

City of Carmel

DRAFT 2018 Community-Wide Greenhouse Gas Inventory Report



DRAFT CITY OF CARMEL 2018 COMMUNITY-WIDE GREENHOUSE GAS (GHG) INVENTORY

PREPARED FOR:

The City of Carmel-By-The-Sea
Monte Verde Street, Carmel-By-The-Sea, CA 93923
Phone: 831.620.2000
Fax: 831.620.2004

PREPARED BY:

Lawrence Garber, Sustainability Program Graduate Student Intern
The Association of Monterey Bay Area Governments
24580 Silver Cloud Court, Monterey, CA 93940
Phone: 831.883.3750
Fax: 831.883.3755

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Executive Summary

The City of Carmel’s 2018 Community-wide GHG Inventory totals 23,883 metric tons of carbon dioxide-equivalent (CO₂e). This represents a 42 percent reduction from the 2005 Baseline Community-wide GHG Inventory. This decrease is the result of emission reductions across most sectors. It is important to note that while analysis of GHG inventory data can identify the amount of change this type of analysis does not specifically identify the factors that contribute to the changes and their level of contribution. Certain general factors that are able to be identified are noted below, but it should be understood that these are only general contributing factors and not the sole factors responsible for the total GHG changes. Figure 1 shows the 2005 to 2018 GHG emissions by sector.

In the residential sector, emission reductions of 30 percent occurred from 2005 to 2018. This can be attributed, in part, to the specific composition of electricity delivered by Pacific Gas & Electric Company (PG&E) and Central Coast Community Energy (3CE) to include both more renewable energy and energy generated from large hydro operations in their energy mix during this time period. The transportation sector emissions decreased by 50 percent from 2005 to 2018. During this period there was a decrease in Vehicle Miles Travelled (VMT) on local roads in Carmel. In the solid waste sector, a decrease in the actual tonnage of waste sent to landfills caused a 46 percent decrease in emissions. In the commercial and industrial sector there was a 43 percent reduction in emissions from 2005 to 2018. This can be attributed, in part, to decreases in electricity and natural gas usage, as well as to policy changes at the state level regarding energy use data access.

Figure 1:

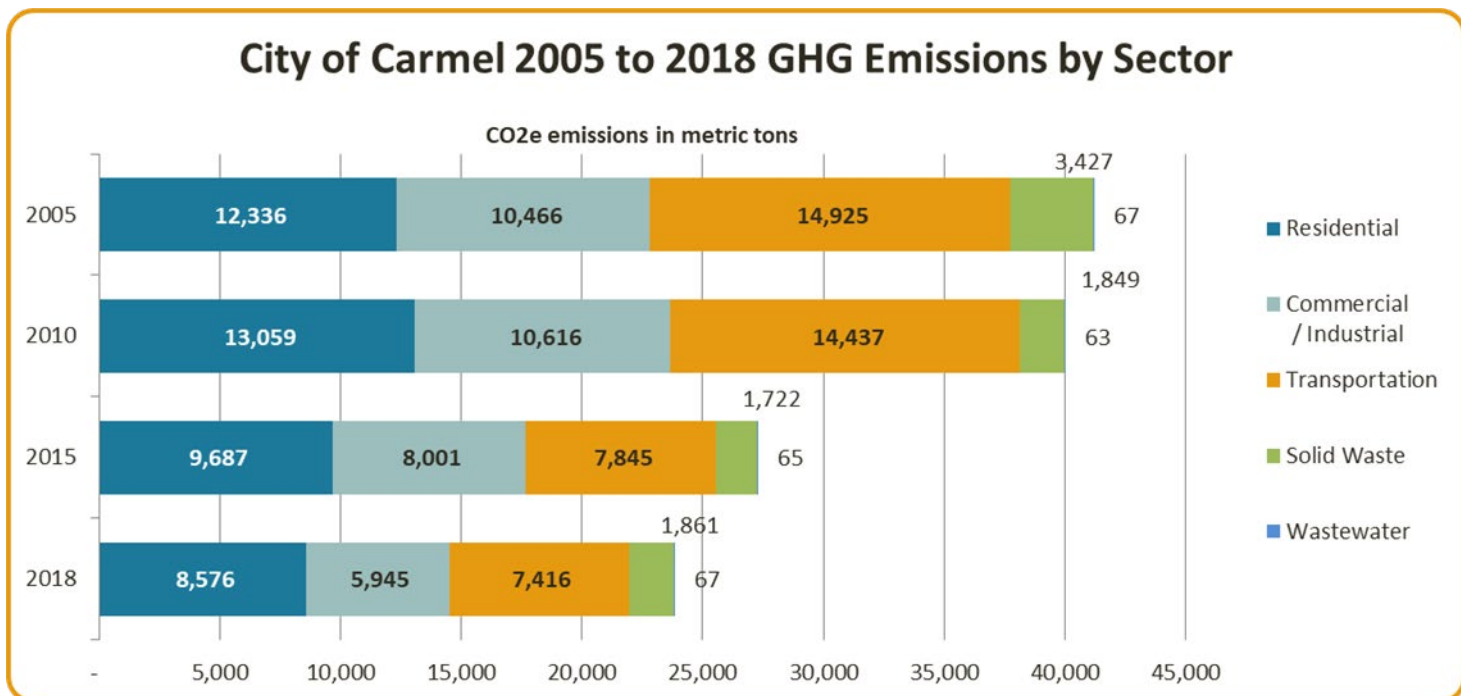


Table 1 summarizes the results of the 2005 Baseline Community-wide GHG Inventory, 2010 Community-wide GHG Inventory, 2015 Community-wide GHG Inventory and 2018 Community-wide GHG Inventory, broken out by sectors. The percentage change from the 2005 inventory to the 2018 inventory is a reduction of 42 percent.

Table 1:

Community CO2e Emissions by Sector	Residential	Commercial / Industrial	Transportation	Solid Waste	Wastewater	Total
2005	12,336	10,466	14,925	3,427	67	41,221
2010	13,059	10,616	14,437	1,849	63	40,024
2015	9,687	8,001	7,845	1,722	65	27,320
2018	8,576	5,945	7,416	1,861	67	23,883
% change 2005- 2018	-30%	-43%	-50%	-46%	1%	-42%

2018 Community-wide GHG Inventory Report

Introduction

A community-wide GHG emissions inventory is an accounting of the GHG emissions that occur as the result of a community's activities in a given year. GHG inventories can be used to determine the largest sources of GHG emissions from within a community, to set GHG emission reduction targets and to better understand how GHG emissions evolve across inventory years. The City of Carmel completed its 2005 Baseline Community-wide GHG Inventory as part of an Association of Monterey Bay Area Governments (AMBAG) regional effort to develop the 2005 baseline GHG inventory reports for all of the AMBAG jurisdictions. Subsequently, the 2010 and 2015 GHG inventories for all AMBAG jurisdictions were also completed by AMBAG. This year, AMBAG received funding from 3CE to complete 2018 Community-wide GHG inventories for all 3CE member jurisdictions which received 3CE electricity generation service as of January 1st 2020.

The Carmel 2005 Baseline, 2010, 2015 and 2018 Community Wide GHG inventories have been completed by following the US *Community Protocol for Accounting and Reporting of Greenhouse Gas Emissions* as per the California Air Resources Board (CARB) 2017 Scoping Plan. The ICLEI ClearPath tool suite was used to perform the emissions calculations for all inventories in accordance with guidance from the Governor's office of planning and research. The methodology used in this 2018 Community-wide GHG Inventory is included in Appendix A.

California's Climate Change mandates

The State of California has adopted bold goals to reduce GHG emissions and address climate change. In order to meet these goals, the state supports local action on climate change by providing guidance for local jurisdictions to develop GHG emissions inventories and climate action plans. Local jurisdictions are required in many instances, and incentivized in others, to address greenhouse gas emissions under the California Environmental Quality Act (CEQA), AB 32 (California Global Warming Solutions Act of 2006), SB 375 (Sustainable Communities and Climate Protection Act of 2008), SB 32 (California Global Warming Solutions Act of 2006: emissions limit, 2016) and various California Executive orders, regulations, and programs.

A part of the effort to address climate Change the California Legislature has laid out clear GHG emissions reduction targets. AB 32 established a target of reducing GHG emissions back to 1990 levels by 2020, which corresponds to a 15% reduction from 2005 level. SB 32 set a GHG emissions reduction target of 40 percent below 1990 levels by 2030. Finally, Executive Order B-55-18, issued in 2018 by Jerry Brown, established a goal of reaching carbon neutrality by 2045 and maintaining negative emissions in subsequent years.

2018 Community-wide GHG Emissions by Sector

Many local governments find a sector-based analysis most relevant to policymaking and project management, as it assists in formulating sector-specific reduction measures and climate action plan components. This inventory evaluates community emissions from the following sectors:

- Residential
- Commercial and Industrial
- Transportation
- Solid Waste
- Wastewater

The community of Carmel emitted 23,883 metric tons of CO₂e in 2018. As visible in Figure 2 and Table 2, 31.1 percent of emissions are from the transportation sector, and were generated by fuel use from travel on local roads. Emissions from electricity and natural gas usage in the residential sector generated 35.9 percent of emissions, while electricity and natural gas consumption in the commercial sector generated 24.9 percent of emissions. The disposal of waste generated by Carmel residents and businesses caused 7.8 percent of total emissions. The remaining 0.3 percent of emissions was generated from wastewater treatment processes.

Figure 2:

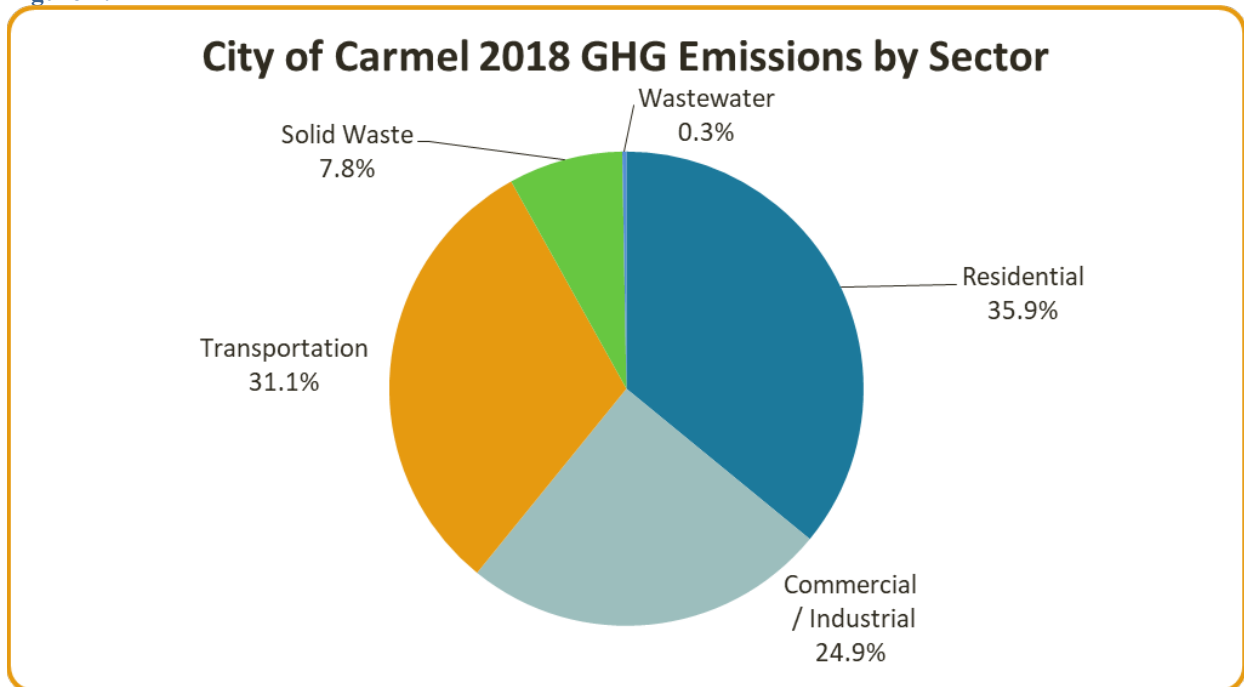


Table 2:

2018 Community Emissions by Sector	Residential	Commercial / Industrial	Transportation	Solid Waste	Wastewater	Total
CO ₂ e (metric tons)	8,576	5,945	7,416	1,861	67	23,883
% of Total CO ₂ e	35.9%	24.9%	31.1%	7.8%	0.3%	100%

Built Environment: Residential, Commercial and Industrial Sector

Carmel’s built environment generated 60.8 percent of community-wide GHG emissions in 2018 or 14,521 metric tons of CO₂e. Emissions were calculated using 2018 electricity and natural gas consumption data provided by PG&E and 3CE.

The residential sector accounted for 8,576 metric tons of CO₂e and only includes emissions arising from the consumption of energy in residential buildings. The combined commercial and industrial sectors accounted for 5,945 metric tons of CO₂e and include emissions arising from the consumption of energy in both commercial and industrial buildings. PG&E was not able to provide a breakdown between commercial and industrial electricity and natural gas consumption due to the California Public Utilities Commission’s (CPUC) 15/15 rule¹.

Figure 3 and Table 3 show the breakdown of natural gas to electricity emissions in Carmel’s built environment. The residential sector natural gas usage comprised 54 percent of emissions while the commercial and industrial sector natural gas comprised 37 percent of emissions.

Figure 3:

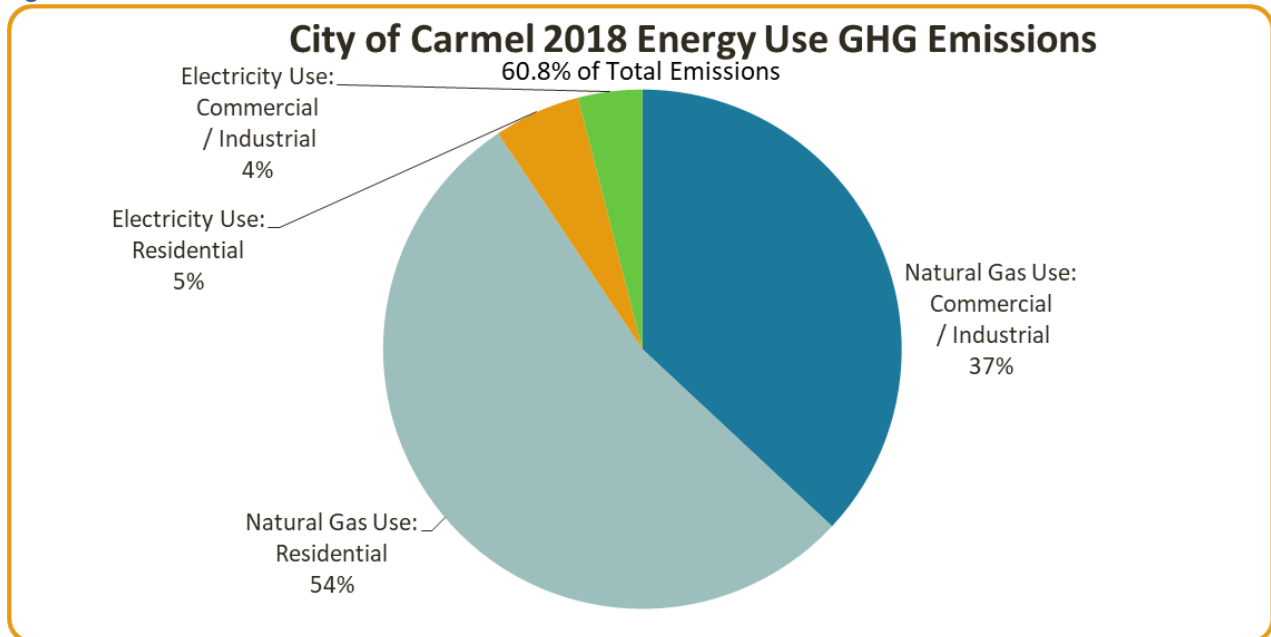


Table 3:

Natural Gas Use Emissions (CO ₂ e):		Electricity Use: Emissions (CO ₂ e):	
Commercial/Industrial	Residential	Commercial/Industrial	Residential
5,364	7,792	581	784

¹ The 15/15 Rule was adopted by the CPUC in the Direct Access Proceeding (CPUC Decision 97-10-031) to protect customer confidentiality. If the number of customers in the compiled data is below 15, or if a single customer’s load is more than 15 percent of the total data, categories must be combined before the information is released.

Transportation Sector

As mentioned previously, Carmel's transportation sector generated 31.1 percent of community-wide GHG emissions in 2018, or 7,416 metric tons of CO₂e. The transportation sector analysis includes emissions from all vehicle use on local roads within Carmel's jurisdictional boundaries. Emissions from air travel of Carmel's residents were not included in the transportation sector analysis.

Solid Waste Sector

As mentioned previously, the solid waste sector accounted for 7.8 percent of community-wide GHG emissions in 2018 or 1,861 metric tons of CO₂e. Emissions from the solid waste sector are an estimate of methane generation from the anaerobic decomposition of organic wastes (such as paper, food scraps, plant debris, wood, etc.) that are deposited in a landfill. Transportation emissions generated from the collection, transfer and disposal of solid waste are included in transportation sector GHG emissions.

Wastewater Sector

As mentioned previously, the wastewater sector accounted for 0.3 percent of community-wide GHG emissions in 2018 or 67 metric tons of CO₂e. This sector accounts for the operation of wastewater treatment facilities used to treat Carmel's wastewater. Emissions from the treatment of wastewater through septic tank systems are not included in this inventory.

Conclusion

The City of Carmel has taken steps toward reducing its impact on the environment by quantifying its 2005 baseline community-wide GHG emissions and regularly updating the inventory in 2010, 2015 and 2018. The City of Carmel has already met the 2020 AB 32 GHG emissions reduction targets. This inventory will now allow the city to look ahead and chart a path towards meeting the SB 32 2030 GHG emissions reduction target as well as the 2045 carbon neutrality goal.

Using a comprehensive approach to reduce community-wide greenhouse gas emissions, this inventory provides an important foundation for the City of Carmel to update its Climate Action Plan. Specifically, this inventory serves to:

- Establish a guideline for setting future emissions reductions targets.
- Identify the largest sources of communitywide emissions.
- Track changes to community emissions over time.
- Evaluate progress towards emission reduction goals.
- Support the development, implementation and evaluation of strategies to reduce emissions

Appendix A: Inventory Methodology by Sector

This appendix, describes in detail the data sources and processes used to calculate emissions in this community-wide GHG inventory.

Overview of Inventory Contents and Approach

The community inventory describes emissions of the major greenhouse gases from the residential, commercial and industrial, transportation, solid waste, and wastewater sectors. Emissions are calculated by multiplying activity data—such as kilowatt hours or VMT —by emissions factors, which provide the quantity of emissions per unit of activity. Activity data is typically available from electric and gas utilities, planning and transportation agencies, and air quality regulatory agencies. Emissions factors are drawn from a variety of sources, including PG&E, and the Community protocol.

Built Environment Methodology: Residential, Commercial and Industrial Sectors

Data on electricity and natural gas sold by PG&E to customers as well as data on electricity sold by 3CE to customers was provided by PG&E and 3CE. Bundled PG&E electricity emissions were calculated in ICLEI's ClearPath software using PG&E-specific emissions factors provided by PG&E as well as 3CE specific emissions factors provided by 3CE. All natural gas emissions were calculated in ClearPath with default emissions factors from the community protocol.

Transportation Sector Methodology

On-road transportation emissions were derived from local jurisdiction vehicle miles traveled (VMT) data and regional vehicle and travel characteristics. Observed VMT on non-state facilities (referred to in the inventory as “local roads”) was obtained from Caltrans' Highway Performance Monitoring System reports. The EMFAC 2017 model developed by CARB was used to calculate emissions from these VMT figures. EMFAC defaults for each county include regionally-specific information on the mix of vehicle classes and model years, as well as ambient conditions and travel speeds that determine fuel efficiency. The model estimates carbon dioxide, methane, and nitrous oxide emissions from these factors as well as from inputted vehicle activity data.

For purposes of this inventory, AMBAG Sustainability Program staff ran the model for each of AMBAG's three counties (Monterey, Santa Cruz, and San Benito), leaving all CARB default values in place (including VMT). Staff then used the EMFAC output to calculate local fleet mix and emissions factors for each vehicle type. Different emissions factors were calculated for CO₂, CH₄ and N₂O. The total VMT was then distributed among the various EMFAC-defined vehicle types according to percentages derived from the EMFAC output. The appropriate emissions factor for each vehicle type was then applied for these greenhouse gases. Finally, global warming potentials were factored in and the total emissions from each vehicle type were summed to reach the total CO₂e emissions from the transportation sector.

Solid Waste Sector Methodology

Emissions from solid waste were captured by estimating future emissions from decomposition of waste generated in the inventory year (“community-generated solid waste”). Community-generated solid waste emissions were calculated in ClearPath using waste disposal data obtained from the California Department of Resources Recycling and Recovery (CalRecycle) Disposal Reporting System, which records tonnages of municipal solid waste and alternative daily cover by local jurisdiction.

As some types of waste (e.g., paper, plant debris, food scraps, etc.) generate methane within the anaerobic environment of a landfill and others do not (e.g., metal, glass, etc.), it is important to characterize the various components of the waste stream. Waste characterization for community-generated solid waste was estimated using the CalRecycle 2003, 2008 and 2014 California statewide waste characterization study.² Most landfills capture methane emissions either for energy generation or for flaring. The EPA estimates that 60 percent to 80 percent³ of total methane emissions are recovered at the landfills to which the City of Carmel sends its waste. Following the recommendation of the community protocol, AMBAG adopted a 75 percent methane recovery factor and a 10% oxidation rate.

Recycling and composting programs are reflected in the emissions calculations as reduced total tonnage of waste going to the landfills. The model, however, does not capture the associated emissions reductions in “upstream” energy use from recycling as part of the inventory.⁴ This is in-line with the “end-user” or “tailpipe” approach taken throughout the development of this inventory. It is important to note that recycling and composting programs can have a significant impact on greenhouse gas emissions when a full lifecycle approach is taken. Manufacturing products with recycled materials avoids emissions from the energy that would have been used during extraction, transportation and processing of virgin material.

Wastewater Sector Methodology

Wastewater coming from homes and businesses is rich in organic matter and has a high concentration of nitrogen and carbon (along with other organic elements). As wastewater is collected, treated, and discharged, chemical processes can lead to the creation and emission of two greenhouse gases: methane and nitrous oxide. Emissions from wastewater treatment were calculated by first assessing the treatment steps used to transform Carmel’s wastewater. Staff then used the ClearPath tool and a population-based method to estimate treatment process emissions, in accordance with the methodology delineated in the US Community protocol.

² CalRecycle Waste Characterization Studies available at <https://www2.calrecycle.ca.gov/WasteCharacterization/Study>

³ AP 42, section 2.4 Municipal Solid Waste, 2.4-6, <http://www.epa.gov/ttn/chief/ap42/index.html>

⁴ “Upstream” emissions include emissions that may not occur in your jurisdiction resulting from manufacturing or harvesting virgin materials and transportation of them.

Appendix B: Glossary

This Appendix provides a brief description of technical terms used in the inventory.

Activity Data:

Data on the magnitude of a human activity resulting in emissions or removals taking place during a given period of time. Data on energy use, metal production, land areas, management systems, lime and fertilizer use and solid waste production are examples of activity data.

Baseline year:

A specific year against which emissions are tracked over time. For this inventory, the baseline year is 2005.

Boundaries:

GHG accounting and reporting boundaries can have several dimensions, i.e., jurisdictional, operational or geopolitical. The inventory boundary determines which emissions are accounted and reported.

Carbon Dioxide Equivalent:

A metric measure used to compare the emissions from various greenhouse gases based upon their global warming potential (GWP). Carbon dioxide equivalents are commonly expressed as metric tons of carbon dioxide equivalents (MTCO₂e). The carbon dioxide equivalent for a gas is derived by multiplying the tons of the gas by the associated GWP. See appendix A.

Community-wide GHG Inventory:

A calculation of GHG emissions generated as a result of activities within a community.

Consistency:

Consistency means that an inventory should be internally consistent in all its elements over a period of years. An inventory is consistent if the same methodologies are used for the base and all subsequent years and if consistent data sets are used to estimate emissions or removals from sources or sinks.

Direct GHG emissions:

Emissions from sources that occur within a jurisdiction's operational or geopolitical boundaries are called direct GHG emissions.

Emissions Factor:

A unique value for scaling emissions to activity data in terms of a standard rate of emissions per unit of activity (e.g., grams of carbon dioxide emitted per kWh of electricity use or per therms of natural gas use).

Fugitive emissions:

Emissions that are not physically controlled but result from the intentional or unintentional releases of GHGs. They commonly arise from the production, processing transmission storage and use of fuels and other chemicals, often through joints, seals, packing, gaskets, etc.

Global Warming Potential:

A measure of the total energy that a gas absorbs over a particular period of time (usually 100 years), compared to carbon dioxide.

Greenhouse gases (GHGs):

Gases which when released in the atmosphere have a warming impact. The GHG's considered in this inventory are carbon dioxide (CO₂), methane (CH₄), nitrous oxide (N₂O).

Indirect emissions:

Emissions that are a consequence of activities inside a jurisdiction, but occur from sources outside of the inventory boundaries, e.g., as a result of the import of electricity, heat, or steam.

Intergovernmental Panel on Climate Change:

The IPCC was established jointly by the United Nations Environment Programme and the World Meteorological Organization in 1988. The purpose of the IPCC is to assess information in the scientific and technical literature related to all significant components of the issue of climate change. Leading experts on climate change and environmental, social, and economic sciences have helped the IPCC to prepare periodic assessments of the scientific underpinnings for understanding global climate change and its consequences. With its capacity for reporting on climate change, its consequences, and the viability of adaptation and mitigation measures, the IPCC is also looked to as the official advisory body to the world's governments on the state of the science of the climate change issue.

Methane (CH₄):

A hydrocarbon that is a greenhouse gas with a global warming potential estimated at 25 times that of carbon dioxide (CO₂). Methane is produced through anaerobic (without oxygen) decomposition of waste in landfills, flooded rice fields, animal digestion, decomposition of animal wastes, production and distribution of natural gas and petroleum, coal production, and incomplete fossil fuel combustion. The GWP is from the IPCC's Fourth Assessment Report (AR4).

Nitrous Oxide (N₂O):

A powerful greenhouse gas with a global warming potential of 298 times that of carbon dioxide (CO₂). Major sources of nitrous oxide include soil cultivation practices, especially the use of commercial and organic fertilizers, manure management, fossil fuel combustion, nitric acid production, and biomass burning. The GWP is from the IPCC's Fourth Assessment Report (AR4).

Process emissions:

Emissions from industrial processes involving chemical transformations other than combustion.