City of Monterey

Draft 2020 Community-Wide Greenhouse Gas Inventory Report

DRAFT CITY OF MONTEREY 2020 COMMUNITY-WIDE GREENHOUSE GAS (GHG) INVENTORY

PREPARED FOR:

The City of Monterey

580 Pacific Street, Monterey, CA 93940

Phone: 831.646.3799

Fax: 831.646.3793

PREPARED BY:

The Association of Monterey Bay Area Governments

24580 Silver Cloud Court, Monterey, CA 93940

Phone: 831.883.3750

Fax: 831.883.3755

FUNDED BY:

Central Coast Community Energy

JULY 2022

Executive Summary

The City of Monterey's 2020 Community-wide GHG Inventory totals 227,061 metric tons of carbon dioxide-equivalent (CO2e). This represents a 29 percent reduction from the 2005 Baseline Community-wide GHG Inventory. This decrease is the result of emission reductions across four sectors primarily. 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. it should be understood that the COVID 19 pandemic had wide ranging impacts on energy consumption and transportation patterns which may have significantly impacted 2020 emissions. Figure 1 shows the 2005 to 2020 GHG emissions by sector.

In the residential sector, emission reductions of 31 percent occurred from 2005 to 2020. 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 53 percent from 2005 to 2020. During this period there was a decrease in Vehicle Miles Travelled (VMT) and an increase in fuel efficiency. In the solid waste sector, a decrease in the actual tonnage of waste sent to landfills caused a 17 percent decrease in emissions. In the commercial and industrial sector there was a 53 percent reduction in emissions from 2005 to 2020. This can be attributed, in part, to decreases in electricity and natural gas usage, as well as decreases in the GHG intensity of electricity.

Figure 1:

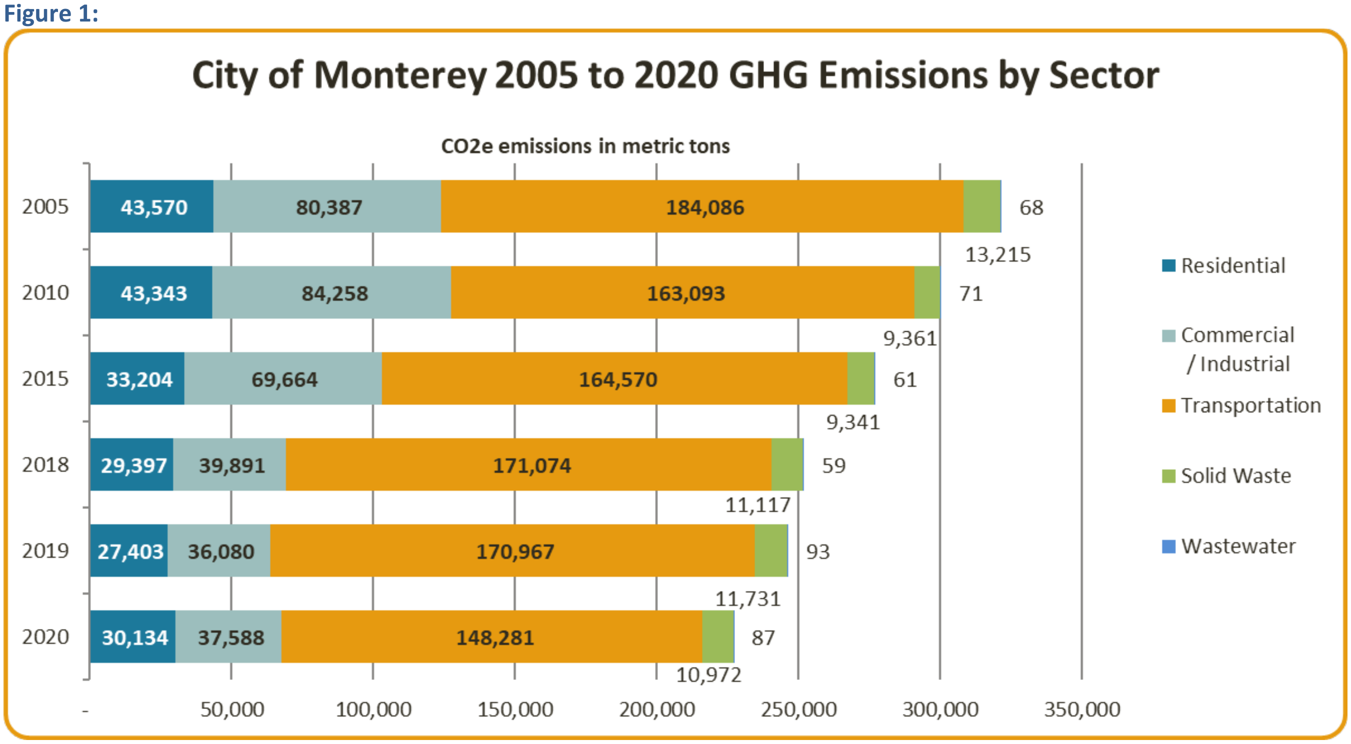

Table 1 summarizes the results of the 2005 Baseline Community-wide GHG Inventory, 2010 Community-wide GHG Inventory, 2015 Community-wide GHG Inventory, 2018 Community-wide GHG Inventory, 2019 Community-wide GHG Inventory, and 2020 Community-wide GHG Inventory, broken out by sectors. The percentage change from the 2005 inventory to the 2020 inventory is a reduction of 29 percent.

Table 1:

Community CO2e Emissions by Sector	Residential	Commercial / Industrial	Transportation	Solid Waste	Wastewater	Total
2005	43,570	80,387	184,086	13,215	68	321,326
2010	43,343	84,258	163,093	9,361	71	300,126
2015	33,204	69,664	164,570	9,341	61	276,840
2018	29,397	39,891	171,074	11,117	59	251,537
2019	27,403	36,080	170,967	11,731	93	246,275
2020	30,134	37,588	148,281	10,972	87	227,061
% change 2005-2020	-31%	-53%	-19%	-17%	27%	-29%

2020 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 Monterey 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. Central Coast Community Energy (3CE) is now providing funding for AMBAG to complete three yearly Community-wide GHG inventories for all 3CE member jurisdictions. The 2018 inventory was completed in 2020, the 2019 inventory was completed in 2021 and the 2020 inventory is now being completed.

The Monterey 2005 Baseline, 2010, 2015, 2018, 2019, and 2020 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. Appendix A details the methodology used in this 2020 Community-wide GHG Inventory. A discussion of methodologies not included in this inventory but that are deemed of importance is included in Appendix B.

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.

2020 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 Monterey emitted 227,061 metric tons of CO2e in 2020. As visible in Figure 2 and Table 2, 65.3 percent of emissions are from the transportation sector, and were generated by on-road vehicle fuel consumption. Emissions from electricity and natural gas usage in the residential sector generated 13.3 percent of emissions, while energy consumption in the commercial sector generated 16.6 percent of emissions. The disposal of waste generated by Monterey residents and businesses caused 4.8 percent of total emissions. The remaining 0.04 percent of emissions was generated from wastewater treatment.

Figure 2:

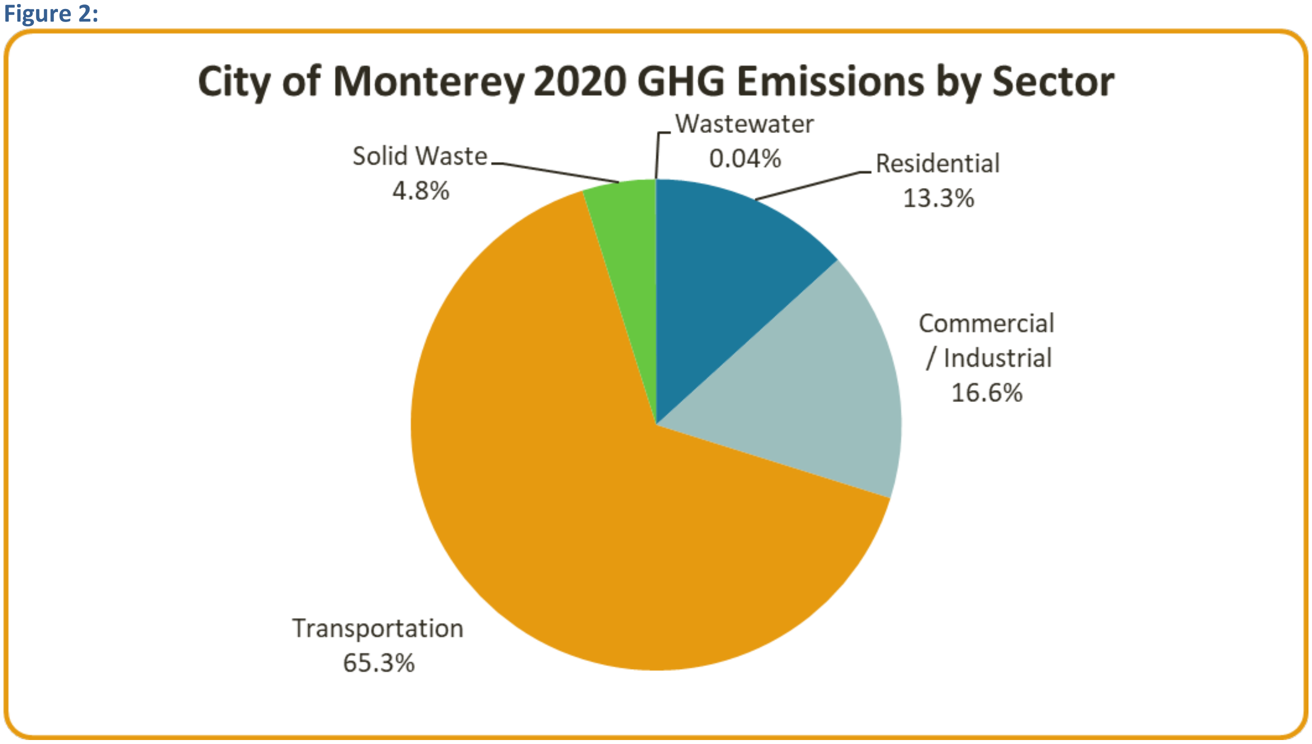

Table 2:

2020 Community Emissions by Sector	Residential	Commercial / Industrial	Transportation	Solid Waste	Wastewater	Total
CO2e (metric tons)	30,134	37,588	148,281	10,972	87	227,061
% of Total CO2e	13.3%	16.6%	65.3%	4.8%	0.04%	100%

Built Environment: Residential, Commercial and Industrial Sector

The City of Monterey's built environment generated 29.9 percent of community-wide GHG emissions in 2020 or 67,722 metric tons of CO2e. Emissions were calculated using 2020 electricity and natural gas consumption data provided by PG&E and 3CE.

The residential sector accounted for 30,134 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 37,588 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 energy usage due to the California Public Utilities Commission's (CPUC) 15/15 rule[1].

Figure 3 and Table 3 show the breakdown of natural gas to electricity emissions in Monterey's built environment. The residential sector natural gas usage comprised 40.1 percent of emissions while the commercial and industrial sector natural gas comprised 42.1 percent of emissions.

Figure 3:

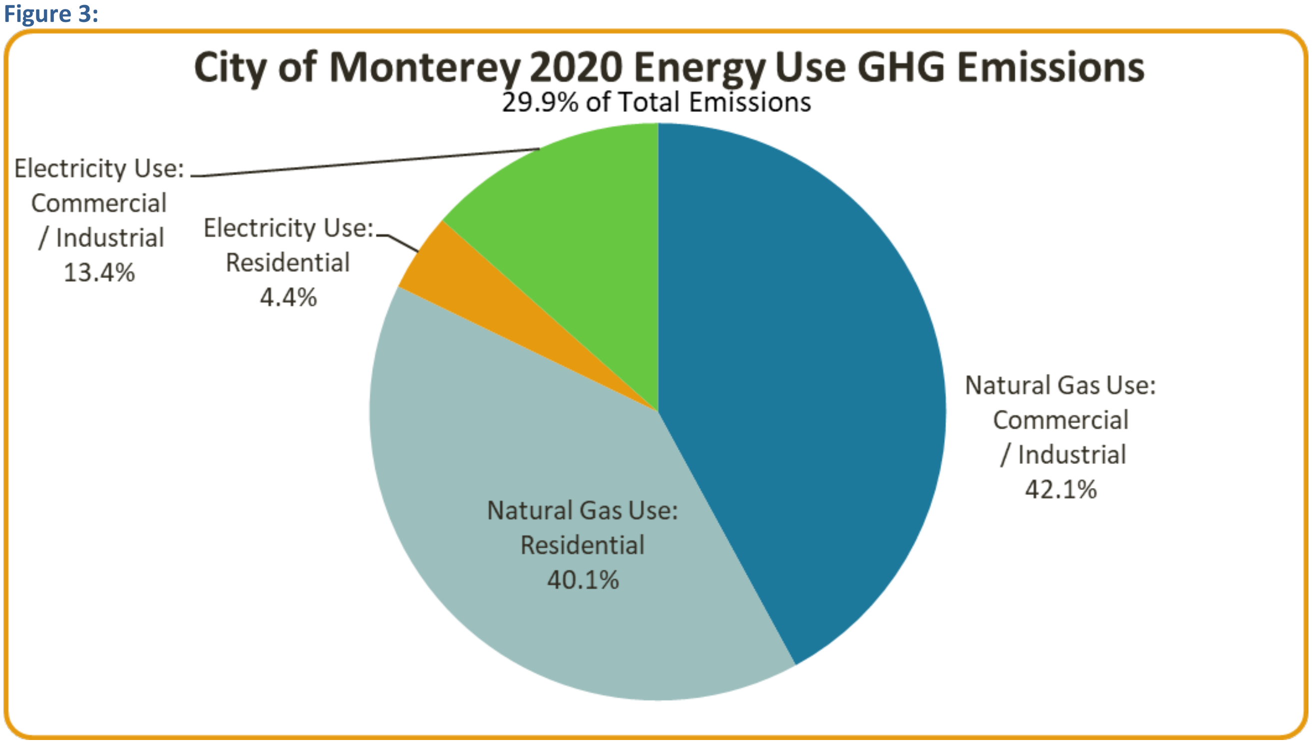

Table 3:

Natural Gas Use Emissions (CO2e):		Electricity Use: Emissions (CO2e):	
Commercial/Industrial	Residential	Commercial/Industrial	Residential
28,485	27,148	9,103	2,986

[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, The City of Monterey's transportation sector generated 65.3 percent of community-wide GHG emissions in 2020, or 148,281 metric tons of CO2e. The transportation sector analysis includes emissions from vehicle use throughout Monterey County, with a portion of vehicle use attributed to each jurisdiction on a household basis. Emissions from air travel of Monterey's residents were not included in the transportation sector analysis.

Solid Waste Sector

As mentioned previously, the solid waste sector accounted for 4.8 percent of community-wide GHG emissions in 2020 or 10,972 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 0.04 percent of community-wide GHG emissions in 2020 or 87 metric tons of CO2e. This sector accounts for the operation of wastewater treatment facilities used to treat Monterey's wastewater. Emissions from the treatment of wastewater through septic tank systems are not included in this inventory.

Conclusion

The City of Monterey 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, 2018,2019, and 2020. The City of Monterey has 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 calculate community-wide greenhouse gas emissions, this inventory can provide an important tool for the City of Monterey to update its Climate Action Plan. Specifically, this inventory serves to:

- Identify the largest sources of communitywide emissions.
- Identify remaining GHG inventorying needs
- Track changes to community emissions over time.
- Establish a guideline for setting future emissions reductions targets.
- 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, the Community protocol, and air quality models produced by CARB.

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. In some instances most recent natural gas and electricity usage in certain customer categories were not provided by PG&E due to data privacy concerns. In these situations AMBAG assumed that electricity and natural gas usage in the city had the same rate of change as the entire county. The county-wide electricity and natural gas use rates of change were then used in combination with older city usage data in order to estimate current electricity and natural gas usage.

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. Both PG&E and 3CE uses the Power Content Label (PCL) methodology to create the emissions factors for their electricity. 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 the EMission FACtor (EMFAC) model developed by CARB. EMFAC 2021 is the tool used by CARB to conduct emissions inventories of on road mobile sources in California. For purposes of this inventory, AMBAG Sustainability Program staff ran the model for Monterey County leaving all default values in place. Staff then used household data from the California Department of Finance to portion out the County-wide VMT and associated CO_2, CH_4 and N_2O emissions to each jurisdiction within the county. The VMT, CO_2, CH_4 and N_2O emissions attributed to the City of Monterey were then entered into Clearpath in order to calculate the total CO_2e emissions.

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 percent[3] of total methane emissions are recovered at the landfills to which the City of Monterey 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 Monterey'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: Additional Methodology Considerations

This Appendix describes methodologies and emissions sources which were not included in this inventory due to their emerging nature or due to a lack of consistent data sources. Some emissions were also not included because they are not required by the US community protocol and are not available for all jurisdictions or across all inventory years. This is because AMBAG staff prepares Community-wide GHG inventories for most of the jurisdictions on the central coast and seeks to use the same data sources and methodologies across all jurisdictions in order to enable an "apples to apples" comparison. Therefore when certain data sources could be used to calculate emissions for certain jurisdictions, and in some inventory years, but not others AMBAG seeks to maintain comparability across inventories.

While the methodologies highlighted in this appendix are not included in the inventory they should be of note to jurisdictions considering using this GHG inventory in the context of climate action planning since they offer insight into the different ways to conceptualize and calculate Community-wide GHG emissions. Further, the methodologies highlighted in this appendix could be included in future inventories prepared by AMBAG, and jurisdictions may choose to include these emissions when calculating and forecasting GHG emissions for the purpose of creating a climate action plan.

Global Warming Potential Values

Global Warming Potential (GWP) values are conversion factors assigned to each greenhouse gas in order to express the result of an inventory with a single Carbon Dioxide Equivalent (CO2e) value. Under this GWP framework CO2 is assigned a GWP of 1 while all other gases are assigned a value based on their comparative potency over a specific time period. This inventory uses the 100 years global warming potential values from the International Panel on Climate Change's 5th assessment report (AR5). In future inventories other GWP values could be used which could significantly modify the importance of different sectors. For example the IPCC has published 20 year GWP values as part of the AR5; using these values as opposed to the 100 year values would result in methane being considered a much more potent greenhouse gas and increase the importance of solid waste emissions. Another consideration is that the IPCC will continue to release assessment reports and that future inventories will most likely be updated with future GWP values. The latest GWP values were released in August 2021 as part of the IPCCs AR6 report. These new values reflect a higher impact for nitrous oxide, and a slight decrease in the impact of non-fossil methane.

Built Environment Emerging Methodologies: Residential, Commercial and Industrial Sectors

Electricity emissions factor methodology

Community wide GHG inventories rely on electricity emissions factors provided by Load Serving Entities (LSE) to calculate emissions from electricity use. Most climate action plans then make the assumption that under the mandates of SB 100 electricity will be significantly less carbon intensive in 2030 and carbon free by 2045. However depending on which emissions factor methodology is used these assumptions may prove to be less than accurate. For example an electricity mix meeting the requirements of SB 100, and procuring 100% of retail sales from qualified renewable and carbon free sources would be carbon neutral under one methodology but could still have significant emissions under other methodologies.

AMBAG has identified three electricity emissions factor methodologies which LSEs use to calculate electricity emissions.

- The Power Content Label (PCL) methodology: only accounts for electricity sold to customers on an annual basis under reporting requirements mandated by the California Energy Commission as part of AB 1110 rulemaking. LSEs are allowed to stack all of their renewable electricity and carbon free attributes (a market based system that enables load serving entities to purchase credits allowing electricity to be claimed as coming from a carbon free source) first and stop tracking emissions when they reach 100% of retail sales. This methodology is used in most GHG inventories and is used by load serving entities to create the Power Content Labels that customers are sent every year.

- The Integrated Resources Plan (IRP) methodology. This is the approached used by the CPUC in their regulatory proceedings in order for the state to meet the SB 100 goals. Load serving entities need to match supply with demand on an hourly basis and also account for electricity procured for resource adequacy as well as transmission and distribution losses. Under this methodology utilities are allowed to apply carbon free attributes to their electricity supply.

- The Clean System (CS) Methodology: this is very similar to the IRP methodology with the difference that carbon free attributes are not allowed.

The use of one of these methodologies over another has significant policy implications since the carbon intensity of electricity informs the effectiveness of GHG reduction measures such as energy efficiency, Integrated Demand Side Management (IDSM), Demand Response (DR), built environment electrification, and transportation sector electrification. In future inventories the methodology used to calculate emissions factors may change, which could have considerable impact on GHG emissions from electricity and associated climate action planning strategies.

Fugitive methane emissions from natural gas production and distribution

The current natural gas emissions calculation methodology only includes emissions resulting from combustion of natural gas in stationary sources within the community such as boilers, furnaces, and water heaters. This methodology does not account for fugitive methane emissions which occur due to leaks across the natural gas production and distribution infrastructure. If these fugitive methane emissions were included they could potentially increase the emissions intensity of natural gas significantly. One solution to calculate these emissions would be to estimate a default percentage of fugitive emissions per amount of natural gas usage and update the natural gas emissions factor accordingly. However there is currently no accepted methodology to make these calculations. Staff will continue to monitor the best available science and calculate emissions accordingly.

Stationary combustion fuels other than natural gas

The only stationary combustion fuel included in this GHG inventory is natural gas however there may be other fuels used within the community such as propane, wood, or liquefied petroleum gas (LPG). While it was not possible to accurately estimate how much emissions these fuels generated as part of this GHG inventory, future efforts may seek to quantify the impact of non-natural gas stationary combustion as new data sources and methodologies become available.

Transportation emissions

On Road Origin Destination Vehicles Miles Traveled (VMT) Methodology

The current GHG inventory calculates VMT and associated GHG emissions by scaling down county-wide data obtained using EMFAC 2021 model on a household per jurisdiction basis. This is different from an origin destination methodology, which relies on a transportation model to assign a start and end point to modeled vehicle trips and attributes the VMT from these trips to jurisdictions based on standard assumptions. Under this methodology, as defined in the U.S. community protocol, VMT from trips that begin or end within a jurisdiction are accounted for while VMT from trips that pass through jurisdictions are not tracked. Under the U.S. Community Protocol the origin destination methodology is the recommended methodology for calculating GHG emissions from on road transportation emissions.

AMBAG, as the Metropolitan Planning Organization (MPO) for the Monterey Bay Area, is required to produce planning and programming documents that maintain the region's eligibility for federal and state transportation assistance. This includes the Metropolitan Transportation Plan/Sustainable Communities Strategy (MTP/SCS) which is published every four years. In order to support the metropolitan transportation planning activities and decision-making process AMBAG staff develops, maintains, and utilizes a Regional Travel Demand Model (RTDM). The current model is a 4-step model which is calibrated at the tri-county regional level for the base year. Model runs are created to evaluate the impact of different transportation infrastructure and land use decisions over a 25+ year time frame.

RTDMs are designed to evaluate performance of regional transportation system and predict future demand based on the regional demographic and economic growth pattern. Considering the regional variation, local development pattern and interdependency of local jurisdiction, using a 4-step regional modeling tool to model individual trips for a jurisdiction by jurisdiction attribution can lead to significant uncertainties. This is especially true for smaller jurisdictions (i.e. Sand City, Carmel, or King City). Furthermore, since model development require substantial datasets, time and cost, they are often calibrated for their base year, and are not intended for back casting or annual updates. This can lead to significant methodological discrepancies between inventory years. AMBAG therefore plans to continue scaling down county-wide EMFAC 2021 as part of the regularly updated jurisdictional inventories. However, as the new activity-based model is developed, staff will continue to reassess modeling capabilities in order to consider a switch to an origin destination methodology as part of the regularly updated GHG inventories.

AMBAG encourages jurisdictions to consider using an origin destination methodology as part of their Climate Action Plan GHG inventory. As always, AMBAG staff is available to meet with jurisdictional staff and discuss the data sources and methods which could be used to calculate transportation emissions as part of its CAP development process.

Off-road transportation and equipment use

Emissions from off-road transportation and equipment account for fossil fuel use from off-road vehicles such as airport ground support vehicles, water borne vessels, and locomotives; as well as equipment use such as pumps, or construction equipment. The California Air Resources Board has created an “OFFROAD” model which provides data at the county-wide level on off-road transportation and equipment use fuel use and emissions. There is currently no accepted methodology for disaggregating this county wide data down to the jurisdictional level, and off-road emissions were therefore not included in this inventory. Staff will continue to evaluate whether these emissions can be included in future inventories, especially as updated data sources and methodologies become available.

Solid Waste emissions

Waste in place methodology

The current inventory uses a methodology which assigns the totality of methane emissions occurring as the result of landfilling waste in the year that it is disposed of. This means all methane emissions from waste sent to landfills in a year is part of that years GHG inventory even though the actual waste decomposition and release of emissions may occur over a much longer time period. It is possible to deploy an alternative so called “waste in place” methodology in order to calculate emissions from each landfill as they are occurring. Under this methodology, data on the amount of waste sent to each landfill is collected since the landfill opening year and yearly emissions are modeled based on this historical data.

Because most jurisdictions send waste to over 10 landfills within a given year, this is currently not a practical methodology. However as new data sources and models become available it may become feasible in future years to calculate solid waste emissions using this methodology.

Landfill Methane capture rates

The current inventory assumes that all landfill have the minimum regulatory methane capture rate. However different landfills, through the adoption of cutting edge technologies, may have higher methane capture rates. Because most jurisdictions send waste to over 10 landfills within a given year it is currently not practical to estimate methane capture rates for each landfill. AMBAG staff will continue to monitor the best available data and methodologies in order to estimate landfill methane capture rates.

Landfill waste composition

The current inventory uses the statewide waste characterization study in order to estimate the methane potency of solid waste sent to landfills. However each landfill has different waste streams and their solid waste composition may vary. While landfill specific waste characterization studies exist they are not updated as regularly as the statewide study, therefore using specific landfill waste composition studies is currently unfeasible. This does mean that local efforts to increase organic waste diversion may not be fully captured as part of the GHG inventory. As new data sources become available it may become feasible in future years to use more localized waste compositions. As such AMBAG staff will continue to monitor this issue as part of each inventory year.

Water and wastewater emissions

Water and wastewater conveyance outside of the community boundaries

The current GHG inventory includes water and wastewater conveyance electricity usage emissions occurring within the community boundaries as part of the electricity and natural gas usage emissions in the Commercial/industrial sector. However emissions from water and wastewater conveyance outside of community boundaries are not included. Different methodologies could be used to estimate total water use and wastewater production in the community which could then be coupled with water energy intensity factors in order to calculate total electricity and natural gas use from water and wastewater conveyance to the community. However using this methodology could double count emissions already included in the inventory. As well, water and wastewater energy intensity factors are only available for certain agencies and can vary drastically depending on the water source and treatment method. While conveyance emissions are currently not included in this inventory future efforts may seek to quantify these emissions especially as updated data sources and methodologies become available.

Fugitive Methane emissions from Septic Tanks

Fugitive methane emissions from septic tank emissions are currently not included in the GHG inventory. However it is possible to assign a percentage of the population that is estimated to be served by septic tanks and use a population based methodology to calculate these emissions.

GHG Emissions from High GWP Gases

The current inventory does not include emissions from high GWP gases such as refrigerants. This is because these emissions are mostly fugitive in nature, occurring as a result of leaks in cooling systems. As part of the yearly California-wide GHG inventory, CARB does include emissions from high GWP gases. In 2019 these high GWP gasses accounted for approximately five percent of total California emissions. There is however currently no accepted methodology to include these gases in jurisdictional inventories. One potential approach is to scale down California-wide emissions using a population-based methodology; however this can lead to significant inaccuracies.

It is also important to note that as communities face increased heat due to climate change and as communities work to meet the state's building decarbonization goals, equipment which uses refrigerants such as heat pumps may be become more prevalent. This will mean that GHG emissions from high GWP gases may become more significant in future years. As with other methodologies included in this appendix staff may seek to quantify these emissions especially as updated data sources and methodologies become available.

Embedded carbon and GHG emissions resulting from the consumption of goods and services

This GHG inventory does not include emissions that occur as a result of consumption of goods such as food and clothing. Likewise GHG emissions generated as part of the production of building materials, the so called "embedded carbon" of a building, are not included. However it is important to acknowledge that these emissions can be significant, especially because most goods a purchased by community members and businesses are produced outside of the community. While there currently is no standard protocol for inventorying consumption-based emissions or evaluating embedded carbon, numerous cities has expressed interest in calculating these emissions. As with other methodologies included in this appendix staff will continue to monitor available data sources and accepted methodologies in order to determine which emissions sources should be included in future GHG inventories.

Natural and working lands carbon stock and yearly change

The current GHG inventory does not include emissions that exist as a result of changes in the natural and working lands carbon stock. In order for these emissions to be calculated regular natural and working lands carbon stock inventories would first have to be created for each jurisdiction. The impact of land use decisions, urban forestry initiatives, and soil conservation measures on the carbon stock could then be taken into account and included in the inventory either as emissions sources or as sinks. As jurisdictions seek to meet aggressive GHG reduction targets, natural and working lands carbon stock emissions could become an integral part of the inventory process. AMBAG staff will continue to monitor this emerging sector and may seek to quantify these emissions as updated data sources and methodologies become available.

Appendix C: 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 bodata.

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 ($MTCO_2e$). 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 (CO_2), methane (CH_4), nitrous oxide (N_2O).

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 (CH_4):
A hydrocarbon that is a greenhouse gas with a global warming potential estimated at 28 times that of carbon dioxide (CO_2). 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 Fifth Assessment Report (AR5).

Nitrous Oxide (N_2O):
A powerful greenhouse gas with a global warming potential of 265 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 Fifth Assessment Report (AR5).

Process emissions:
Emissions from industrial processes involving chemical transformations other than combustion.