City of Dallas (TX) 2019 Greenhouse Gas Inventory Report

Prepared for the Office of Environmental Quality & Sustainability, Carlos Evans, Director

Prepared by Michael Young (NREL), Brittany Speetles (NREL), Kevin Overton (City of Dallas)

November 11, 2022

Acknowledgments

The authors of this report would like to thank Kevin Overton and Susan Alvarez in the City of Dallas Office of Environmental Quality & Sustainability for his significant contributions to the completion of this report. Various entities contributed valuable data and other supporting information that were vital to the preparation of this greenhouse gas emissions inventory. In particular, the North Central Texas Council of Governments provided data and written description for the regional transportation modeling that was utilized in this report.

This work was authored by the National Renewable Energy Laboratory, operated by Alliance for Sustainable Energy, LLC, for the U.S. Department of Energy (DOE) under Contract No. DE-AC36-08GO28308. Support for the work was also provided by the City of Dallas Texas under Agreement FIA-21-17557-0. The views expressed in the article do not necessarily represent the views of the DOE or the U.S. Government. The U.S. Government retains and the publisher, by accepting the article for publication, acknowledges that the U.S. Government retains a nonexclusive, paid-up, irrevocable, worldwide license to publish or reproduce the published form of this work, or allow others to do so, for U.S. Government purposes.

Executive Summary

The City of Dallas has declared a goal to reduce greenhouse gas (GHG) emissions by 43% below 2015 levels by 2030, and to achieve net zero emissions (100% reduction) by 2050. In its Comprehensive Environmental and Climate Action Plan (CECAP), the City lays out 45 actions across eight sectors that are aimed primarily at reducing GHG emissions. As these actions are implemented, it is critical to measure the City's progress toward its goals by completing regular inventories of GHG emissions. With this information, the City can take action to ensure that it remains on track to meet its goals.

This report includes inventories of GHG emissions in the City of Dallas during the 2019 calendar year. The primary output of this report is a community-scale inventory of emissions, which estimates all of the direct and indirect emissions associated with energy consumed in the city, transportation of people and goods in, around, and through the city, and waste generated within the city. A subset of these emissions is attributable to local government operations, so a separate inventory is also provided to report emissions from sources owned/controlled by the Dallas City Government. Reporting the City Government's emissions inventory in addition to the community-wide inventory provides detail on the emissions-generating activities and sources that are within the government's ownership and control. This information empowers government officials with actionable insight into the opportunities and challenges that exist regarding reducing emissions attributable to government operations.

Overall, the community-wide total GHG emissions and removals in 2019 were 18,146,261 MT CO_2e, which represents a -11% change from 2015. Despite a population growth of roughly 5% during this time, the community-wide emissions also decreased on a per capita basis to 14.2 MT CO_2e per capita in 2019 (-10% decline from 2015).

When considering where these emissions physically occurred relative to the city boundary, 35% occurred inside the city (Scope 1), 41% occurred outside the city boundary due to electricity use inside the city (Scope 2), and 24% occurred outside the city boundary as the result of other activities within the city (Scope 3).

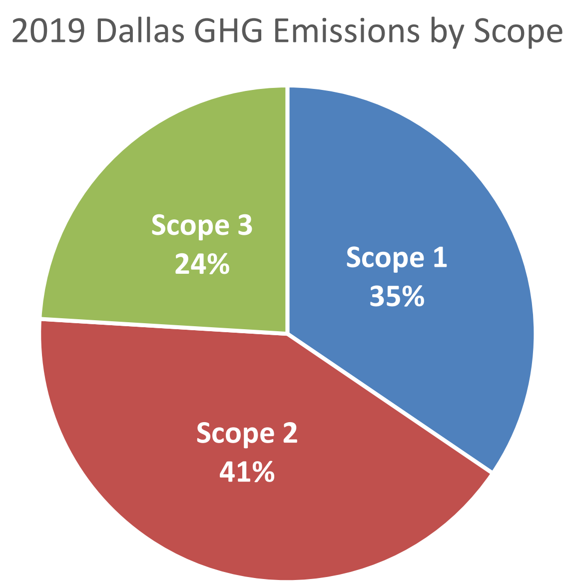


Figure 1: 2019 Dallas GHG Emissions by Scope

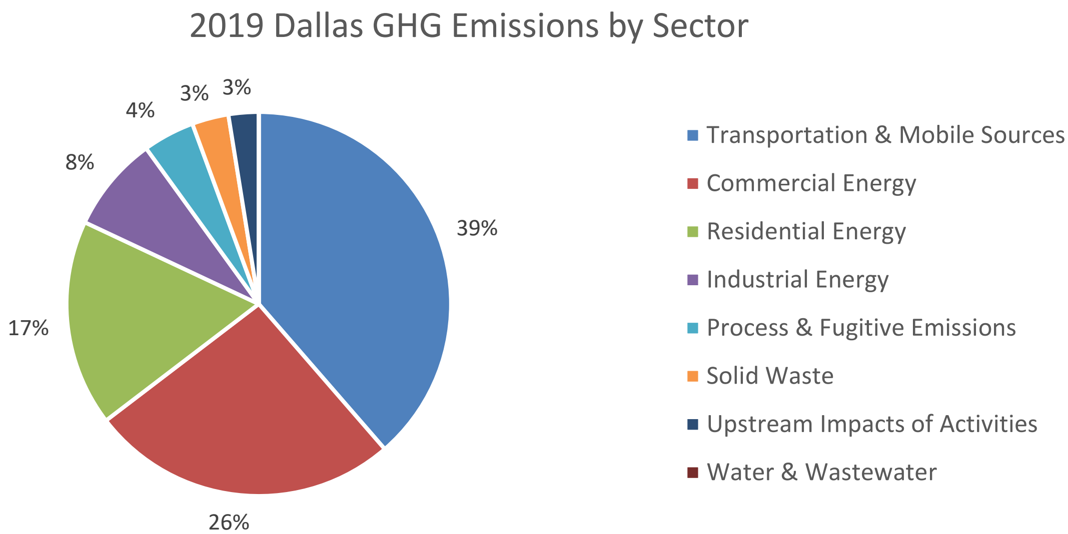


Figure 2: 2019 Dallas GHG Emissions by Sector

When analyzing the city's GHG emissions by sector, Transportation is the largest contributor. Over one-third of the city's emissions come from this sector, which is primarily due to on-road vehicle travel in and through the city. After Transportation, the Commercial and Residential Energy sectors follow as the second and third-most emitting sectors in Dallas. When combined, however, these sectors (i.e., commercial and residential buildings) make up the largest source of GHG emissions and contribute to nearly half of the city's emissions (see Figure 2 and Table 1).

Table 1: 2019 Dallas GHG Emissions by Sector

Sector	2019 GHG Emissions (MT CO_2e)	Percent of Total
Transportation and Mobile Sources	7,133,487	38%
Commercial Energy	4,798,388	27%
Residential Energy	3,209,285	17%
Industrial Energy	1,485,283	8%
Process & Fugitive Emissions	802,455	4%
Solid Waste	534,478	3%
Upstream Impacts of Activities	502,020467,948	3%
Water & Wastewater	252	<1%
Total Emissions	***18,465,648***	
Agriculture, Forestry, and Other Land Use (AFOLU)	-319,387	
Total Emissions & Removals	**18,146,261**	

The distribution of GHG emissions across economic sectors in Dallas in 2019 aligns closely with other community-level GHG emissions inventories, especially considering how people spend most of their time in buildings and transportation is how people and goods get to/from these buildings. The charts below illustrate how Dallas compares to North American cities that have reported data to the C40 Cities network[1]. In Figure 3, Dallas' 2019 emissions are less than cities like Los Angeles, Houston, and Guadalajara, and slightly higher than cities like Phoenix, Philadelphia, Toronto, and Austin. Also, it can be seen how Stationary Energy and Transportation contribute to GHG emissions in each of the cities shown in the chart.

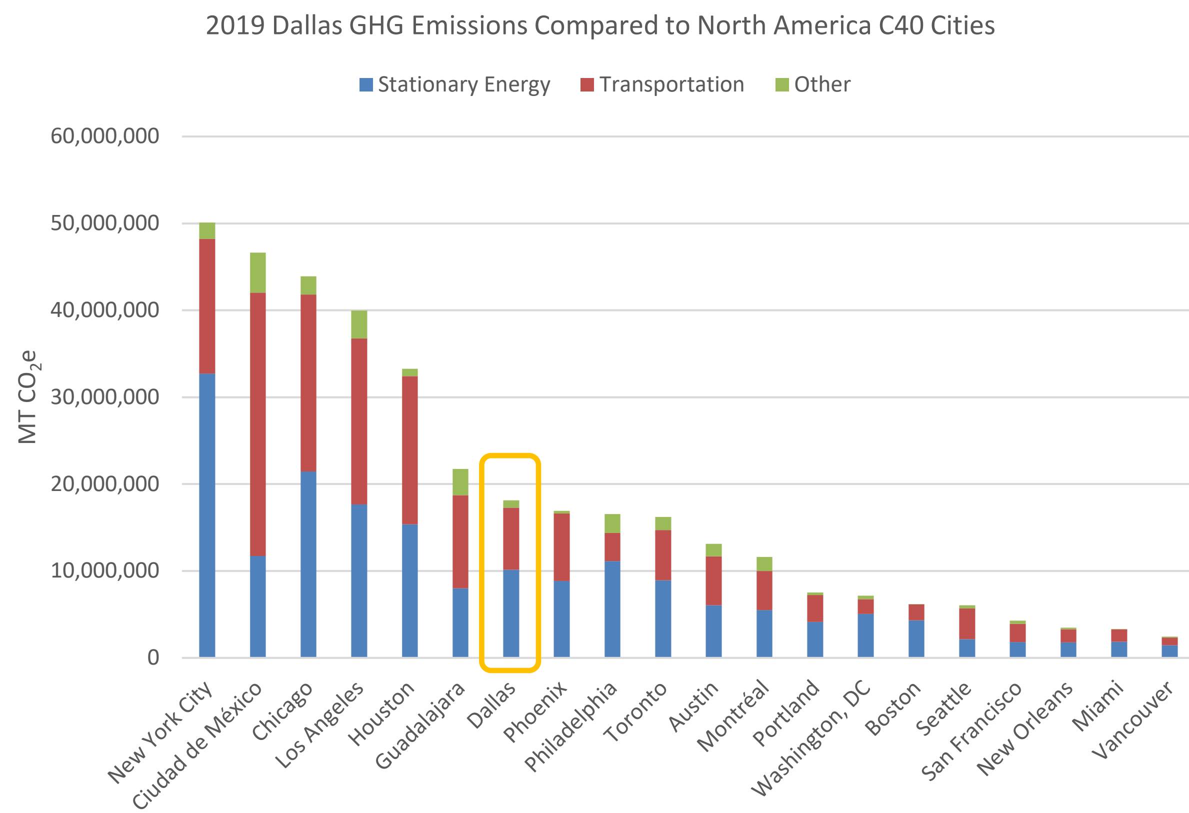


Figure 3: 2019 Dallas GHG Emissions Compared to North America C40 Cities

Figure 4 below compares GHG emissions to population, and – as one would expect – emissions are generally higher in cities with larger populations. Dallas, indicated by the red diamond

[1] "Greenhouse Gas Emissions Interactive Dashboard," accessed September 17, 2022, https://www.c40knowledgehub.org/s/article/C40-cities-greenhouse-gas-emissions-interactive-dashboard?language=en_US.

marker, is near many of its peers but its emissions are among the highest of the “under 2,000,000 people” group.

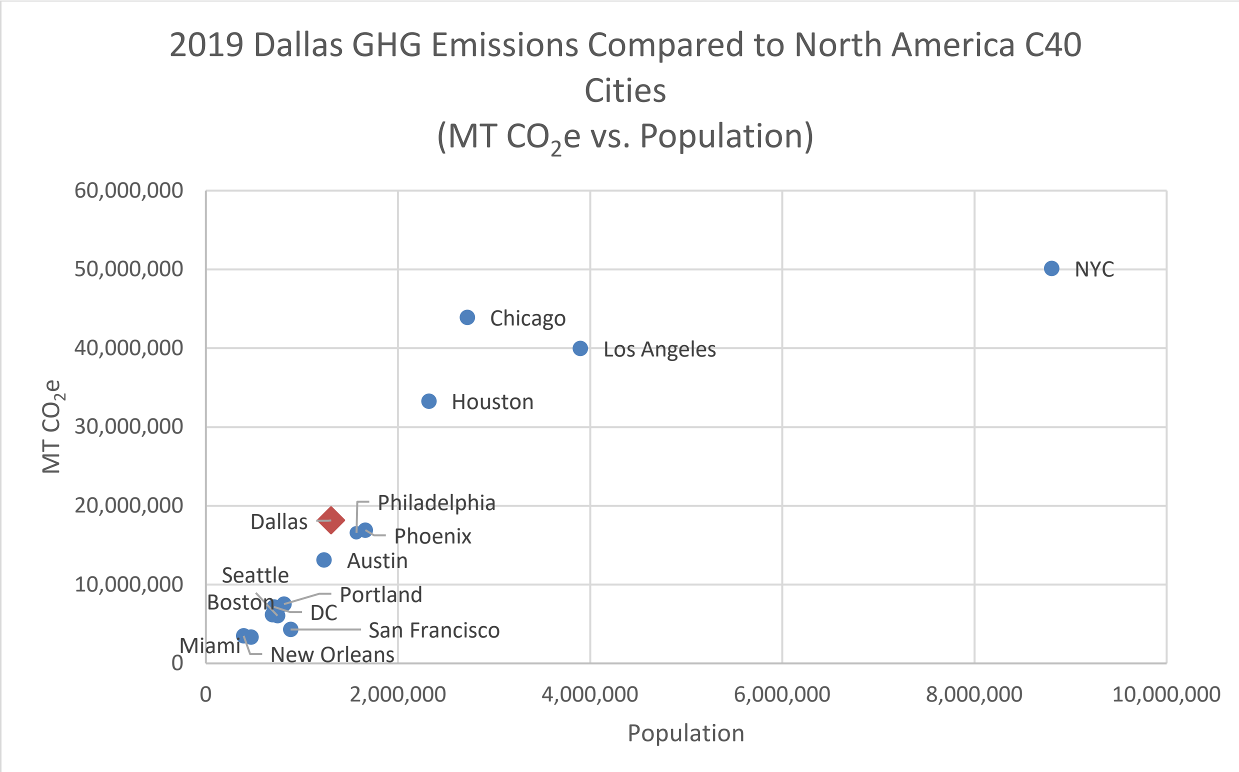


Figure 4: 2019 Dallas GHG Emissions vs. Population (comparison to North America C40 Cities

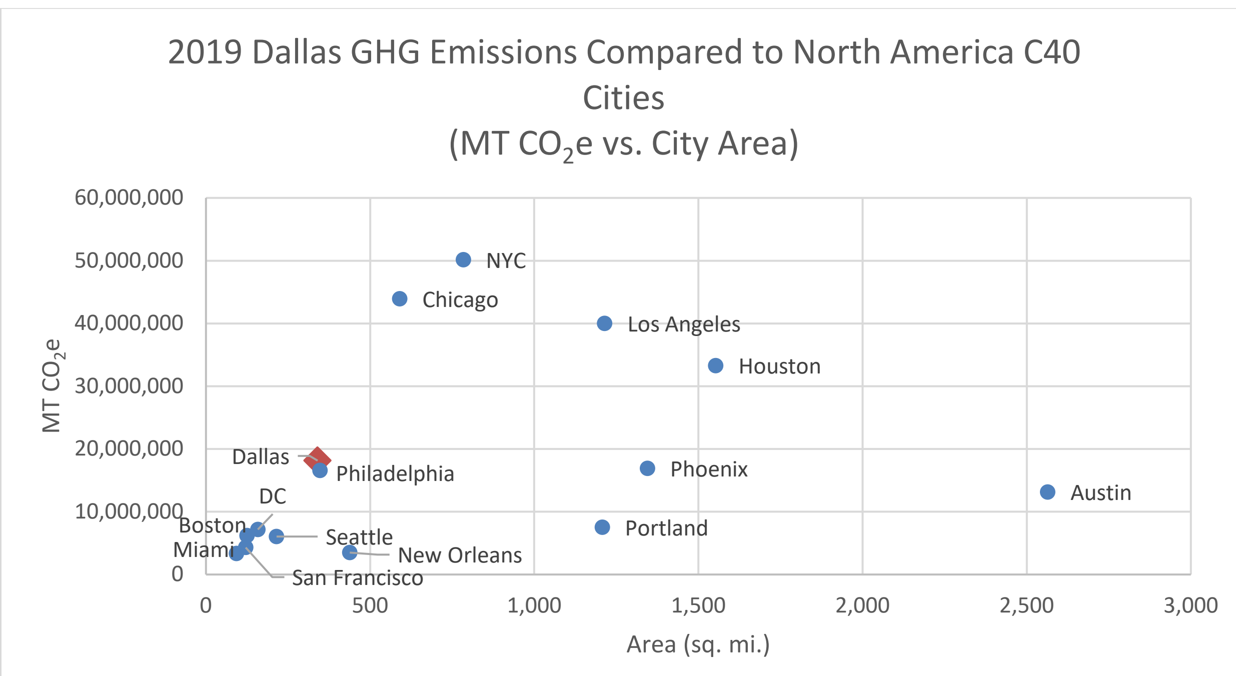


Figure 5: 2019 Dallas GHG Emissions vs. Area (comparison to North America C40 Cities)

Figure 5 compares GHG emissions with the geographic city area. There is less correlation in the data for this comparison, which could indicate that the size of a city influences GHG emissions less directly than other parameters. Dallas, again indicated by the red diamond marker, overlaps very closely with Philadelphia on this chart.

Finally, in Figure 6 the city-level GHG emissions data is compared to their gross domestic product (GDP). As economic activity and GDP increase, GHG emissions also generally increase. However, since this metric (MT CO_2e per Million USD of GDP) indicates the emissions intensity of a city's economy, values that fall below the diagonal line can be considered more "emissions efficient" than those that fall above the diagonal line.

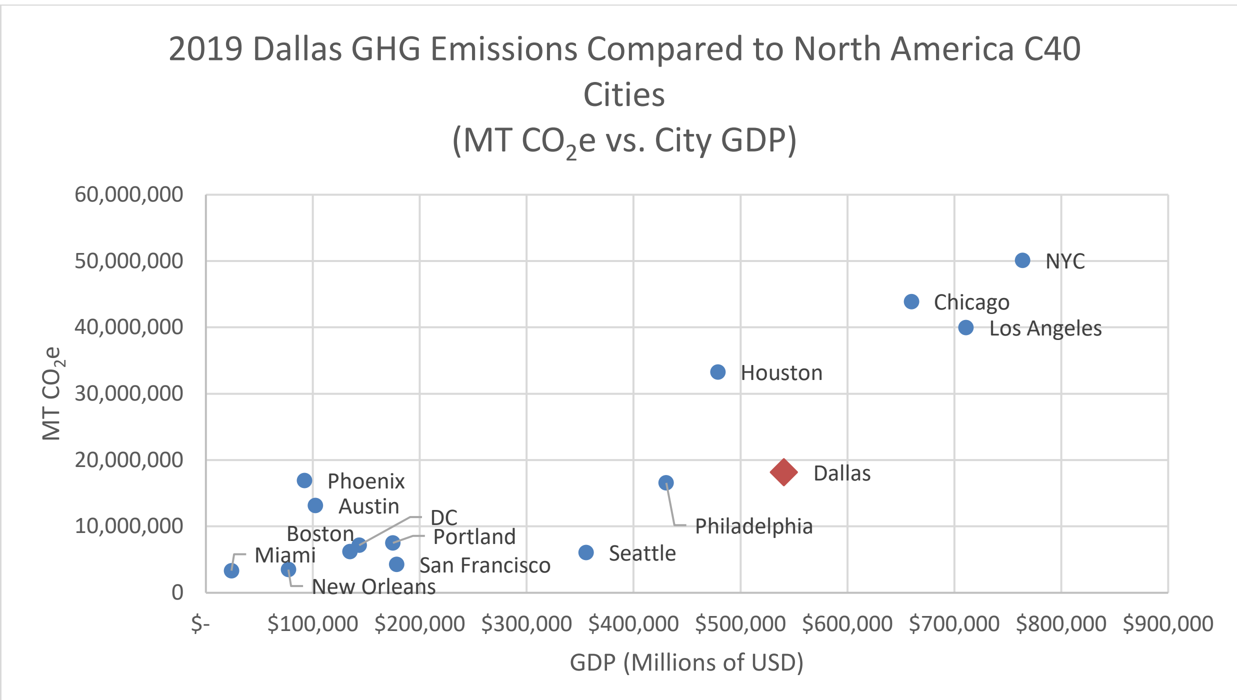
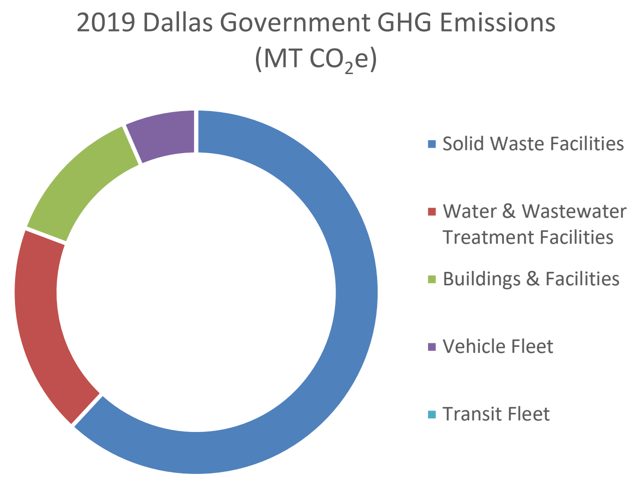


Figure 6: 2019 Dallas GHG Emissions vs. GDP (comparison to North America C40 Cities)

Within the City of Dallas, the city government owns and operates numerous buildings, vehicles, and other assets that generate GHG emissions. This report provides a detailed inventory of this information as a subset of the community-wide inventory. However, the emissions attributable to the local government operations amount to 936,918 MT CO_2e, or 5% of the total community-wide emissions. Despite being a small portion of the overall Dallas GHG emissions inventory, the local government can reduce the emissions for which it is directly responsible, and in doing so, the city can lead the way for reducing emissions throughout the rest of the community.

Figure 7: 2019 Dallas Government GHG Emissions



The key climate goals and action plan for Dallas to reduce its emissions are outlined in the CECAP mentioned above. This plan, released in April 2020, includes a 2050 carbon neutrality target and an intermediate 2030 target to reduce emissions 43% below 2015 levels. With the results of this 2019 inventory of GHG emissions, Dallas has already achieved an 11% reduction compared to the 2015 year. Meeting the 2030 target will require continued measurement and monitoring of GHG emissions, as well as implementation of emissions reduction measures throughout the city.

Table of Contents

List of Figures

List of Tables

1 Introduction

This greenhouse gas emissions inventory report includes a community-scale inventory of emissions for the City of Dallas, Texas from 2019, as well as a government-scale inventory of emissions for the Dallas city government from 2019. These inventories represent an update to the City's progress since the 2015 GHG Emission Inventory Report. As such, this report will review the inventory of greenhouse gas emissions in 2019 as well as discuss trends since 2015 and progress toward goals outlined by the City in its Comprehensive Environmental and Climate Action Plan (CECAP).

Reporting the City Government's emissions inventory in addition to the community-wide inventory provides detail on the emissions-generating activities and sources that are within the government's ownership and control. This information empowers government officials with actionable insight into the opportunities and challenges that exist regarding reducing emissions attributable to government operations. The emissions reported in the government-scale inventory are included in the broader community-scale inventory for the City of Dallas, which estimates emissions from city-wide sources and activities, such as energy consumption, transportation, solid waste, water and wastewater treatment, industrial processes, fugitive emissions, and land use.

Due to the evolving methodologies and protocols for GHG emissions accounting, this 2019 inventory includes data that was collected and calculated to a greater level of specificity compared to previous inventories. This results in some discrepancies and/or inconsistencies between this inventory and previous years. While consistency is a core principle of proper GHG emissions accounting, accuracy and completeness are also highly important[2]; and due to the incremental improvements made to the process of collecting data from stakeholders and calculating emissions from that data, the City of Dallas 2019 inventory report is more accurate and more complete than previous years.

In the development of this report, several greenhouse gas emissions reporting protocols were consulted, including the ICLEI U.S. Community Protocol[3], the ICLEI Local Government Operations Protocol[4], and the Greenhouse Gas Global Protocol for Community-Scale Greenhouse Gas Emission Inventories[5]. This report has been developed in compliance with these guidance documents. Wherever applicable, emissions calculations were completed using the ICLEI ClearPath modeling tool[6]. Other emissions values were sourced from separate models, databases, or tools.

[2] World Resources Institute and World Business Council for Sustainable Development, "The Greenhouse Gas Protocol: A Corporate Accounting and Reporting Standard," n.d.
[3] ICLEI - Local Governments for Sustainability, "U.S. Community Protocol for Accounting and Reporting of Greenhouse Gas Emissions," July 2019.
[4] "Local Government Operations Protocol Version 1.1," May 2010.
[5] Wee Kean Fong et al., *Global Protocol for Community-Scale Greenhouse Gas Emission Inventories: An Accounting and Reporting Standard for Cities*, 2015, https://www.deslibris.ca/ID/246277.
[6] ICLEI USA, "ClearPath | ICLEI USA," December 11, 2020, https://icleiusa.org/clearpath/.

The emissions of carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), and various fluorinated gases (i.e., hydrofluorocarbons, perfluorocarbons, sulfur hexafluoride) are reported in this inventory. Each of these gases contributes to the greenhouse effect in Earth's atmosphere with varying degrees of intensity, which is indicated by the gas's Global Warming Potential (GWP)[7]. GWP values measure of how much energy the emissions of one ton of a gas will absorb over a given time period, relative to the emissions of one ton of carbon dioxide (CO_2). The common time horizon used for GWP is 100 years, which translates to the energy absorption rate of 1 ton of the specified greenhouse gas over the period of 100 years. GWP values are indexed to CO_2 (GWP = 1), which is used as the reference compared to other greenhouse gases. If a greenhouse gas has a larger GWP than CO_2, it means that it warms the Earth more than CO_2 over the period specified. For example, methane has a global warming potential of 28, meaning it is 28 times more impactful as a greenhouse gas than carbon dioxide over time. Although methane does not last as long in the atmosphere as CO_2, it absorbs more energy comparatively which results in a higher GWP. To simplify the accounting of these varied GHGs, and to allow for comparisons of the global warming impacts of different gases, the mass of each gas emitted is converted to a common unit of measure called carbon dioxide equivalent (CO_2e) using the GWP value for each gas.

2 City of Dallas Community-Wide GHG Emissions Inventory

Dallas covers approximately 340 square miles and about 1.3 million residents live within the city limits. Additionally, Dallas is a major center of commerce, and nearly 650,000 people from outside the city commute in every day for work. Dallas is a destination for leisure and entertainment, as well as a major throughway for various modes of transportation. With this economic activity and movement of people in and around the City of Dallas, there are several activities and sources that emit GHG emissions. In the following sections, the emissions from these sources and activities will be discussed and analyzed.

[7] "Understanding Global Warming Potentials | US EPA," accessed May 18, 2022, https://www.epa.gov/ghgemissions/understanding-global-warming-potentials.

Table 2: City Statistics (2019)

Description	Data	Source
Land Area (square miles)	339.6	US Census Bureau
Total Population (people)	1,304,379	US Census Bureau
Total Housing Units	572,194	US Census Bureau
Median Household Income ($)	$54,747	US Census Bureau
Employment Rate (%)	65.3%	US Census Bureau
Climate Zone	3A (Hot-Humid)	US DOE[8]
2019 Heating Degree Days[9]	945	Climate Prediction Center[10]
2019 Cooling Degree Days[11]	3,008	Climate Prediction Center[12]

[8] "Building America Best Practices Series, Volume 7.3: Guide to Determining Climate Regions by County," Energy.gov, accessed May 27, 2022, https://www.energy.gov/eere/buildings/downloads/building-america-best-practices-series-volume-73-guide-determining-climate

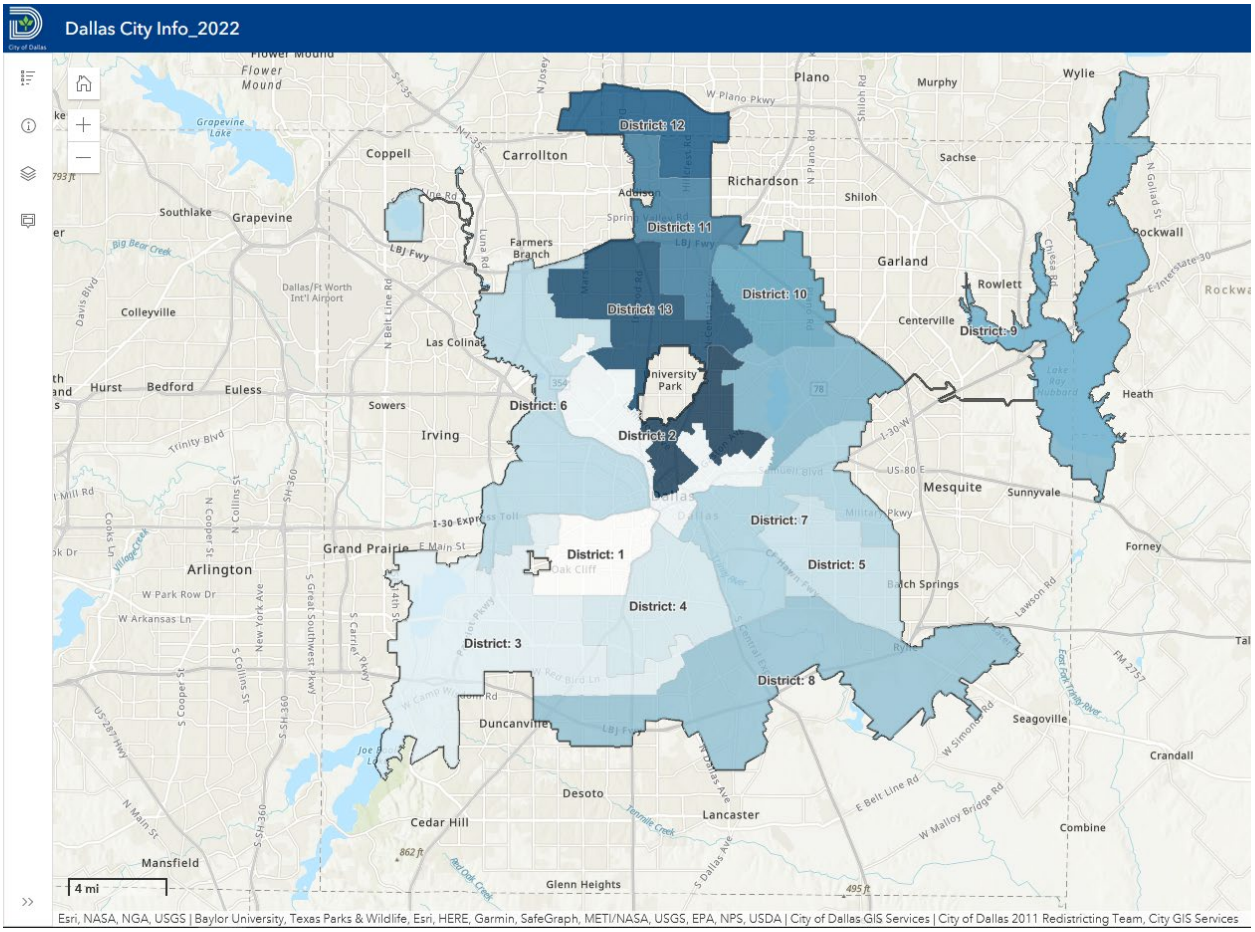
[9] According to the EIA: "A *degree day* compares the mean (the average of the high and low) outdoor temperatures recorded for a location to a standard temperature, usually 65° Fahrenheit (F) in the United States. *Heating degree days* (HDD) are a measure of how cold the temperature was on a given day or during a period of days. For example, a day with a mean temperature of 40°F has 25 HDD. Two such cold days in a row have a total of 50 HDD for the two-day period." https://www.eia.gov/energyexplained/units-and-calculators/degree-days.php

[10] "Climate Prediction Center – Monitoring & Data: Degree Days Statistics," accessed May 27, 2022, https://www.cpc.ncep.noaa.gov/products/analysis_monitoring/cdus/degree_days/.

[11] According to the EIA: "*Cooling degree days* (CDD) are a measure of how hot the temperature was on a given day or during a period of days. A day with a mean temperature of 80°F has 15 CDD (assuming an average temperature in the US of 65°F). If the next day has a mean temperature of 83°F, it has 18 CDD. The total CDD for the two days is 33 CDD." https://www.eia.gov/energyexplained/units-and-calculators/degree-days.php

[12] "Climate Prediction Center – Monitoring & Data: Degree Days Statistics"

Figure 8: Map of the City of Dallas[13]



2.1 Community-Wide Inventory Boundary and Scope

For clarity and transparency, greenhouse gas emissions inventories must define the various parameters of the analysis. These include geographic area, time span, gases inventoried, global warming potential (GWP) values used, and emissions sources and activities. The parameters of the 2019 City of Dallas Community-Wide GHG Inventory are defined in Table 3 below.

[13] "Dallas City Info_2022," accessed May 27, 2022, https://dallasgis.maps.arcgis.com/apps/instant/minimalist/index.html?appid=807494fddae04830852e4b13e6847979/.

Table 3: Community-Scale Inventory Boundary and Parameters

Geographic Area	Municipal boundary of the City of Dallas
Time Span	Calendar Year 2019
Gases Inventoried	Carbon Dioxide (CO_2), Methane (CH_4), Nitrous Oxide (N_2O), Hydrofluorocarbons (HFCs), Perfluorocarbons (PFCs), Sulfur Hexafluoride (SF_6)
Global Warming Potentials	IPCC 5th Assessment 100-Year Values: - CO_2 = 1 - CH_4 = 28 - N_2O = 265 - CFCs = 2–13,900 - HFCs = 4–12,400 - PFCs = 6,630–23,500

This GHG emissions inventory was completed in accordance with the ICLEI U.S. Community Protocol and the Greenhouse Gas Protocol Global Protocol for Community-Scale Greenhouse Gas Emission Inventories. As such, the emissions for the City of Dallas are reported and categorized in several ways, including "scopes," sectors and subsectors, and activities. These are summarized in Table 4 and explained further in the following text.

Table 4: Methods for Categorizing GHG Emissions in a Community-Wide Inventory

GHG Emissions Accounting Categorization	Description
Scopes	In a community wide GHG emissions inventory, "scopes" (i.e., Scope 1, Scope 2, Scope 3) categorize emissions based on the location where they are released.
Sectors and Subsectors	Categories that describe the various sources of GHG emissions in a community are defined by the Global Protocol for Community-Scale Greenhouse Gas Emission Inventories. These sectors and subsectors are used to classify emissions based on types of activities and the general economic sectors with which they are associated.
Five Basic Emissions Generating Activities	The ICLEI U.S. Community Protocol identifies a non-exhaustive list of activities commonly occurring at the community level for which GHG emissions should be reported. These activities can span sectors and scopes, as they are not specific to individual sources of emissions.

The first categorization, known as "scopes," distinguishes between the various locations where emissions are generated based on sources and activities within the community boundary. Table 5 defines these scopes and Figure 9 illustrates some examples.

Table 5: Definitions for GHG Emissions Scopes (Source: GHG Protocol for Cities)

Scope	Definition
Scope 1	GHG emissions from sources located within the city boundary
Scope 2	GHG emissions occurring due to the use of grid-supplied electricity, heat, steam, and/or cooling within the city boundary.
Scope 3	All other GHG emissions that occur outside the city boundary due to activities taking place within the city boundary.

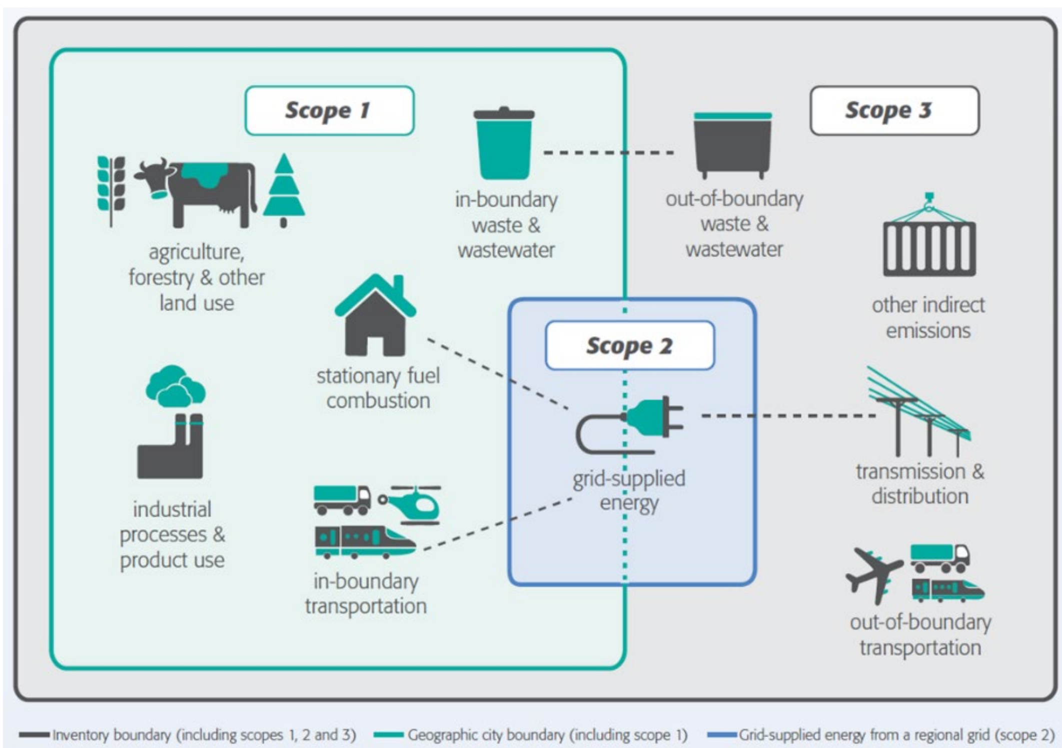


Figure 9: Community-Scale Emissions Accounting Scopes[14]

In addition to scopes, GHG emissions from activities within the city can be classified into six main sectors, each including various subsectors. These are listed in Table 6 and are used to further categorize GHG emissions in the city-wide inventory. Not all cities generate emissions in

[14] Fong et al., *Global Protocol for Community-Scale Greenhouse Gas Emission Inventories*.

every one of these subsectors, and each city has its own unique set of activities occurring within its boundaries that influence the emissions of GHGs. The City of Dallas does not have emissions generating activities in every one of the subsectors listed in Table 6.

Table 6: Sectors and Sub-Sectors for Community-Scale GHG Emissions Inventories

Stationary Energy

- Residential buildings
- Commercial and institutional buildings and facilities
- Manufacturing industries and construction
- Energy industries
- Agriculture, forestry, and fishing activities
- Non-specified sources
- Fugitive emissions from mining, processing, storage, and transportation of coal
- Fugitive emissions from oil and natural gas systems

Transportation

- On-road
- Railways
- Waterborne navigation
- Aviation
- Off-road

Waste

- Solid waste disposal
- Biological treatment of waste
- Incinceration and open burning
- Wastewater treatment and discharge

Industrial Processes and Product Use (IPPU)

- Industrial processes
- Product use

Agriculture, Forestry, and Other Land Use (AFOLU)

- Livestock
- Land
- Aggregate sources and non-CO_2 emission sources on land

Other Scope 3

- Any other emissions occurring outside the geographic boundary as a result of city activities.

Lastly, the ICLEI U.S. Community Protocol defines a minimum set of five Basic Emissions Generating Activities that must be included in all Protocol-compliant GHG inventory reports. These activities are emphasized because local governments often have influence over them, the data associated with the activities is readily available, and the emissions generated by the activities are typically significant. The list of five Basic Emissions Generating Activities is shown below in Table 7[15]:

Table 7: Five Basic Emissions Generating Activities (required by the ICLEI U.S. Community Protocol)

1. Use of Electricity by the Community

- Power plant emissions associated with generating electricity used within the jurisdictional boundary of the community, regardless of the location of the electricity generation facility.

2. Use of Fuel in Residential and Commercial Stationary Combustion Equipment

- Combustion emissions associated with fuels used in residential and commercial stationary applications (e.g., natural gas used in boilers and furnaces) within the jurisdictional boundary of the community, excluding fuels used for production of electricity or district energy.

3. On-Road Passenger and Freight Motor Vehicle Travel

- Emissions associated with transportation fuels used by on-road passenger and freight motor vehicles.

4. Use of Energy in Potable Water and Wastewater Treatment and Distribution

- Emissions associated with energy used in the treatment and delivery of potable water used in the community and in the collection and treatment of wastewater used in the community, regardless of the location of the water and wastewater infrastructure.

5. Generation of Solid Waste by the Community

- End-of-life emissions (i.e., projected future methane emissions) associated with disposal of waste generated by members of the community during the analysis year, regardless of disposal location or method.

Emissions for each of the sectors listed in Table 6, as well as the five basic emissions generating activities in Table 7 are reported in this inventory and described in more detail in the following sections.

2.2 2019 Community-Scale GHG Emissions Inventory

The Dallas city-wide inventory of greenhouse gas emissions reports direct and indirect emissions associated with energy consumed in the city, transportation of people and goods in, around, and through the city, and waste generated within the city. Several tables and graphics in this section explain various perspectives on the breakdown of emissions in Dallas in 2019.

[15] ICLEI - Local Governments for Sustainability, "U.S. Community Protocol for Accounting and Reporting of Greenhouse Gas Emissions."

Table 8: 2019 City of Dallas Community-Scale GHG Emissions Summary (by Scope)

Scope / Category	Metric Tons of Carbon Dioxide-Equivalent Emissions (MT CO_2e)	Notes
Scope 1 Emissions	6,579,664	Direct emissions from sources located within the city boundary
Scope 2	7,523,000	Indirect emissions occurring due to the use of grid-supplied electricity within the city boundary
Scope 1 & 2 Subtotal	**14,102,664**	
Scope 3	4,362,984	All other indirect emissions that occur outside the city boundary as a result of activities taking place within the city boundary
Total Emissions	**18,465,648**	
Scope 1 Removals (AFOLU)	*-319,387*	*Estimated absorption of carbon dioxide by trees in the city of Dallas. This is categorized under Scope 1 in the AFOLU[16] category.*
Total Emissions & Removals	***18,146,261***	

Scope 1 and 2 emissions were approximately even in 2019, indicating that there are similar levels of emissions occurring in the city from activities and sources located in the city as there are emissions occurring outside the city from activities taking place in the city.

Figure 10: City of Dallas Community-Scale GHG Emissions Inventory Comparison by Scope (2015 vs. 2019)

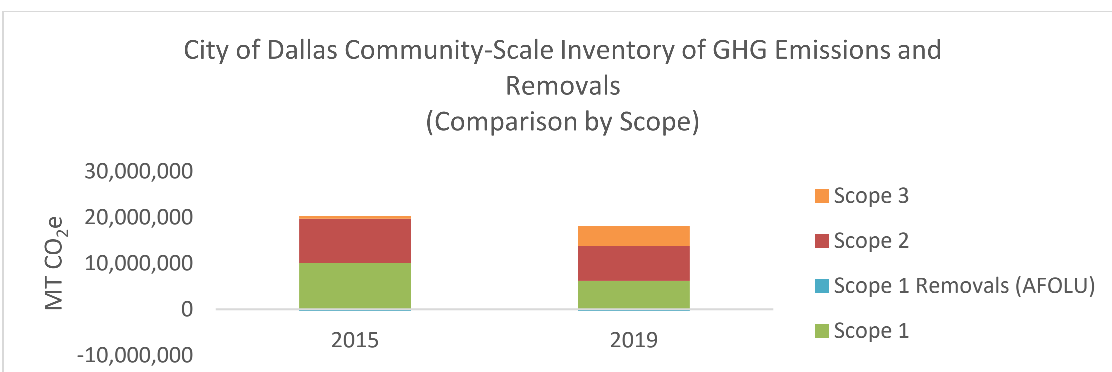


Table 9 provides more detail with a breakdown of the Dallas community-scale emissions inventory by sector, subsector, and scope. With this detail, it can be observed that energy consumption for buildings and transportation are the most significant sources of emissions in the city.

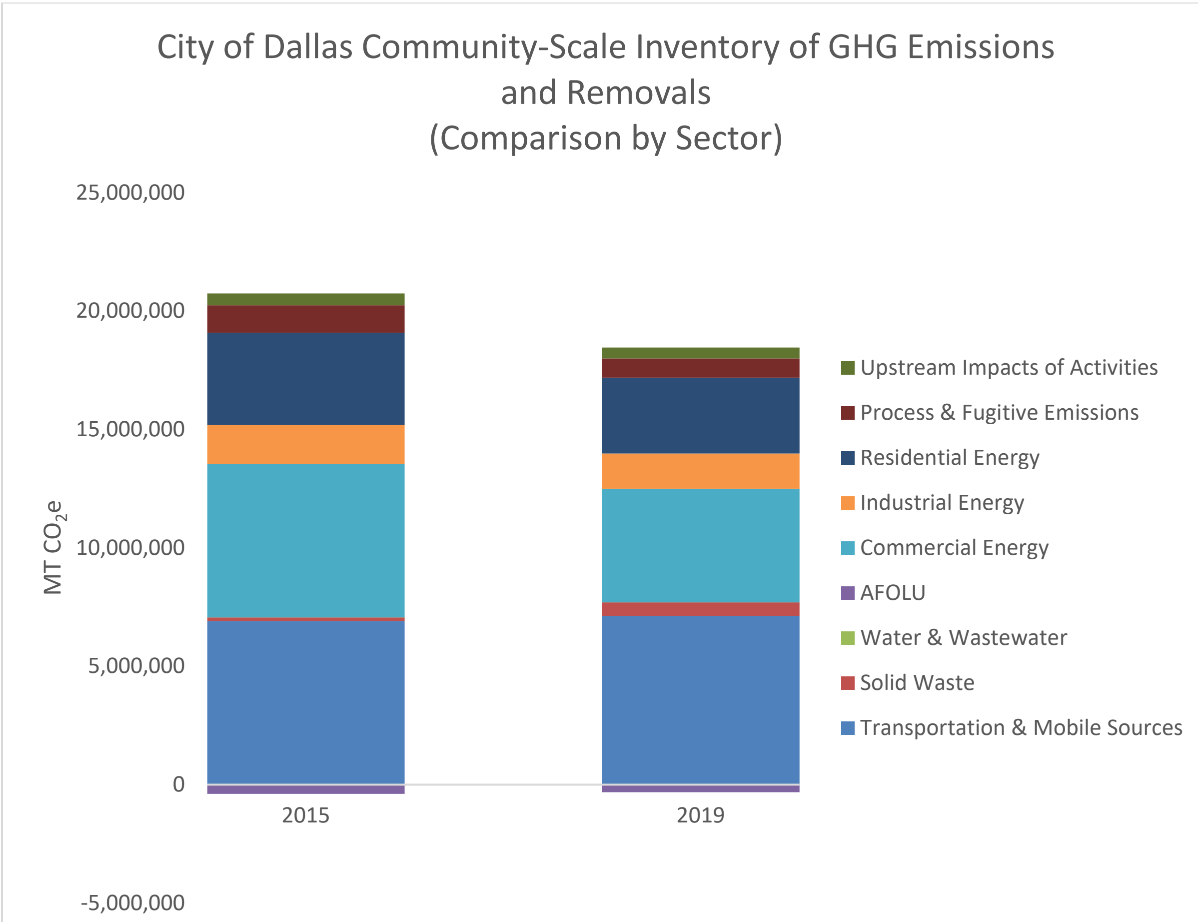
[16] Agriculture, Forestry, and Other Land Use (AFOLU).

Table 9: City of Dallas Community-Scale Summary of GHG Emissions and Removals (by GPC Sector and Sub-Sector)[17]

Sector	Sub-Sector	Scope 1 (MT CO_2e)	Scope 2 (MT CO_2e)	Scope 3 (MT CO_2e)	Total (MT CO_2e)
I Stationary Energy	I.1 Residential	769,879	2,439,406	0	3,209,285
	I.2 Commercial	762,631	4,035,757	0	4,798,388
	I.3 Industrial	134,943	1,017,331	0	1,152,273
	I.4 Energy Industries	333,009	0	0	333,009
	I.6 Non-Specified Sources	0	0	446,014	446,014
	I.8 Fugitive Emissions from Oil and Natural Gas Systems	220,096	0	0	220,096
Stationary Energy Subtotal		***2,220,557***	***7,492,494***	***446,014***	***10,159,065***
II Transportation	II.1 On-Road	3,038,753	0	3,665,124	6,703,877
	II.2 Railway	191,796	30,506	0	222,302
	II.4 Aviation	11,468	0	195,840	207,308
Transportation Subtotal		***3,242,018***	***30,506***	***3,860,964***	***7,133,487***
III Waste	III.1 Solid Waste	534,478	0	0	534,478
	III.4 Wastewater Treatment and Discharge	252	0	0	252
Waste Subtotal		***534,730***	***0***	***0***	***534,730***
IV Industry	IV.1 Industry Process	582,359	0	0	582,359
V Forestry	V.2 Land Use	-319,387	0	0	-319,387
VI Other Scope 3	VI.1 Other Scope 3	0	0	56,006	56,006
Totals		**6,260,277**	**7,523,000**	**4,362,984**	**18,146,261**

[17] GPC refers to the Global Protocol for Community-Scale Greenhouse Gas Inventories.

Figure 11: City of Dallas Community-Scale GHG Emissions Inventory Comparison by Sector (2015 vs. 2019)



With previous inventories having been reported by the City of Dallas, the 2019 emissions can be compared against historical data. However, as noted in Section 1, the evolving methodologies and protocols for GHG emissions accounting have resulted in data collection and emissions calculations at a greater level of specificity compared to previous inventories.[18] Therefore, comparisons between the absolute emissions values reported in 2019 and previous years may not be fully accurate. Additionally, the Dallas-Fort Worth metropolis is one of the fastest-growing metro areas in the country[19], so the 2019 emissions inventory represents part of the environmental impact of a growing economy. Figure 12 shows how the population and emissions have changed on a percent change basis from a 1990 base year. Between 2015 and 2019, the percentage change in emissions

---

[18] Per ICLEI, the only change to the calculation methodology in its ClearPath tool from 2018 (when the 2015 inventory was compiled) to 2022 (when the 2019 inventory was compiled) was an update to the waste generation calculation for landfills in order to more closely align with other models (i.e., EPA WARM Model).

[19] Texas Demographic Center, "Demographic Trends and Population Projections for Texas and the North Texas Region," January 15, 2021.

declined and population grew from the base year, indicating an emissions and per capita emissions decline between the two years that will hopefully become a recurring trend.

Figure 12: Historical Trend of Dallas GHG Emissions and Population (1990-2019)

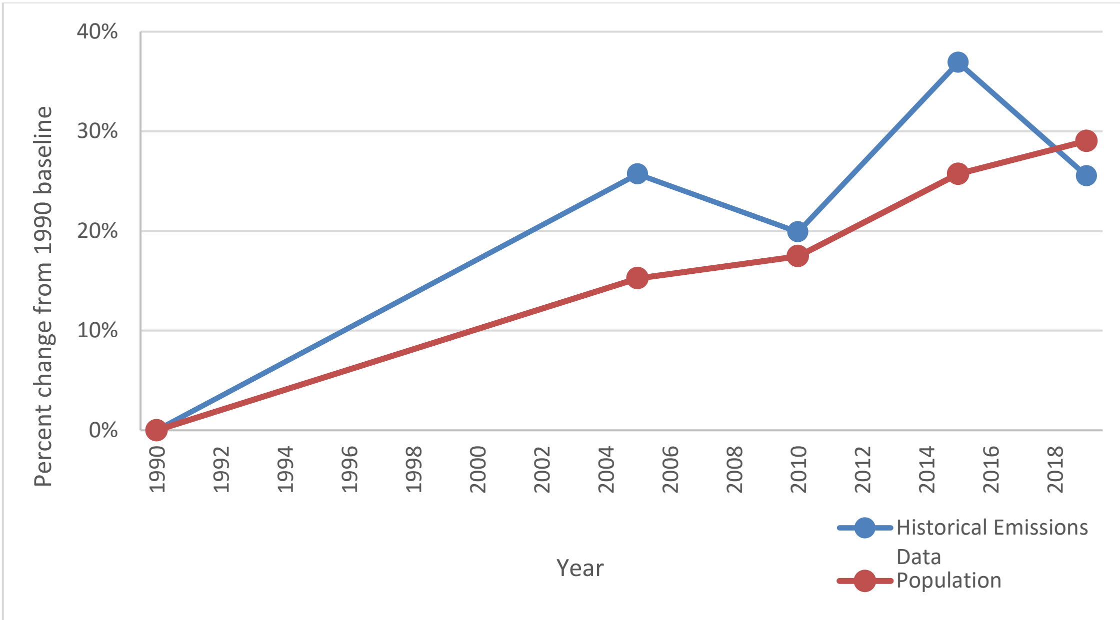


Table 10 compares the 2019 inventory results to the previous 2015 inventory, with the inclusion of comparisons in emissions intensity (e.g., MT CO_2e per capita, MT CO_2e per GDP) to put the city's emissions into context with the growth that Dallas is experiencing. Additionally, it is notable that Scope 3 emissions have increased dramatically from 2015 to 2019, which is primarily due to continued improvement in the collection of data and methodologies used for calculating emissions.

Table 10: 2015 to 2019 Dallas Community-Wide Emissions Comparison

	2015 (MT CO_2e)	2019 (MT CO_2e)	% Change
Scope 1	10,046,614	6,579,664	-35%
Scope 2	9,748,609	7,523,000	-23%
Scope 3	569,381	4,362,984	+666%
Total Community-Wide Emissions	20,364,604	18,465,648	-9%
Total Community-Wide Emissions per Capita (MT CO_2e per Capita)	15.7	14.2	-10%
Total Community-Wide Emissions per GDP (MT CO_2e per Million $ of GDP[20])	46.5	34.2	-26%

[20] U.S. Bureau of Economic Analysis, "Total Gross Domestic Product for Dallas-Fort Worth-Arlington, TX (MSA)," FRED, Federal Reserve Bank of St. Louis (FRED, Federal Reserve Bank of St. Louis, January 1, 2001), https://fred.stlouisfed.org/series/NGMP19100.

2.2.1 Stationary Energy Sources

In the City of Dallas, stationary energy sources are one of the most significant contributors to greenhouse gas emissions. These sources largely include fuel combustion for electricity supplied to buildings, space heating and water heating in buildings, and fugitive emissions released during the generation, delivery, and consumption of energy (i.e., electricity, heat, cooling/refrigeration).

Table 11: Comparison of Stationary Energy Emissions 2015-2019

Sub-Sectors of Stationary Energy	2015 (MT CO_2e)	2019 (MT CO_2e)
Residential Buildings	4,055,071	3,209,285
Commercial and Institutional Buildings and Facilities	6,742,187	4,798,388
Manufacturing Industries and Construction	1,726,464	1,152,273
Fugitive Emissions from Oil and Natural Gas Systems	514,008	220,096
Energy Industries	N/A	333,009
Non-Specified Sources	3,571	446,014
Total	**13,041,301**	**10,159,065**

Stationary Energy sources in Scope 1 include emissions from fuel combustion (Residential, Commercial, and Industrial Energy), as well as Fugitive Emissions. Fuel combustion in these sectors primarily consists of natural gas for heating and cooking in buildings, but also included in this category is the consumption of coal, fuel oil, and kerosene. Compared to the 2015 inventory, emissions in this category decreased by 20% in 2019. This decrease was likely influenced, at least in part, to improvements in building energy efficiency since 2015. Policies like the 2015 City of Dallas Green Ordinance (effective March 1, 2017)[21] and the Dallas Energy Conservation Code (effective September 2016)[22] required new buildings to meet more stringent energy consumption targets and may have contributed to this decrease in GHG emissions. Behavioral change (i.e., how building occupants use energy) is another factor that may have influenced this observed decrease in Scope 1 Stationary Energy emissions.

Scope 2 wholly consists of emissions from the generation of grid-connected electricity consumed in the Residential, Commercial, and Industrial sectors. These are categorized in Scope 2 because the electricity was used within the City of Dallas, but the location of the generators/power plants are not necessarily located within the city boundary. Most of the electricity in Dallas is delivered to customers by Oncor, which owns and operates the

[21] "GreenBuilding," accessed May 27, 2022, https://dallascityhall.com:443/departments/sustainabledevelopment/buildinginspection/pages/greenBuilding.aspx.
[22] "Dallas Energy Conservation Code (Adopt 2015 International Energy Conservation Code)," Pub. L. No. 30325, Dallas City Code (2017).

wires and other infrastructure that transmit electricity from the power stations to the end-users. Generators located throughout the region are owned by various entities and supply electricity into the Texas power grid, which is operated by the Electric Reliability Council of Texas (ERCOT). ERCOT is responsible for roughly 90% of the state's electric load, including all the grid-connected load in Dallas, and oversees one of the three U.S. electricity interconnections. Currently, Texas's electric grid has limited connection to other states and cannot easily transfer electricity across state boundaries because of limited transmission and distribution connectivity. Thus, Dallas's current and future Scope 2 emissions are primarily dictated by the planning processes and goals of ERCOT and Texas as a whole. In 2019, grid-connected electricity in the state of Texas was primarily generated by natural gas (53%), coal (19%), wind (17%), and nuclear energy (9%)[23]. This corresponds with an average emissions factor of approximately 991 pounds of carbon dioxide-equivalent emissions per megawatt-hour of electricity generated, which is roughly 17% lower than the estimated emissions rate in 2015.

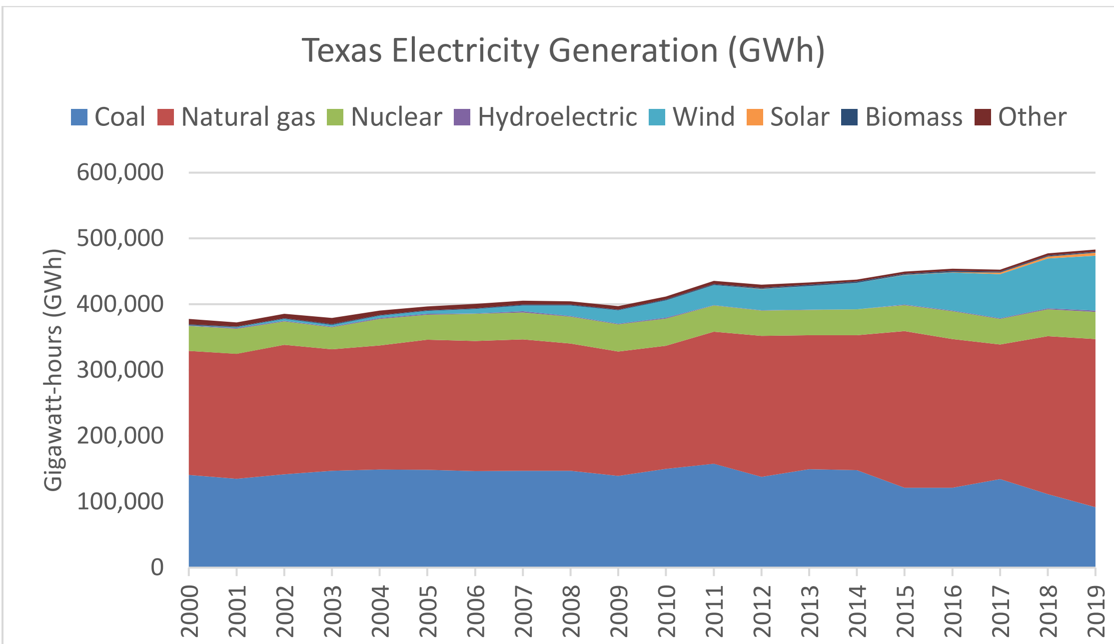


Figure 13: Electricity Generation in Texas 2000-2019[24]

While more than 25% of electricity generated in Texas in 2019 came from non-combustion sources, the remaining portion resulted in over 200 million metric tons of carbon dioxide emissions.[25] As the state of Texas and the broader U.S. electric system transition away from coal and install more renewable energy generation, these emissions have decreased over time (down 10% from 2015 to 2019). But nonetheless, these

[23] U.S. Energy Information Administration, "Texas Electricity Profile 2019," November 2, 2020.
[24] U.S. Energy Information Administration.
[25] U.S. Energy Information Administration.

emissions contribute to the greenhouse effect in the atmosphere and to the warming of the global climate, and they also negatively affect the regional air quality throughout Texas.

Figure 14 maps the location of over fifty combustion power plants in the region surrounding Dallas, which demonstrates the density of power generation in highly populated urban areas.

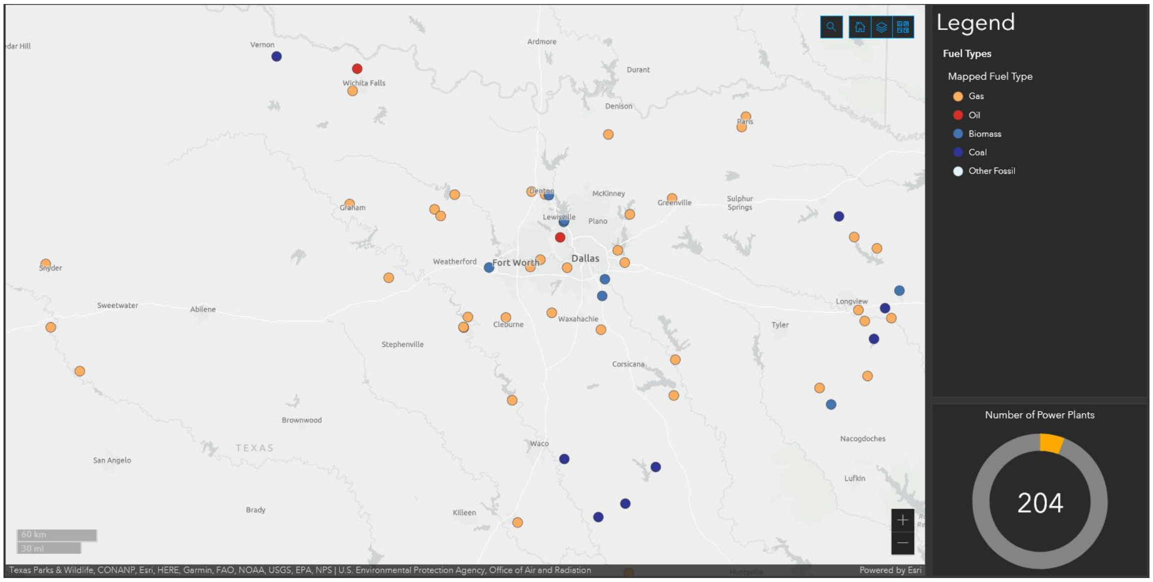


Figure 14: Map of Combustion Power Plants in the Region Surrounding Dallas[26]

Within the Stationary Energy category, Scope 3 includes the indirect emissions associated with energy lost to inefficiencies in the transmission and distribution of electricity. Between the power generating station and the point of electricity consumption, electricity is transmitted via wires, transformers, and other infrastructure equipment, and along this process energy is lost to inefficiencies (i.e., heat). In Dallas in 2019, approximately 5.1% of electricity generated at power plants was lost during transmission and distribution. Therefore, for every 1,000 kWh of electricity that is needed for use in buildings and equipment, 1,054 kWh need to be generated at the power plant; and the emissions created by the generation of this additional electricity that ultimately is lost during transmission are attributable to the consumer and categorized as Scope 3.

2.2.2 Transportation and Mobile Sources

The single most-emitting sector in Dallas in 2019 was Transportation & Mobile Sources. This sector consists of the passenger vehicles, freight vehicles, aviation, rail, and other modes of transportation that move within, into, out of, and through Dallas. As a major urban center, multiple interstate highways, rail lines, and air traffic pass through the city;

[26] U.S. Environmental Protection Agency, "Power Plants and Neighboring Communities Mapping Tool," accessed May 27, 2022, https://experience.arcgis.com/experience/2e3610d731cb4cfcbcec9e2dcb83fc94.

and with a large majority of this transportation still relying on combustion engines, significant air pollution and GHG emissions are released.

The movement of people into and out of Dallas for commuting to their place of employment is illustrated below in Figure 15. The US Census Bureau[27] provides this data via an "Inflow/Outflow Analysis" and shows that 914,160 people were employed in Dallas in 2019. Of this total, 649,881 (71.1%) live outside the city boundary (i.e., commute into the city) and 264,279 (28.9%) live inside the city boundary (i.e., commute within the city). An additional 326,609 people that live in Dallas commute out of the city to their place of employment.

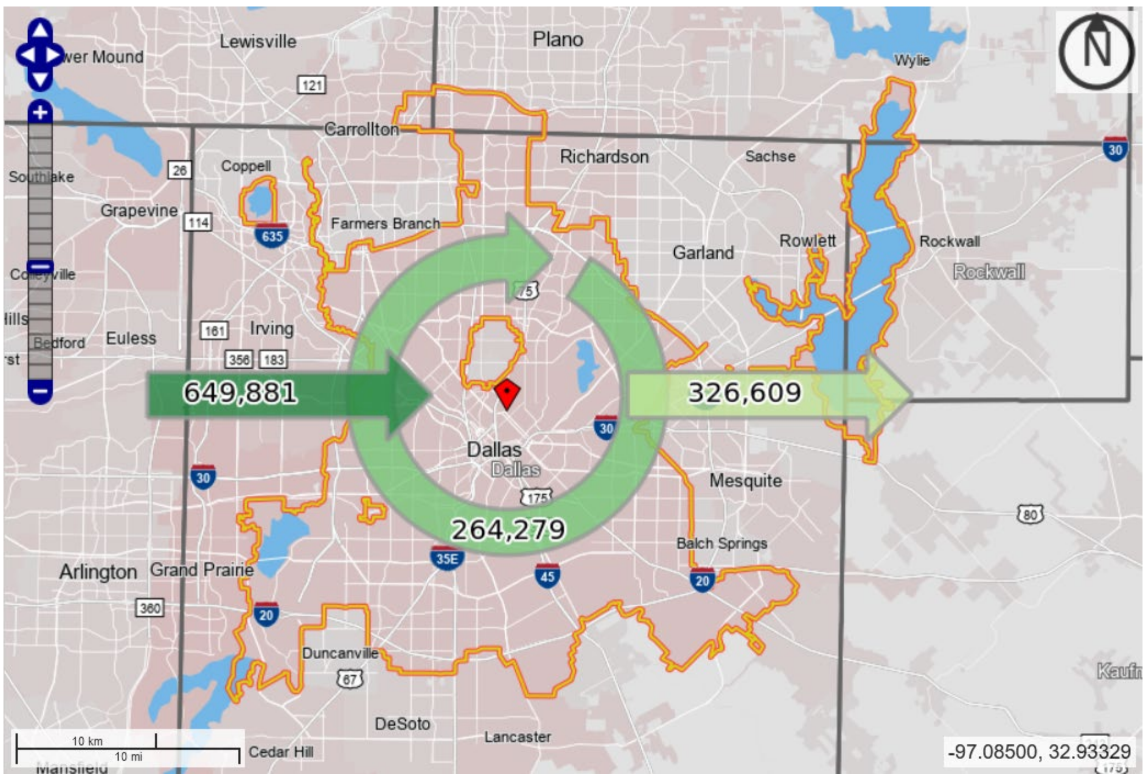


Figure 15: US Census Bureau Commuter Inflow/Outflow Analysis for the City of Dallas (2019)

Data for the on-road transportation portion of the inventory was provided by the North Central Texas Council of Governments (NCTCOG), who collects and models transportation data for municipalities throughout North Texas to report on regional GHG emissions. The ICLEI ClearPath tool was used to calculate estimate GHG emissions by entering data in the form of total annual vehicle miles travelled (VMT). This VMT data was provided by NCTCOG and grouped based on vehicle fuel type and location of travel (i.e., in-boundary or cross-boundary). The NCTCOG provided the following description of the approach and methodology used to model transportation in Dallas in 2019.

[27] "OnTheMap," accessed May 21, 2022, https://onthemap.ces.census.gov/.

The Environmental Protection Agency's (EPA) Motor Vehicle Emission Simulator version 3 (MOVES3) was used to develop the analysis year 2019 vehicle emission factors. The emission factors are one component in the equation to determine emissions from on-road vehicles. These emissions factors were generated at a county level, and Dallas County factors were used. For the details of the MOVES3 parameters (including the data source and/or methodology), refer to the NCTCOG regional inventory document[28].

The Vehicle Miles Traveled (VMT) is the other component to determine the emissions from on-road vehicles. The VMT estimates for this Emission Inventory are from the network-based Dallas-Fort Worth (DFW) Travel Model, Transportation Analytical Forecasting Tool (TAFT). The NCTCOG Transportation Department executed TAFT in the TransCAD environment for the analysis year 2019. TransCAD is a Geographic Information System-based commercial travel demand software package for transportation planning. The TAFT is based on a multi-step (Trip Generation, Trip Distribution, Mode Choice, and Roadway Assignment) sequential process designed to model travel behavior and predict travel demand at regional, sub-area, or corridor levels.

A Transportation Analysis Zones (TAZs)-to-city mapping file was created to estimate the VMT at a city level. The TAZs were assigned to municipalities using intersecting activity areas. For this analysis, activity areas are defined as areas with human activity depicted by a combination of NCTCOG land use data and the National Land Cover Dataset's "Developed" classification. The municipality with the preponderance of activity area in a TAZ was assigned to that TAZ. Using this mapping file and the TAFT multi-step sequential process, the total VMT at a city level was estimated. For additional information, refer to the NCTCOG regional inventory document.

Overall, the emissions from the Transportation and Mobile Sources sector increased by 3% from 2015 to 2019. Some of this increase was driven by more detailed accounting in the aviation sector, but on-road transportation did not change much between the two years (on-road emissions decreased by about 1%). Detail for each sub-sector within Transportation is provided below in Table 12.

Table 12: Transportation and Mobile Sources Emissions by Sub-Sector (MT CO_2e)

Transportation Sub-Sector	2015 (MT CO_2e)	2019 (MT CO_2e)
Aviation	70,252	207,308
On-Road Transportation	6,779,889	6,703,877
Railways	69,738	222,302
Waterborne Navigation	N/A	N/A
Total	6,919,879	7,133,487

[28] "Local and Regional Greenhouse Gas Emission Inventory," accessed September 19, 2022, https://www.nctcog.org/trans/quality/air/emissions-inventories/local-regional-greenhouse-gas-emission-inventory.

2.2.3 Waste

For the 2019 GHG emissions inventory, the Waste sector collectively includes emissions from solid waste and wastewater treatment processes within the city. As opposed to the emissions from fuel combustion in the Stationary Energy and Transportation sectors, emissions generated in the Waste sector generally are produced through the aerobic or anaerobic decomposition of organic material.

Overall, the Waste sector emissions for Dallas in 2019 were 534,730 MT CO_2e, representing a 280% change from 2015. This large increase is explained further in Section 2.2.3.1, but in summary the increase is due to a change in the methodology for calculating emissions from activity data for Solid Waste (i.e., tons of waste landfilled) that resulted in a larger but more accurate representation of the emissions from this sector. The raw activity data (i.e., tons of waste landfilled) did not change dramatically. In 2015, approximately 1.8 million tons of waste were sent to landfills, and in 2019 this only increased to around 2.0 million tons (9% increase).

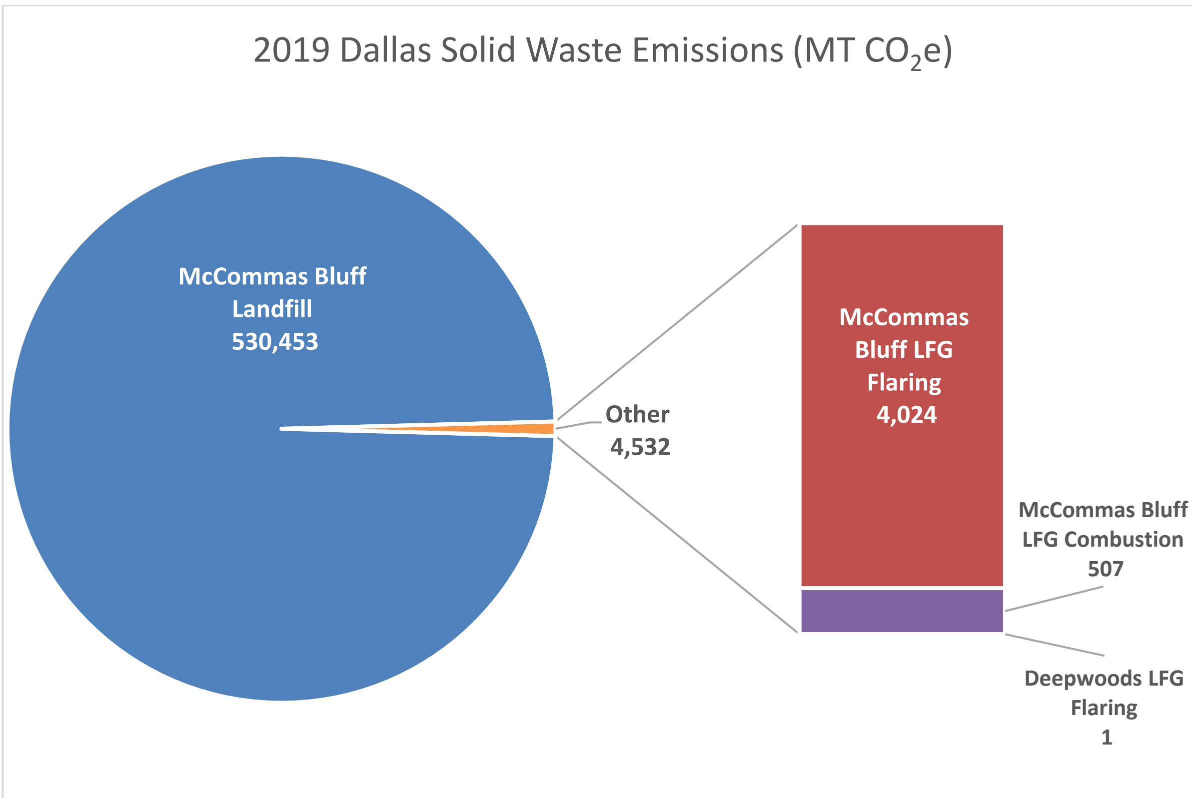
Table 13: Waste Emissions by Sub-Sector (MT CO_2e)

Waste Sub-Sector	Source	2015 (MT CO_2e)	2019 (MT CO_2e)
Solid Waste	McCommas Bluff Landfill Emissions	135,055	530,453
	McCommas Bluff Landfill Gas Flaring Emissions	2,433	4,024
	Deepwoods Landfill Gas Flaring Emissions	9	1
	McCommas Bluff Landfill Gas Combustion Emissions		507
Wastewater Treatment	Dallas Water Utilities Southside Water Treatment Plant Digester Emissions	113	101
	Dallas Water Utilities N_2O Emissions	160	252
Total		137,770	535,339

2.2.3.1 *Solid Waste*

In Dallas, Solid Waste emissions in 2019 came from two landfills: McCommas Bluff and Deepwoods. McCommas Bluff landfill actively collects and stores waste from throughout the city. The Deepwoods landfill is a closed site with two capped areas containing mixed types of solid waste. After being capped in 2003, the Deepwoods site has captured landfill gas for venting and flaring. The emissions from these landfills, primarily methane, are released into the atmosphere as the result of the decomposition process. Through flaring of landfill gas, other emissions are generated; and at McCommas Bluff Landfill a portion of the landfill gas is refined to pipeline quality and sold as renewable natural gas.

Figure 16: 2019 Dallas Solid Waste Emissions



Additional emissions generated by landfill operations include energy use for processing solid waste and the collection and transportation of solid waste to the landfills. In the context of the community scale inventory, these categories are reported in the Solid Waste section as "information only," since the Stationary Energy and Transportation sectors are broad enough to capture these emissions. This is an accounting method to avoid double-counting, but for transparency these emissions are explained below in Table 14.

Table 14: Solid Waste Inventory Records Provided as Information Only

Inventory Records	2019 MT CO_2e
Landfill Energy Consumption Emissions	53,500
Solid Waste Collection & Transportation Emissions	34,072

Because the data collected for this inventory consists of waste landfilled at facilities within the city, these emissions are categorized as Scope 1. With more complete data, additional Solid Waste emissions associated with activities in the City of Dallas could include those from waste generated within the city but treated at facilities outside the city (categorized as Scope 3). However, data for these Scope 3 emissions were not available at the time this inventory was compiled so it is not included.

2.2.3.2 Water and Wastewater Treatment

The treatment of potable water supply to the city occurs at three water treatment plants: East Side, Bachman, and Elm Fork. These plants consume energy to treat water, however the emissions that are generated from this activity are reported here as Information Only since they are captured in the broader Industrial Energy sub-sector.

The treatment of wastewater at facilities located within the city (regardless of origin) generates Scope 1 emissions. In 2019, Dallas had two wastewater treatment facilities in the city that treated over 66 billion gallons of wastewater.

Wastewater treatment emissions result from energy used at the facilities and from the aerobic and anaerobic decomposition of organic matter in the wastewater. Since the energy consumed in these treatment facilities is captured in the Industrial Energy sub-sector, these emissions are reported here as Information Only. The emissions that are formally reported for Wastewater Treatment in the Solid Waste sector are those that result from decomposition of organic matter in the wastewater. Details are provided in Table 15 below.

Table 15: Wastewater Treatment Plant Emissions Sources

Inventory Records	2019 MT CO_2e
Water & Wastewater Treatment Process Emissions	353
Wastewater Treatment Plant Energy Consumption Emissions (Information Only)	*189,709*

2.2.4 Industrial Processes and Product Use (IPPU)

As a highly commercial and residential city, the City of Dallas does not generate many emissions from industrial processes. Because of this, the data collected for this inventory focused only on the industrial facilities large enough to trigger the federal mandate to report emissions. These facilities report their emissions to the U.S. Environmental Protection Agency's (EPA) Facility Level Information on Greenhouse Gases Tool (FLIGHT). The FLIGHT database returns three results that generate Scope 1-3 emissions within the City of Dallas in 2019, which are outlined in Table 16 below. The University of Texas Southwestern Medical Center and Westrock come up as results in FLIGHT, but the processes that occur at these facilities are already counted in the inventory's stationary combustion category; thus they are displayed for "information only" rather than counted again in the inventory. The Texas Instruments North Campus is included in the inventory, because its emissions primarily come from electronics manufacturing.

Table 16: 2019 GHG Emissions from Dallas Industrial Processes (Source: EPA FLIGHT Database)

Industrial Facility	2019 Emissions (MT CO_2e)
Texas Instruments North Campus	582,359
The University of Texas Southwestern Medical Center at Dallas*	*67,927*
Westrock (Dallas Mill)*	*33,855*
**Provided as information only, since the emissions reported for these facilities falls within the stationary energy sector.*	

2.2.5 *Agriculture, Forestry, and Other Land Use (AFOLU)*

Various sources of emissions and emissions-generating activities fall under the AFOLU sector, including emissions from harvested wood products, biomass burning, enteric emissions, manure management, managed soils, liming, urea application, and fertilizer use, and rice cultivation. The City of Dallas has no significant sources of AFOLU emissions, and therefore none are reported in this inventory.

That said, this inventory does provide an entry on the carbon dioxide emissions captured by the trees within the city. Urban tree cover in Dallas, surveyed by the Texas Trees Foundation, is approximately 2,500 hectares and captures an estimated 87,114 metric tons of carbon per year, which translates to an estimated 319,387 metric tons CO_2e using the molecular weight ratio of 3.6663 to convert the amount of C sequestered to its CO_2 equivalent[29,30]. This data is provided as "information only" to comply with the emissions reporting protocols, and because of the level to which this data is estimated. However, it is important to note that trees, particularly mature trees, can be a significant carbon sink that capture and sequester carbon dioxide from the atmosphere. Therefore, planting new trees and conserving and managing existing trees can lower the net emissions profile of the City of Dallas in the future. The city of Dallas has several tree-planting programs,

[29] "Dallas Urban Forest Master Plan," *Texas Trees* (blog), September 13, 2019, https://www.texastrees.org/projects/dallas-urban-forest-master-plan/.

[30] "How to calculate the amount of CO2 sequestered in a tree per year," University of New Mexico, https://www.unm.edu/~jbrink/365/Documents/Calculating_tree_carbon.pdf

including Dallas City Hall's "Branch out Dallas" and a Parks and Recreation-run Reforestation Program[31].

3 Dallas City Government GHG Emissions Inventory

The inventory of greenhouse gas emissions from City Government activities is a subset of the Dallas community-wide inventory reported in Section 2, since these activities occur within the city boundary. As suggested by the GHG Protocol for Cities[32], a local government operations (LGO) inventory is provided in this report to inform the Dallas City Government of the emissions generated by the activities and sources under its ownership and control. The city government can also use this information to identify GHG emissions reduction opportunities and demonstrate leadership through action.

The Dallas city government has a total of 13,000 employees and an annual budget of $3.6 billion dollars.[33] While local government operations vary between jurisdictions, several key community services are common. These include water supply, waste collection, sanitation, mass transit systems, roads, primary education, and healthcare. For the Dallas LGO inventory, activities and sources of GHG emissions are primarily concentrated in city-owned/operated landfills, water and wastewater treatment facilities, and buildings. Another significant contributor to GHG emissions is the fleet of city vehicles (i.e., police, parks maintenance, sanitation, etc.).

3.1 Local Government Operations Inventory Boundary and Scope

Like corporate GHG emissions inventories, the boundary of the 2019 LGO inventory for the Dallas government includes sources and activities owned and/or controlled by the city government. The accounting methodology categorizes emissions into scopes, where:

- Scope 1 includes direct emissions from city-owned buildings/facilities, equipment, and other assets.
- Scope 2 includes indirect emissions from purchased utilities (primarily electricity) in city-owned buildings/facilities, equipment, and other assets.
- Scope 3 includes other indirect emissions from sources outside of the city's ownership and control, but which are influenced by activities related to the city government's operation.

---

[31] https://dallascityhall.com/departments/waterutilities/Pages/branch-out-dallas.aspx
[32] Fong et al., *Global Protocol for Community-Scale Greenhouse Gas Emission Inventories*.
[33] "Financial Transparency Prior Budgets – Financial Transparency: City of Dallas," accessed May 27, 2022, https://dallascityhall.com:443/departments/budget/financialtransparency/Pages/Prior-Budgets.aspx

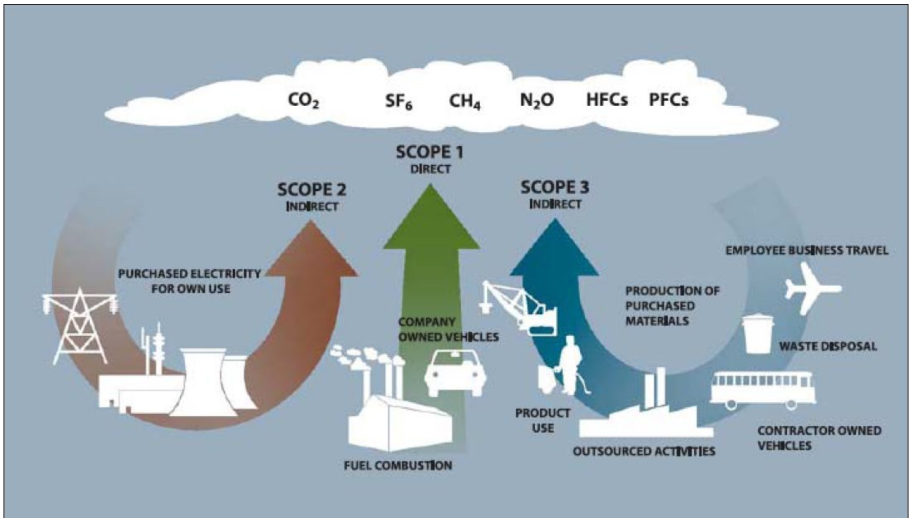


Figure 17: GHG Emissions Scopes for Local Government Operations Inventories[34]

The LGO inventory follows the same approach as the community-scale inventory, using ICLEI's ClearPath tool for collecting and modeling data. Emissions are reported in MT CO_2e, which includes carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), and fluorinated gases (HFCs, PFCs, and SF_6). Additionally, the same global warming potentials were used from the UN IPCC 5th Assessment Report.

Emissions are reported by Scope, as well as by local government sectors, which are described below in Table 17. While the standard LGO inventory should consider all these sectors, not all local governments provide the same services and therefore some sectors are reported as "N/A" in order to indicate "not applicable" as opposed to zero emissions in that sector.

[34] World Resources Institute and World Business Council for Sustainable Development, "The Greenhouse Gas Protocol: A Corporate Accounting and Reporting Standard."

Table 17: Local Government Sectors[35]

Local Government Sectors	Description
Buildings and Other Facilities	Typically includes emissions from stationary combustion, purchased utilities, and fugitive emissions in administrative facilities, public venues, parks and recreational facilities, storm water pumping, storage facilities, etc.
Streetlights and Traffic Signals	Includes emissions from purchased electricity for these types of lighting.
Water Delivery Facilities	Includes emissions from stationary combustion, purchased utilities, and fugitive emissions related to facilities used for the transportation, treatment, and/or distribution of drinking water.
Wastewater Facilities	Includes emissions from stationary combustion, purchased utilities, and processing related to facilities used for the transportation, collection, and/or treatment of wastewater.
Port Facilities[36]	Includes emissions from stationary combustion, purchased utilities, and fugitive emissions sources related to port facilities.
Airport Facilities	Includes emissions from stationary combustion, purchased utilities, and fugitive emissions related to airports.
Vehicle Fleet	Includes emissions from mobile combustion, purchased utilities, and fugitive emissions related to vehicles operated by the city government.
Transit Fleet	Includes emissions from mobile combustion, purchased utilities, and fugitive emissions related to mass transit vehicles operated by the city government.
Power Generation Facilities	Includes emissions from stationary combustion, purchased utilities, transmission and distribution losses, and fugitive emissions related to facilities used by the city government to generate or distribute electricity.
Solid Waste Facilities	Includes emissions from stationary combustion, purchased utilities, and fugitive emissions related to government-owned/operated disposal facilities.
Other Process and Fugitive Emissions	Can include emissions from natural gas system leaks (where government operates the transmission system), as well as other process and fugitive emissions.

[35] "Local Government Operations Protocol Version 1.1."
[36] There are no Port Facilities in the City of Dallas.

3.2 2019 City of Dallas Local Government Operations GHG Emissions Inventory

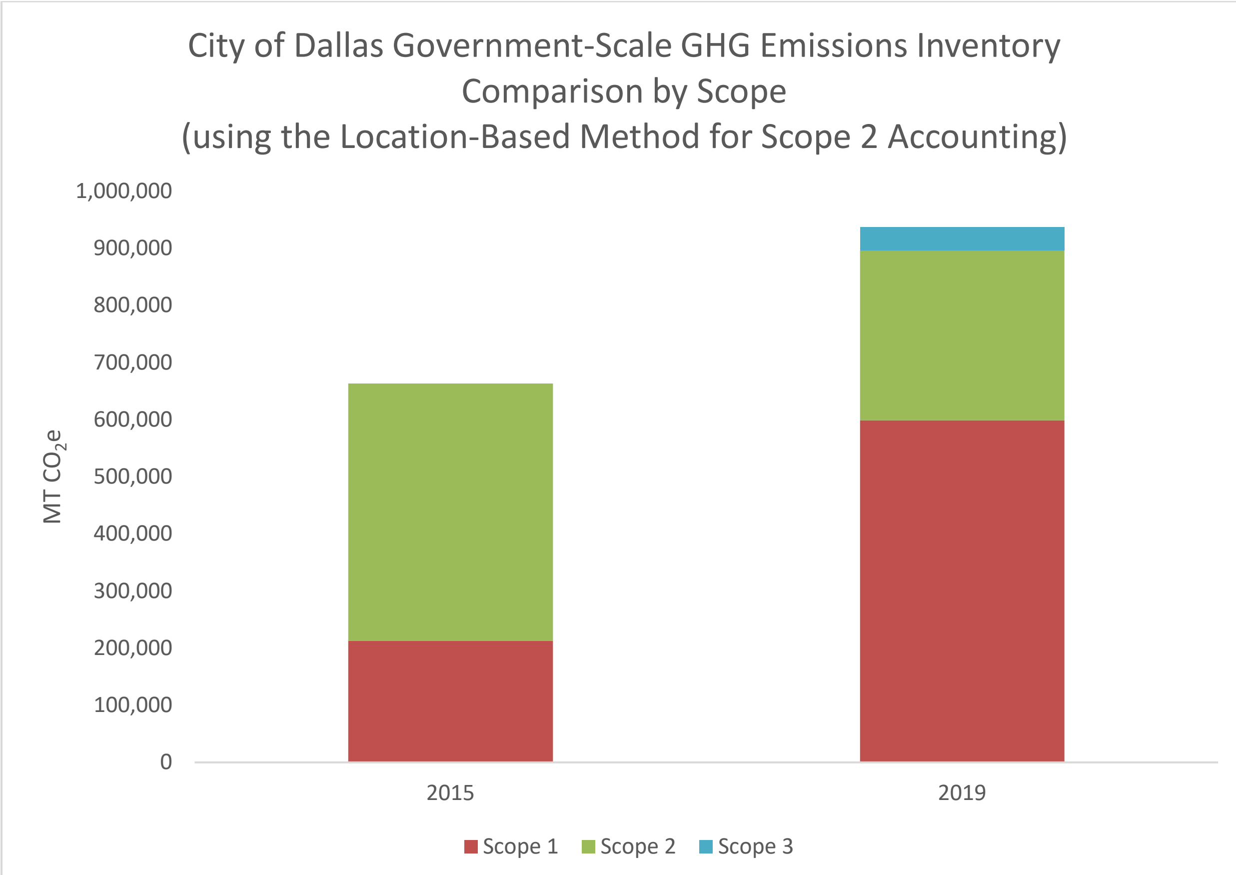
Total reported GHG emissions for the Dallas city government in 2019 are summarized below in Table 18.

It is important to note that the GHG Protocol recommends "dual reporting" in organizational GHG emissions inventories, which involves two approaches to the accounting of scope 2 emissions from purchased electricity. These approaches are the *Location Based Accounting Method* and the *Market Based Accounting Method*, and are explained further in Section 3.2.1. As such, the data reported in Table 18 (and elsewhere in this section) is notated accordingly to indicate the two methods being used.

Table 18: 2019 City Government GHG Emissions by Scope

Scopes	2015 LGO Emissions ($MT\ CO_2e$)	2019 LGO Emissions ($MT\ CO_2e$)
Scope 1	212,960	599,092
Scope 2 (Location Based Method)	450,622	297,779
Scope 2 (Market Based Method)	*264,392*	*0*
Scope 1 & 2 Subtotal (Location Based Method for Scope 2)	663,582	896,871
Scope 1 & 2 Subtotal (Market Based Method for Scope 2)	*477,352*	*599,092*
Scope 3	0	40,047
Scope 1, 2 & 3 Total (using location Based Method for Scope 2)	663,582	936,918
Scope 1, 2 & 3 Total (using market Based Method for Scope 2)	*477,352*	*639,137*

Figure 18: City of Dallas Government-Scale GHG Emissions Inventory Comparison by Scope (2015 vs. 2019)



Scope 1 emissions were primarily a product of direct emissions at solid waste facilities, as well as the city government's vehicle fleet. Purchased electricity was the main contributor to Scope 2 emissions.

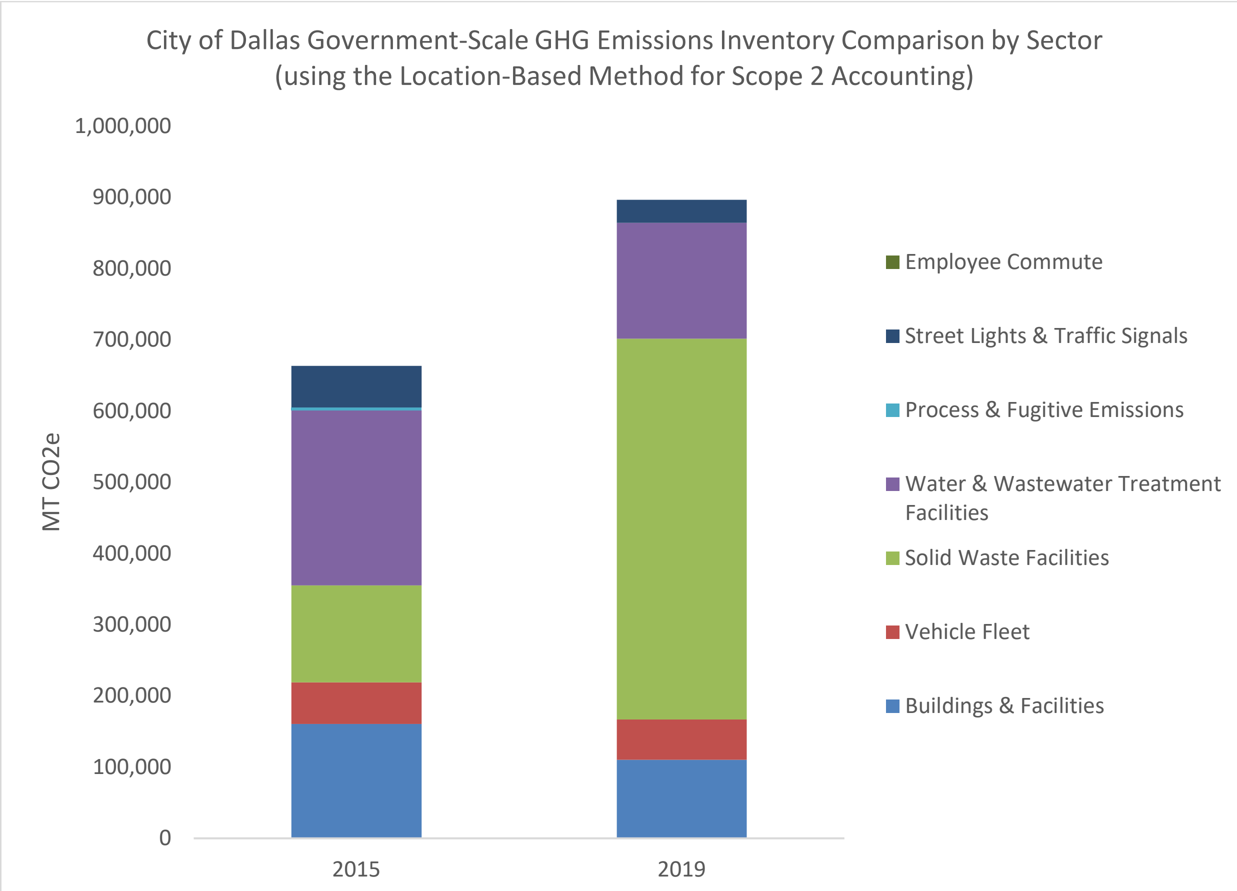
As referenced in Section 3.1, the emissions from purchased electricity reported in Scope 2 are accounted using a particular method. This LGO inventory complies with Local Government Operations Protocol and reports Scope 2 emissions using the location-based approach, with RECs associated with the city's green power purchase reported as supplemental information.

Table 19: 2019 City Government Scope 1 & 2 GHG Emissions by Sector

Sectors	2019 LGO Emissions (MT CO_2e)
Buildings and Other Facilities[37]	92,984
Streetlights and Traffic Signals	32,506
Water and Wastewater Facilities	189,701
Port Facilities	N/A
Airport Facilities	17,426
Vehicle Fleet	56,323
Transit Fleet[38]	N/A
Power Generation Facilities	N/A
Solid Waste Facilities	535,097
Other Process and Fugitive Emissions	N/A

[37] Does not include emissions for Water Treatment/Delivery Facilities, Wastewater Treatment Facilities, Airport Facilities, or Solid Waste/Sanitation Facilities.
[38] Transit emissions are sourced from Dallas Area Rapid Transit (DART) and are included in the community emissions accounting section.

Figure 19: City of Dallas Government-Scale GHG Emissions Inventory Comparison by Sector (2015 vs. 2019)



3.2.1 Accounting for Purchased Electricity Emissions

As described in Section 3.1 and Figure 17, organizational GHG emissions accounting categorizes purchased electricity as Scope 2. By definition, these emissions are indirectly influenced as the result of the reporting entity's activity (i.e., the consumption of electricity) and can therefore be complex to report accurately and transparently. This is due to the equally complex system of generating electricity and delivering it to a network of users (i.e., the "power grid"). Adding to this are the varying market structures that exist for buying and selling electricity. To ease this complexity and provide methods for accurate and transparent reporting of Scope 2 emissions, two accounting approaches are broadly accepted and used: the location-based method and the market-based method. The GHG Protocol Scope 2 Guidance[39] defines these methods as:

- Location-Based Method:

[39] Mary Sotos, "GHG Protocol Scope 2 Guidance" (World Resources Institute, 2015).

    - A method to quantify scope 2 GHG emissions based on average energy generation emission factors for defined geographic locations, including local, subnational, or national boundaries.

- Market-Based Method:
    - A method to quantify the scope 2 GHG emissions of a reporter based on GHG emissions emitted by the generators from which the reporter contractually purchases electricity bundled with contractual instruments, or contractual instruments of their own.

The World Resources Institute/ World Business Council for Sustainable Development (WRI/WBCSD) GHG Protocol requires dual reporting of Scope 2 emissions, where emissions are calculated and reported using both methods. Since neither method provides a perfect representation of the emissions from purchased electricity, reporting both improves the overall accuracy and transparency of the emissions inventory report. Along with this requirement from the GHG Protocol, the ICLEI Local Government Operations Protocol[40] recommends reporting Scope 2 emissions using the location-based method only.

In compliance with both requirements/recommendations, the GHG emissions reported for the Dallas City Government in this section of the report will include Scope 2 emissions calculated using the location-based method as well as the market-based method, but the formally reported results of the 2019 City of Dallas Local Government Operations GHG Emissions Inventory is calculated using the location-based method for Scope 2 accounting.

3.2.1.1 Electricity Purchased for City of Dallas Local Government Operations

In 2019, the Dallas city government purchased "100% wind-generated electricity" via a contractual sales agreement with an electricity supplier (also known as a "green power purchase"). As a market-based purchase of electricity through the deregulated ERCOT electricity market, this contractual mechanism provides the city government operations with electricity generated by wind farms that is bundled with the environmental attribute or "renewable energy certificates" (RECs). Using the market-based method for Scope 2 emissions accounting, these RECs would effectively make the emissions factor for the city's purchased electricity 0 MT CO_2e per MWh; and therefore, the emissions from purchased electricity would be zero.

However, when using the location-based method for Scope 2 emissions accounting, the contract to purchase zero-emissions wind energy is not considered. Instead, the average emissions factor for the regional electricity grid is used to represent the mix of power plants that actually provide the electricity to the consumer. For this inventory, the

[40] "Local Government Operations Protocol Version 1.1."

location-based emissions factor for Dallas comes from the EPA eGRID2019 data[41]. Specifically, it is 872.4 lbs. (0.396 MT) CO_2e per MWh which represents the total output emissions rate for the ERCT subregion in 2019.

3.2.2 Buildings & Facilities

Dallas Government buildings and facilities consume electricity and natural gas for space conditioning, water heating, plug and process loads, as well as other energy uses. This energy consumption causes both direct and indirect emissions of greenhouse gases. Note that, due to the existence of other dedicated reporting categories for Water and Wastewater Treatment Facilities, Airport Facilities, and Solid Waste Facilities, data reported in this section represents all other government owned/operated buildings and facilities. These include administrative buildings, police and fire departments, parks and recreation facilities, and libraries, among others. Detailed activity data and emissions for this sector are shown below.

Table 20: 2019 City Government Emissions for Buildings & Facilities Sector

Source/Activity	Activity Data	Unit of Measure	2019 GHG Emissions (MT CO_2e)
Natural Gas	1,558,505	Therms	8,289
Grid-Purchased Electricity	214,040,203	kWh	84,695
**Only Scope 1 and 2 emissions are reported in this table*			

3.2.3 Streetlights and Traffic Signals

Electricity consumed by city owned/operated streetlights and traffic signals is reported separately from other facilities as they are typically metered separately and have a very specific use profile. It is estimated that 71 streetlight meters and 1,352 traffic signal meters are under the ownership/control of the Dallas government. Additional streetlights are owned and operated by Oncor, and therefore are not included in this inventory.

Table 21: 2019 City Government Emissions for Streetlights and Traffic Signals Sector

Source/Activity	Activity Data	Unit of Measure	2019 GHG Emissions (MT CO_2e)
Streetlight Electricity	78,457,606	kWh	31,045
Traffic Signal Electricity	3,693,128	kWh	1,461
**Only Scope 1 and 2 emissions are reported in this table*			

[41] "EGRID Summary Tables 2019" (US Environmental Protection Agency, February 23, 2021), https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=&cad=rja&uact=8&ved=2ahUKEwiTz8SLjoP6AhXwjIkEHVaHCNAQFnoECBMQAQ&url=https%3A%2F%2Fwww.epa.gov%2Fsites%2Fproduction%2Ffiles%2F2021-02%2Fdocuments%2Fegrid2019_summary_tables.pdf&usg=AOvVaw2SSUFtSfS2rVb5R566UezL.

3.2.4 Water and Wastewater Facilities

Dallas Water Utilities (DWU) owns/operates three water treatment facilities (Bachman, East Side, and Elm Fork) and two (Central and Southside) wastewater treatment facilities for the City of Dallas. The majority of emissions attributed to these facilities are generated from electricity and natural gas consumed for their operations. A minor emissions source in addition to energy consumption is the biogas digester at the South Side Wastewater Treatment Plant, which captures biogas to fuel on-site generators and power the treatment plant. Therefore, despite the small amount of emissions created by the digester, this process actually helps avoid a significant amount of GHG emissions that would otherwise be created from the consumption of grid-supplied electricity.

Table 22: 2019 City Government Emissions for Water and Wastewater Facilities Sector

Source/Activity	Activity Data	Unit of Measure	2019 GHG Emissions (MT CO_2e)
Bachman WTP Electricity	33,489,663	kWh	13,252
East Side WTP Electricity	44,615,030	kWh	17,654
Elm Fork WTP Electricity	68,661,465	kWh	27,169
Bachman WTP Natural Gas	212	Therms	1
Elm Fork WTP Natural Gas	106	Therms	0.6
DWU Central Wastewater Treatment Plant Electricity	75,254,562	kWh	29,778
DWU South Side Wastewater Treatment Plant Electricity	75,023,560	kWh	29,686
DWU Central Wastewater Treatment Plant Natural Gas	34	Therms	0.2
DWU Water and Wastewater Facilities Other Electricity	182,367,558	kWh	72,162
South Side Wastewater Treatment Plant Digester Emissions	438,300	scf / year	0.1
**Only Scope 1 and 2 emissions are reported in this table*			

3.2.5 Port Facilities

The Dallas Government did not own or operate any port facilities in 2019.

3.2.6 Airport Facilities

The City of Dallas owns two airports, Dallas Love Field and Dallas Executive Airport. Emissions generating activities at these airports can be summarized into Stationary Combustion, Purchased Electricity, Mobile Assets and other airport vehicles, and Aircraft. Due to the availability and formatting of activity data, only Purchased Electricity and Aircraft emissions are able to be disaggregated. These are provided below, but emissions from other categories are aggregated and reported in the respective categories.[42]

Table 23: 2019 City Government Emissions for Airport Facilities Sector

Source/Activity	Activity Data	Unit of Measure	2019 GHG Emissions (MT CO_2e)
Airport Facilities Electricity	44,038,041	kWh	17,426
Aircraft Operations – Dallas Love Field	231,879	Aircraft Movements	195,840
Aircraft Operations – Dallas Executive Airport	46,503	Aircraft Movements	11,468
**Only Scope 1 and 2 emissions are reported in this table*			

3.2.7 Vehicle Fleet

The fleet of vehicles owned and operated by the Dallas Government consists of approximately 5,400 vehicles and other equipment. Due to this quantity of mobile assets, the GHG emissions data is reported below based on fuel type for on-road vehicles. More information fuel types included in the city fleet is shown in Figure 20 below. All off-road vehicles and equipment are grouped together, regardless of fuel type.

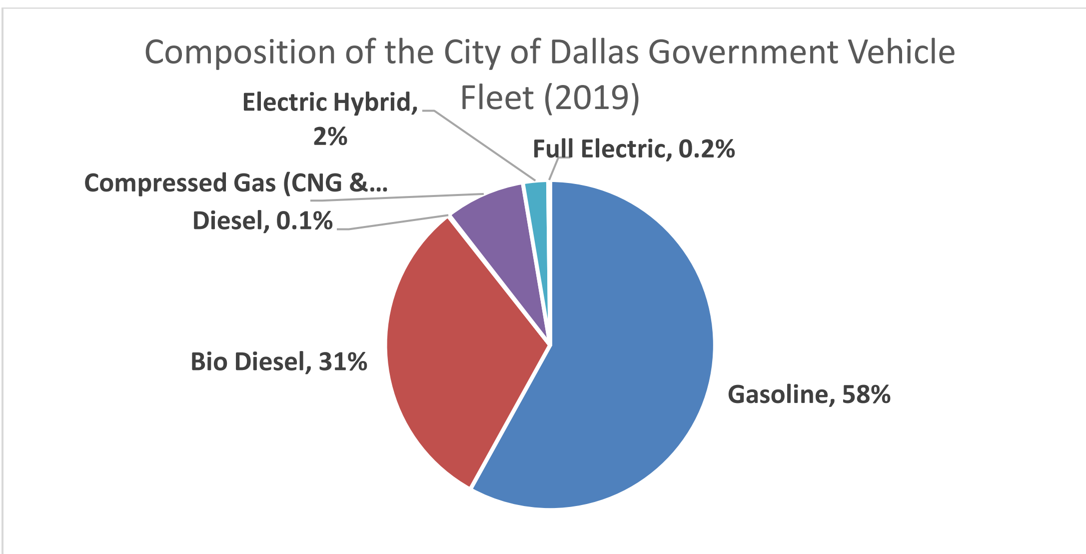


Figure 20: Composition of the City of Dallas Government Vehicle Fleet (2019)

[42] Stationary Combustion emissions from Airport Facilities are included in Section 3.2.1 and Mobile Combustion emissions from Airport Facilities are included in Section 3.2.7.

Table 24: 2019 City Government Emissions for Vehicle Fleet Sector

Source/Activity	Activity Data	Unit of Measure	2019 GHG Emissions (MT CO_2e)
On-Road Gasoline Fleet	2,674,061	Gallons	23,543
On-Road Diesel Fleet	1,554,221	Gallons	15,876
On-Road Biodiesel (B20) Fleet	1,412,491	Gallons	11,544
On-Road CNG Fleet	372,019	Gallons	277
Off-Road Fleet and Other Heavy Vehicles	493,735	Gallons	5,083
**Only Scope 1 and 2 emissions are reported in this table*			

3.2.8 Transit Fleet

The Dallas Government did not own or operate any transit vehicles in 2019.

3.2.9 Power Generation Facilities

The only power generation facility owned by the City of Dallas is the biogas digester at the South Side Wastewater Treatment Plant, which generates electricity for the plant operations using biogas captured from the wastewater treatment process. Since this facility is located at and affiliated with a wastewater treatment facility, it is reported in Section 3.2.4.

3.2.10 Solid Waste Facilities

Solid waste in Dallas is collected, transported, and landfilled by city authorities at two facilities: McCommas Bluff Landfill and Deepwoods Landfill. Greenhouse gas emissions in this sector are produced by the vehicles that collect and transport the waste, the facilities that consume energy in their operations, the decomposition of waste in landfills, and the flaring of landfill gas.

Table 25: 2019 City Government Emissions for Solid Waste Sector

Source/Activity	Activity Data	Unit of Measure	2019 GHG Emissions (MT CO_2e)
McCommas Bluff Landfill	1,952,572	Wet Tons of Waste	530,453
City of Dallas Sanitation Services Electricity Consumption	1,569,291	kWh	621
McCommas Bluff Landfill Gas Flaring	767,025,000	scf / year	4,024
Deepwoods Landfill Gas Flaring	1,141,627	scf / year	1
**Only Scope 1 and 2 emissions are reported in this table*			

3.2.11 Other Process and Fugitive Emissions

No emissions from the "Other Process and Fugitive" category are reported for 2019.

3.2.12 Scope 3 Emissions

As an optional reporting category, Scope 3 emissions are provided below for select activities/sources where data was readily available. As a broad category of indirect emissions, the Dallas Government seeks to continue improving its ability to measure/estimate, report, and manage Scope 3 emissions in the future.

For 2019, Scope 3 emissions were estimated for three categories: Transmission and Distribution Losses from Grid-Purchased Electricity, Pipeline Losses from Purchased Natural Gas, and Employee Commute. Electricity and natural gas system losses are estimated based on a reported loss rate as a percentage of the total electricity and natural gas consumed. Employee Commute emissions are estimated based on a survey of annual vehicle miles traveled by city employees, along with an estimate of annual passenger miles traveled on public transit by city employees.

Additionally, there are an estimated 9,569 MT CO_2e avoided from the Employee Commute category by "alternative commuting" (e.g., carpooling). These avoided emissions are reported here as Information Only due to the nature of the estimate and the guidelines of the Local Government Operations Protocol.

Table 26: 2019 City Government Scope 3 Emissions

Source/Activity	Activity Data	Unit of Measure	2019 GHG Emissions (MT CO_2e)
Transmission & Distribution Losses from Grid-Purchased Electricity	5.2	Percent	26,520
Pipeline Losses from Purchased Natural Gas	0.4	Percent	361
Employee Commute**	37,063,377	Vehicle Miles Traveled	12,923
Employee Commute (Public Transit)**	4,181,792	Passenger Miles	243

**= information only

4 Discussion of Data Observations

This GHG inventory report quantifies Dallas's annual 2019 GHG emissions, which have been reported in various categories to provide context and detail regarding the sources of emissions in the city. GHG emissions are accounted for and reported for both the entire community and the local government operations using the ICLEI ClearPath tool.

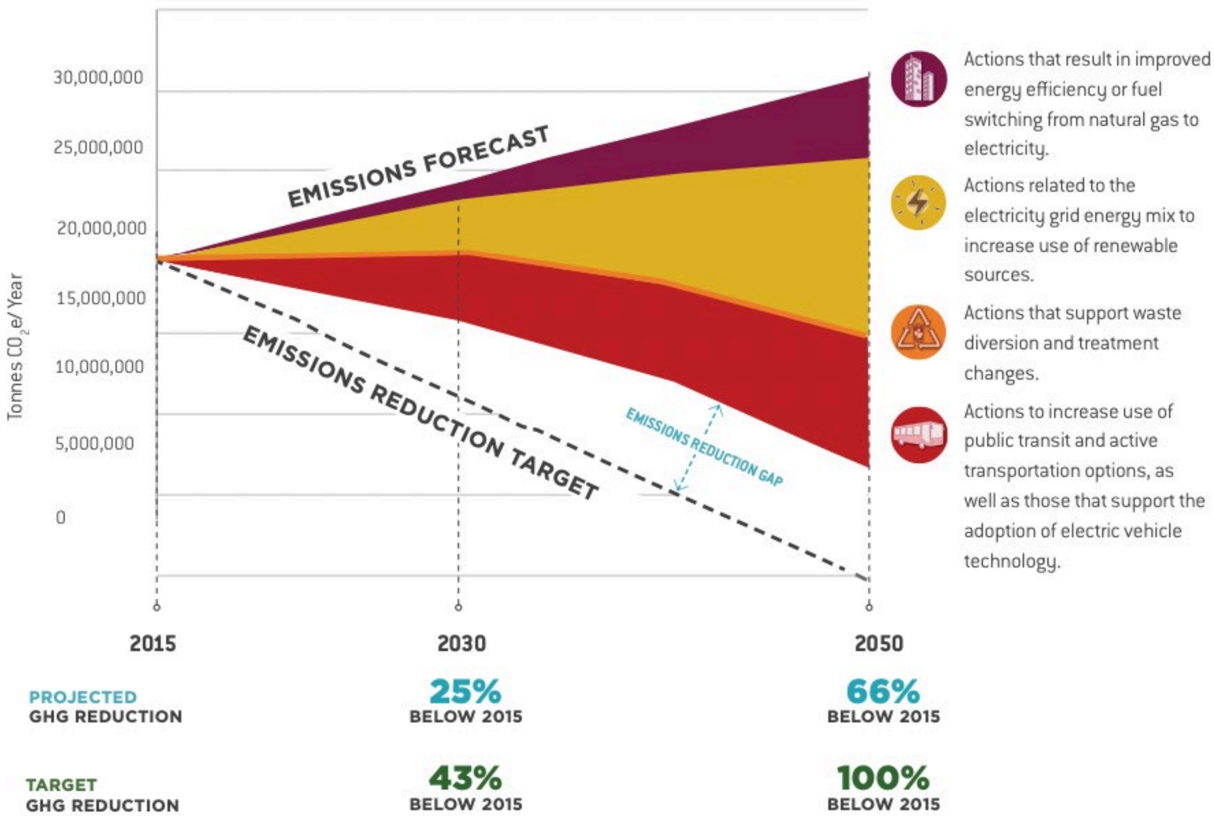
In 2019, the City of Dallas emitted approximately 18.5 million MT CO_2e total, compared to 21 million MT CO_2e in 2015, indicating a 11% decline in total GHG emissions over that time. In 2019 there are several sectors wherein emissions increase compared to 2015; however, at the community level, these sectoral increases in GHG emissions compared to those of 2015 can generally be explained by methodological changes and more granular data collection, both of which have led to increased accuracy in the City's emissions inventory process. For instance, community-level Scope 3 emissions were reported as 666% higher in 2019 compared to 2015 due to increased data availability and granularity in the current inventory. Additionally, in 2019 the inventory included more inclusive data collection from the aviation and waste sectors compared to that of 2015.

Local government-owned emissions[43] increased by 41% overall between 2015 and 2019. This is mostly due to increases in Scope 1 emissions, which rose from approximately 213,000 MT CO_2e in 2015 to approximately 599,000 MT CO_2e in 2019. The primary driver of this increase was from the solid waste sector and a change in the methodology used to calculate GHG emissions. Despite this increase, it is important to note that the emissions from local government operations are only 5% of the total GHG emissions in the community-wide inventory.

The City of Dallas's Comprehensive Environmental and Climate Action Plan (CECAP), released in April 2020, outlines Dallas's climate goals and highlights methods towards city-wide decarbonization. As outlined in the CECAP, Dallas has a 2050 carbon neutrality target and an intermediate 2030 target to reduce emissions 43% below 2015 levels, which implies a 2030 target of approximately 11,159,000 MT CO_2e. To work towards these targets, Dallas outlines 97 actions across 8 sectors which collectively result in a projected 25% emissions reduction from 2015 levels by 2030 and a projected 66% reduction by 2050. These projected reductions would not meet the CECAP targets, and continued tracking of progress through emissions inventories will be important to inform the actions required to meet the city's goals. To illustrate this, see the "Emissions Reduction Gap" noted in Figure 21.

[43] As described in Section 3.2.1, the local government-owned emissions are expressed using the dual reporting method required by the GHG Protocol. Since the ICLEI Community Protocol recommends using the location-based method for Scope 2 accounting, the results of the Dallas LGO Inventory will be presented as such.

Figure 21: Excerpt from CECAP Report - Dallas GHG Emissions Forecast and Reduction Targets



4.1 Dallas Community-Wide GHG Emissions Inventory

Section 2 of this report outlines the results of a community-wide GHG emissions inventory for 2019. The following subsections will discuss the community-wide GHG emissions by sector, how GHG emissions accounting methodologies and data have changed since 2015, and the scale at which GHG emissions must decline to comply with the goals outlined in Dallas's CECAP.

4.1.1 Stationary Energy

The stationary energy sector consists of energy use in residential and commercial buildings, industrial energy from energy-related industrial processes, and other energy-related activities. Between 2015 and 2019, the community-level GHG emissions from stationary energy declined by 22%. This encompasses declines across all stationary energy subsectors, including a 29% decline in commercial energy emissions, a 33% decline in industrial energy, and a 22% decline in residential energy. The commercial and residential subsectors make up the largest shares of emissions in both years.

Scope 1 emissions (i.e., emissions occurring within the city boundary) make up 22% of the total Stationary Energy category at 2,220,557 MT CO_2e. These emissions result from activities such as combustion of fossil fuels for heating in residential, commercial, and industrial applications, and fugitive emissions related to energy consumption. The remainder of the stationary energy emissions are categorized as Scope 2 and come from Dallas's electricity use. Scope 2 stationary energy emissions account for 7.5 million MT CO_2e including 4.04 million MT CO_2e from commercial buildings, 2.44 million MT CO_2e from residential buildings and 1.02 million MT from the industrial sector. Scope 2 stationary energy emissions from electricity use make up over 99% of Dallas's community-wide Scope 2 emissions overall. The small remainder of Scope 2 emissions (<1%) comes from electricity use in the transportation sector, which currently is not widespread.

Over 19 terawatt-hours (TWh) – or 19 billion kWh – of electricity was consumed from the regional power grid in Dallas in 2019. The GHG emissions from this electricity use make up more than 40% of the total community-wide emissions in 2019, and therefore is a significant source to consider when evaluating emissions reduction targets. Dallas's current and future Scope 2 emissions are dictated by two main factors: electricity consumption from the regional power grid and the emissions-intensity of the electricity generated for the power grid. Currently, grid-connected electricity in Texas is primarily generated by natural gas (53%), coal (19%), wind (17%), and nuclear energy (9%)[44]. This implies an average emissions factor of approximately 991 pounds of carbon dioxide-equivalent emissions per megawatt-hour of electricity generated, which suggests a 17% decline from the emissions rate in 2015. Texas has the 25th highest state-wide average emissions factor compared to other US states and is above the US average emissions rate, even though the state has placed record amounts of wind online in the last several years. Emissions from electricity could be reduced if (a) emissions-intensity of the grid decreases (i.e., the "greening of the grid"), or (b) end-use energy efficiency improves. The city has more control over end-use efficiency improvements, including changing to more efficient lightbulbs, weatherizing buildings, or installing more efficient and electrified appliances. Dallas outlines efficiency and building standards as part of its 2020 CECAP report, which include (1) reducing energy use in existing buildings by 10% by 2030 and 25% by 2050 and (2) making all new construction starting in 2030 100% net zero.

Additionally, ERCOT is also expected to install more renewables in the coming years, and the state of Texas has ample resources that translate to high renewable potential[45]. Decarbonization of Texas's electric grid could improve Dallas's potential to meet the broader emissions reduction impacts outlined in the CECAP.

4.1.2 Transportation

The transportation sector makes up about 39% of overall community-wide emissions in Dallas. The sector can be categorized into several sub-sectors, which include on-road transportation, off-road transportation, aviation, railways, and waterways. A major change in the present inventory compared to the 2015 emissions inventory was the methodology for aviation sector emissions accounting.

---

[44] U.S. Energy Information Administration, "Texas Electricity Profile 2019."
[45] Potomac Economics, "2021 State of the Market Report for the ERCOT Electricity Markets," May 2022, https://www.potomaceconomics.com/wp-content/uploads/2022/05/2021-State-of-the-Market-Report.pdf.

The bulk of transportation-related GHG emissions consisted of on-road transportation, which accounts for roughly 98% of total transportation GHG emissions in the city of Dallas. In 2019, emissions from on-road transportation were about 6.70 million Metric Tons CO_2e, compared with 6.77 million metric tons CO_2e in 2015. This implies a 1% decline for total on-road transportation emissions, meaning that there was very little change in on-road transportation emissions in 2015 versus 2019.

Dallas is one of the major urban hubs in Texas, and many people commuted into or out of the city for work in 2019. The CECAP estimates that nearly 2% of people had "super commutes" of longer than 90 minutes, and that 76.8% of Dallas residents drive to work by themselves. Additionally, less than 20% of residents live within 10 minutes walking distance to a transit stop. All of this contributes to GHG emissions, and actions to reduce them will require a multifaceted approach.

The CECAP report outlines nineteen major recommendations for transportation decarbonization, which include:

- Converting the City of Dallas, DISD and DART to transition buses and light duty fleet to 100% electric by 2040
- Encouraging business and commercial fleets to electrify
- Installing EV charging in new buildings
- Expanding cross-city transit and improving transit within the city
- Implementing green infrastructure and mobility programs

The CECAP also includes language around increased funding for bike lanes and walkability, incentives for public transportation ridership such as the DART Vanpool service, and electrification of vehicles and fleets.

Over time, as more vehicles transition to zero-emissions vehicles (ZEVs) and plug-in hybrid vehicles (PHEVs), electricity demand and thus Scope 2 emissions from the transportation sector may increase slightly, depending on the speed of the electricity decarbonization transition versus that of electric vehicle adoption in transportation, and on the time of day that people charge their cars. However, research suggests that overall emissions will trend downward for the transportation sector if people and fleets adopt ZEVs, more people begin to work remotely, and non-passenger vehicle modes of transportation and commuting are made more convenient and become more widely adopted in the City of Dallas.

4.1.3 Waste

The waste sector accounts for emissions from solid waste (i.e., landfills) and wastewater treatment processes that occur within Dallas. The emissions in this sector mostly come from the breakdown of organic compounds during the waste decomposition process. In 2019, the sector emitted 534,730 MT CO_2e compared to 140,761 MT CO_2e in 2015. The drastic change between the two inventory years was driven by changes in emissions accounting methodology for solid waste, which used an updated and more accurate accounting methodology for the waste sector in 2019.

Solid waste emissions in Dallas in 2019 is represented by two landfills. Only one of these is active (McCommas Bluff), but the other (Deepwoods) still contributes to overall emissions with flaring of landfill gas. Since the landfills are within city bounds, these emissions are characterized as Scope 1. Waste that is generated within the city and is treated at a landfill outside city bounds would be categorized as Scope 3, but this was not included in this inventory due to data limitations. Other emissions from solid waste include those from processing, collecting, and transporting the waste, but most of these are captured in the stationary energy and transportation sectors and omitted from solid waste emissions to avoid double counting.

Emissions from water and wastewater treatment in Dallas are small compared to the solid waste sub-sector. These emissions are mostly unchanged from 2015 to 2019.

The CECAP report outlines nine goals involving waste, which include supporting recycling education and reduction, developing a comprehensive green procurement plan for trash and biodegradable items and new materials markets, developing a zero-waste management plan, landfill improvements, and electric waste collection trucks. Dallas hopes to become a zero-waste city and has several targets to achieve waste reductions, including:

- Diverting 35% of organic waste by 2030 and 80% by 2050
- Diverting 60% of paper waste by 2030 and 90% by 2050
- Achieving reductions in waste diverted from landfills at the scale of 35% by 2030 and 45% by 2040
- GHG emissions from treatment activities

4.1.4 Industrial Processes and Product Use (IPPU)

Emissions from industrial sector decreased approximately 10% compared to 2015. The energy-related industrial processes are accounted for within the stationary energy sector. The City of Dallas does not have many industrial processes within city bounds, and thus the emissions from this category are not large compared to other sectors. Industrial processes and product use emissions make up only 3% of emissions in Dallas overall at 582,359 MT CO_2e. The EPA FLIGHT tool was used to find the three industrial facilities that were reported in Dallas's 2019 GHG inventory. These are Texas Instruments North Campus, the University of Texas Southwestern Medical Center at Dallas, and Westrock (Dallas Mill).

4.1.5 Agriculture, Forestry and Other Land Use (AFOLU)

The AFOLU sector emissions generally can include those from harvested wood products, biomass burning, enteric emissions, manure management, managed soils, liming, urea application, and fertilizer use, and rice cultivation. The City of Dallas has no significant sources of AFOLU emissions, and none are reported in this inventory; however, the inventory does provide an entry on the carbon dioxide emissions captured by the trees within the city, which capture an estimated 87,114 metric tons of carbon per year. This means that trees in Dallas capture an estimated 319,387 metric tons CO_2e using the molecular weight ratio of 3.6663 to convert the amount of carbon sequestered to its CO_2

equivalent[46,47]. In the CECAP, the city notes that it is hoping to establish a "City Urban Forest Carbon Sequestration" program which quantifies carbon sequestered or absorbed through trees as a carbon credit.

The city of Dallas has several tree-planting programs that are outlined in Section 2.2.5 and the Dallas CECAP includes explicit goals involving the enhancement of ecosystems, trees, and greenspaces, which are currently not evenly distributed throughout the city. According to the CECAP, only 60% of residents in Dallas are less than half a mile from a park, which is low compared to other cities like Chicago (97%), Seattle (94%) and Denver (84%). Additionally, although a widespread and lengthy drought in 2011 killed an estimate 5.6 million trees in urban areas of Texas, the city of Dallas outlines targets to expand urban tree canopy, which has benefits for biodiversity beyond emissions reductions such as reducing urban heat, helping to manage flooding and habitat protection.

4.2 Local Government Inventory

Local government emissions make up only 5% of Dallas's total community-wide emissions. The major sources of emissions specific to government-owned assets and processes are city-owned/operated landfills, water and wastewater treatment facilities, buildings, and the city-owned transportation fleet, which encompasses light- and heavy-duty vehicles, several boats and landing/takeoff operations from two airports within the city bounds.

Scope 1 local government emissions are represented by direct emissions from city-owned buildings/facilities, equipment, and other assets. Emissions from this category accounted for 64% of the local government's emissions at 599,092 MT CO_2e total. They are mostly represented by the vehicle fleet and solid waste treatment at landfills that occurs within city bounds.

Scope 2 includes indirect emissions from purchased electricity in city-owned buildings/facilities, equipment, and other assets. In 2019 the Dallas city government purchased electricity from a supplier in 2019 that provided "100% wind-generated electricity" via contractual means, also known as a "green power purchase". As a market-based purchase of electricity through the deregulated ERCOT electricity market, this contractual mechanism provides the city government operations with electricity that is bundled with RECs generated by wind farms contracted with the supplier. Using the market-based method for Scope 2 emissions accounting, these RECs would effectively make the emissions factor for the city's purchased electricity 0 MT CO_2e per MWh; and therefore, the emissions from purchased electricity would be zero.

---

46 "Dallas Urban Forest Master Plan."

47 "How to calculate the amount of CO_2 sequestered in a tree per year," University of New Mexico, https://www.unm.edu/~jbrink/365/Documents/Calculating_tree_carbon.pdf

However, the ICLEI Local Government Operations Protocol prohibits these emissions from being deducted from the Scope 2 inventory[48]. The recommended accounting method is the location-based method that reports emissions that physically occur at power plants in the Dallas region as the result of electricity consumed by city government operations. In this method, the green power purchase is reported as supplemental information. As such, the Scope 2 emissions using the location-based method were 297,779 MT CO_2e, representing 32% of the government total.

Scope 3 includes other indirect emissions from sources outside of the city's ownership and control, but which are influenced by activities related to the city government's operation. This includes emissions from city government employee commutes, electricity and natural gas system losses, and other fugitive emissions. Other sources of Scope 3 emissions could be inventoried in the future, but data collection is typically the most significant barrier to improved organizational Scope 3 accounting.

References

1. "Dallas City Info_2022." Accessed May 27, 2022. https://dallasgis.maps.arcgis.com/apps/instant/minimalist/index.html?appid=807494fddae04830852e4b13e6847979/.
2. Dallas Energy Conservation Code (adopt 2015 International Energy Conservation Code), Pub. L. No. 30325, Dallas City Code (2017).
3. Texas Trees. "Dallas Urban Forest Master Plan," September 13, 2019. https://www.texastrees.org/projects/dallas-urban-forest-master-plan/.
4. "EGRID Summary Tables 2019." US Environmental Protection Agency, February 23, 2021. https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=&cad=rja&uact=8&ved=2ahUKEwiTz8SLjoP6AhXwjIkEHVaHCNAQFnoECBMQAQ&url=https%3A%2F%2Fwww.epa.gov%2Fsites%2Fproduction%2Ffiles%2F2021-02%2Fdocuments%2Fegrid2019_summary_tables.pdf&usg=AOvVaw2SSUFtSfS2rVb5R566UezL.
5. Fong, Wee Kean, Mary Sotos, Michael Doust, Seth Schultz, Ana Marques, Chang Deng-Beck, and World Resources Institute. *Global Protocol for Community-Scale Greenhouse Gas Emission Inventories: An Accounting and Reporting Standard for Cities*, 2015. https://www.deslibris.ca/ID/246277.
6. "GreenBuilding." Accessed May 27, 2022. https://dallascityhall.com:443/departments/sustainabledevelopment/buildinginspection/pages/greenBuilding.aspx.
7. "Greenhouse Gas Emissions Interactive Dashboard." Accessed September 17, 2022. https://www.c40knowledgehub.org/s/article/C40-cities-greenhouse-gas-emissions-interactive-dashboard?language=en_US.

[48] "Local Government Operations Protocol Version 1.1."

8. ICLEI - Local Governments for Sustainability. “U.S. Community Protocol for Accounting and Reporting of Greenhouse Gas Emissions,” July 2019.
9. “Local and Regional Greenhouse Gas Emission Inventory.” Accessed September 19, 2022. https://www.nctcog.org/trans/quality/air/emissions-inventories/local-regional-greenhouse-gas-emission-inventory.
10. “Local Government Operations Protocol Version 1.1,” May 2010.
11. Mary Sotos. “GHG Protocol Scope 2 Guidance.” World Resources Institute, 2015.
12. “OnTheMap.” Accessed May 21, 2022. https://onthemap.ces.census.gov/.
13. Potomac Economics. “2021 State of the Market Report for the ERCOT Electricity Markets,” May 2022. https://www.potomaceconomics.com/wp-content/uploads/2022/05/2021-State-of-the-Market-Report.pdf.
14. Texas Demographic Center. “Demographic Trends and Population Projections for Texas and the North Texas Region,” January 15, 2021.
15. “Understanding Global Warming Potentials | US EPA.” Accessed May 18, 2022. https://www.epa.gov/ghgemissions/understanding-global-warming-potentials.
16. U.S. Bureau of Economic Analysis. “Total Gross Domestic Product for Dallas-Fort Worth-Arlington, TX (MSA).” FRED, Federal Reserve Bank of St. Louis. FRED, Federal Reserve Bank of St. Louis, January 1, 2001. https://fred.stlouisfed.org/series/NGMP19100.
17. U.S. Energy Information Administration. “Texas Electricity Profile 2019,” November 2, 2020.
18. U.S. Environmental Protection Agency. “Power Plants and Neighboring Communities Mapping Tool.” Accessed May 27, 2022. https://experience.arcgis.com/experience/2e3610d731cb4cfcbcec9e2dcb83fc94.
19. USA, ICLEI. “ClearPath | ICLEI USA,” December 11, 2020. https://icleiusa.org/clearpath/.
20. World Resources Institute and World Business Council for Sustainable Development. “The Greenhouse Gas Protocol: A Corporate Accounting and Reporting Standard,” n.d.

Appendix A. Detailed Data Reports from ICLEI ClearPath

A.1 Community Inventory – GPC Overview (export of outputs in the format of GPC Table 4.3)

GPC Reference Number	Scope	GHG Emissions Source (By Sector and Subsector)	Notation Keys	CO2	CH4	N2O	HFC	PFC	SF6	NF3	Total CO2e	CO2(b)	Activity Data Quality	Emission Factors Quality
I		STATIONARY ENERGY												
I.1		Residential buildings												
I.1.1	1	Emissions from fuel combustion within the city boundary		767468.59	72.38	1.45					769878.79		Medium; Medium	Medium; Medium
I.1.2	2	Emissions from grid-supplied energy consumed within the city boundary		2429015.04	159.39	22.37					2439406.25		Medium	High
I.1.3	3	Transmission and distribution losses from grid-supplied energy												
I.2		Commercial and institutional buildings and facilities												
I.2.1	1	Emissions from fuel combustion within the city boundary		760076.58	74.12	1.81					762630.96		Medium; Medium; Medium; Medium	Medium; Medium; Medium; Medium
I.2.2	2	Emissions from grid-supplied energy consumed within the city boundary		4018565.83	263.70	37.01					4035757.06		Medium	High
I.2.3	3	Transmission and distribution losses from grid-supplied energy												
I.3		Manufacturing industries and construction												
I.3.1	1	Emissions from fuel combustion within the city boundary		134156.97	10.13	1.89					134942.50	20572.92	Medium; Medium; Medium; Medium	Medium; Medium; Medium; Medium
I.3.2	2	Emissions from grid-supplied energy consumed within the city boundary		1012997.30	66.47	9.33					1017330.86		Medium	High
I.3.3	3	Transmission and distribution losses from grid-supplied energy												
I.4		Energy industries												
I.4.1	1	Emissions from energy production used in power plant auxiliary operations within the city												
I.4.2	2	Emissions from grid-supplied energy consumed by energy industries												
I.4.3	3	Emissions from transmission and distribution losses from grid-supplied energy used in power plant auxiliary operations												
I.4.4	1	Emissions from energy generation supplied to the grid		286643.00	139.33	160.25					333009.41	102985.54		
I.5		Agriculture, forestry, and fishing activities												
I.5.1	1	Emissions from fuel combustion within the city boundary												
I.5.2	2	Emissions from grid-supplied energy consumed within the city boundary												
I.5.3	3	Transmission and distribution losses from grid-supplied energy												
I.6		Non-specified sources												
I.6.1	1	Emissions from fuel combustion within the city boundary												
I.6.2	2	Emissions from grid-supplied energy consumed within the city boundary												
I.6.3	3	Transmission and distribution losses from grid-supplied energy		446013.77							446013.77			

I.7		Fugitive emissions from mining, processing, store, and transportation of coal												
I.7.1	1	Fugitive emissions from mining, processing, storage, and transportation of coal within the city boundary												
I.8		Fugitive Emissions from oil and natural gas systems												
I.8.1	1	Fugitive emissions from oil and natural gas systems within the city boundary		84.13	7857.56						220095.74			
II		TRANSPORTATION												
II.1		On-road transportation												
II.1.1	1	Emissions from fuel combustion on-road transportation occurring in the city		3031993.57	96.05	15.36					3038753.46		Medium; Medium; Medium	Medium; Medium; Medium
II.1.2	2	Emissions from grid-supplied energy consumed in the city for on-road transportation												
II.1.3	3	Emissions from transboundary journeys occurring outside the city, and T and D losses from grid-supplied energy use		3653495.64	160.44	26.93					3665123.77		Medium	Medium
II.2		Railways												
II.2.1	1	Emissions from fuel combustion for railway transportation occurring in the city		190096.32	14.89	4.84					191796.21			
II.2.2	2	Emissions from grid-supplied energy consumed in the city for railways		30375.95	1.99	0.28					30505.90			
II.2.3	3	Emissions from transboundary journeys occurring outside the city, and T and D losses from grid-supplied energy use												
II.3		Waterborne navigation												
II.3.1	1	Emissions from fuel combustion for waterborne navigation occurring in the city												
II.3.2	2	Emissions from grid-supplied energy consumed in the city for waterborne navigation												
II.3.3	3	Emissions from transboundary journeys occurring outside the city, and T and D losses from grid-supplied energy use												
II.4		Aviation												
II.4.1	1	Emissions from fuel combustion for aviation occurring in the city		11468.00							11468.00		Medium	Medium
II.4.2	2	Emissions from grid-supplied energy consumed in the city for aviation												
II.4.3	3	Emissions from transboundary journeys occurring outside the city, and T and D losses from grid-supplied energy use		195840.00							195840.00		Medium	Medium
II.5		Off-road transportation												
II.5.1	1	Emissions from fuel combustion for off-road transportation occurring in the city												
II.5.2	2	Emissions from grid-supplied energy consumed in the city for off-road transportation												
II.5.3	3	Emissions from transboundary journeys occurring outside the city, and T and D losses from grid-supplied energy use												
III		WASTE												
III.1		Solid waste disposal												

III.1.1	1	Emissions from solid waste generated in the city and disposed in landfills or open dumps within the city			19088.50						534477.93		Medium	High
III.1.2	3	Emissions from solid waste generated in the city but disposed in landfills or open dumps outside the city												
III.1.3	1	Emissions from waste generated outside the city and disposed in landfills or open dumps within the city												
III.2		Biological treatment of waste												
III.2.1	1	Emissions from solid waste generated in the city that is treated biologically in the city												
III.2.2	3	Emissions from solid waste generated in the city but treated biologically outside of the city												
III.2.3	1	Emissions from waste generated outside the city boundary but treated in the city												
III.3		Incineration and open burning												
III.3.1	1	Emissions from waste generated and treated within the city												
III.3.2	3	Emissions from waste generated within but treated outside of the city												
III.3.3	1	Emissions from waste generated outside the city boundary but treated within the city												
III.4		Wastewater treatment and discharge												
III.4.1	1	Emissions from wastewater generated and treated within the city	C			0.95					252.26		Medium	Medium
III.4.2	3	Emissions from wastewater generated within but treated outside of the city												
III.4.3	1	Emissions from wastewater generated outside the city boundary but treated within the city												
IV		INDUSTRIAL PROCESSES and PRODUCT USES (IPPU)												
IV.1	1	Emissions from industrial processes occurring in the city boundary									582359.00			
IV.2	1	Emissions from product use occurring within the city boundary												
V		AGRICULTURE, FORESTRY and OTHER LAND USE (AFOLU)												
V.1	1	Emissions from livestock												
V.2	1	Emissions from land									-319387.00		Medium	Medium
V.3	1	Emissions from aggregate sources and non-CO2 emission sources on land												
VI		OTHER SCOPE 3												
VI.1	3	Other Scope 3									56006.38			

A.2 LGO Inventory – Emissions Factor and Activity Data Report (Buildings & Facilities)

Inventory Record	Calculator	Gpc Scope	Factor Profiles	Global Warming Potential	Category	CO2 (MT)	CH4 (MT)	N2O (MT)	CO2e (MT)	Electricity Energy Equivalent (MMBtu)	CO2 Emissions Factor	CO2 Emissions Factor Units	CH4 Emissions Factor	CH4 Emissions Factor Units	N2O Emissions Factor	N2O Emissions Factor Units	T&D Energy Equivalent (MMBtu)	Energy Equivalent (MMBtu)

City of Dallas Grid Loss 2019	Emissions from Electric Power Transmission and Distribution Losses	Scope 3	ERCOT All (ERCT) eGRID 2019	IPCC 5th Assessment 100 Year Values	Buildings & Facilities	26407	1.7329	0.24321	26520		0.11544	MT/MMBtu	7.5755×10^{-6}	MT/MMBtu	1.0632×10^{-6}	MT/MMBtu	228746	
City of Dallas - Other Buildings and Facilities Electricity Use 2019	Emissions from Grid Electricity	Scope 2	ERCOT All (ERCT) eGRID 2019	IPCC 5th Assessment 100 Year Values	Buildings & Facilities	84334	5.5340	0.77670	84695	730513	0.11544	MT/MMBtu	7.5755×10^{-6}	MT/MMBtu	1.0632×10^{-6}	MT/MMBtu		
City of Dallas - Airports Electricity Use 2019	Emissions from Grid Electricity	Scope 2	ERCOT All (ERCT) eGRID 2019	IPCC 5th Assessment 100 Year Values	Buildings & Facilities	17351	1.1386	0.15980	17426	150300	0.11544	MT/MMBtu	7.5755×10^{-6}	MT/MMBtu	1.0632×10^{-6}	MT/MMBtu		
City of Dallas - Water Delivery Facilities Electricity Use 2019 (IO)	Emissions from Grid Electricity	Scope 2	ERCOT All (ERCT) eGRID 2019	IPCC 5th Assessment 100 Year Values	Buildings & Facilities	90485	5.9376	0.83335	90872	783799	0.11544	MT/MMBtu	7.5755×10^{-6}	MT/MMBtu	1.0632×10^{-6}	MT/MMBtu		
City of Dallas - Wastewater Treatment Facilities Electricity Use 2019 (IO)	Emissions from Grid Electricity	Scope 2	ERCOT All (ERCT) eGRID 2019	IPCC 5th Assessment 100 Year Values	Buildings & Facilities	71354	4.6822	0.65716	71659	618079	0.11544	MT/MMBtu	7.5755×10^{-6}	MT/MMBtu	1.0632×10^{-6}	MT/MMBtu		
City of Dallas - Solid Waste Facilities Electricity Use 2019 (IO)	Emissions from Grid Electricity	Scope 2	ERCOT All (ERCT) eGRID 2019	IPCC 5th Assessment 100 Year Values	Buildings & Facilities	618.31	0.040574	0.0056946	620.96	5355.9	0.11544	MT/MMBtu	7.5755×10^{-6}	MT/MMBtu	1.0632×10^{-6}	MT/MMBtu		
IO - Total Electricity	Emissions from Grid Electricity	Scope 2	ERCOT All (ERCT) eGRID 2019	IPCC 5th Assessment 100 Year Values	Buildings & Facilities	296511	19.457	2.7308	297779	2.5684×10^{6}	0.11544	MT/MMBtu	7.5755×10^{-6}	MT/MMBtu	1.0632×10^{-6}	MT/MMBtu		
City of Dallas Natural Gas Use 2019	Emissions from Stationary Fuel Combustion	Scope 1	2018 Google EIE	IPCC 5th Assessment 100 Year Values	Buildings & Facilities	8263.2	0.77925	0.015585	8289.1		0.053020	MT/MMBtu	5.0×10^{-6}	MT/MMBtu	1.0000×10^{-7}	MT/MMBtu		155851

A.3 LGO Inventory – Emissions Factor and Activity Data Report (Employee Commute)

Inventory Record	Calculator	Gpc Scope	Factor Profiles	Global Warming Potential	Category	CO2 (MT)	CH4 (MT)	N2O (MT)	CO2e (MT)	Employee Commute VMT	Employee Commute Energy (MMBtu)	CO2 Emissions Factor	CO2 Emissions Factor Units	Bio CO2 Emissions Factor	Bio CO2 Emissions Factor Units	CH4 Emissions Factor	CH4 Emissions Factor Units	N2O Emissions Factor	N2O Emissions Factor Units	Total Employee Passenger Miles	CO2 Factor Used (kg / Passenger Mile)	CH4 Factor Used (g / Passenger Mile)	N2O Factor Used (g / Passenger Mile)	CO2 Factor Units	CH4 Factor Units	N2O Factor Units
City of Dallas Employee Commuter Data	Employee Commute	Scope 3	ERCOT All (ERCT) eGRID 2019 and 2019 NCTCOG Emissions Factors	IPCC 5th Assessment 100 Year Values	Employee Commute	12876	0.63367	0.10982	12923	3.7063×10^{7}	183316	0.07024	MT/MMBtu	0.0	MT/MMBtu	1.7097×10^{-8}	MT/Mile	2.963×10^{-9}	MT/Mile							
City of Dallas 2019 Estimated Employee Alternative Commute	Employee Commute	Scope 3	ERCOT All (ERCT) eGRID 2019 and 2019 NCTCOG Emissions Factors	IPCC 5th Assessment 100 Year Values	Employee Commute	-9569.0			-9569.0	2.4433×10^{7}	134481	0.0	MT/MMBtu	0.0	MT/MMBtu	0.0	MT/Mile	0.0	MT/Mile							
City of Dallas Employee Transit Commutes	Employee Transit Use	Scope 3		IPCC 5th Assessment 100 Year Values	Employee Commute	242.54	0.0029273	0.0029273	243.40											4.1818×10^{6}	0.058	7×10^{-4}	4×10^{-4}	kg/passenger mile	g/passenger mile	g/passenger mile

A.4 LGO Inventory – Emissions Factor and Activity Data Report (Vehicle Fleet)

Inventory Record	Calculator	Gpc Scope	Factor Profiles	Global Warming Potential	Category	CO2 (MT)	CH4 (MT)	N2O (MT)	CO2e (MT)	Fleet Vehicle VMT	Fossil Energy Equivalent (MMBtu)	Biofuel Energy Equivalent (MMBtu)	CO2 Emissions Factor	CO2 Emissions Factor Units	Biogenic CO2 Emissions Factor	Biogenic CO2 Emissions Factor Units	CH4 Emissions Factor	CH4 Emissions Factor Units	Biofuel CH4 Emissions Factor	Biofuel CH4 Emissions Factor Units	N2O Emissions Factor	N2O Emissions Factor Units	Biofuel N2O Emissions Factor	Biofuel N2O Emissions Factor Units	Energy Equivalent (MMBtu)	CO2 Emissions Factor	Biofuel Energy Equivalent
City of Dallas Off-Road	Emissions from Off Road Vehicles	Scope 1	2019 NCTCOG Emissions Factors	IPCC 5th Assessment 100 Year Values	Vehicle Fleet	5041.0	0.28637	0.12837	5083.1		68155			MT/MMBtu	0.0	MT/MMBtu	4.2017×10^{-6}	MT/MMBtu	0.0	MT/vehicle mile	1.8835×10^{-6}	MT/MMBtu	0.0	MT/vehicle mile	68155	0.073964	0.0

Emissions 2019																											
City of Dallas Gasoline Fleet 2019	Fleet Vehicle Emissions	Scope 1	ERCOT All (ERCT) eGRID 2019 and 2019 NCTCOG Emissions Factors	IPCC 5th Assessment 100 Year Values	Vehicle Fleet	23478	0.88067	0.15207	23543	4.4440 x10^{7}	334124	0.0	0.070268	MT/MMBtu	0.0	MT/MMBtu	1.9817 x10^{-8}	MT/vehicle mile	0.0	MT/vehicle mile	3.4220 x10^{-9}	MT/vehicle mile	0.0	MT/vehicle mile			
City of Dallas Diesel Fleet 2019	Fleet Vehicle Emissions	Scope 1	ERCOT All (ERCT) eGRID 2019 and 2019 NCTCOG Emissions Factors	IPCC 5th Assessment 100 Year Values	Vehicle Fleet	15869	0.12953	0.015493	15876	6.3995 x10^{6}	214545	0.0	0.073964	MT/MMBtu	0.0	MT/MMBtu	2.024 x10^{-8}	MT/vehicle mile	0.0	MT/vehicle mile	2.421 x10^{-9}	MT/vehicle mile	0.0	MT/vehicle mile			
City of Dallas CNG Fleet 2019	Fleet Vehicle Emissions	Scope 1	ERCOT All (ERCT) eGRID 2019 and 2019 NCTCOG Emissions Factors	IPCC 5th Assessment 100 Year Values	Vehicle Fleet	0.0	5.7352	0.43767	276.57	5.8355 x10^{6}	0.0	0.0	0.05306	MT/MMBtu	0.0	MT/MMBtu	9.8280 x10^{-7}	MT/vehicle mile	0.0	MT/vehicle mile	7.5 x10^{-8}	MT/vehicle mile	0.0	MT/vehicle mile			
City of Dallas Bio Diesel Fleet 2019	Fleet Vehicle Emissions	Scope 1	ERCOT All (ERCT) eGRID 2019 and 2019 NCTCOG Emissions Factors	IPCC 5th Assessment 100 Year Values	Vehicle Fleet	11537	0.091890	0.010991	11544	5.6750 x10^{6}	156047	36187	0.073964	MT/MMBtu	0.073803	MT/MMBtu	1.6192 x10^{-8}	MT/vehicle mile	8.3200 x10^{-10}	MT/vehicle mile	1.9368 x10^{-9}	MT/vehicle mile	8.3200 x10^{-10}	MT/vehicle mile			

A.5 LGO Inventory – Emissions Factor and Activity Data Report (Streetlights & Traffic Signals)

Inventory Record	Calculator	Gpc Scope	Factor Profiles	Global Warming Potential	Category	CO2 (MT)	CH4 (MT)	N2O (MT)	CO2e (MT)	Electricity Energy Equivalent (MMBTU)	CO2 Emissions Factor	CO2 Emissions Factor Units	CH4 Emissions Factor	CH4 Emissions Factor Units	N2O Emissions Factor	N2O Emissions Factor Units
2019 Electricity Use for Streetlights	Emissions from Grid Electricity	Scope 2	ERCOT All (ERCT) eGRID 2019	IPCC 5th Assessment 100 Year Values	Street Lights & Traffic Signals	30913	2.0285	0.28470	31045	267773	0.11544	MT/MMBtu	7.5755 x10^{-6}	MT/MMBtu	1.0632 x10^{-6}	MT/MMBtu
2019 Electricity Use for Traffic Signals	Emissions from Grid Electricity	Scope 2	ERCOT All (ERCT) eGRID 2019	IPCC 5th Assessment 100 Year Values	Street Lights & Traffic Signals	1455.1	0.095485	0.013401	1461.4	12605	0.11544	MT/MMBtu	7.5755 x10^{-6}	MT/MMBtu	1.0632 x10^{-6}	MT/MMBtu

A.6 LGO Inventory – Emissions Factor and Activity Data Report (Water & Wastewater Treatment Facilities)

Inventory Record	Calculator	Gpc Scope	Factor Profiles	Global Warming Potential	Category	CO2 (MT)	CH4 (MT)	N2O (MT)	CO2e (MT)	CO2 Emissions Factor	CO2 Emissions Factor Units	CH4 Emissions Factor	CH4 Emissions Factor Units	N2O Emissions Factor	N2O Emissions Factor Units	CO2 Emissions Factor (kg/MMBtu)	CH4 Emissions Factor (kg/MMBtu)	N2O Emissions Factor (kg/MMBtu)	Biogenic CO2 Emissions Factor (kg/MMBtu)	Biofuel CH4 Emissions Factor (kg/MMBtu)	Biofuel N2O Emissions Factor (kg/MMBtu)	Biogenic CO2 Emissions Factor Units
2019 DWU Central Wastewater Treatment Grid Electricity Use	Emissions from Grid Electricity	Scope 2	ERCOT All (ERCT) eGRID 2019	IPCC 5th Assessment 100 Year Values	Water & Wastewater Treatment Facilities	29651	1.9457	0.27308	29778	0.11544	MT/MMBtu	7.5755 x10^{-6}	MT/MMBtu	1.0632 x10^{-6}	MT/MMBtu							
2019 DWU South Side Wastewater Treatment Electricity Use	Emissions from Grid Electricity	Scope 2	ERCOT All (ERCT) eGRID 2019	IPCC 5th Assessment 100 Year Values	Water & Wastewater Treatment Facilities	29560	1.9397	0.27224	29686	0.11544	MT/MMBtu	7.5755 x10^{-6}	MT/MMBtu	1.0632 x10^{-6}	MT/MMBtu							
2019 DWU Bachman WTP Electricity Emissions	Emissions from Grid Electricity	Scope 2	ERCOT All (ERCT) eGRID 2019	IPCC 5th Assessment 100 Year Values	Water & Wastewater Treatment Facilities	13195	0.86587	0.12153	13252	0.11544	MT/MMBtu	7.5755 x10^{-6}	MT/MMBtu	1.0632 x10^{-6}	MT/MMBtu							
2019 DWU East Side WTP Electricity Emissions	Emissions from Grid Electricity	Scope 2	ERCOT All (ERCT) eGRID 2019	IPCC 5th Assessment 100 Year Values	Water & Wastewater Treatment Facilities	17579	1.1535	0.16190	17654	0.11544	MT/MMBtu	7.5755 x10^{-6}	MT/MMBtu	1.0632 x10^{-6}	MT/MMBtu							

2019 DWU Elm Fork WTP Electricity Emissions	Emissions from Grid Electricity	Scope 2	ERCOT All (ERCT) eGRID 2019	IPCC 5th Assessment 100 Year Values	Water & Wastewater Treatment Facilities	27053	1.7752	0.24915	27169	0.11544	MT/MMBtu	7.5755×10^{-6}	MT/MMBtu	1.0632×10^{-6}	MT/MMBtu							
NEW - 2019 DWU Water and Wastewater OTHER Electricity	Emissions from Grid Electricity	Scope 2	ERCOT All (ERCT) eGRID 2019	IPCC 5th Assessment 100 Year Values	Water & Wastewater Treatment Facilities	44801	2.9398	0.41261	44993	0.11544	MT/MMBtu	7.5755×10^{-6}	MT/MMBtu	1.0632×10^{-6}	MT/MMBtu							
2019 DWU Central Wastewater Treatment Natural Gas Emissions	Emissions from Stationary Fuel Combustion	Scope 1		IPCC 5th Assessment 100 Year Values	Water & Wastewater Treatment Facilities	0.17836	1.682×10^{-5}	3.3640×10^{-7}	0.17892							53.02	0.005	1×10^{-4}	0.0	0.0	0.0	
2019 DWU South Side Wastewater Treatment Natural Gas Emissions	Emissions from Stationary Fuel Combustion	Scope 1		IPCC 5th Assessment 100 Year Values	Water & Wastewater Treatment Facilities	0.0	0.0	0.0	0.0							0.0	0.0	0.0	0.0	0.0	0.0	
2019 DWU East Side WTP Natural Gas Emissions	Emissions from Stationary Fuel Combustion	Scope 1		IPCC 5th Assessment 100 Year Values	Water & Wastewater Treatment Facilities	0.0	0.0	0.0	0.0							53.02	0.005	1×10^{-4}	0.0	0.0	0.0	
2019 DWU Elm Fork WTP Natural Gas Emissions	Emissions from Stationary Fuel Combustion	Scope 1		IPCC 5th Assessment 100 Year Values	Water & Wastewater Treatment Facilities	0.56233	5.3030×10^{-5}	1.0606×10^{-6}	0.56410							53.02	0.005	1×10^{-4}	0.0	0.0	0.0	
2019 DWU Bachman WTP Natural Gas Emissions	Emissions from Stationary Fuel Combustion	Scope 1		IPCC 5th Assessment 100 Year Values	Water & Wastewater Treatment Facilities	1.1221	1.0582×10^{-4}	2.1163×10^{-6}	1.1256							53.02	0.005	1×10^{-4}	0.0	0.0	0.0	
City of Dallas 2019 Digester Emissions SSWTP	Emissions from the Combustion of Digester Gas	Scope 1	ERCOT All (ERCT) eGRID 2019	IPCC 5th Assessment 100 Year Values	Water & Wastewater Treatment Facilities		9.0465×10^{-4}	1.7810×10^{-4}	0.072528				kg/MMBtu		kg/MMBtu		0.0032	6.3×10^{-4}	52.07			kg/MMBtu

A.7 LGO Inventory – Emissions Factor and Activity Data Report (Solid Waste Facilities)

Inventory Record	Calculator	Gpc Scope	GPC Ref Number	Factor Profiles	Global Warming Potential	Category	CO2 (MT)	CH4 (MT)	N2O (MT)	CO2e (MT)	Waste Generated (wet tons)	Mixed MSW LFG Capture Rate (%)	Newspaper LFG Capture Rate (%)	Office Paper LFG Capture Rate (%)	Corrugated Containers LFG Capture Rate (%)	Magazines/Third Class Mail LFG Capture Rate (%)	Food Scraps LFG Capture Rate (%)	Grass LFG Capture Rate (%)	Leaves LFG Capture Rate (%)	Branches LFG Capture Rate (%)	Dimensional Lumber LFG Capture Rate (%)	Oxidation Rate	Electricity Energy Equivalent (MMBtu)	CO2 Emissions Factor	CO2 Emissions Factor Units	CH4 Emissions Factor	CH4 Emissions Factor Units	N2O Emissions Factor	N2O Emissions Factor Units	Annual Landfill Gas Flared (scf / year)
McCommas Bluff Landfill Flaring Emissions 2019	Emissions from Flaring of Landfill Gas	Scope 1			IPCC 5th Assessment 100 Year Values	Solid Waste Facilities		143.70		4023.6																1.8735×10^{-7}	MT/scf			7.6703×10^{8}
Deepwood s Landfill Gas Flaring Emissions 2019	Emissions from Flaring of Landfill Gas	Scope 1			IPCC 5th Assessment 100 Year Values	Solid Waste Facilities		0.048444		1.3564																4.2434×10^{-8}	MT/scf			1.1416×10^{6}
2019 City of Dallas Sanitation Services Electricity Use	Emissions from Grid Electricity	Scope 2		ERCOT All (ERCT) eGRID 2019	IPCC 5th Assessment 100 Year Values	Solid Waste Facilities	618.31	0.040574	0.0056946	620.96													5355.9	0.11544	MT/MMBtu	7.5755×10^{-6}	MT/MMBtu	1.0632×10^{-6}	MT/MMBtu	
2019 City of Dallas Solid Waste Gov Emissions	Waste Generation	Scope 1		2019 EPA Solid Waste Characterization	IPCC 5th Assessment 100 Year Values	Solid Waste Facilities		18945		530453	1.9526×10^{6}	60.0	59.0	59.0	56.0	54.0	52.0	41.0	49.0	54.0	58.0	0.1								

A.8 LGO Inventory – Emissions Factor and Activity Data Report (Process & Fugitive Emissions)

Inventory Record	Calculator	Gpc Scope	GPC Ref Number	Global Warming Potential	Category	CO2 (MT)	CH4 (MT)	N2O (MT)	CO2e (MT)	Natural Gas Used (MMBtu)	CH4 Emissions Factor	CH4 Emissions Factor Units	CO2 Emissions Factor	CO2 Emissions Factor Units
City of Dallas 2019 Natural Gas Fugitive Emissions	Fugitive Emissions from Natural Gas Distribution	Scope 3	I.8.1	IPCC 5th Assessment 100 Year Values	Process & Fugitive Emissions	0.13794	12.884		360.89	155851	8.2668×10^{-5}	MT CH4/MMBtu natural gas used	8.8510×10^{-7}	MT CO2/MMBtu natural gas used