Prepared on 7/24/2025 by:

SOUTH BAY CITIES
COUNCIL OF GOVERNMENTS

# GREENHOUSE GAS EMISSIONS INVENTORY UPDATE 2019 & 2020

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# Section 1: Introduction

## 1.1 – Inventory Purpose and Description

In 2006, Assembly Bill 32 was signed into state law to address rising greenhouse gas (GHG) levels in the atmosphere. The primary goal of the legislation was to encourage local jurisdictions to monitor their emissions and develop actionable reduction targets. Since then, the state of California has passed Assembly Bill 1279, which requires the state achieve carbon neutrality by 2045, as well as reduce statewide GHG emissions by 85% compared to 1990 levels. In response to state action, this report presents six years of historic GHG emissions inventories for the City of Hermosa Beach, spanning 15 years, offering insights into various emission sources sectors and their variations over time. Inventory years include 2005, 2007, 2010, 2012, 2019, and 2020. The 2005 inventory year serves as a baseline, guiding the emission reduction targets set in the City of Hermosa Beach's General Plan "Plan Hermosa" which also serves as the City's Climate Action Plan (CAP). Plan Hermosa serves as a guide in setting policies and related actions to reduce GHG emissions. Emissions for all inventories are reported in metric tons of carbon dioxide equivalents (MT $CO_2e$) to create a standard to measure and compare the impacts of different greenhouse gases. This report provides an update of emissions for the community, including municipal operations, for the years 2019 and 2020, comparing pre- and post-2020 COVID-19 pandemic operations. Due to the advent of COVID-19, the 2019 inventory year is a more accurate estimate of normal operations and should serve as the basis for future emission targets.

## 1.2 – Executive Summary and Key Findings

This section summarizes the City of Hermosa Beach's community emissions inventories for 2019 and 2020. The methodology and a detailed analysis are provided in subsequent sections of this report. Note that the municipal emissions are a subset of the community inventory. Some municipal sector data has been provided separately so that the city has a better understanding of their municipal operations' contributions to GHG emissions. This information can be used to develop specific strategies for municipal operations.

The baseline year for comparing inventories and assessing progress is 2005. Emissions for the 2005 baseline were 137,160 MT $CO_2e$.

Emission Reduction Targets per City of Hermosa Beach's adopted Climate Action Plan are:

- **2020:** 15% reduction from 2005 levels
- **2035:** 49% reduction from 2005 levels

**Key Findings**:

- **Total Emissions**: In Hermosa Beach, the total GHG emissions amounted to 122,434 MT $CO_2e$ in 2019 and 94,896 MT $CO_2e$ in 2020.

- **Overall Trends and Climate Action Plan Goals**: Between 2005 and 2020, a span of 15 years, GHG emissions decreased by approximately 31%. Based on 2020 emissions levels, Hermosa Beach has successfully met the 2020 adopted reduction goal and is on track for meeting the 2035 goal. As stated in Section 1.1, the 2020 inventory is not the best estimate of normal operations. Hermosa Beach emissions also indicate a decrease of 11% in 2019 – within 6,000 MT CO2e of their adopted target.

- **State Goals:** Importantly, emission targets at the State level have increased since the adoption of the city's CAP with the addition of new legislation, specifically AB 1279. The new legislation sets a goal for California to reduce emissions by 85% from 1990 levels by 2045. As the city looks to build on GHG reduction successes, new State targets should be considered.

- **Emissions by Year:**
    - In 2020, during the COVID-19 pandemic, community emissions decreased an additional 22.49% compared to 2019.
    - Additional declines in 2020 were also attributed to reduced vehicle trips.
    - The decrease of emissions in both 2019 and 2020 are largely driven by an increase in renewable electricity adoption, as well as a decline in natural gas consumption. Between 2005 and 2019 renewable energy use increased by 18.1%.
    - The introduction of Cap and Trade in 2012 has diverted large industry emitters to be regulated by the California Air Resources Board (CARB). As such, more significant reductions in the commercial sector have been observed.
- **Emissions by Sector** (MT $CO_2e$): The community emissions sectors considered in this inventory include Transportation & Mobile Sources, Commercial/Industrial Energy, Solid Waste, Residential Energy, Wastewater, and Fugitive.
    - In 2019 and 2020, Transportation & Mobile Sources made up the largest portion of emissions (68% and 58% respectively) among all sectors, with the second greatest portion being Residential Energy (20% and 28% respectively).
    - Commercial/industrial energy represented 9% of total emissions in 2019 and represented 11% of total emissions in 2020.
    - Solid Waste, Fugitive, and Wastewater sectors maintained similar percentages of total emissions across 2019 and 2020 (around 2%, 0.6%, and 0.06%, respectively).

**Observations and Analysis:**

- Based on the 2019 inventory findings, the City of Hermosa Beach is on track to achieve its 2020 Climate Action Plan goal and was approximately 52,000 MT $CO_2e$ short of its 2035 CAP emissions target.
- Reductions across Residential and Commercial/Industrial sectors are driven in part by an increase in renewable electricity use (18.1%) and energy efficiency -18.0% electricity use and -7.1% natural gas use). In addition, the implementation of Cap & Trade in 2012 diverted a large portion of commercial emissions to state oversight through the California Air Resources Board (CARB).
- Between 2005 and 2019 there was a 12% increase in transportation emissions. Between 2019 and 2020 there was a 26% decrease in transportation emissions. This significant drop is attributable to the reduced vehicle trips that occurred during the COVID-19 lockdown.

# Section 2: Inventory Overview

## 2.1 – Protocols and Methodologies

The emissions inventory for the City of Hermosa Beach was completed following the U.S. Community Protocol for Accounting and Reporting of Greenhouse Gas Emissions (USCP). The process included collecting available data, conducting calculations, and preparing analysis in the ICLEI ClearPath Tool. ClearPath is an industry-standard online software for completing GHG inventories, forecasts, climate action plans, and monitoring at the community-wide or government-operations scales. GHG inventories of both community-wide and government-operations are included in this report.

It is important to note that over time, emission inventory protocols and standards develop and change as the climate science community finds more effective ways of capturing data. As such, methodologies may change to reflect more advanced and accurate reporting methods. Updating an inventory may result in changes to the way each sector is collected and how it contributes to the overall inventory. For older inventory years, the fugitive sector was not included as the data did not exist. GHG emissions are influenced by a variety of factors, including some that are beyond the city's control. These include weather patterns, shifts in demographics, economic activity, and federal and state policies. In this inventory, there is a change in how community vehicle transportation data was collected, which is different from previous inventory years. The data was collected based on travel information, resulting in a more accurate accounting of emissions. In addition, per USCP recommendations, a new Fugitive emission sector was included, accounting for the emissions associated with gas leaks in the local natural gas distribution system.

## 2.2 – Emissions Sectors and Sources

GHG emitters with similar characteristics are categorized into larger groups known as sectors. Different sectors contribute to GHG emissions in unique ways. By breaking down emissions into sectors such as transportation, energy, industry, agriculture, and waste, analysts can better understand the specific sources and processes responsible for emissions. Depending on the operations being examined, sectors can vary. At the community scale, sectors include Energy (Residential, Commercial, and Industrial), Transportation, Solid Waste, and others. In contrast, municipal sectors include Buildings & Facilities, Street Lights & Traffic Signals, Vehicle Fleet, and Employee Commute, among others.

It is important to note that municipal operations are included in the community-scale emissions report. Since the City has more direct control over municipal operations, examining municipal performance as a subset of the community can help evaluate the effectiveness of local governments in achieving their outlined goals. The following subsections provide information on the sectors used in the community inventory and highlights what is included in the municipal emissions. This section also includes the data sources and methodologies employed.

**Community Sectors**

1. **Building Energy** is divided into two sectors:
    a. Commercial/Industrial Energy includes emissions from electricity and natural gas consumption in non-residential buildings and facilities (including energy use related to water supply) in the city.

   b. Residential Energy includes emissions from electricity and natural gas consumption in residential buildings in the city.

2. **Transportation and Mobile Sources** includes emissions from vehicle fuel use in trips wholly within the city (in-boundary) and trips that either originate or end in the city (cross-boundary). Emissions from in-boundary trips are fully accounted for in the inventory, whereas only half of the emissions from cross-boundary trips are accounted for. Trips that pass through the city are not accounted for in the inventory because the city has little or no control of these emissions. As a result, this methodology reflects only trips or parts of trips within city borders that the city can affect.

   This sector also includes transit vehicle miles traveled (VMT) from the Southern California Association of Governments' Regional Travel Demand Model, which uses the latest modeling data from their 2020 Regional Transportation Plan/Sustainable Communities Strategy and 2016 as their base year. After extrapolation by population to each inventory year, these transit VMT are used to estimate emissions.

3. **Solid Waste** was estimated using data provided by the Los Angeles Regional Agency (LARA). This data was broken down and categorized into solid waste streams, based on their emissions characteristics. Using emissions factors provided by CalRecycle for each of the respective waste streams, the emissions were then estimated.

4. **Wastewater** includes emissions from treating wastewater generated in the community.

5. **Fugitive** emissions account for leakage in the local natural gas distribution system. The calculation is based on the total quantity of natural gas consumed and a leakage rate obtained from the Environmental Defense Fund (EDF) User Guide for Natural Gas Leakage Rate Modeling Tool.

**Community Sector Exclusions and Methodological Notes**

1. **Cap-and-Trade Emissions:** It is important to note that emissions covered under Cap-and-Trade systems are not included in this inventory. Cap and Trade includes electricity generators and large industrial facilities emitting 25,000 MT $CO_2e$ or more annually. These industries are regulated and overseen by the California Air Resources Board. The emissions produced by these facilities are accounted for and reduced or offset under the Cap-and-Trade program.
2. **Transportation and Mobile Source:** For 2019 and 2020, off-road sector emissions were excluded. Off-road emissions include emissions from operating equipment for construction, commercial, light industrial and agricultural activities; lawn and garden equipment; and recreational vehicles such as all-terrain vehicles. Emissions from the off-road sector are included in this report under the Transportation and Mobile Source sector for the years 2005, 2007, 2010, and 2012. Off-road sector emissions contributed to less than 1% of Hermosa Beach's community inventory for those respective years.
3. **Water:** For 2019 and 2020, water emissions were integrated into the commercial sector. This approach avoids double counting, as Southern California Edison (SCE) and SoCalGas aggregate the water pumping activity data within this sector. Additionally, this categorization is in-line with recommendations from ICLEI. It should be noted this is a change in methodology from previous

inventories. For 2005, 2007, 2010, and 2012, emissions from the water sector were disaggregated from the energy sector and reported separately.

4. **Solid Waste:** For 2019 and 2020, emissions resulting from alternative daily cover (ADC) were excluded. ADC is green waste (grass, leaves, and branches) that is used to cover landfill emissions. In past inventories, ADC comprised less than 1% of Hermosa Beach's community inventory.
5. **Fugitive** emissions were not previously accounted for in the past inventories due to changes in reporting methods. These emissions attribute a small percentage to the overall GHG emissions (0.55% in 2019 and 0.67% in 2020).

**Municipal Sectors**

**Municipal Energy** activity was collected from the ENERGY STAR Portfolio Manager that is populated with energy use by utility meter. The emissions were calculated in the same way as community building energy and are further broken down into three sectors:

1. **Building & Facilities** include energy use by the government, including electricity and natural gas.
2. **City-Owned Outdoor Lights** include electricity for streetlights on fixtures owned by the city, traffic control signals, and outdoor lighting.
3. **Water Pumping & Irrigation** includes electricity and natural gas for water pumping and irrigation.

**Municipal Sector Exclusions and Methodological Notes**

While all emissions are included in the community inventory, emissions from four Municipal Sectors were excluded from the municipal inventory. To have a complete municipal inventory, these sectors should be included:

1. **Municipal Vehicle Fleet & Equipment** activity includes emissions from vehicles owned or operated by the city or contracted by the city for services, such as street cleaning. It also includes equipment, such as mowers and chippers.
2. **Employee Commute** includes emissions from fuel use in vehicle trips by municipal employees commuting to and from work in the city.
3. **Solid Waste** includes emissions from waste generated by municipal employees or at municipally owned facilities.
4. **Water Pumping & Irrigation (2020)** includes electricity and natural gas for water pumping and irrigation.

# Section 3: Data and Analysis

## 3.1 – Community Emissions

The community inventory includes the GHG emissions that result from activities within city boundaries. The City of Hermosa Beach's community GHG emissions amounted to 122,434 MT $CO_2e$ in 2019 and 94,896 MT $CO_2e$ in 2020 (Table 1). This represents a 10.74% and 30.81% reduction in GHG emissions from the City's 2005 baseline, respectively. Hermosa Beach has surpassed its 2020 emissions reduction goal, and it is on track to meet its 2035 goal.

**Table 1.** *Hermosa Beach Historical Community GHG Emissions in MT $CO_2e$*

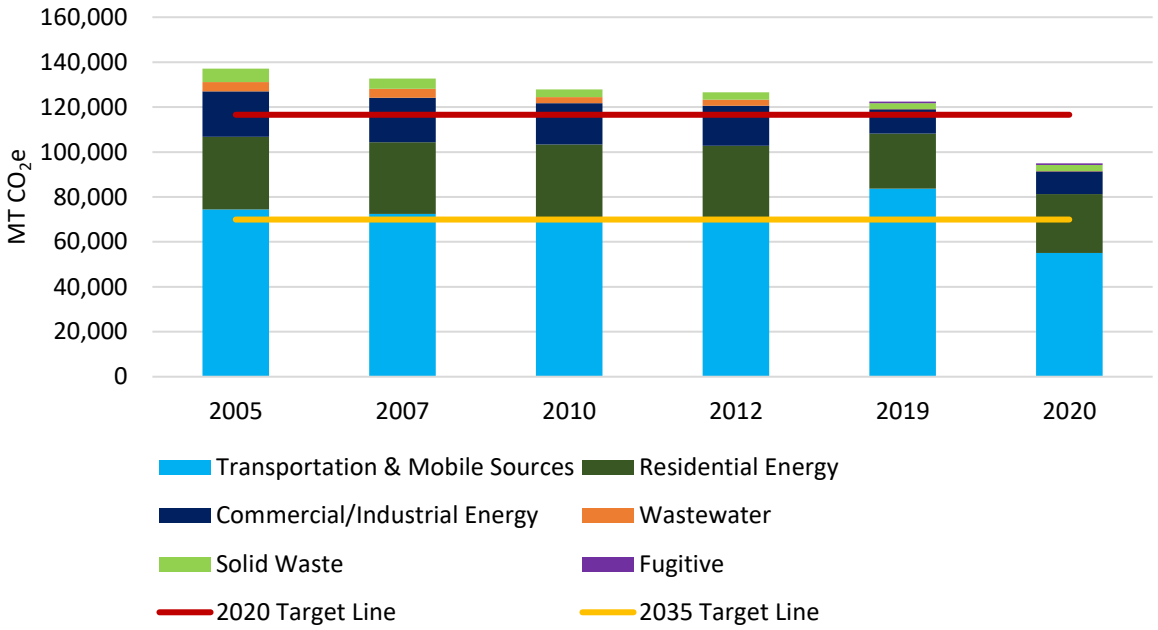
| **Community GHG Emissions in MT $CO_2e$** | | | | | | |
|---|---|---|---|---|---|---|
| | **2005** | **2007** | **2010** | **2012** | **2019** | **2020** |
| Transportation & Mobile Sources[1] | 74,455 | 72,451 | 70,696 | 68,980 | 83,672 | 55,087 |
| Residential Energy | 32,293 | 31,964 | 32,700 | 33,808 | 24,565 | 26,254 |
| Commercial/Industrial Energy | 20,280 | 19,792 | 18,372 | 17,830 | 10,820 | 10,129 |
| Water[2] | 4,065 | 3,942 | 2,552 | 2,600 | See footnote | See footnote |
| Wastewater | 52 | 35 | 59 | 59 | 56 | 57 |
| Solid Waste | 6,015 | 4,584 | 3,510 | 3,334 | 2,644 | 2,736 |
| Fugitive | N/A | N/A | N/A | N/A | 677 | 633 |
| **Total** | **137,160** | **132,768** | **127,889** | **126,611** | **122,434** | **94,896** |

[1] Transportation & Mobile Sources includes off-road sector emissions for 2005, 2007, 2010, and 2012, but excludes off-road sector emissions for 2019 and 2020. For more explanation, see Section 2.2.

[2] For 2019 and 2020, water sector emissions are included in the commercial/industrial energy sector to avoid double counting. For more explanation on this change in methodology, see Section 2.2.

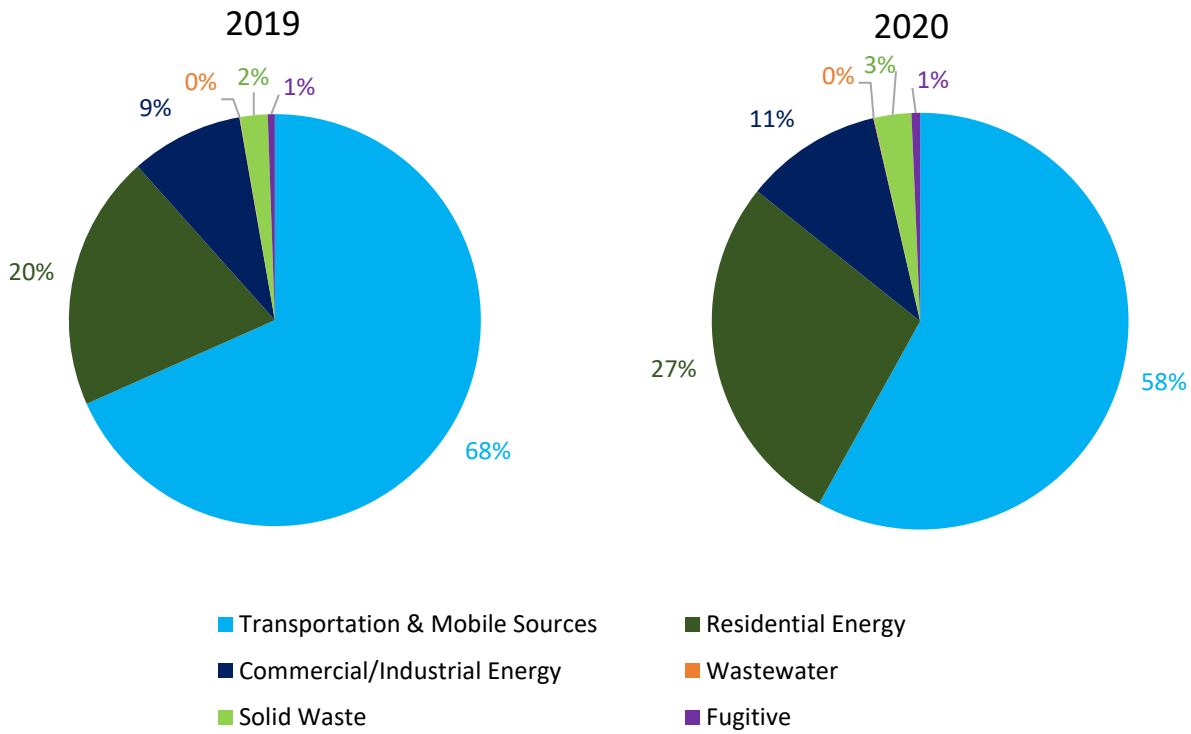
Figure 1 shows the community emissions for all inventory years, with 2020 and 2035 emissions reduction targets highlighted in red and yellow. Figure 2 illustrates community emissions for the current inventory years (2019 and 2020).

**Figure 1.** *Annual Community Emissions for all sectors and inventory years with targets (in metric tons of carbon dioxide equivalent)*




1 For this figure, the wastewater sector includes water sector emissions for the years 2005, 2007, 2010, and 2012. See Section 2.2 for explanation of how water sector emissions were included in the 2019 and 2020 inventories.

**Figure 2.** *Annual Community Emissions for 2019 and 2020 broken down by sector (in metric tons of carbon dioxide equivalent)*



As shown in Figure 2, the Transportation & Mobile Sources sector was the largest contributor to emissions in 2019 with 83,672 MT $CO_2e$ and in 2020 with 55,087 MT $CO_2e$. This sector comprised 68.34% and 58.05% of all emissions in 2019 and 2020, respectively. Between 2005 and 2019, emissions in this sector increased by 12.38%, but emissions decreased by 34.16% from 2019 to 2020, due to the COVID-19 pandemic stay-at-home orders. This 2020 decrease led to an overall 26.01% decrease in GHG emissions for this sector compared to 2005 baseline levels (Table 2).

**Table 2.** *Activity Data and GHG Emissions of Transportation 2005-2020*

| Sector | 2005 | | 2019 | | 2020 | | % Change in Activity 2005-2019 | % Change in Emissions 2005-2019 | % Change in Activity 2005-2020 | % Change in Emissions 2005-2020 |
|---|---|---|---|---|---|---|---|---|---|---|
| | Activity (VMT) | Emissions (MT $CO_2e$) | Activity (VMT) | Emissions (MT $CO_2e$) | Activity (VMT) | Emissions (MT $CO_2e$) | | | | |
| **Transportation & Mobile Sources** | | | | | | | | | | |
| Gasoline | 133,101,759 | 63,482 | 185,127,685 | 69,735 | 132,887,138 | 46,210 | 39.09% | 9.85% | -0.16% | -27.21% |
| Diesel | 7,582,342 | 10,085 | 19,750,231 | 13,825 | 14,176,981 | 8,765 | 160.48% | 37.08% | 86.97% | -13.09% |
| CNG (Transit) | N/A | N/A | 1,103,473 | 112 | 1,108,136 | 112 | N/A | N/A | N/A | N/A |
| Off-Road[1] | See footnote | 888 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| **Total (MT $CO_2e$)** | | **74,455** | | **83,672** | | **55,087** | | **12.38%** | | **-26.01%** |

1 Off-road activity data is described in detail in the 2010 and 2012 inventory update report, "City of Hermosa Beach GHG Inventory, Forecasting, Target-Setting Report for an Energy Efficiency Climate Action Plan" (January 2015).

The second largest contributor in 2019 and 2020 to emissions was the combined building energy sectors (Residential, Commercial and Industrial), contributing a total of 35,385 MT $CO_2e$ in 2019 and 36,383 MT $CO_2e$ in 2020 (Table 3). These sectors comprised 28.90% and 38.34% of all emissions in 2019 and 2020, respectively. Notably, Figure 1 demonstrates a significant decrease in emissions from 2012 to 2019, and emissions from all building energy sectors decreased by 32.69% from 2005 to 2019 and 30.8% from 2005 to 2020. Decreases in this sector are the result of implementation of numerous measures, including but not limited to policy, methodological changes, energy efficiency programs, and the increase of renewable energy usage. The drop in building energy emissions is also the result of the State Cap and Trade program which was implemented in that same year and changed the way in which large GHG emitting sources were reported as well as offset.

**Table 3.** *Activity Data and GHG Emissions of Energy 2005-2020*

| Sector | 2005 | | 2019 | | 2020 | | % Change in Activity 2005-2019 | % Change in Emissions 2005-2019 | % Change in Activity 2005-2020 | % Change in Emissions 2005-2020 |
|---|---|---|---|---|---|---|---|---|---|---|
| | Activity (kWh or Therms) | Emissions (MT $CO_2e$) | Activity (kWh or Therms) | Emissions (MT $CO_2e$) | Activity (kWh or Therms) | Emissions (MT $CO_2e$) | | | | |
| **Residential Energy** | | | | | | | | | | |
| Electricity | 47,843,215 | 14,534 | 45,588,683 | 8168 | 47,664,367 | 10,117 | -4.71% | -43.80% | -0.37% | -30.39% |
| Natural Gas | 3,339,783 | 17,759 | 3,083,005 | 16,397 | 3,033,951 | 16,137 | -7.69% | -7.67% | -9.16% | -9.13% |
| **Commercial/Industrial Energy** | | | | | | | | | | |
| Electricity | 51,741,467 | 15,719 | 36,118,148 | 6,471 | 32,276,622 | 6,851 | -30.19% | -58.83% | -37.62% | -56.42% |
| Natural Gas | 857,687 | 4,561 | 817,657 | 4,349 | 616,248 | 3,278 | -4.67% | -4.65% | -28.15% | -28.13% |
| **Total (MT $CO_2e$)** | | **52,573** | | **35,385** | | **36,383** | | **-32.69%** | | **-30.80%** |

The third largest contributor to GHG emissions was Solid Waste, which contributed to 2,644 MT $CO_2e$ in 2019 and 2,736 MT $CO_2e$ in 2020 (Table 4). For these respective years, solid waste contributed a total of 2.16% (2019) and 2.88% (2020) to the city's GHG emissions. Emissions in this sector rose by 3.48% from 2019 to 2020. Compared to 2005, however, Hermosa Beach has reduced its solid waste-related emissions by 55.68% in 2019 and 54.14% in 2020. Emissions for ADC were not captured in the 2019 and 2020 data. Emissions for ADC in 2005 were 49 MT $CO_2e$, representing approximately 0.04% of the total GHG emissions. Improvements in this category are likely the cause of waste reduction and recycling programs, organic waste diversion, landfill gas capture, and legislation/regulations.

**Table 4.** *Activity Data and GHG Emissions of Solid Waste Sector 2005-2020*

| Sector | 2005 | | 2019 | | 2020 | | % Change in Activity 2005-2019 | % Change in Emissions 2005-2019 | % Change in Activity 2005-2020 | % Change in Emissions 2005-2020 |
|---|---|---|---|---|---|---|---|---|---|---|
| | Activity (tons) | Emissions (MT $CO_2e$) | Activity (tons) | Emissions (MT $CO_2e$) | Activity (tons) | Emissions (MT $CO_2e$) | | | | |
| **Solid Waste** | | | | | | | | | | |
| Landfilled | 24,578 | 5,966 | 10,999 | 2,644 | 10,525 | 2,736 | -55.25% | -55.68% | -57.18% | -54.14% |

The fourth largest contributor to GHG emissions was Fugitive, which contributed 677 MT $CO_2e$ in 2019 and 633 MT $CO_2e$ in 2020 (Table 5). This sector comprised 0.55% and 0.67% of the city's emissions in 2019 and 2020, respectively. Since fugitive emissions were not calculated in previous inventories, there is no comparison to the 2005 baseline that can be made.

**Table 5.** *Activity Data and GHG Emissions of Fugitive Sector 2019-2020*

| Sector | 2019 | | 2020 | | % Change in Activity 2019-2020 | % Change in Emissions 2019-2020 |
|---|---|---|---|---|---|---|
| | Activity (Therms) | Emissions (MT $CO_2e$) | Activity (Therms) | Emissions (MT $CO_2e$) | | |
| **Fugitive** | | | | | | |
| Natural Gas Distribution | 3,900,662 | 677 | 3,650,199 | 633 | -6.42% | -6.50% |

The smallest contributor to GHG emissions was Wastewater, which contributed 56 MT $CO_2e$ in 2019 and 57 MT $CO_2e$ in 2020 (Table 6). This sector comprised 0.05% and 0.06% of the city's emissions in 2019 and 2020. Compared to 2005, this sector appears to have shrunk significantly, in part due to emissions already being accounted for in commercial/industrial sectors.

**Table 6.** *Activity Data and GHG Emissions of Wastewater Sector 2019-2020*

| Sector | 2019 | | 2020 | | % Change in Emissions 2019-2020 |
|---|---|---|---|---|---|
| | Activity (population or kg N/day)[1] | Emissions (MT $CO_2e$) | Activity (population or kg N/day)[1] | Emissions (MT $CO_2e$) | |
| Process $N_2O$ | 19,011 | 20 | 19,735 | 21 | 5.00% |
| Effluent Discharge Process $N_2O$ | 47.97 | 36 | 47.97 | 36 | 0.00% |
| **Total (MT $CO_2e$)** | | **56** | | **57** | **1.79%** |

[1] Population refers to the population served by Process $N_2O$. Daily N Load at Facility with Release to the Environment (kg N/day) refers to the Effluent Discharge Process $N_2O$.

## 3.2 – Municipal Emissions

A municipal GHG emissions inventory is a subset of the community inventory. The municipal inventory includes emissions from activities conducted as part of government operations in the city (Table 7). While emissions from government operations are normally a fraction of the overall community emissions, the city has the most direct control over municipal emissions, and the city can demonstrate leadership in the community by implementing GHG reduction strategies. This municipal inventory is not complete as employee commute and solid waste data need to be collected and analyzed. However, the report does include the sources which have historically contributed the most GHG emissions.

**Table 7.** *Hermosa Beach Historical Municipal Emissions in MT $CO_2e$.*

| Municipal GHG Emissions in MT $CO_2e$ | | | | | | |
|---|---|---|---|---|---|---|
| | **2005** | **2007** | **2010** | **2012** | **2019** | **2020** |
| Buildings & Facilities | 301 | 333 | 276 | 305 | 169 | 133 |
| Streetlights & Traffic Signals | 405 | 392 | 307 | 359 | 47 | 39 |
| Vehicle Fleet | 227 | 270 | 320 | 328 | N/A | N/A |
| Water Pumping | 5.0 | 0.49 | 0.55 | 0.64 | 0.04 | N/A |
| Employee Commute | 348 | 333 | 274 | 218 | N/A | N/A |
| Solid Waste | 215 | 213 | 162 | 162 | N/A | N/A |
| **Total** | **1,501** | **1,541** | **1,340** | **1,373** | **216** | **172** |

For emissions from municipal energy use, there is an overall decrease of municipal GHG emissions of 62.10% from 2005 to 2019 (Figure 3). This change is mostly due to a 42.65% decrease in the city's building & facility electricity emissions, as well as a -82.20% decrease in emissions associated with outdoor lighting and a 99.20% decrease in water pumping and irrigation electricity (Table 8). This decrease in GHG emissions from electricity is due to a cleaner energy mix supplied by Southern California Edison (SCE). Between 2019 and 2020, municipal energy GHG emissions continue to decrease

slightly by 20.39%, due to a decrease of 6.62% in building & facilities natural gas use. These decreases are likely due to the city transitioning to remote work.

**Figure 3.** *Municipal Greenhouse Gas Emissions due to energy use in 2005, 2019, and 2020 (in metric tons of carbon dioxide equivalent)*

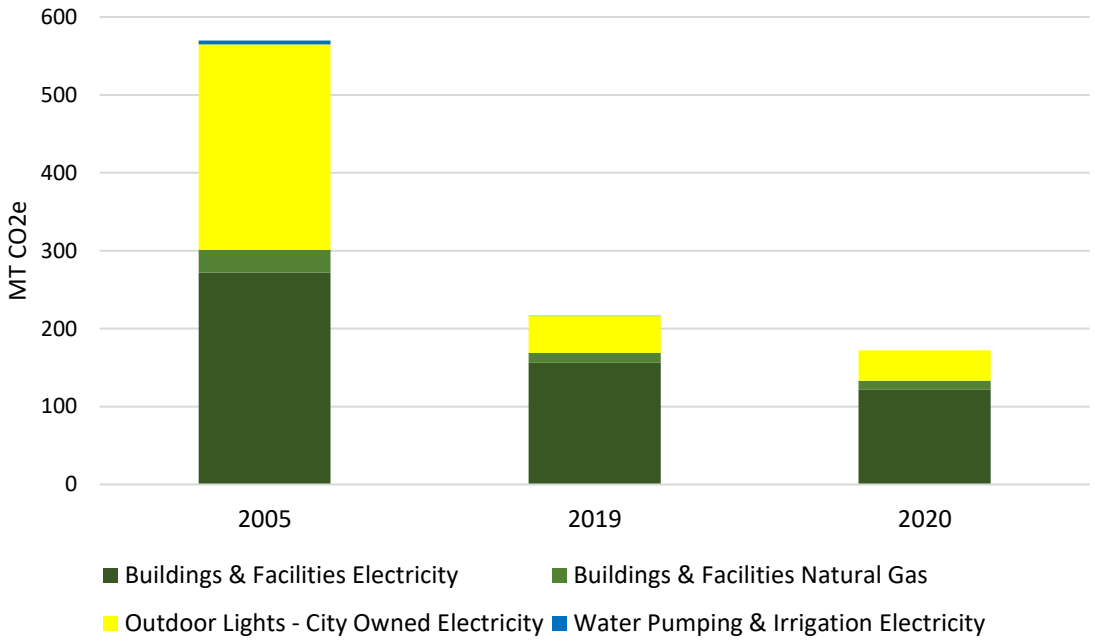



**Table 8.** *Municipal Activity Data and GHG Emissions of Energy in 2005, 2019, and 2020*

| Sector | 2005 | | 2019 | | 2020 | | % Change in Activity 2005-2019 | % Change in Emissions 2005-2019 | % Change in Activity 2005-2020 | % Change in Emissions 2005-2020 |
|---|---|---|---|---|---|---|---|---|---|---|
| | Activity (kWh, Therms) | Emissions (MT $CO_2e$) | Activity (kWh, Therms) | Emissions (MT $CO_2e$) | Activity (kWh, Therms) | Emissions (MT $CO_2e$) | | | | |
| **Buildings & Facilities** | | | | | | | | | | |
| Electricity | 895,746 | 272 | 871,287 | 156 | 571,711 | 122 | -2.73% | -42.65% | -36.17% | -55.15% |
| Natural Gas | 5,383 | 29 | 2,296 | 13 | 2,144 | 11 | -57.35% | -55.17% | -60.17% | -62.07% |
| **Outdoor Lights – City Owned[1]** | | | | | | | | | | |
| Electricity | 868,589 | 264 | 260,755 | 47 | 185,841 | 39 | -69.98% | -82.20% | -78.60% | -85.23% |
| **Water Pumping & Irrigation** | | | | | | | | | | |
| Electricity | 17,033 | 5.0 | 228 | 0.04 | N/A | N/A | -98.66% | -99.20% | N/A | N/A |
| **Total (MT $CO_2e$)** | | **570** | | **216** | | **172** | | **-62.10%** | | **-69.82%** |

[1] Outdoor Lights – SCE-Owned have been removed from these tables in comparison to the last inventories. Reducing the activity or emissions of streetlights and traffic control lights are not something the municipality has direct control over.

## Section 4: Next Steps

The 2019 and 2020 GHG emissions inventory update provides a detailed view of the City of Hermosa Beach's community GHG emissions, categorized by sector, and highlights emissions changes since the city's 2005 baseline year. This update enables the city to reassess its CAP and fine-tune its emissions reduction measures to ensure Hermosa Beach remains on track to achieve its 2035 emissions reduction target.

Prioritization should be given to emissions reduction strategies in the transportation and energy sectors (residential, commercial, and industrial), as these sectors collectively accounted for over 96% of Hermosa Beach's emissions in both 2019 and 2020. Targeted actions in these sectors are essential to making significant progress toward emissions goals.

In addition, the CAP should be updated to align with California's 2045 carbon neutrality target set forth by Assembly Bill 1279 (AB 1279). This alignment requires the city to establish a 2045 emissions reduction target. To support this long-term planning, the city will need to develop both a Business-as-Usual (BAU) scenario and an Adjusted BAU scenario. The BAU scenario will project emissions based solely on anticipated population growth, while the Adjusted BAU scenario will incorporate existing policies expected to reduce future GHG emissions. These scenarios will allow Hermosa Beach to establish a trajectory toward carbon neutrality and adjust its CAP measures to account for evolving state and local policy landscapes.

## *Appendix A: Hermosa Beach Historical Emissions*

The tables below contain the total community and municipal emissions (in $CO_2e$) across each sector for each inventory year in the past, 2019, and 2020.

| Community GHG Emissions in MT $CO_2e$ | | | | | | |
|---|---|---|---|---|---|---|
| | **2005** | **2007** | **2010** | **2012** | **2019** | **2020** |
| Transportation & Mobile Sources[1] | 74,455 | 72,451 | 70,696 | 68,980 | 83,672 | 55,087 |
| Residential Energy | 32,293 | 31,964 | 32,700 | 33,808 | 24,565 | 26,254 |
| Commercial/Industrial Energy | 20,280 | 19,792 | 18,372 | 17,830 | 10,820 | 10,129 |
| Water[2] | 4,065 | 3,942 | 2,552 | 2,600 | See footnote | See footnote |
| Wastewater | 52 | 35 | 59 | 59 | 56 | 57 |
| Solid Waste | 6,015 | 4,584 | 3,510 | 3,334 | 2,644 | 2,736 |
| Fugitive | N/A | N/A | N/A | N/A | 677 | 633 |
| **Total** | **137,160** | **132,768** | **127,889** | **126,611** | **122,434** | **94,896** |

[1] Transportation & Mobile Sources includes off-road sector emissions for 2005, 2007, 2010, and 2012, but excludes off-road sector emissions for 2019 and 2020. For more explanation, see Section 2.2.

[2] For 2019 and 2020, water sector emissions are included in the commercial/industrial energy sector to avoid double counting. For more explanation on this change in methodology, see Section 2.2.

| Municipal GHG Emissions in MT $CO_2e$ | | | | | | |
|---|---|---|---|---|---|---|
| | **2005** | **2007** | **2010** | **2012** | **2019** | **2020** |
| Buildings & Facilities | 301 | 333 | 276 | 305 | 169 | 133 |
| Streetlights & Traffic Signals | 405 | 392 | 307 | 359 | 47 | 39 |
| Vehicle Fleet | 227 | 270 | 320 | 328 | N/A | N/A |
| Water Pumping | 5.0 | 0.49 | 0.55 | 0.64 | 0.04 | N/A |
| Employee Commute | 348 | 333 | 274 | 218 | N/A | N/A |
| Solid Waste | 215 | 213 | 162 | 162 | N/A | N/A |
| **Total** | **1,501** | **1,541** | **1,340** | **1,373** | **216** | **172** |

## *Appendix B: Activity Data and Sector Descriptions*

A. Community Building Energy

**Description:** Community Building Energy is organized into three subsectors: residential, commercial, and industrial buildings. The city obtains community-level data for annual energy use, both electricity and natural gas, and an emission factor is applied. An emission factor is a coefficient that describes the rate at which a given activity releases specific GHGs into the atmosphere. The electric utility Southern California Edison (SCE) provides the most recent emission factors for the top three GHGs (carbon dioxide, methane, and nitrous oxide) through their annual corporate sustainability reports. The emissions factor for natural gas combusted in buildings, supplied by the Southern California Gas Company (SoCalGas), does not vary because the chemical make-up of natural gas (primarily methane) is constant when combusted. In the future, the emissions factor may decrease if renewable natural gas becomes more prevalent in the gas supply system.

**Residential:** Domestic Service for a Single-Family Accommodation or an individually metered Single-Family Dwelling in a Multifamily Accommodation.

**Commercial:** Commercial services with the following demand kW range GS1 rates (Small, 0 to 20 kW), GS2 rates (Medium, 20 kW to 200 kW), and GS3 rates (Large, 200 kW to 500 kW).

**Industrial:** All customers whose monthly maximum demand is expected to exceed 500 kW or has exceeded 500 kW in any three months during the preceding 12 months.

**Reference:** Frank Kao, Southern California Edison 626-302-0380, Frank.Kao@sce.com

**Calculation Equations for Emissions from Grid Electricity**

Electricity ($CO_2$)

$$Emissions\ (metric\ tons\ CO_2) = Electricity\ Use\ (MWh) \times Emissions\ Factor\left(lb\ \frac{CO_2}{MWh}\right) \times \frac{1\ metric\ ton}{2204.6\ lbs}$$

Electricity ($CH_4$)

$$Emissions\ (metric\ tons\ CH_4) = Electricity\ Use\ (MWh) \times Emissions\ Factor\left(\frac{lb\ CH_4}{GWh}\right) \times \left(\frac{1\ metric\ ton}{2204.6\ lbs}\right) \times \left(\frac{1\ GWh}{1000\ MWh}\right)$$

Electricity ($N_2O$)

$$Emissions\ (metric\ tons\ N_2O) = Electricity\ Use\ (MWh) \times Emissions\ Factor\left(\frac{lb\ N_2O}{GWh}\right) \times \left(\frac{1\ metric\ ton}{2204.6\ lbs}\right) \times \left(\frac{1\ GWh}{1000\ MWh}\right)$$

**Reference**: ICLEI ClearPath Calculator for Grid Electricity (USCP Required)
Emissions computed from Grid Electricity use according to **U.S. Community Protocol Method BE.2.1**

| **Calculation Equations for Emissions from Stationary Fuel Combustion** |
|---|
| Natural Gas ($CO_2$)<br>$$Emissions\ (metric\ tons\ CO_2) = Fuel\ Used\ (MMBtu) \times Emission\ Factor\left(\frac{kg\ CO_2}{MMBtu}\right) \div 1000\left(\frac{kg}{metric\ ton}\right)$$ |
| Natural Gas ($CH_4$)<br>$$Emissions(metric\ tons\ CH_4) = Fuel\ Used\ (MMBtu) \times Emission\ Factor\left(\frac{kg\ CH_4}{MMBtu}\right) \div 1000\left(\frac{kg}{metric\ ton}\right)$$ |
| Natural Gas ($N_2O$)<br>$$Emissions(metric\ tons\ N_2O) = Fuel\ Used\ (MMBtu) \times Emission\ Factor\left(\frac{kg\ N_2O}{MMBtu}\right) \div 1000\left(\frac{kg}{metric\ ton}\right)$$ |
| **Reference:** ICLEI ClearPath Calculator for Stationary Fuel Combustion (USCP Required)<br>Emissions computed from Stationary Combustion according to **U.S. Community Protocol Method BE.1.1** |

B. Transportation and Mobile Sources

**Description: Community Vehicle Transportation** emissions are estimated using three processes. First, vehicle miles traveled (VMT) are estimated based on data received from Google's Environmental Insights Explorer for both inventory years 2019 and 2020. VMT is estimated using the "Origin-Destination Methodology," which is standard practice for calculating vehicle transportation emissions. Using this method, the city assumes 100% of all in-boundary trips and half of each trip that starts and ends in Hermosa Beach. Pass-through trips are not associated with Hermosa Beach, as each community would claim their respective half of the trip. Second, the VMT data that is generated is then applied to the city's vehicle mix, gathered from vehicle registration data obtained from Polk Automotive Solutions by S&P Global Mobility. Lastly, the data is computed to estimate total GHG emissions generated from fossil fuel combustion as a result of vehicle transportation.

| **Calculation Descriptions for Emissions from On-Road Transportation** |
|---|
| **VMT & MPG**<br>This calculation method is done on ClearPath and requires VMT as well as vehicle characterizations that are saved in a Factor Set created by ICLEI. Quantities of fuel are required for alternative fuels. Outputs are calculated as follows:<br><br>MMBtu:<br>• For Gasoline, Diesel, and Electric - calculated from VMT attributed by vehicle class and corresponding fuel economy from the selected factor set.<br>• For Ethanol and Biodiesel - calculated from VMT attributed by vehicle class and corresponding fuel economy from the selected factor set.<br>• Fuel split between Ethanol/Gasoline and Biodiesel/Diesel based on user-specified "% Biofuel" field and energy densities for each applied to the relative portion of the blend. |

- All other fuels from quantity of fuel entered directly in gallons or standard cubic feet.

$CO_2$:

- For all fossil fuels - calculated from MMBtu output and appropriate emissions factor.
- For Ethanol and Biodiesel - Only the fossil portion of the fuel blend based on user-specified "% Biofuel" field.
- For Electricity - calculated from MMBtu output and grid emissions factor from the selected Grid Emissions Factor Set.

$CH_4$ & $N_2O$:

- For Gasoline, Diesel, and Electric - calculated from VMT attributed by vehicle class and corresponding per-mile rates from the selected factor set for each vehicle class.
- For fossil alternative fuels - calculated from VMT attributed by vehicle class and corresponding static per-mile rates from Local Government Operations Protocol (LGOP) Table G.13.
- For Ethanol and Biodiesel - Only the fossil portion of the fuel blend based on user-specified "% Biofuel" field.
- For Electricity - calculated from MMBtu output and grid emissions factor from the selected Grid Emissions Factor Set.

Biogenic $CO_2$:

- Ethanol and Biodiesel - calculated from biofuel portion of the MMBtu output and static emissions factors from LGOP Table G.11. Values in this output are not included in summary $CO_2e$.

Biofuel $CH_4$ and $N_2O$:

- Ethanol and Biodiesel - calculated from VMT attributed by % biofuel and % vehicle class and corresponding static per-mile emissions factors from LGOP Table G.13. These values do contribute to total $CO_2e$ for the record.

**On-Road Factor**

This calculation method is done on ClearPath and requires VMT as well as on-road factors for each GHG. Quantities of fuel are required for energy outputs. Outputs are calculated as follows:

MMBtu:

- All fuels from quantity of fuel entered directly in gallons, standard cubic feet, or kWh.

$CO_2$:

- For all fossil fuels - calculated from user specified on-road $CO_2$ factor.
- For Ethanol and Biodiesel - Only the fossil portion of the fuel blend based on user-specified "% Biofuel" field and the user specified on-road $CO_2$ factor.

$CH_4$ & $N_2O$:

- For all fossil fuels- calculated from user specified on-road $CH_4$ or $N_2O$ factor.
- For Ethanol and Biodiesel - Only the fossil portion of the fuel blend based on user-specified "% Biofuel" field and the user specified on-road $CH_4$ or $N_2O$ factor.

Biogenic $CO_2$:

- Ethanol and Biodiesel - calculated from biofuel portion of VMT and user specified on-road Biogenic $CO_2$ Factor. Values in this output are not included in summary $CO_2e$.

Biofuel $CH_4$ and $N_2O$:

- Ethanol and Biodiesel - calculated from biofuel portion of VMT and user specified on-road Biogenic $CH_4$ and $N_2O$ Factor. These values do contribute to total $CO_2e$ for the record.

**Fuel Use**

This calculation method is done on ClearPath and requires quantities of fuels. For $CH_4$ and $N_2O$ calculations, VMT as well as vehicle characterizations are required due to the nature of emissions factors for those gases. Outputs are calculated as follows:

MMBtu:

- All Fuels - Calculated from quantity of fuel entered.

$CO_2$:

- All Fuels - Calculated from quantity of fuel entered.

$CH_4$ & $N_2O$:

- For Gasoline, Diesel, and Electric - calculated from VMT attributed by vehicle class and corresponding per-mile rates from the selected factor set for each vehicle class.
- For Electricity - calculated from MMBtu output and grid emissions factor from the selected Grid Emissions Factor Set.
- For fossil alternative fuels - calculated from VMT attributed by vehicle class and corresponding static per-mile rates from LGOP Table G.13.
- For Ethanol and Biodiesel - Only the fossil portion of the fuel blend based on user-specified "% Biofuel" field.

Biogenic $CO_2$:

- Ethanol and Biodiesel - calculated from biofuel portion of the MMBtu output and static emissions factors from LGOP Table G.11. Values in this output are not included in summary $CO_2e$.

Biofuel $CH_4$ and $N_2O$:

- Ethanol and Biodiesel - calculated from VMT attributed by % biofuel and % vehicle class and corresponding static per-mile emissions factors from LGOP Table G.13. These values do contribute to total $CO_2e$ for the record.

Direct Entry

All outputs directly reflect user inputs.

**Reference:** ICLEI ClearPath Calculator for On Road Transportation (USCP Required)

| **Calculation Descriptions for Emissions from Public Transit** |
|---|
| The calculator used to compute emissions from public transit is designed to allow you to calculate emissions from public transit attributable to your community. Calculations are performed according to methods TR.4.a, TR.4.b, and TR.4.c of the Community Protocol, depending on the fuel type selected.<br><br>$CH_4$ and $N_2O$ calculations for Gasoline and Diesel vehicles are designed to reference separate Factor Sets. |
| **Reference:** ICLEI ClearPath Calculator for Emissions from Public Transit (USCP Recommended). Emissions computed from Public Transit according to **U.S. Community Protocol Methods TR.4.a, TR.4.b, and TR.4.c.** |

C. Solid Waste

| **Description:** Community Solid Waste was estimated using data provided by the Los Angeles Regional Agency (LARA). This data was broken down and categorized into solid waste streams, based on their emissions characteristics. Emissions were then estimated using emissions factors provided by CalRecycle for each of the respective waste streams. |
|---|

| **Calculations for Landfill Methane Emissions** |
|---|
| $$CH_4 = tons\ waste \times (1 - 0.1) \times sum(\%_m \times EF_m \times (1 - LFG_m))$$<br>$$1kg\ CH_4 = 29.8kg\ CO_2e$$<br>Where:<br>0.1 is the oxidation percent<br>$\%_m$ is the percent of material type m in the waste<br>$EF_m$ is the lifetime $CH_4$ emissions factor for material type m<br>LFG is the lifetime landfill gas capture percentage for material type m |
| **Reference**: ICLEI ClearPath Calculator for Landfilled Waste (USCP Required) |

D. Water & Wastewater

| **Description:** The emissions for wastewater include the $CH_4$ and $N_2O$ emissions from processing. Calculations for Emissions from the Supply of Potable Water were computed separately in 2005, 2007, 2010 and 2012 inventories but are now incorporated into the Commercial/Industrial energy sector. |
|---|

**Calculations for Emissions from the Supply of Potable Water**

Electricity ($CO_2$)

$$Emissions\ (metric\ tons\ CO_2) = Electricity\ use\ (MWh) \times Emissions\ Factor\left(lb\ \frac{CO_2}{MWh}\right) \times \left(\frac{1\ metric\ ton}{2204.6\ lbs}\right)$$

Electricity ($CH_4$)

$$Emissions\ (metric\ tons\ CH_4) = Electricity\ use\ (MWh) \times Emissions\ Factor\left(\frac{lb\ CH_4}{GWh}\right) \times \left(\frac{1\ metric\ ton}{2204.6\ lbs}\right) \times \left(\frac{1\ GWh}{1000\ MWh}\right)$$

Electricity ($N_2O$)

$$Emissions\ (metric\ tons\ N_2O) = Electricity\ Use\ (MWh) \times Emissions\ Factor\left(\frac{lb\ N_2O}{GWh}\right) \times \left(\frac{1\ metric\ ton}{2204.6\ lbs}\right) \times \left(\frac{1\ GWh}{1000\ MWh}\right)$$

**Reference:** ICLEI ClearPath Calculator for Emissions from the Supply of Potable Water (USCP Recommended). The calculator used to compute emissions from Grid Electricity does so according to **Community Protocol Method WW.14** for electricity used in the supply and distribution of potable water.

**Calculation Descriptions for Process $N_2O$ Emissions**

Process $N_2O$ Emissions from Wastewater Treatment

The calculator used to compute $N_2O$ emissions from centralized wastewater treatment facilities and covers both cases of whether the facility does or does not employ Nitrification/Denitrification, according to methods WW.7 and WW.8 of the Community Protocol respectively.

Process $N_2O$ from Effluent Discharge to River, Ocean, or Deep Well Injection

This calculator will compute $N_2O$ emissions from effluent discharge to rivers and estuaries. This calculator may be used for either condition of whether the total rate of discharge is known or if using a population-based method, according to Methods WW.12 or WW.12 (alt) of the Community Protocol.

**Reference:**
ICLEI ClearPath Calculator for Process $N_2O$ Emissions from Wastewater Treatment (USCP Recommended). Emissions were computed according to **Community Protocol Methods WW.7 and WW.8.**
ICLEI ClearPath Calculator for Process $N_2O$ from Effluent Discharge to River, Ocean, or Deep Well Injection (USCP Recommended). Emissions were computed according to **Community Protocol Method WW.12.**

E. Fugitive

**Description:** Fugitive emissions account for leakage in the local natural gas distribution system. The calculation is based on the total quantity of natural gas consumed and a leakage rate obtained from Environmental Defense Fund (EDF) User Guide for Natural Gas Leakage Rate Modeling Tool.

**Calculations for Fugitive Emissions from Natural Gas Distribution**

Fugitive Emissions from natural gas calculations are based on the total quantity of Natural Gas Consumed and a leakage rate. The default value of 0.3% (three-tenths of one percent) is obtained from the Environmental Defense Fund (EDF) User Guide for Natural Gas Leakage Rate and Modeling.

$$(Total\ Quantity\ of\ Natural\ Gas\ Consumed)\ \times\ (0.3\%)$$

**Reference:** ICLEI ClearPath Calculator for Fugitive Emissions from Natural Gas Distribution (USCP Recommended)

F. Municipal Buildings, Facilities, & Parks Energy

**Description:** Local governments own, operate, and occupy a large variety of buildings and facilities. The city obtains interval data for annual energy use for all municipal buildings, both electricity and natural gas, which is automatically uploaded to ENERGY STAR Portfolio Manager. From these data, an emission factor is applied. An emission factor is a coefficient that describes the rate at which a given activity releases specific GHGs into the atmosphere. The electric utility Southern California Edison (SCE) provides the most recent emission factors for the top three GHGs (carbon dioxide, methane, and nitrous oxide) through their annual corporate sustainability reports. The emissions factor for natural gas combusted in buildings, supplied by the Southern California Gas Company (SoCalGas), does not vary because the chemical make-up of natural gas (primarily methane) is constant when combusted. In the future, the emissions factor may decrease if renewable natural gas becomes more prevalent in the gas supply system.

**Reference:** Frank Kao, Southern California Edison 626-302-0380, Frank.Kao@sce.com

**Calculations for Municipal Building Grid Electricity Use**

Electricity ($CO_2$)

$$Emissions\ (metric\ tons\ CO_2) = Electricity\ use\ (MWh)\ \times\ Emissions\ Factor\ \left(lb\ \frac{CO_2}{MWh}\right)\ \times\ \left(\frac{1\ metric\ ton}{2204.6\ lbs}\right)$$

Electricity ($CH_4$)

$$Emissions\ (metric\ tons\ CH_4) = Electricity\ use\ (MWh) \times Emissions\ Factor\ \left(\frac{lb\ CH_4}{GWh}\right) \times \left(\frac{1\ metric\ ton}{2204.6\ lbs}\right) \times \left(\frac{1\ GWh}{1000\ MWh}\right)$$

Electricity ($N_2O$)

$$Emissions\ (metric\ tons\ N_2O) = Electricity\ Use\ (MWh) \times Emissions\ Factor\ \left(\frac{lb\ N_2O}{GWh}\right) \times \left(\frac{1\ metric\ ton}{2204.6\ lbs}\right) \times \left(\frac{1\ GWh}{1000\ MWh}\right)$$

**Reference:** ICLEI ClearPath Calculator for Grid Electricity Use

**Calculation Equations for Municipal Emissions from Stationary Fuel Combustion**

Natural Gas ($CO_2$)

$$Emissions\ (metric\ tons\ CO_2) = Fuel\ Used\ (MMBtu) \times Emission\ Factor\ \left(\frac{kg\ CO_2}{MMBtu}\right) \div 1000\left(\frac{kg}{metric\ ton}\right)$$

Natural Gas ($CH_4$)

$$Emissions(metric\ tons\ CH_4) = Fuel\ Used\ (MMBtu) \times Emission\ Factor\ \left(\frac{kg\ CH_4}{MMBtu}\right) \div 1000\left(\frac{kg}{metric\ ton}\right)$$

Natural Gas ($N_2O$)

$$Emissions(metric\ tons\ N_2O) = Fuel\ Used\ (MMBtu) \times Emission\ Factor\ \left(\frac{kg\ N_2O}{MMBtu}\right) \div 1000\left(\frac{kg}{metric\ ton}\right)$$

**Reference:** ICLEI ClearPath Calculator for Stationary Fuel Combustion.
Emissions computed from Stationary Combustion according to the Recommended Approach in the **Local Government Operations Protocol, Section 6.1.1**

G. Street Lights & Traffic Signals

**Description:** The city obtains interval data for annual electricity use for streetlights, which is automatically uploaded to ENERGY STAR Portfolio Manager. From these data, an emission factor is applied. An emission factor is a coefficient that describes the rate at which a given activity releases specific GHGs into the atmosphere (see F. Municipal Buildings, Facilities, & Parks Energy).

**Reference:** Frank Kao, Southern California Edison 626-302-0380, Frank.Kao@sce.com

H. Vehicle Fleet

| **Calculation Descriptions for Fleet Vehicle Emissions** |
|---|
| This calculation method is done on ClearPath and requires the total quantity of fuel consumed for energy and $CO_2$ calculations, as well as total vehicle miles traveled for each vehicle type. This method calculates emissions for Gasoline or Diesel powered fleet vehicles. |
| Mobile Combustion ($CO_2$)<br>$$Emissions\ (metric\ tons\ CO_2) = Fuel\ Consumed\ (gallons) \times Emission\ Factor\left(\frac{kg\ CO_2}{gallon}\right) \div 1000\left(\frac{kg}{metric\ ton}\right)$$ |
| Mobile Combustion ($CH_4$)<br>$$Emissions(metric\ tons\ CH_4) = Annual\ distance\ (mi) \times Emission\ Factor\left(\frac{g\ CH_4}{mi}\right) \div 1{,}000{,}000\left(\frac{g}{metric\ ton}\right)$$ |
| Mobile Combustion ($N_2O$)<br>$$Emissions(metric\ tons\ N_2O) = Annual\ distance\ (mi) \times Emission\ Factor\left(\frac{g\ N_2O}{mi}\right) \div 1{,}000{,}000\left(\frac{g}{metric\ ton}\right)$$ |
| **Reference:** ICLEI ClearPath Calculator for Fleet Vehicle Emissions; **Local Government Operations Protocol, Section 7.1** |

| **Calculation Descriptions for Emissions from Off-Road Vehicles** |
|---|
| This calculation method is done on ClearPath to compute emissions from off-road mobile sources, such as construction, agricultural, and recreational type vehicles; based on the quantity of fuel consumed. The emission factor used for these calculations is different from that of the Vehicle Fleet Emissions above. |
| Mobile Combustion ($CO_2$)<br>$$Emissions\ (metric\ tons\ CO_2) = Fuel\ Consumed\ (gallons) \times Emission\ Factor\left(\frac{kg\ CO_2}{gallon}\right) \div 1000\left(\frac{kg}{metric\ ton}\right)$$ |
| **Reference:** ICLEI ClearPath Calculator for Emissions from Off Road Vehicles; **Local Government Operations Protocol, Section 7.2** |

I. Municipal Water & Wastewater Treatment Facilities

| **Calculations for Water & Wastewater Emissions from Grid Electricity Use** |
|---|
| This calculation is done on ClearPath to compute emissions from Grid Electricity use from Water & Wastewater Facilities. This includes water pumping. |

Electricity ($CO_2$)

$$Emissions\ (metric\ tons\ CO_2) = Electricity\ use\ (MWh) \times Emissions\ Factor\left(lb\ \frac{CO_2}{MWh}\right) \times \left(\frac{1\ metric\ ton}{2204.6\ lbs}\right)$$

Electricity ($CH_4$)

$$Emissions\ (metric\ tons\ CH_4) = Electricity\ use\ (MWh) \times Emissions\ Factor\left(\frac{lb\ CH_4}{GWh}\right) \times \left(\frac{1\ metric\ ton}{2204.6\ lbs}\right) \times \left(\frac{1\ GWh}{1000\ MWh}\right)$$

Electricity ($N_2O$)

$$Emissions\ (metric\ tons\ N_2O) = Electricity\ Use\ (MWh) \times Emissions\ Factor\left(\frac{lb\ N_2O}{GWh}\right) \times \left(\frac{1\ metric\ ton}{2204.6\ lbs}\right) \times \left(\frac{1\ GWh}{1000\ MWh}\right)$$

**Reference:** ICLEI ClearPath Calculator for Emissions from Grid Electricity for Water & Wastewater Facilities.

**Calculations for Water & Wastewater Emissions from Stationary Fuel Combustion**

This calculation is done on ClearPath to compute emissions from Stationary Fuel Combustion from Water & Wastewater Facilities. This includes water pumping.

Natural Gas ($CO_2$)

$$Emissions\ (metric\ tons\ CO_2) = Fuel\ Used\ (MMBtu) \times Emission\ Factor\left(\frac{kg\ CO_2}{MMBtu}\right) \div 1000\left(\frac{kg}{metric\ ton}\right)$$

Natural Gas ($CH_4$)

$$Emissions(metric\ tons\ CH_4) = Fuel\ Used\ (MMBtu) \times Emission\ Factor\left(\frac{kg\ CH_4}{MMBtu}\right) \div 1000\left(\frac{kg}{metric\ ton}\right)$$

Natural Gas ($N_2O$)

$$Emissions(metric\ tons\ N_2O) = Fuel\ Used\ (MMBtu) \times Emission\ Factor\left(\frac{kg\ N_2O}{MMBtu}\right) \div 1000\left(\frac{kg}{metric\ ton}\right)$$

**Reference:** ICLEI ClearPath Calculator for Emissions from Stationary Fuel Combustion for Water & Wastewater Facilities; **Local Government Operations Protocol, Section 6.1.1**

## *Appendix C: Abbreviations and Acronyms*

| | |
|---|---|
| AB 1279 | Assembly Bill 1279 – The California Climate Crisis Act |
| CAP | Climate Action Plan |
| CARB | California Air Resources Board |
| $CO_2$ | Carbon Dioxide |
| $CH_4$ | Methane |
| CNG | Compressed Natural Gas |
| $CO_2e$ | Carbon Dioxide Equivalents |
| GHG | Greenhouse Gas |
| ICLEI | International Council for Local Environmental Initiatives |
| kWh | Kilowatt-hours |
| LGOP | Local Government Operations Protocol |
| MMBtu | Million British Thermal Units, used to measure Natural Gas |
| MPG | Miles Per Gallon |
| $MTCO_2e$ | Metric Tons of Carbon Dioxide Equivalents |
| USCP | United States Community Protocol for Accounting and Reporting of Greenhouse Gas Emissions |
| VMT | Vehicle Miles Traveled |

## *Appendix D: Glossary of Terms*

| | |
|---|---|
| AB 1279 | The California Climate Crisis Act (2022). This statute codified Executive Order B-55-18's 2045 carbon neutrality target and established an additional GHG emissions target to reduce anthropogenic emissions 85 percent below 1990 levels by 2045. |
| AB 32 | The Global Warming Solutions Act (2006). This statute codified Executive Order S-3-05 and authorized the California Air Resources Board to implement a comprehensive, multiyear program to reduce GHG emissions from all sources throughout the state. |
| Activity Data | Data on the magnitude of a human activity resulting in emissions taking place during a given period of time. Data on energy use, fuel used, miles traveled, input material flow, and product output are all examples of activity data that might be used to compute GHG emissions. |
| Cap and Trade | A market-based approach to reducing pollution through setting a limit (cap) on pollution as well as tradable allowances that allow entities to emit a certain amount of pollution. The cap helps ensure the achievement of the pollution reduction goal while the tradable allowances provide flexibility for individual emissions sources to set their own compliance path. |
| Community Inventory | GHG emissions that result from the activities by residents and businesses in the city. |

| | |
|---|---|
| Carbon Neutrality | When GHG emissions generated by sources such as transportation, power plants, and industrial processes are less than or equal to the amount of carbon dioxide that is stored, both in natural sinks and mechanical sequestration. |
| Carbon Dioxide Equivalent ($CO_2e$) | The universal unit for comparing emissions of different GHGs expressed in terms of the global warming potential of one unit of carbon dioxide. |
| Emissions Factor | A unique value for determining an amount of a GHG emitted on a per unit activity basis (for example, metric tons of $CO_2$ emitted per million Btus of coal combusted, or metric tons of $CO_2$ emitted per kWh of electricity consumed). |
| Greenhouse Gases (GHG) | Gases that trap heat in the atmosphere by absorbing and emitting solar radiation within the atmosphere, causing a greenhouse effect that warms the atmosphere and leads to global climate change. The GHGs factored in this inventory were carbon dioxide ($CO_2$), methane ($CH_4$), and nitrous oxide ($N_2O$). |
| Metric Ton (MT, tonne) | Common international measurement for the quantity of GHG emissions, equivalent to 1,000 kilograms, or about 2,204.6 pounds or 1.1 short tons. |
| Municipal Inventory | GHG emissions that result from the activities performed as part of the government operations in the city and are a subset of the community inventory. |
| Sector | A subset of the emissions inventory classified by types of activities or emissions sources. |