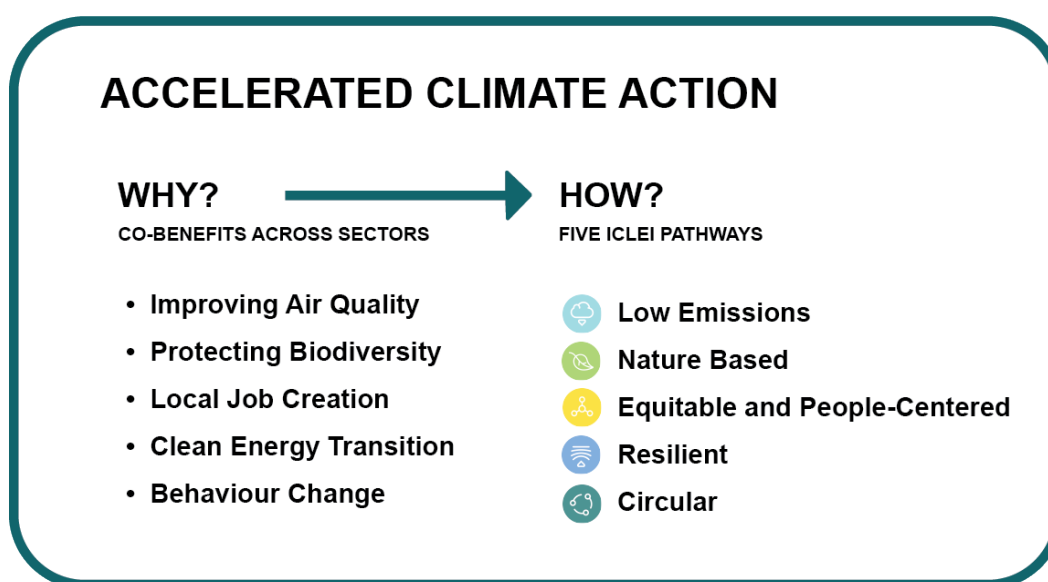
Facing the climate crisis requires the concerted efforts of local governments and their partners, those that are close to the communities directly dealing with the impacts of climate change.

Cities, towns, and counties are well placed to develop coherent and inclusive plans that address integrated climate action — climate change adaptation, resilience, and mitigation. Existing targets and plans need to be reviewed to bring in the necessary level of ambition and outline how to achieve net-zero emissions by 2050 at the latest. Creating a roadmap for climate neutrality requires Littleton to identify priority sectors for action, while considering climate justice, inclusiveness, local job creation, and other benefits of sustainable development.

To complete this inventory, Littleton utilized tools and guidelines from ICLEI - Local Governments for Sustainability (ICLEI), which provides authoritative direction for greenhouse gas emissions accounting and defines climate neutrality as follows:

The targeted reduction of greenhouse gas (GHG) emissions and GHG avoidance in government operations and across the community in all sectors to an absolute net-zero emission level at the latest by 2050. In parallel, it is critical to adapt to climate change and enhance climate resilience across all sectors, in all systems and processes.

To achieve ambitious emissions reduction and move toward climate neutrality, Littleton will need to set a clear goal and act rapidly following a holistic and integrated approach. Climate action presents an opportunity for our community to experience a wide range of co-benefits, such as creating socio-economic opportunities, reducing poverty and inequality, and improving the health of both people and nature.



ICLEI GreenClimateCities Framework

For this inventory, Littleton’s process is informed by ICLEI’s GreenClimateCities Framework for integrated climate action. Littleton follows the stepwise approach shown below in Figure 3, which involves collecting and analyzing climate data, action, implementation, leadership, and collaboration, always with an equity lens.

The Framework is organized into three phases: Analyze, Act, and Accelerate, designed for communities pursuing integrated climate action. The Framework incorporates greenhouse gas emissions reductions, climate adaptation actions, and equitable, inclusive decision-making. Littleton’s inventory has Science-Based Targets⁴ and falls under Step C- Analyze and set a baseline.

Over 600 U.S. communities have followed this basic Framework, previously known as ICLEI’s Five Milestones for Emissions Management, and today, it is represented through the streamlined Analyze-Act-Accelerate model shown below.

Figure 3: ICLEI GreenClimateCities Framework

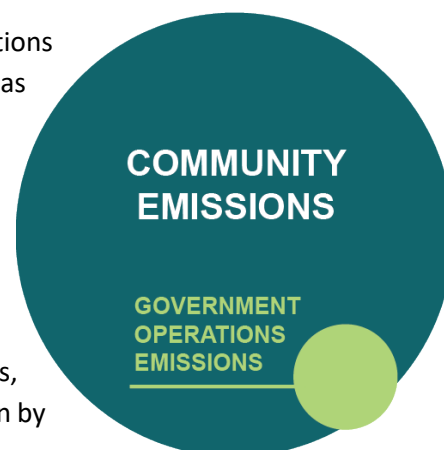


⁴ Science-Based Targets are calculated climate goals, in line with the latest climate science, that represent your community’s fair share of the ambition necessary to meet the Paris Agreement commitment of keeping warming below 1.5°C. To achieve this goal, the Intergovernmental Panel on Climate Change (IPCC) states that we must reduce global emissions by 50% by 2030 and achieve climate neutrality by 2050. Equitably reducing global emissions by 50% requires that high-emitting, wealthy nations reduce their emissions by more than 50%.

Inventory Methodology

Understanding a Greenhouse Gas Emissions Inventory

The first step toward achieving tangible GHG emission reductions requires identifying baseline emissions levels and sources, as well as activities generating emissions in the community. This report presents emissions from both the Littleton community and from the operations of Littleton’s government. The government operations inventory is a subset of the community inventory, as shown to the right in *Figure 4: Relationship of Community and Government Operations Inventories*. For example, data on commercial energy use by the community includes energy consumed by municipal buildings, and community vehicle-miles-traveled estimates include miles driven by municipal fleet vehicles.



As local governments continue to join the climate movement, the need for a standardized approach to quantify GHG emissions has proven essential. This inventory uses the approach and methods provided by the U.S. Community Protocol for Accounting and Reporting Greenhouse Gas Emissions (Community Protocol) and the Local Government Operations Protocol for Accounting and Reporting Greenhouse Gas Emissions (LGO Protocol), both of which are described below. This inventory includes three greenhouse gases: carbon dioxide (CO₂), methane (CH₄), and nitrous oxide (N₂O). Many of the charts in this report represent emissions in “carbon dioxide equivalent” (CO₂e) values, calculated using the Global Warming Potentials (GWP) for methane and nitrous oxide from the IPCC 6th Assessment (100-Year Values) Report⁵.

Table 1: Global Warming Potential Values (IPCC, 2023)

Greenhouse Gas	Global Warming Potential
Carbon Dioxide (CO ₂)	1
Methane (CH ₄)	29.8
Nitrous Oxide (N ₂ O)	273

⁵ Forster, P., T. Storelvmo, K. Armour, W. Collins, J.-L. Dufresne, D. Frame, D.J. Lunt, T. Mauritsen, M.D. Palmer, M. Watanabe, M. Wild, and H. Zhang, 2021: The Earth’s Energy Budget, Climate Feedbacks, and Climate Sensitivity. In *Climate Change 2021: The Physical Science Basis. Contribution of Working Group I to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change* [Masson-Delmotte, V., P. Zhai, A. Pirani, S.L. Connors, C. Péan, S. Berger, N. Caud, Y. Chen, L. Goldfarb, M.I. Gomis, M. Huang, K. Leitzell, E. Lonnoy, J.B.R. Matthews, T.K. Maycock, T. Waterfield, O. Yelekçi, R. Yu, and B. Zhou (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, pp. 923–1054, doi: [10.1017/9781009157896.009](https://doi.org/10.1017/9781009157896.009).

Community Emissions Protocol

Version 1.2 of the U.S. Community Protocol for Accounting and Reporting GHG Emissions⁶ was released by ICLEI in 2019 and represents a national standard for guidance to help U.S. local governments develop effective community GHG emissions inventories. It establishes reporting requirements for all community GHG emissions inventories, provides detailed accounting guidance for quantifying GHG emissions associated with a range of emission sources and community activities, and offers several optional reporting frameworks to help local governments customize their community GHG emissions inventory reports based on their local goals and capacities.

The community inventory in this report includes emissions from the five Basic Emissions Generating Activities required by the Community Protocol. These activities are:

- Use of electricity by the community
- Use of fuel in residential and commercial stationary combustion equipment
- On-road passenger and freight motor vehicle travel
- Use of energy in potable water and wastewater treatment and distribution
- Generation of solid waste by the community

The community inventory also includes the following activities:

- Wastewater processing
- Fugitive emissions from natural gas leakage

Local Government Operations (LGO) Protocol

In 2010, ICLEI, the California Air Resources Board (CARB), and the California Climate Action Registry (CCAR) released Version 1.1 of the LGO Protocol⁷. The LGO Protocol serves as the national standard for quantifying and reporting GHG emissions from local government operations. The purpose of the LGO Protocol is to provide the principles, approach, methodology, and procedures needed to develop a local government operations GHG emissions inventory.

The following activities are included in the LGO inventory:

- Energy and natural gas consumption from buildings & facilities
- Wastewater treatment processes
- On-road transportation from employee commute and vehicle fleet

⁶ ICLEI. 2012. US Community Protocol for Accounting and Reporting Greenhouse Gas Emissions. Retrieved from <http://www.iclei.org/tools/ghg-protocol/community-protocol>

⁷ ICLEI. 2008. Local Government Operations Protocol for Accounting and Reporting Greenhouse Gas Emissions. Retrieved from <http://www.iclei.org/programs/climate/ghg-protocol/ghg-protocol>

Quantifying Greenhouse Gas Emissions

Sources and Activities

Communities contribute to GHG emissions in many ways. Two central categorizations of emissions are used in the community inventory: 1) GHG emissions that are produced by “sources” located within the community boundary, and 2) GHG emissions produced as a consequence of community “activities”.

Source	Activity
Any physical process inside the jurisdictional boundary that releases GHG emissions into the atmosphere.	The use of energy, materials, and/or services by members of the community that result in the creation of GHG emissions.

By reporting on both GHG emissions sources and activities, local governments can develop and promote a deeper understanding of GHG emissions associated with their communities. A purely source-based emissions inventory could be summed to estimate total emissions released within the community’s jurisdictional boundary. In contrast, a purely activity-based emissions inventory could provide perspective on the efficiency of the community, even when the associated emissions occur outside the jurisdictional boundary. The division of emissions into sources and activities replaces the scopes framework that is used in government operations inventories, but that does not have a clear definition for application to community inventories.

Base Year

The inventory process requires the selection of a base year with which to compare current emissions. Littleton’s community GHG emissions inventory utilizes 2023 as its baseline year, because it is the most recent year for which the necessary data are available.

Quantification Methods

Greenhouse gas emissions can be quantified in two ways:

- Measurement-based methodologies refer to the direct measurement of greenhouse gas emissions (from a monitoring system) emitted from a flue of a power plant, wastewater treatment plant, landfill, or industrial facility.
- Calculation-based methodologies calculate emissions using activity data and emission factors. To calculate emissions accordingly, the basic equation below is used:

$$\text{Activity Data} \times \text{Emission Factor} = \text{Emissions}$$

Most emission sources in this inventory are quantified using calculation-based methodologies. Activity data refer to the relevant measurement of energy use or other greenhouse gas-generating processes,

such as fuel consumption by fuel type, metered annual electricity consumption, and annual vehicle miles traveled. Please see the appendices for a detailed listing of the activity data used in composing this inventory.

Known emission factors are used to convert energy usage or other activity data into associated quantities of emissions. Emission factors are usually expressed in terms of emissions per unit of activity data (e.g., lbs CO₂/kWh of electricity). For this inventory, calculations were made using ICLEI's ClearPath tool.



Community Emissions Inventory Results

The total community-wide emissions for the 2023 inventory are shown in Table 2 and Figure 5.

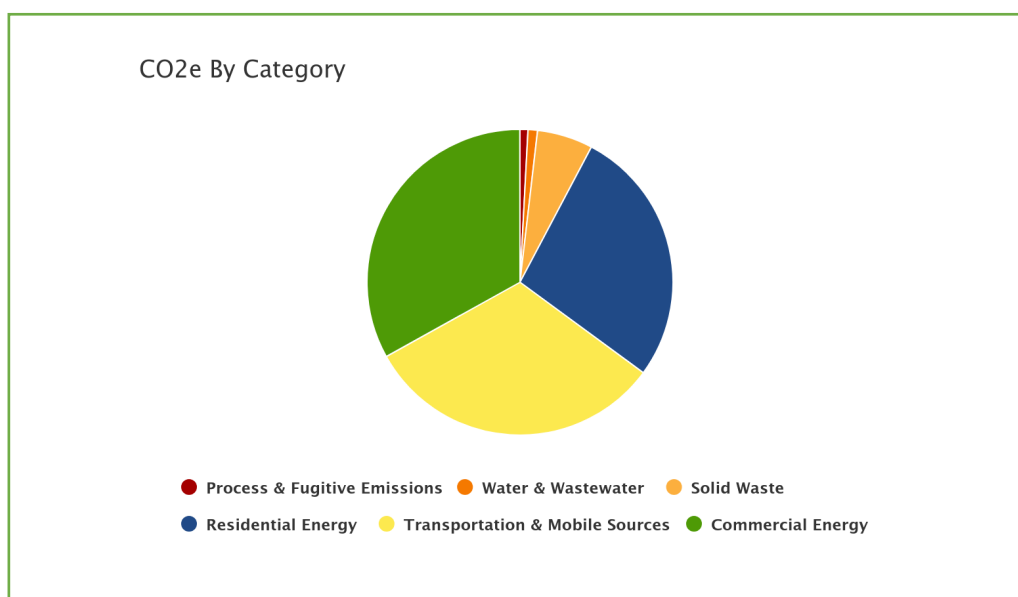
Table 2: Community-wide Emissions Inventory

Sector	Fuel or source	2023 Usage	Usage unit	2023 Emissions (MTCO _{2e})
Residential energy	Electricity	142,566,433	kWh	61,121
	Natural Gas	12,258,258	Therms	65,193
	Propane (HGL)	11,244.32	MMBtu	698
	Wood	7,496.34	MMBtu	73.03
Residential energy total				127,085.03
Commercial energy	Electricity	210,369,406	kWh	90,190
	Natural gas	8,938,775	Therms	47,539
	Motor Gasoline	102,004	MMBtu	7,216.1
	Distillate Fuel Oil	63,268	MMBtu	4,710.5
	Propane (HGL)	58,104	MMBtu	3,605.9
	Wood and Wood Residuals	28,406	MMBtu	276.73
	Kerosene	646	MMBtu	48.91
Commercial energy total				153,587.14
On-road transportation	Gasoline (passenger vehicles)	264,726,324.85	Annual VMT	103,222
	Diesel (freight trucks)	31,628,947.82	Annual VMT	41,362
Transit – Bus	Diesel	229,347.3	Annual VMT	458.98
RTD Light Rail	Electricity	6,837,883.42	kWh	2,931.5
Transportation & mobile sources total				147,974.48
Solid Waste	Waste Generated	45,429	Tons	27,384
Solid waste total				27,384
Water and wastewater	Supply of Potable Water – Electricity	1,512,904	kWh	755.31
	Supply of Potable Water – Natural Gas	20,062	Therms	
	Wastewater Treatment Energy Usage – Electricity	3,636,361	kWh	1,912.2
	Wastewater Treatment Energy Usage – Natural Gas	66,413	Therms	
	Fossil Fuel Derived Methanol (Anaerobic Digestion)	2.3	MT CH ₃ OH / day	1,035.8
	Process N ₂ O Emissions	1.25	Decimal	716.63

	Process N2O from Effluent Discharge to river	145	kg N / day	113.5
	Flaring of Digester Gas – Digester Gas Produced	47,100	Cubic Feet / Day	105.2
	Flaring of Digester Gas – Fraction of CH4 in Digester Gas	0.6	Decimal	
	Flaring of Digester Gas – Destruction Efficiency	0.98	Decimal	
	Combustion of Digester Gas – Gas Production	210,000	scf / day	19.79
	Combustion of Digester Gas – Heat Content	996	Btu / scf	
Water and wastewater total				4,658.43
Process & Fugitive Emissions	Fugitive Emissions from Natural Gas Distribution	21,197,033	Therms	3,913.9
Process & Fugitive total				3,913.9
Total community-wide emissions				464,602.98

Figure 5 shows the distribution of community-wide emissions by sector. Commercial Energy is the largest contributor, followed by Transportation & Mobile Sources and Residential Energy.

Figure 5: Community-wide Emissions by Sector



Next Steps:

The inventory should be used to focus and prioritize actions to reduce emissions. Based on the inventory results, the following areas have the greatest potential for emissions reduction:

- Commercial Energy
- Transportation & Mobile Sources
- Residential Energy

Completion of another GHG inventory in two to five years is recommended to assess progress resulting from any actions implemented. The detailed methodology section of this report, as well as notes and attached data files in the ClearPath tool and a master data Excel file provided to Littleton, will be helpful to complete a future inventory consistent with this one.

Government Operations

Emissions Inventory Results

Government operations emissions for 2023 are shown in Table 3 and Figure 6.

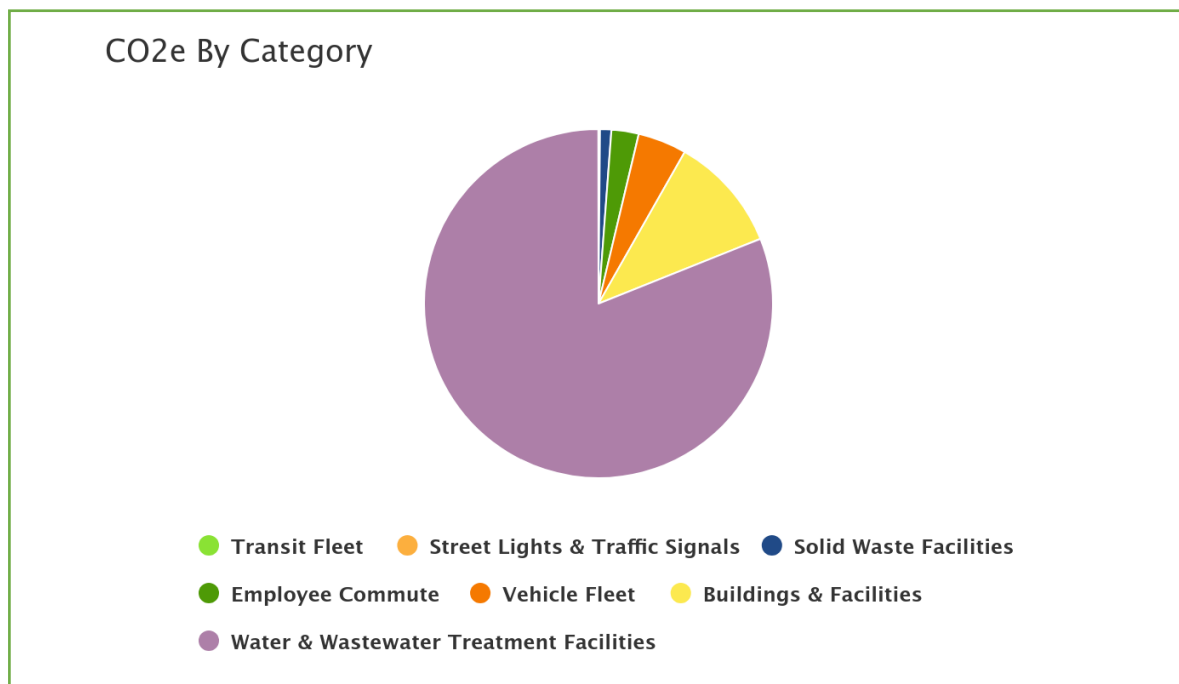
Table 3: Local Government Operations Inventory

Sector	Fuel or source	2023 Usage	Usage unit	2023 Emissions (MTCO ₂ e)
Buildings & Facilities	Electricity	3,622,696	kWh	1,553.1
	Natural Gas	81,481	Therms	433.34
Buildings & Facilities total				1,986.44
Street Lights & Traffic Signals	Electricity	37,404	kWh	16.04
Street Lights & Traffic Signals total				16.04
Vehicle Fleet	Gasoline (off-road) – Small Utility	117.73	Gallons	1.04
	Gasoline (off-road) – Construction	84.1	Gallons	0.75
	Diesel (off-road) – Large Utility	2,388.47	Gallons	24.59
	Gasoline (on-road)	73,566.06	Gallons	647.55
	Diesel (on-road)	16,030.56	Gallons	164.34
Vehicle Fleet total				838.27
	Gasoline – Paratransit Bus	1,192.9	Gallons	10.5
Transit Fleet total				10.5
Employee Commute	Gasoline	1,168,642.45	Annual VMT	462.57
	Diesel	8,189.25	Annual VMT	4.67
	Electric	8,189.25	Annual VMT	1.3
Employee Commute Total				468.54
Solid Waste	Waste Generation	123	Tons	195.12
Solid waste total				195.12
Water and wastewater	Wastewater Treatment Energy Usage – Electricity	24,793,371	kWh	10,629
	Wastewater Treatment Energy Usage – Natural Gas	452,817	Therms	2,408.2
	Fossil Fuel Derived Methanol (Anaerobic Digestion)	2.3	Metric Tons CH ₃ OH / day	1,035.8
	Process N ₂ O Emissions	1.25	Decimal	716.63
	Process N ₂ O from Effluent Discharge to river	145	kg N / day	113.5

	Flaring of Digester Gas – Digester Gas Produced	47,100	Cubic Feet / Day	105.2
	Flaring of Digester Gas – Fraction of CH4 in Digester Gas	0.6	Decimal	
	Flaring of Digester Gas – Destruction Efficiency	0.98	Decimal	
	Combustion of Digester Gas – Gas Production	210,000	scf / day	19.79
	Combustion of Digester Gas – Heat Content	996	Btu / scf	
	Combustion of Digester Gas – Gas Composition	98.6	Percent CH4	
Water and wastewater total				15,028.12
Total government emissions				18,542.03

Figure 6 shows the distribution of emissions among the sectors included in the inventory. Water and wastewater represent the majority of emissions, followed by Buildings and Facilities, and Vehicle Fleet. Street Lights & Traffic Signals, Transit Fleet, Employee Commute, and Solid Waste account for a small portion of emissions.

Figure 6: Local Government Operations Emissions by Sector

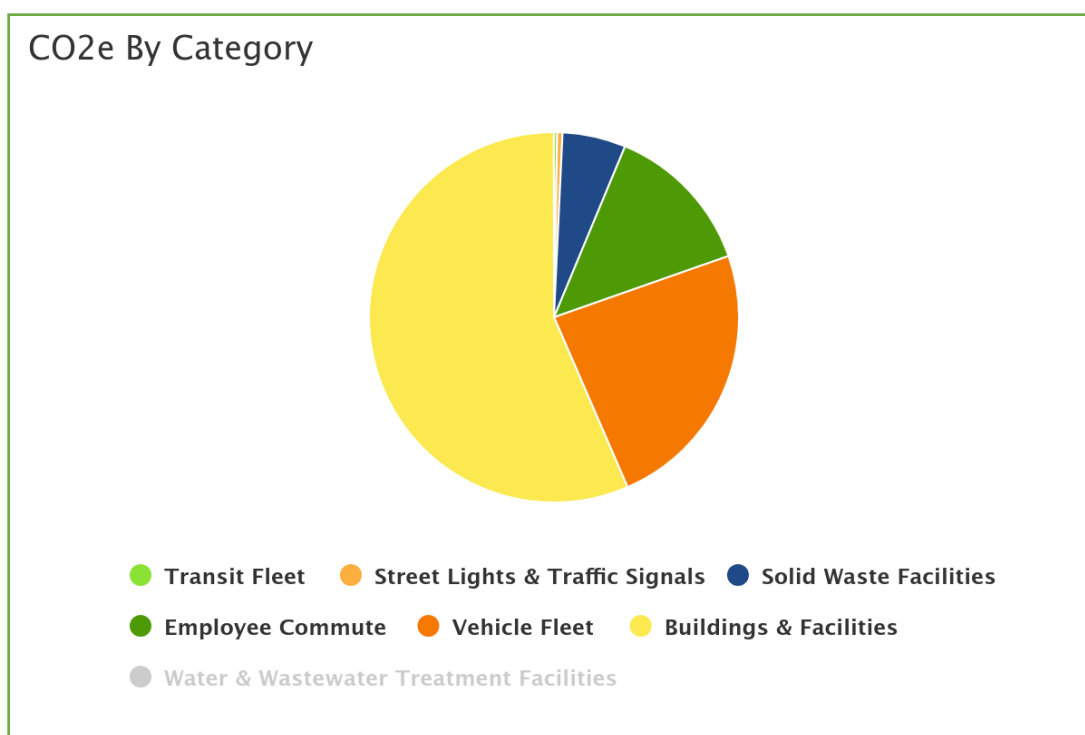


Understanding the Data:

Littleton owns and operates a wastewater treatment plant, South Platte Renew (SPR), which is a joint venture with the City of Englewood. SPR serves a population of 300,000 in the south metro area. The facility is located within the City of Englewood's city boundaries. For the community-wide emissions inventory, this makes water and wastewater treatment Scope 3, or emissions that occur outside the city boundary as a result of activities taking place within the city boundary.

However, for the local government operations inventory, since Littleton has operational and financial control over SPR, it is considered Scope 1 emissions. While water and wastewater emissions are the largest portions of Littleton's municipal greenhouse gas emissions, if you reference Littleton's community-wide inventory, water and wastewater emissions make up an exceedingly small amount comparatively. SPR has shown incredible leadership in sustainability, being the first to implement a Renewable Natural Gas (RNG) pipeline injection project in the state. The RNG facility offsets an annual 3,500 Metric Tons (MT) of Carbon Dioxide Equivalent (CO₂e) relative to flaring biogas, the standard disposal method of anaerobic digester biogas; however, given the purchaser of the renewable credits uses the carbon credits, the official carbon footprint only includes carbon emissions from electricity and natural gas usage. If you converted that 3,500 MT of CO₂e saved to vehicle miles driven, it would be 8.7 million. To better address municipal greenhouse gas emissions, refer to Figure 7, which depicts the local government operations inventory with water and wastewater excluded.

Figure 7: Local Government Operations Emissions by Sector Without Water and Wastewater



Based on the adjusted inventory, the largest contributor is Building & Facilities (56.5%), followed by Vehicle Fleet (23.9%), and Employee Commute (13.3%). Solid Waste Facilities, Street Lights & Traffic Signals, and Transit Fleet Emissions were responsible for the remaining (less than 6.3%) emissions.

Next Steps:

Based on the adjusted inventory results, the following areas have the greatest potential for emissions reduction:

- City Buildings & Facilities
- Vehicle Fleet
- Employee Commute

Conclusion

This inventory marks the completion of Milestone One of the Five ICLEI Climate Mitigation Milestones. The next steps are to forecast emissions, set an emissions-reduction target, and build upon the existing Environmental Stewardship Action Plan with a more robust resilience and adaptation plan that identifies specific, quantifiable strategies that can cumulatively meet that target.

The Intergovernmental Panel on Climate Change (IPCC) states that to meet the Paris Agreement commitment of keeping warming below 1.5°C, we must reduce global emissions by 50% by 2030 and reach climate neutrality by 2050. Equitably decreasing global emissions by 50% requires that high-emitting, wealthy nations reduce their emissions by more than 50%. More than ever, it is imperative that countries, regions, and local governments set targets that are ambitious enough to slash carbon emissions between now and mid-century.

Science-Based Targets are calculated climate goals, in line with the latest climate science, that represent a community's fair share of the global ambition necessary to meet the Paris Agreement commitment. To achieve a science-based target, community education, involvement, and partnerships will be instrumental.

Additionally, Littleton will continue to monitor key energy use and emissions indicators on an ongoing basis. It is recommended that communities update their inventories regularly, especially as plans are implemented, to ensure measurement and verification of impacts. Regular inventories also allow for "rolling averages" to provide insight into sustained changes and can help reduce the chance of an anomalous year being incorrectly interpreted. This inventory shows that Commercial & Residential Energy, as well as community-wide transportation patterns, will be fundamental to focus on. Through these efforts and others, Littleton can achieve environmental, economic, and social benefits beyond reducing emissions.

Appendix: Methodology Details

Energy

The following tables show each activity, related data sources, and notes on data gaps.

Table 4: Energy Data Sources

Activity	Data Source	Data Gaps/Assumptions
Community-wide		
Residential and commercial electricity consumption	Xcel Energy 2023 Community Energy Reports ⁸	N/A
Residential and commercial natural gas consumption	Xcel Energy 2023 Community Energy Reports ⁹	N/A
Residential and commercial HGL (propane) consumption	State Energy Data System ¹⁰	Residential usage is downscaled based on the number of households. Commercial usage is downscaled based on the number of commercial jobs.
Residential and commercial wood consumption	State Energy Data System ¹¹	The same data gaps exist from “Residential and commercial HGL (propane) consumption”.

⁸ https://www.xcelenergy.com/community_energy_reports

⁹ https://www.xcelenergy.com/community_energy_reports

¹⁰ <https://www.eia.gov/state/seds/seds-data-complete.php?sid=US>

¹¹ <https://www.eia.gov/state/seds/seds-data-complete.php?sid=US>

Commercial distillate fuel oil no. 2 consumption	State Energy Data System ¹²	The same data gaps exist from “Residential and commercial HGL (propane) consumption”.
Commercial kerosene consumption	State Energy Data System ¹³	The same data gaps exist from “Residential and commercial HGL (propane) consumption”.
Commercial gasoline consumption	State Energy Data System ¹⁴	The same data gaps exist from “Residential and commercial HGL (propane) consumption”.
Local Government Operations		
Electricity consumption	Xcel Energy	N/A
Natural gas consumption	Xcel Energy	N/A

Table 5: Emissions Factors for Electricity Consumptionⁱ

Year	CO ₂ (lbs./MWh)	CH ₄ (lbs./GWh)	N ₂ O (lbs./GWh)
2023	1036.02	90	13

Transportation

Table 6: Transportation Data Sources

Activity	Data Source	Data Gaps/Assumptions
Community-wide		
Vehicle miles travelled (VMT)	Google Environmental Insights Explorer for	To learn more about how Google extrapolates this data, go here .

¹² <https://www.eia.gov/state/seds/seds-data-complete.php?sid=US>

¹³ <https://www.eia.gov/state/seds/seds-data-complete.php?sid=US>

¹⁴ <https://www.eia.gov/state/seds/seds-data-complete.php?sid=US>

	the City of Littleton ¹⁵	
Transit ridership	RTD	N/A
Local Government Operations		
Government vehicle fleet	City of Littleton Fleet Department	N/A
Employee commute	City of Littleton Employees	The survey was conducted in 2025 but used total employee numbers from 2023. Current employees filled out the survey to reflect their current driving habits.

For vehicle transportation, it is necessary to apply average miles per gallon and emissions factors for CH₄ and N₂O to each vehicle type. The factors used are shown in Table 6.

Table 7: MPG and Emissions Factors by Vehicle Type

Fuel	Vehicle type	MPG	CH ₄ g/mile	N ₂ O g/mile
Gasoline	Passenger car	24.7	0.0073	0.0054
Gasoline	Light truck	17.9	0.0104	0.0062
Gasoline	Heavy truck	7.1	0.032	0.0041
Gasoline	Motorcycle	44	0.0073	0.0054
Diesel	Passenger car	24.7	0.0302	0.0192
Diesel	Light truck	17.9	0.029	0.0214
Diesel	Heavy truck	7.1	0.0095	0.0431

Wastewater

Table 8: Wastewater Data Sources

Activity	Data Source	Data Gaps/Assumptions
Community-wide & Local Government Operations		
Nitrogen Discharge	South Platte Renew (SPR)	N/A
Digester Gas Combustion/Flaring		

¹⁵ <https://insights.sustainability.google/places/ChIJKzvi-z98a4cRwDzWrumXBQc?ty=2023&hl=en-US>

Fossil Fuel Derived Methanol		
Effluent Discharge to river		
Energy used in wastewater facilities	South Platte Renew (SPR)	N/A

Potable Water

Table 9: Potable Water Data Sources

Activity	Data Source	Data Gaps/Assumptions
Community-wide		
Supply of Potable Water, Electricity Consumption	Denver Water	The data provided by Denver Water was downscaled based on the population of the City of Littleton.
Supply of Potable Water, Natural Gas Consumption	Denver Water	The data provided by Denver Water was downscaled based on the population of the City of Littleton.

Solid Waste

Table 10: Solid Waste Data Sources

Activity	Data Source	Data Gaps/Assumptions
Community-wide		
Waste Generated (Tonnage)	South Metro Waste Diversion Study through RRS and the Colorado Department of Public Health and the Environment ¹⁶	The data for tonnage is projected data from CDPHE ¹⁷ and the US Census Bureau ¹⁸ . Utilized the total Municipal Solid Waste (MSW) number and took out the diversion (recycling and composting) for the City of Littleton.
Local Government Operations		

¹⁶

<https://static1.squarespace.com/static/65f83de9a4a67c5e34d4abdb/t/679a6897747005426c6db006/1738172570512/Activity+7+South+Metro+Generation+Modeling+Memo+Final.pdf>

¹⁷ <https://cdphe.colorado.gov/hm/colorado-recycling-totals>

¹⁸

<https://www.census.gov/quickfacts/fact/table/centennialcitycolorado,sheridancitycolorado,littletoncitycolorado,englewoodcitycolorado/PST045223>

Waste Generated (Tonnage)	Republic Services and Waste Management	Tonnage from two companies required assumptions for waste generated ⁱⁱ .
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Process & Fugitive Emissions

Table 11: Fugitive Emissions Data Sources

Activity	Data Source	Data Gaps/Assumptions
Community-wide		
Natural Gas Utilized	Xcel Energy 2023 Community Energy Reports ¹⁹	N/A

Inventory Calculations

The 2023 inventory was calculated following the US Community Protocol and ICLEI's ClearPath software. As discussed in the Inventory Methodology, the IPCC 6th Assessment Report was used to determine global warming potential (GWP) values, which were then used to convert methane and nitrous oxide into CO2 equivalent units. ClearPath's inventory calculators allow for input of the sector activity (i.e., kWh or VMT) and emission factor to calculate the final CO2e emissions.



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ⁱ CO2 lbs/MWh data from Xcel Annual Community Littleton Profile in 2023. Original data was provided in metric tons CO2/MWh and that number was 0.426. Converted to lbs/MWh to match the above units. Xcel does not provide CH4 and N2O so those numbers are from WECC Rockies (RMPA) eGRID 2023 (updated in January 2025).

ⁱⁱ 110 tons reported by Waste Management, 8 billing accounts in total (for ~5-7 facilities)

oMissing 1 facility's tonnage data, which is serviced by Republic Services (Geneva Lodge/Village)

oRepublic Services reports that it is a 1 small container, which could be anywhere from 2-8 yards

oAssuming we are conservative in the estimate, let's say it is an 8-yard container

oHow much trash does an 8 yard container hold? [8 Yard Trash & Recycling Commercial Dumpster | WM](#)

~1800 pounds, which is ~1 ton (rounding up)

Assume the container is ¼ full every week because Geneva Village only services 1 resident, and Geneva lodge is relatively small

¼ ton/week with 52 weeks in a year puts the estimate at 13 tons/year

Total tonnage from the 2 companies would then be 123 tons/year attributed to "local government operations" alone

¹⁹ https://www.xcelenergy.com/community_energy_reports