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DRAFT GREENHOUSE GAS EMISSIONS INVENTORY REPORT

Monterey County

Community Climate Action and Adaptation Plan

Prepared for:

Final Greenhouse Gas Emissions Inventory Report for the Monterey County Community Climate Action and Adaptation Plan

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TABLE OF CONTENTS

Appendices

Figures

Tables

LIST OF ABBREVIATIONS

2030 MCAP	2030 Municipal Climate Action Plan
3CE	Central Coast Community Energy
ACO	Agricultural Commissioner's Office
ADC	alternative daily cover
AMBAG	Association of Monterey Bay Area Governments
CalRecycle	California Department of Resources Recycling and Recovery
CAP	climate action plan
Cap-and-Trade	California Greenhouse Gas Cap-and-Trade Program
CARB	California Air Resources Board
CCAAP	Community Climate Action and Adaptation Plan
CDFA	California Department of Food and Agriculture
CDPR	California Department of Pesticide Regulation
CEC	California Energy Commission
CH_4	methane
CO_2	carbon dioxide
CO_2e	carbon dioxide equivalent
Community Protocol	*U.S. Community Protocol for Accounting and Reporting of Greenhouse Gas Emissions*
County	County of Monterey
county	unincorporated Monterey County
CPUC	California Public Utilities Commissions
eGRID	Emissions & Generation Resource Integrated Database
EMFAC2021	EMissions FACtor model
EPA	U.S. Environmental Protection Agency
GHG	greenhouse gas
GWP	global warming potential
ICLEI	ICLEI - Local Governments for Sustainability
IPCC	Intergovernmental Panel on Climate Change
kBTU	kilo British thermal unit
kWh/AF	kilowatt-hours per acre-foot
lb/kBTU	pounds per kilo British thermal unit
lb/MWh	pounds per megawatt-hour
lb/therm	pounds per therm
LFG	landfill gas
LPG	liquid propane gas

M1W	Monterey One Water
MBARD	Monterey Bay Air Resources District
MCWRA	Monterey County Water Resources Agency
Methane Regulation	Greenhouse Gas Emission Standards for Crude Oil and Natural Gas Facilities
MSW	municipal solid waste
$MTCO_2e$	metric tons of carbon dioxide equivalent
MWh	megawatt-hour
N_2O	nitrous oxide
NWCG	National Wildfire Coordinating Group
OPR	Governor's Office of Planning and Research
PG&E	Pacific Gas and Electric Company
RTAC	Regional Targets Advisory Committee
RTDM	Regional Transportation Demand Model
SB	Senate Bill
TCR	The Climate Registry
USDA	U.S. Department of Agriculture
VMT	vehicle miles traveled
WWTP	wastewater treatment plant

1 INTRODUCTION

1.1 PROJECT OVERVIEW

The County of Monterey (County) is developing its Community Climate Action and Adaptation Plan (CCAAP) to reduce greenhouse gas (GHG) emissions within the unincorporated county (county). The County is also updating its Municipal Climate Action Plan for 2030 (2030 MCAP) to reduce GHG emissions associated with local government operations. These efforts are driven by Mitigation Measure CC-1a included in the County's 2010 General Plan Final Environmental Impact Report, which requires the County to develop a GHG Reduction Plan (or climate action plan [CAP]). Measure CC-1a also requires the establishment of an updated baseline GHG emissions inventory for community and municipal operations emissions, a business-as-usual forecast of GHG emissions, and a 2030 reduction goal, along with the identification and quantification of GHG reduction measures and an implementation plan. The CCAAP and 2030 MCAP are intended to align with the requirements of the County's 2010 General Plan, as well as State goals, and will serve to reduce GHG emissions for target years 2030 and 2045. The long-term target year of 2045 was chosen to align with the statewide carbon neutrality goal expressed in Assembly Bill 1279.

1.2 INVENTORY PURPOSE AND DESCRIPTION

The first step in the climate action planning process is to develop a GHG emissions inventory, which is a snapshot of the GHG emissions associated with a jurisdiction in a given year. The purpose of an inventory is to:

- establish a baseline against which future emissions levels and future reduction targets can be measured,
- understand the sectors and sources generating GHG emissions and their relative contribution to total emissions, and
- monitor progress towards achievement of GHG reduction targets.

Preparing a GHG emissions inventory is a critical step in climate action planning. To develop and implement a CAP that will effectively reduce GHG emissions, local governments must first have a comprehensive understanding of the emissions that are generated by activities within their jurisdictions. GHG emissions inventories not only serve to provide this knowledge, but they also act as the basis for measuring progress and provide agencies with a framework to track emissions over time and assess the effectiveness of CAP implementation. Additionally, local governments often prepare inventories to exhibit accountability and leadership, motivate community action, and demonstrate compliance with regulations.

A GHG emissions inventory estimates emissions generated within a defined geographic boundary during a single year. It identifies the sectors, sources, and activities that are producing these emissions and the relative contribution of each, while also providing a baseline used to forecast emissions trends into the future. This information is used to set reduction targets that are consistent with State objectives and then to create solutions for reducing GHG emissions locally through the creation of a CAP.

1.3 COUNTY INVENTORY BACKGROUND

The County's metropolitan planning organization, the Association of Monterey Bay Area Governments (AMBAG), regularly provides GHG emissions inventories to the jurisdictions within its service territory. AMBAG completed an emissions inventory for the unincorporated county for 2019, the year for which the most recent data were available at the time this analysis was conducted. While AMBAG's inventory generally follows industry standards and best practices for GHG inventorying, an evaluation of AMBAG's 2019 inventory revealed methodologies and assumptions that needed to be refined to use the 2019 inventory as the basis for the County's CCAAP. These refinements include the following:

- updated global warming potential (GWP) values;

- updated on-road transportation data and emissions;
- revised emissions factors for electricity supplied by Pacific Gas & Electric Company (PG&E); and
- the inclusion of off-road vehicles and equipment emissions, additional wastewater treatment-related emissions, and additional agriculture-related emissions.

This first phase in preparation of the CCAAP involved evaluating AMBAG's 2019 community GHG emissions inventory for the unincorporated county and revising the 2019 community inventory to be consistent with recommended protocols. This report describes protocols, methods, and other considerations for preparing a GHG emissions inventory; discusses associated methods, assumptions, emissions factors, and data sources; provides an evaluation of the 2019 community GHG emissions inventory prepared by AMBAG; and presents the results of the revised 2019 community inventory. This GHG emissions inventory provides a foundation for the subsequent phases of the CCAAP development processes, including forecasting future emissions, setting GHG emissions reduction targets, developing GHG emissions reduction measures, and creating an implementation plan that will help the County achieve identified targets.

1.4 ORGANIZATION OF THIS REPORT

This report consists of three main parts:

- Section 2: Inventory Overview outlines considerations for preparing a community GHG emissions inventory, summarizes industry-leading protocols and methods for inventories, discusses inventory boundaries, and describes the emissions sectors and sources that are included and excluded in the County's 2019 community GHG emissions inventory.
- Section 3: Data, Methods, and Assumptions describes the data, methods, and assumptions used in the County's 2019 community inventory and presents GHG emissions estimates by sector, including new methods and emissions sources recommended by GHG inventory protocols but not previously included in prior inventories.
- Section 4: Summary of Inventory Results presents the results of the 2019 community GHG emissions inventory for each sector and source.

1.5 UPDATES SINCE PREVIOUS INVENTORY PUBLICATIONS

Since previous unincorporated Monterey County emissions inventories were published on the County's Konveio website, several updates were made based on comments received. These updates are described in more detail in the following sections and are related to the following specific sources: livestock operations on agricultural lands (see Section 3.4.9), fertilizer application on agricultural lands (see Section 3.4.9), pesticide application on agricultural lands (see Section 3.4.10), and vehicle miles traveled associated with residents, employees, and visitors of the unincorporated county (see Section 3.4.4). All other data, methods, and assumptions remain the same since the August 2022 publication.

2 INVENTORY OVERVIEW

2.1 CONSIDERATIONS FOR DEVELOPING AN INVENTORY

Nations, states, local jurisdictions, public agencies, and corporations estimate GHG emissions for different purposes. Several general approaches exist to quantify GHG emissions, and the method chosen by governments or private entities is driven by the purpose for developing an inventory. State, federal, and international agencies have developed industry protocols and recommendations for local governments preparing GHG emissions inventories at the community level.

The traditional GHG emissions inventory used by local governments in the climate action planning process, known as a "production-based" inventory, estimates GHG emissions generated by activities occurring within a defined boundary during a single year. This has become the standard approach recommended by industry protocols and includes emissions that are generated from community activities that occur within the jurisdictional boundary of the agency/entity, such as those emitted from natural gas furnaces used for heating buildings throughout a community. It also includes certain "trans-boundary" emissions that are associated with activities occurring within the inventory's boundary but are released into the atmosphere outside of the boundary. For example, electricity emissions in a production-based inventory are attributed to a community based on electricity consumption within the inventory boundary, even if the electricity was generated and produced GHG emissions outside of the inventory boundary. More information regarding considerations for preparing production-based inventories is included in Sections 2.2 through 2.4.

In addition to traditional production-based emissions inventories, corporations, local governments, and other entities may prepare a "consumption-based" emissions inventory. A consumption-based emissions inventory includes the total lifecycle GHG emissions generated by the production, shipping, use, and disposal of goods and services consumed by residents of a community within a given year. For example, for transportation GHG emissions, this approach includes the emissions embedded in motor vehicle production, emissions from shipping the vehicle to the consumer, emissions from producing and refining fuel used in the vehicle, emissions from the combustion of the fuel used in the vehicle, and the emissions resulting from the ultimate disposal of the vehicle.

The production-based approach was chosen for the County's community GHG emissions inventory, which is the focus of this report. This is consistent with recommendations and guidance from industry protocols (described further below), as well as State agencies, including the California Air Resources Board (CARB) and the Governor's Office of Planning and Research (OPR). Production-based inventories provide local governments with the information needed to develop effective climate action policy within their communities; because of this, the production-based inventory method is the most common approach taken by local governments across California and nation.

2.1.1 General Plan Consistency

In the 2010 Monterey County General Plan Final Environmental Impact Report, preparation of a GHG Reduction Plan was identified as a mitigation measure that would reduce climate change impacts associated with development contemplated in the General Plan. Policy OS-10.11 was added to provide the desired mitigation and updated in 2020 to reflect the latest State targets and advancements in climate action planning.

Included in Policy OS-10.11 are minimum requirements for the CCAAP, which state that the CCAAP shall: "Establish a current inventory of GHG emissions in the County of Monterey including but not limited to residential, commercial, industrial, and agricultural emissions" (County of Monterey 2020).

The inventory presented in the report includes all of the required sectors that meet the objectives of Policy OS-10.11.

2.2 PROTOCOLS AND METHODOLOGIES

2.2.1 U.S. Community Protocol for Accounting and Reporting of Greenhouse Gas Emissions

Several inventory protocols have been developed to provide guidance for communities and local governments to account for emissions accurately and consistently. ICLEI – Local Governments for Sustainability (ICLEI) develops protocols for local-scale accounting of emissions that have become the industry standard for local governments developing GHG emissions inventories. The most recent guidance for community-scale emissions inventories is ICLEI's July 2019 publication *U.S. Community Protocol for Accounting and Reporting of Greenhouse Gas Emissions* (Community Protocol), Version 1.2 (ICLEI 2019). State agencies, including CARB and OPR, recommend that jurisdictions prepare community GHG emissions inventories using the guidelines included in the Community Protocol (CARB 2017:100; OPR 2017:226).

The Community Protocol identifies six principles for GHG accounting and reporting. These principles were adapted from internationally recognized sources and were used to guide the development of the Community Protocol. ICLEI recommends that local governments consider the principles when preparing an inventory. The GHG accounting and reporting principles are summarized below.

- Relevance, Including Policy Relevance, and Utility for Users: The ultimate objective and intent of an inventory should be considered during the inventory development process. Inventories should be organized in a way that is understandable and useful for policy makers and the public while appropriately reflecting community GHG emissions and enabling the evaluation of emissions trends over time.
- Accuracy: The use of GHG emissions accounting methods that are expected to systematically under- or over-estimate emissions should be avoided. Decisionmakers should be able to take action with reasonable assurance as to the integrity of emissions estimates.
- Completeness: Community GHG emissions inventories should be as comprehensive as possible and include all emissions associated with the community, as well as community GHG emissions "sinks" (i.e., the opposite of an emissions source; any reservoir, natural or otherwise, that accumulates and stores GHG emissions)[1].
- Measurability: Methods used to quantify GHG emissions should be readily available, adequately substantiated and of known quality, and updated regularly as established methods evolve.
- Consistency and Comparability: Community inventories should consistently use preferred, established methods to enable tracking of emissions over time, evaluation of reduction measures effectiveness, and comparison between communities. Alternative methods should be documented and disclosed.
- Transparency: All relevant data sources, methods, and assumptions should be disclosed and described to allow for future review and replication. Similarly, all relevant issues should be documented and addressed coherently.

Consistent with these recommendations as well as industry standards and best practices, the County's community GHG emissions inventory primarily follows methodologies provided by the Community Protocol. However, additional established methods were used for selected GHG emissions sources where the Community Protocol does not provide guidance, or where updated methods have been established that improve the accuracy of emissions estimates. Table 1 below (on page 8) provides a summary of places in which alternate methods were used. This approach is consistent with guidance from the Community Protocol: "Protocol estimation methods must be used in Protocol-compliant inventories except where the user identifies and documents another method that is likely to better satisfy the Protocol reporting principles" (ICLEI 2019:20-21). The following sections describe additional methods used for estimating GHG emissions in the county.

[1] The County's GHG emissions sinks include carbon stored in soil and vegetation in agricultural and natural lands. An estimate of carbon stock within the unincorporated county is part of a separate technical memorandum and will be published with the CCAAP.

2.2.2 California Air Resources Board Methods

Each year, CARB develops and publishes the California GHG Emission Inventory for emissions statewide in California. CARB follows Intergovernmental Panel on Climate Change (IPCC) guidelines for national reporting, and its overarching approach and many of its methods align with the Community Protocol. As climate change science and GHG emissions accounting practices have evolved, CARB has implemented additional methodologies for certain emissions sectors and sources that are not included in the Community Protocol.

The County aims to align with CARB's inventory as much as possible. Consistency with the State's methodologies and approaches will be beneficial for upcoming phases of the CCAAP development process, including estimating projected GHG emissions in the future (i.e., forecasting emissions), setting GHG emissions reduction targets, and measuring progress towards established targets.

The County's inventory utilizes methods provided by CARB and the California GHG Emission Inventory for several emissions sectors and sources. For example, although the Community Protocol recommends using the U.S. Environmental Protection Agency's (EPA's) NONROAD model, emissions from off-road vehicles and equipment in the county were obtained from CARB's OFFROAD models, which provide more geographically specific emissions estimates for California using the best available data.

2.2.3 Alternative Methods

Although nearly all emissions calculations relied on protocols and methods from the Community Protocol and CARB, some emissions estimates were prepared using alternative methodologies from established sources. This approach was only taken when methods were not provided by the Community Protocol or CARB, which aligns with Community Protocol guidance. For example, GHG emissions from open burning (i.e., the burning of vegetative material), were estimated using methodologies and emissions factors from the National Wildfire Coordinating Group (NWCG)'s *Smoke Management Guide for Prescribed Fire* (NWCG 2018). This sector was included because of the County's ability to have authority or significant influence over this sector. This is discussed in more detail in Section 2.3.2 below.

2.3 EMISSIONS SECTORS AND SOURCES

There are several approaches for categorizing and grouping GHG emissions in community inventories. Generally, GHG emissions are organized into emissions sectors, which frequently include agriculture, building energy, transportation, solid waste, water, and wastewater. Sometimes these sectors are subcategorized further, such as residential building energy and nonresidential building energy, and sectors may also be combined, such as water and wastewater. The purpose of categorizing GHG emissions into broad sectors is to provide local governments and the public with a useful organization of community emissions. Importantly, GHG emissions sectors may not align directly with economic sectors (e.g., hospitality), but there may be overlaps for some communities.

Within GHG emissions sectors, emissions are generated in a variety of ways. Motor vehicles burn fossil fuels and emit GHGs directly into the atmosphere; the electricity used in homes and businesses produces indirect emissions from power plants; and solid waste that ends up in landfills breaks down and releases GHG emissions over time. The Community Protocol organizes different types of community GHG emissions into two general categories:

- GHG emissions **sources** are those that release emissions directly into the atmosphere as a result of any physical process that occurs within the jurisdictional boundary of the inventory. Natural gas combustion for heating in homes and diesel fuel combustion in motor vehicles within the community are examples of GHG emissions sources.
- GHG emissions **activities** are those that release emissions into the atmosphere either directly or indirectly as a result of the use of energy, materials, and/or services within the community. For example, GHG emissions from a community's electricity use are accounted for and considered GHG emissions activities, even if the burning of fossil fuels to generate the electricity occurred and produced emissions outside of the inventory boundary.

For the sake of clarity, this report uses "GHG emissions sources" to represent both direct in-boundary emissions *sources* as well as indirect emissions that are produced out-of-boundary as a result of *activities* that occur within the community. The GHG emissions sources in the County's community inventory are organized under seven sectors: building energy (residential and nonresidential), on-road transportation, off-road vehicles and equipment, solid waste, water supply, wastewater treatment, and agriculture.

Figure 1 depicts how sectors, sources, and activities are considered and categorized in the County's inventory.

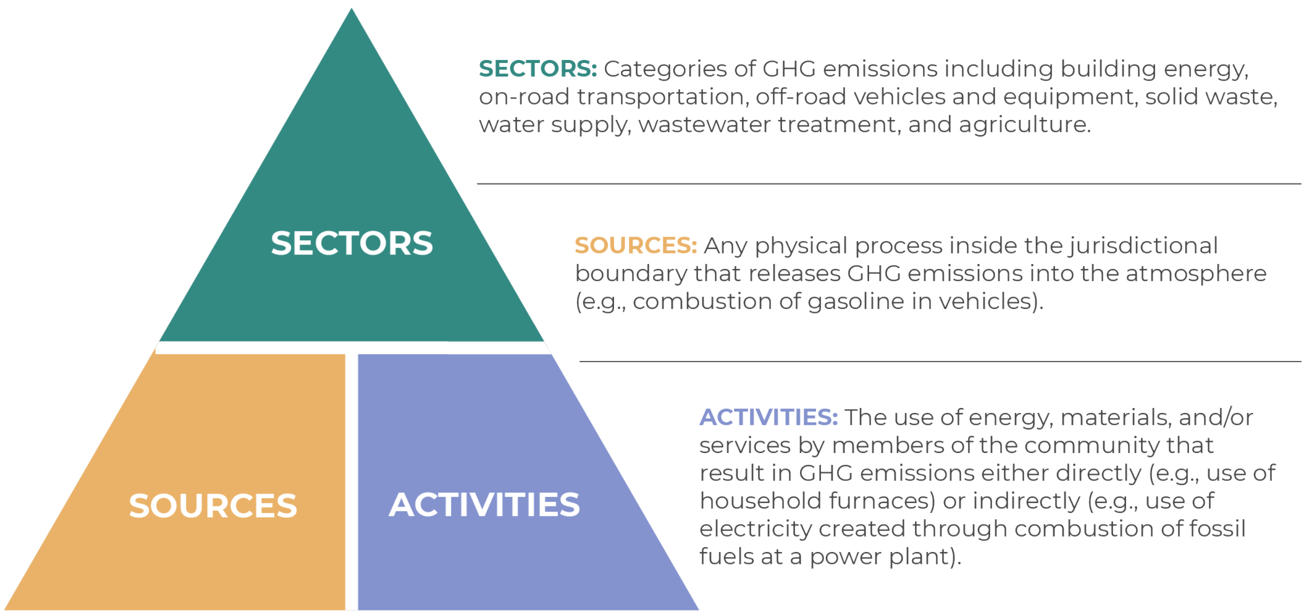

Figure 1 Emissions Sectors, Sources, and Activities Hierarchy

2.3.1 Community Protocol-Compliant Sources

When developing a community inventory, it is important for local governments to determine what will be included in the inventory scope. This may be influenced by factors such as the purpose and intended narrative of the inventory, the reporting framework that will be used, and the GHG emissions sources present in the community. While local governments have some flexibility in determining an inventory's scope, the Community Protocol requires the inclusion of a minimum of five emissions sources in community inventories:

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

The Community Protocol strongly encourages local governments to include other emissions-generating sources in accounting and reporting as well. For the County, this includes the four emissions sectors required by Policy OS-10.11 of the General Plan: residential, commercial, industrial, and agricultural emissions. Considerations for including additional sources are outlined in the following section.

2.3.2 Additional Sources

Many local governments go beyond the minimum requirements of the Community Protocol. For example, many community inventories in California account for GHG emissions from off-road vehicles and equipment. Communities that have agricultural land uses also commonly include agriculture-related emissions in inventories.

Beyond the five emissions sources required by the Community Protocol, the additional GHG emissions sources included in a community inventory are determined by the jurisdiction conducting the inventory. The Community Protocol recommends the Local Government Significant Influence reporting framework, where local governments account for all emissions sources over which they have authority or significant influence. This approach benefits the overall climate action planning process because it emphasizes the emissions sources that the local government has the greatest ability to address (ICLEI 2019:29). For example, because California's local air districts regulate permits issued for open burning, the County decided to include emissions from open burning in the CCAAP's inventory. Conversely, because the County has limited control over the waste that is generated by other communities but is disposed at landfills within the unincorporated county, imported waste-related emissions are excluded from the County's inventory.

2.4 BOUNDARIES

The scope and boundary chosen for estimating GHG emissions may vary depending on the focus and/or intent of the inventory. For example, while corporate inventories use the concept of ownership to guide GHG emissions accounting—where emissions generated by all sources and activities owned by the entity are accounted for, regardless of where emissions are produced—community-scale inventories serve to convey information about emissions associated with politically-defined communities (ICLEI 2019:12).

As described in the previous sections, production-based community inventories include emissions that are produced within a community's geographic boundary as well as those that are produced outside the boundary but result from activities within the community. Inventories following the Community Protocol are required to include several emissions sources; however, certain emissions sources that are located within the inventory boundary may be excluded from a community inventory. The following section outlines considerations and the decision-making framework for determining what GHG emissions sources are included or excluded from an inventory.

2.4.1 County Inventory Boundary

The CCAAP aims to reduce GHG emissions from sources within the unincorporated county for which the County has regulatory authority or significant influence. Importantly, the CCAAP will not apply to incorporated places within the county. Because of this, the County's inventory only includes emissions generated from sources and activities occurring within the boundaries of the unincorporated county; it does not account for GHG emissions generated from activities occurring outside of the County's jurisdiction, as the County does not have operational control of or authority over these emissions sources. Therefore, GHG emissions generated from activities within incorporated places (e.g., City of Salinas) or lands owned and/or managed by State and federal agencies (e.g., Federal Responsibility Areas) are excluded from the inventory.

Additionally, the County's community inventory does not account for embedded or lifecycle GHG emissions. The County's inventory evaluates emissions using the production-based approach; therefore, the County's inventory does not consider the upstream emissions generated by the consumption of goods and services within the community.

The GHG emissions sectors and sources included and excluded in the County's 2019 community inventory are presented in Table 1 below. Additionally, Table 1 identifies the protocol that provided the methodology for estimating GHG emissions from each emissions source. Emissions sources that identify multiple protocols used a combination of data and methods from multiple protocols. Fertilizer application and off-road vehicles and equipment calculations used methods consistent with IPCC and the Community Protocol but substituted California-specific data obtained from CARB for less geographically specific data provided by the protocols. More information can be found in Appendix A.

Table 1 2019 Monterey County Summary of Sectors and Sources

Sector/Source	Included	Excluded	Protocol(s)
Agriculture			
Livestock Management – Enteric Fermentation	Emissions from enteric fermentation from livestock within the county		ICLEI
Livestock Management – Manure Management	Emissions associated with manure management practices within the county		ICLEI
Fertilizer Application	Emissions associated with fertilizer use within the county		CARB/IPCC
Agricultural Equipment - Off-Road Vehicles and Equipment	Emissions from agricultural off-road vehicles and equipment within the county		ICLEI/CARB
Agricultural Equipment – Irrigation Pumps	Emissions from diesel fuel use for irrigation pumps within the county		CARB
Open Burning	Emissions from open burning of vegetative matter within the county		NWCG
On-Road Transportation			
On-Road Transportation[1]	Emissions from all vehicle miles traveled (VMT) associated with vehicles registered in the unincorporated county	Emissions from VMT associated with vehicles registered outside the unincorporated county, even if the vehicle is driven within the unincorporated county	CARB
Building Energy			
Electricity	Emissions associated with all electricity consumed within the unincorporated county		ICLEI
Natural Gas	Emissions from natural gas consumed within the unincorporated county		ICLEI
Backup Generators	Emissions from diesel, liquid propane gas, and natural gas consumed in backup generators within the unincorporated county		ICLEI
Solid Waste			
Community-Generated Solid Waste	Emissions from all waste generated within the unincorporated county	Emissions from waste generated outside of the county but disposed of within the county	ICLEI
Off-Road Vehicles and Equipment			
Off-Road Vehicles and Equipment	Emissions from off-road vehicles and equipment within the unincorporated county		ICLEI/CARB

Sector/Source	Included	Excluded	Protocol(s)
Wastewater Treatment			
Wastewater Treatment	Emissions associated with wastewater generated within the unincorporated county	Emissions from wastewater generated outside of the county but treated within the county	ICLEI
Water Supply			
Water Supply	Emissions associated with water use within the unincorporated county		ICLEI

Notes: CARB = California Air Resources Board; ICLEI = ICLEI – Local Governments for Sustainability; IPCC = Intergovernmental Panel on Climate Change; NWCG = National Wildfire Coordinating Group; VMT = vehicle miles traveled.

[1] A more detailed description of the methodology used to estimate on-road transportation emissions is included in Section 3.4.4.

Source: Compiled by Ascent Environmental in 2024.

3 DATA, METHODS, AND ASSUMPTIONS

3.1 OVERVIEW OF ACTIVITY DATA AND EMISSIONS FACTORS

The basic calculation for estimating GHG emissions involves two primary inputs: activity data and emissions factors. Activity data refers to the relevant measurement of a community's activity resulting in emissions, and emissions factors represent the amount of a GHG emitted on a per unit of activity basis. Emissions factors are applied to activity data (i.e., the two values are multiplied together) to estimate GHG emissions. For example, in the residential energy sector, activity data of annual community electricity consumption in megawatt-hours (MWh) is multiplied by an emissions factor in pounds of GHG per MWh, which results in a pounds of GHG emissions value. This calculation-based methodology is used for estimating emissions from most sources in the County's inventory. An overview of activity data and emissions factors for each emissions source, along with data sources, is shown in Table 2. Detailed methods are described in the following sections.

Table 2 2019 Monterey County Summary of Activity Data and Emissions Factors

Sector/Source	Input Type	Description and Data Sources
Agriculture		
Livestock Management	Activity data	Livestock population data from the County of Monterey Agricultural Commissioner's Office's 2019 Crop Report and U.S. Department of Agriculture's 2017 Census of Agriculture, supplemented by information from local stakeholders and University of California, Agriculture and Natural Resources
	Emissions factor	Livestock-specific emissions factors from CARB
Fertilizer Application	Activity data	Fertilizer application data from the Central Coast Regional Water Quality Control Board
	Emissions factor	Organic and synthetic fertilizer emissions factors from CARB
Agricultural Equipment - Off-Road Vehicles and Equipment	Activity data	Off-road vehicles and equipment activity data and emissions factors from CARB
	Emissions factor	
Agricultural Equipment – Irrigation Pumps	Activity data	Diesel-powered irrigation pumps data from Monterey Bay Air Resources District (MBARD)
	Emissions factor	Monterey County region-specific average emissions factor from CARB
Open Burning	Activity data	Open burning data from MBARD
	Emissions factor	Average emissions factors from NWCG
On-Road Transportation		
On-Road Transportation[1]	Activity data	Vehicle miles traveled data for Monterey County from CARB's EMission FACtor (EMFAC) model, prorated to unincorporated area only based on its share of households
	Emissions factor	Monterey County-specific emissions factors from CARB
Building Energy		
Electricity	Activity data	Electricity consumption data from Pacific Gas and Electric Company (PG&E) and Central Coast Community Energy (3CE)
	Emissions factor	Utility-specific emissions factors from 3CE, The Climate Registry (TCR), and EPA
Natural Gas	Activity data	Natural gas consumption data from PG&E and California Energy Commission
	Emissions factor	Average emissions factors from TCR
Backup Generators	Activity data	Fuel consumption data from MBARD
	Emissions factor	Average emissions factors from TCR

Sector/Source	Input Type	Description and Data Sources
Solid Waste		
Community-Generated Solid Waste	Activity data	Waste disposal data from the California Department of Resources Recycling and Recovery
	Emissions factor	Mixed municipal solid waste emissions factor from EPA
Off-Road Vehicles and Equipment		
Off-Road Vehicles and Equipment	Activity data	Off-road vehicles and equipment activity and emissions factors data from CARB
	Emissions factor	
Wastewater Treatment		
Wastewater Treatment	Activity data	Wastewater generation and process-related data from Monterey One Water (M1W) and the County
	Emissions factor	Emissions factors based on treatment processes from M1W and ICLEI
Water Supply		
Water Supply	Activity data	Water consumption data from Monterey County Water Resources Agency Energy intensity factors from California Public Utilities Commission
	Emissions factor	

Notes: 3CE = Central Coast Community Energy; AMBAG = Association of Monterey Bay Area Governments; CARB = California Air Resources Board; EPA = U.S. Environmental Protection Agency; ICLEI = ICLEI – Local Governments for Sustainability; IPCC = Intergovernmental Panel on Climate Change; M1W = Monterey One Water; MBARD = Monterey Bay Air Resources District; NWCG = National Wildfire Coordinating Group; PG&E = Pacific Gas and Electric Company; TCR = The Climate Registry.

[1] A more detailed description of the methodology used to estimate on-road transportation emissions is included in Section 3.4.4.

Source: Compiled by Ascent Environmental in 2024.

3.2 GLOBAL WARMING POTENTIALS AND EMISSIONS UNITS

GHG emissions other than carbon dioxide (CO_2) generally have a stronger insulating effect and thus, a greater ability to warm the Earth's atmosphere through the greenhouse effect. This effect is measured in terms of a pollutant's Global Warming Potential (GWP). CO_2 has a GWP factor of one while all other GHGs have GWP factors measured in multiples of one relative to the GWP of CO_2. This conversion of non-CO_2 gases to one unit enables the reporting of all emissions in terms of carbon dioxide equivalent (CO_2e), which allows for the consideration of all gases in comparable terms and makes it easier to communicate how various sources and types of GHG emissions contribute to climate change. The standard unit for reporting emissions is metric tons of carbon dioxide equivalent ($MTCO_2e$).

Consistent with the best available science, these inventories use GWP factors published in the Sixth Assessment Report from IPCC, where methane (CH_4) and nitrous oxide (N_2O) have GWP factors of 27.9 and 273, respectively (IPCC 2021). These values represent the GWP of GHG on a 100-year time horizon. This means that CH_4 is approximately 28 times stronger than CO_2 and N_2O is 273 times stronger than CO_2 in their potential to warm Earth's atmosphere over the course of 100 years. The use of 100-year GWP values is consistent with CARB methods and reflects the long-term planning horizon of the CCAAP.

3.3 DATA QUALITY AND ACCURACY

When preparing a GHG emissions inventory, the goal is to use the best available data and methodologies to develop the most accurate picture of a community's emissions. However, some degree of inaccuracy is inherent to all inventories. As described by the Community Protocol, "While no community inventory is fully comprehensive (some emissions cannot be estimated due to a lack of valid methods, a lack of emissions data, or for other reasons), community inventories often aim to provide as complete a picture of GHG emissions associated with a community as is feasible" (ICLEI 2019:12). The accuracy of a GHG emissions inventory is primarily dependent on activity data (e.g., tons of solid waste generated by a community), emissions factors (e.g., grams of CO_2 per vehicle mile traveled [VMT] in a county), and scaling factors (e.g., percentage of county-level off-road vehicles and equipment emissions attributed to a local jurisdiction).

Development of the County's GHG emissions inventory was a robust and comprehensive process rooted in industry standards and best practices, and it included extensive research and consultation with County staff and departments, regional and State agencies and organizations, and community stakeholders to ensure data was as accurate as feasible. The County recognizes that even though its inventory is consistent with all protocols previously discussed and the data used are as accurate as feasible, perfect precision in emissions estimates will never be possible. The following are some assumptions that were made due to the unavailability of data:

- **Electricity consumption by electricity utility.** Assumptions regarding electricity consumption by provider were made based on the availability of data from utilities. It was assumed that all nonresidential and Direct Access electricity was supplied by Central Coast Community Energy (3CE).
- **Nonresidential natural gas consumption.** A complete dataset for nonresidential natural gas usage in 2019 was not available from PG&E. Average annual change in countywide nonresidential natural gas consumption, including incorporated places, was used to estimate nonresidential natural gas usage in the unincorporated county.
- **On-road transportation emissions.** The preferred methodology for estimating on-road transportation emissions was not feasible due to lack of data availability. An alternative methodology was required to estimate emissions from VMT for the on-road transportation sector. Refer to Section 3.4.4, "On-Road Transportation," for additional information.
- **Open burning activity data.** Open burning data for the county was obtained from Monterey Bay Air District (MBARD). However, MBARD was not able to provide a complete dataset of all tons of vegetative matter burned within the county; some burn operations were excluded and not accounted for in emissions estimates.
- **Water and wastewater activity data.** Data for water consumption within the unincorporated county were limited. Approximate total water supply was obtained from the Monterey County Water Resources Agency (MCWRA) and verified through County sources, and it was assumed that all water used within the unincorporated county was extracted, conveyed, treated, and distributed within the unincorporated county. Additionally, water consumption electricity usage could not be differentiated by use type; therefore, water supply emissions were assumed to be captured entirely within the building energy sector, which accounts for all electricity consumption. Similarly, wastewater-related data was limited. It was assumed that Monterey One Water (M1W) was the only centralized wastewater treatment plant (WWTP) serving the unincorporated county and that onsite septic systems served the rest of the community.
- **Agriculture data granularity.** Much of the data used to calculate agriculture-related GHG emissions are specific to the unincorporated county and were obtained from local sources. For example, cattle population data for the unincorporated county were derived using data from the County of Monterey Agricultural Commissioner's Office (ACO) combined with information from local stakeholders and University of California, Agriculture and Natural Resources (UCANR). However, some of the agricultural data used for emissions calculations were aggregated at the regional level. For example, agricultural off-road vehicles and equipment data were obtained from CARB, and these data were provided for the entire county (i.e., including incorporated places). For data that were provided for the entire county, it was assumed that all agricultural operations countywide occurred in the unincorporated county. Refer to Section 3.4.9, "Agriculture," for additional information.
- **Scaling factors used to attribute emissions to the unincorporated county level.** Certain emissions sectors use data that are not specific to the unincorporated county but the county as a whole (including incorporated places), and scaling factors were used to apportion data to the unincorporated county. For example, emissions data for off-road vehicles and equipment, obtained from CARB's OFFROAD models, are provided for the entire county (including incorporated cities). Population, employment, and service population factors (i.e., the proportion of the unincorporated county compared to the entire county) were used to scale county-level data to the unincorporated area. Additionally, agricultural data were obtained for the entire county, and it was assumed that all agricultural land in the county is located in the unincorporated county.

3.4 COMMUNITY INVENTORY DATA AND ASSUMPTIONS

3.4.1 Sector-Specific Assumptions and Methods

The following sections describe in detail the methods, data, and assumptions that were used in estimating the county's community GHG emissions in 2019. Population and employment data were used to scale activity levels for certain emissions sources and sectors. Population and employment data for 2019 were obtained from AMBAG's 2022 Final Regional Growth Forecasts, which were developed for AMBAG's 2045 Metropolitan Transportation Plan/Sustainable Communities Strategy (AMBAG 2020).

The list below summarizes this information at a high level for each sector.

- Building Energy: Annual electricity and natural gas usage data for the county were provided by PG&E and 3CE, and additional natural gas usage data was obtained from the California Energy Commission (CEC). Utility emissions factors were provided by 3CE, The Climate Registry (TCR), and EPA (see Table 3 below). Annual nonresidential backup generator usage was provided by MBARD. Emissions factors for nonresidential backup generator fuels were obtained from TCR.
- On-Road Transportation: For the on-road transportation sector, annual VMT at the entire county level were obtained from the 2021 EMissions FACtor (EMFAC2021) model, CARB's statewide mobile source emissions inventory model. Countywide VMT (including incorporated cities) was scaled to the unincorporated county using the proportion of households within the unincorporated county compared to the county as a whole (explained further in Section 3.4.4, "On-Road Transportation"). Vehicle emissions factors were derived from the EMFAC2021 model.
- Off-Road Vehicles and Equipment: Off-road vehicles and equipment emissions were estimated from CARB's OFFROAD2007 and OFFROAD2021 models and scaled by population, employment, or service population (i.e., the sum of population and employment) depending on the equipment type.
- Solid Waste: Emissions associated with waste generated by residents and businesses in the county were estimated using disposal data available from the California Department of Resources Recycling and Recovery (CalRecycle) for landfills receiving waste from the county. Landfill gas (LFG) collection information was available from EPA.
- Water Supply: Using guidance provided by ICLEI, water supply emissions were estimated using approximate water consumption volumes obtained from MCWRA in combination with region-specific energy intensity factors obtained from the California Public Utilities Commissions (CPUC).
- Wastewater Treatment: Emissions from wastewater treatment depend on the types of treatment processes and equipment that centralized WWTPs use. Emissions in this sector are also generated from onsite wastewater treatment systems, or septic systems. Data regarding treatment processes, population served, digester gas combustion, and daily nitrogen load were obtained from M1W to estimate emissions from centralized WWTPs. Population data for calculating emissions from septic systems was estimated using M1W service population data combined with population data from AMBAG.
- Agriculture: Emissions associated with the agriculture sector result from livestock management, fertilizer application, open burning, and operation of agricultural equipment. Agriculture emissions were estimated using data available from the County, UCANR, CARB, California Department of Food and Agriculture (CDFA), the Central Coast Regional Water Quality Control Board, U.S. Department of Agriculture (USDA), and MBARD.

3.4.2 Utility Emissions Factors

Emissions of CO_2, CH_4, and N_2O per MWh of electricity or therm of natural gas can vary by location and from year to year depending on several factors. Utility-specific emissions factors were obtained and used throughout the 2019 inventories to estimate GHG emissions from electricity and natural gas consumption. Sources for electricity and natural gas emissions factors are shown below.

- **Electricity:** Utility electricity emissions factors for CO_2, CH_4, and N_2O were obtained from 3CE, TCR, and EPA's Emissions & Generation Resource Integrated Database (eGRID). 3CE provided a CO_2 emissions factor for 2019, and the CO_2 emissions factor for PG&E in 2019 was interpolated using PG&E's 2018 CO_2 emissions factor obtained from TCR's 2020 Default Emission Factors and the requirements of the Renewables Portfolio Standard included in Senate Bill (SB) 100 (TCR 2020)[2]. California-specific emissions factors for CH_4 and N_2O obtained from eGRID2019 were used for PG&E (EPA 2021). For 3CE, these emissions factors were adjusted using additional data available from eGRID2019 to account for the specific energy resources used in 3CE's energy generation portfolio.
- **Natural Gas:** Utility natural gas emissions factors for CO_2, CH_4, and N_2O were obtained from TCR's 2020 Default Emission Factors (TCR 2020).

Specific utility emissions factors used in the inventory calculations are shown below in Tables 3 and 4. Emissions factors are shown in standards units for electricity (pounds of GHG per MWh) and natural gas (pounds per therm). Emissions factors are also presented in pounds of GHG per kilo British thermal unit (kBTU) to enable a comparison between energy types in similar terms.

Table 3 2019 Monterey County Electricity Emissions Factors

Provider	Pollutant	Emissions Factor (lb/MWh)	Emissions Factor (lb/kBTU)
3CE	CO_2	9.99	0.0029
	CH_4	0.028	0.0000081
	N_2O	0.0036	0.0000011
PG&E	CO_2	198.65	0.0528
	CH_4	0.033	0.0000097
	N_2O	0.004	0.0000012

Notes: 3CE = Central Coast Community Energy; CH_4 = methane; CO_2 = carbon dioxide; kBTU = kilo British thermal unit; lb = pounds; MWh = megawatt-hours; N_2O = nitrous oxide; PG&E = Pacific Gas and Electric Company.

Source: Utility emissions factors provided by 3CE, TCR, and EPA. Compiled by Ascent Environmental in 2022.

Table 4 2019 Monterey County Natural Gas Emissions Factors

Provider	Pollutant	Emissions Factor (lb/therm)	Emissions Factor (lb/kBTU)
PG&E	CO_2	11.7	0.117
	CH_4	0.00104	0.0000104
	N_2O	0.0000220	0.0000002

Notes: CH_4 = methane; CO_2 = carbon dioxide; kBTU = kilo British thermal unit; lb = pounds; MWh = megawatt-hours; N_2O = nitrous oxide; PG&E = Pacific Gas and Electric Company.

Source: Utility emissions factors provided by TCR. Compiled by Ascent Environmental in 2022.

3.4.3 Building Energy

Residential and nonresidential building energy use in the county resulted in approximately 252,388 $MTCO_2e$ in 2019. This sector generated approximately 20 percent of the county's emissions in 2019 and represents the third-largest emissions sector in the inventory. Most of these emissions were a result of natural gas combustion for heating and cooking in homes and businesses, while a small proportion of the county's building energy emissions were associated with electricity use, primarily for lighting and heating, ventilation, air conditioning, and cooling, and to power appliances, due to nearly-carbon-free electricity supplied by 3CE (see the residential energy section below for

[2] A third party-verified CO_2 emissions factor for PG&E in 2019 was not available at the time this analysis was conducted. Therefore, the 2019 emissions factor was interpolated using the third party-verified CO_2 emissions factor for 2018 and the requirements of the Renewables Portfolio Standard under SB 100.

additional information). A marginal amount of nonresidential building energy emissions was associated with the consumption of diesel, liquified petroleum gas (i.e., propane), and natural gas in backup generators.

Nonresidential natural gas use accounted for approximately 66 percent of the county's 2019 building energy emissions, and residential natural gas use accounted for approximately 32 percent. Electricity from both residential and nonresidential buildings accounted for approximately 2 percent of emissions from the building energy sector, and nonresidential backup generators accounted for less than 1 percent of emissions from the building sector in 2019. Annual electricity, natural gas, and backup generator usage and GHG emissions are shown in Table 5, and additional information regarding each emissions source and calculations are discussed below.

Table 5 2019 Monterey County Community Building Energy Use and GHG Emissions

Energy Type	Quantity	GHG Emissions
Electricity	**MWh**	**$MTCO_{2e}$**
Residential	196,520	2,137
Nonresidential	712,851	3,931
Electricity Total	*909,370*	*6,067*
Natural Gas	**therms**	**$MTCO_2e$**
Residential	14,959,603	79,613
Nonresidential	31,290,974	166,526
Natural Gas Total	*46,250,577*	*246,138*
Backup Generators	**NA**	**$MTCO_2e$**
Nonresidential	NA	183
Energy Combined	**NA**	**$MTCO_2e$**
Residential	NA	81,750
Nonresidential	NA	170,639
Total	**NA**	**252,388**

Notes: Totals in columns may not sum exactly due to independent rounding. GHG = greenhouse gas; $MTCO_2e$ = metric tons of carbon dioxide equivalent; MWh = megawatt-hours; NA = not applicable.

Source: Calculated conducted by Ascent Environmental in 2022.

RESIDENTIAL ENERGY

Residential energy emissions in the county result indirectly from electricity consumption and directly from onsite combustion of natural gas. 3CE and PG&E are the providers of residential energy in the county. 3CE is a community-owned community choice energy agency established to source clean and renewable electricity for Monterey, San Benito, Santa Cruz, San Luis Obispo, and Santa Barbara counties. It began providing clean, near-zero-emissions electricity to the county in 2018 and currently serves approximately 96 percent of residential and nonresidential accounts, while the remaining electricity accounts are served by PG&E. Because 3CE provides almost all of the grid-supplied electricity consumed within the county, its near-carbon-free electricity results in a minor amount of electricity-related GHG emissions. Residential natural gas in the county is provided by PG&E.

Annual residential electricity usage data in the county in MWh was obtained from PG&E and 3CE. To calculate the $MTCO_2e$ of residential electricity consumption, emissions factors (shown in Table 3) for CO_2, CH_4, and N_2O were applied to electricity consumption data. Figure 2 below shows a sample calculation for estimating CO_2 emissions from residential electricity supplied by 3CE.

$$3CE\ Residential\ CO_2\ Electricity\ Emissions\ (MTCO_2) = residential\ electricity\ use\ (MWh) * CO_2\ emissions\ factor\ \left(\frac{lb\ CO_2}{MWh}\right) * pounds\ to\ metric\ ton\ conversion\ factor\ \left(\frac{MT}{lb}\right)$$

$$3CE\ Residential\ CO_2\ Electricity\ Emissions\ (MTCO_2) = 183{,}798\ MWh * 9.99 \frac{lb\ CO_2}{MWh} * \frac{1\ MT}{2{,}204.62\ lb} = 833\ MTCO_2$$

Source: ICLEI 2019; calculations conducted by Ascent Environmental in 2022.

Figure 2 Sample Calculation for Estimating Carbon Dioxide Emissions from Residential Electricity

Annual residential natural gas consumption in therms was obtained from PG&E. CO_2, CH_4, and N_2O emissions factors for natural gas were applied to consumption data to estimate $MTCO_2e$ from residential natural gas usage. Figure 3 below shows a sample calculation for estimating CO_2e emissions from residential natural gas supplied by PG&E.

$$PG\&E\ Residential\ Natural\ Gas\ Emissions\ (MTCO_2e) = residential\ natural\ gas\ use\ (therms) * \left[\left(CO_2\ emissions\ factor\ \left(\frac{lb\ CO_2}{therm}\right) * CO_2\ GWP\right) + \left(CH_4\ emissions\ factor\ \left(\frac{lb\ CH_4}{therm}\right) * CH_4\ GWP\right) + \left(N_2O\ emissions\ factor\ \left(\frac{lb\ N_2O}{therm}\right) * N_2O\ GWP\right)\right] * pounds\ to\ metric\ ton\ conversion\ factor\ \left(\frac{MT}{lb}\right)$$

$$PG\&E\ Residential\ Natural\ Gas\ Emissions\ (MTCO_2e) = 14{,}959{,}603\ therms\ * \left[\left(11.7 \frac{lb\ CO_2}{therm} * 1\right) + \left(0.00104 \frac{lb\ CH_4}{therm} * 27.9\right) + \left(0.000022 \frac{lb\ N_2O}{therm} * 273\right)\right] * \frac{1\ MT}{2{,}204.62\ lb} = 79{,}613\ MTCO_2e$$

Source: ICLEI 2019; calculations conducted by Ascent Environmental in 2022.

Figure 3 Sample Calculation for Estimating Carbon Dioxide Equivalent Emissions from Residential Natural Gas

NONRESIDENTIAL ENERGY

Nonresidential energy emissions, which are generated by commercial and industrial uses, result indirectly from electricity consumption and directly from onsite combustion of natural gas. PG&E and 3CE provide nonresidential electricity in the county. Both PG&E and 3CE provided nonresidential electricity in 2019, with over 99 percent of nonresidential electricity being supplied by 3CE. Nonresidential natural gas in the county is provided by PG&E.

Annual nonresidential electricity usage data in MWh was obtained from PG&E and 3CE. Annual commercial natural gas consumption in therms was obtained from PG&E, but PG&E was unable to provide industrial natural gas usage due to the 15/15 Rule[3]. Countywide (including incorporated places) commercial and industrial natural gas consumption data for 2013 through 2019 were obtained from CEC, which were used to calculate the percent change in natural gas consumption for the entire county from 2013 to 2019. This change, calculated to be an increase of approximately 11 percent, was applied to commercial and industrial natural gas consumption data provided by PG&E for 2013, the most recent year for which both commercial and industrial natural gas consumption was reported. Emissions associated with nonresidential energy consumption were quantified using the same methods as described above for residential energy calculations.

Data for annual nonresidential backup generators were obtained from MBARD, expressed as gallons for diesel fuel and standard cubic feet for propane and natural gas. Emissions factors obtained from TCR were applied to fuel consumption data to estimate GHG emissions associated with nonresidential backup generator usage.

[3] The 15/15 Rule originates from a CPUC ruling in 1997 that enacted privacy standards for utilities to help ensure customer anonymity when energy data is released to third parties without customer consent. The 15/15 Rule requires that aggregated data include a minimum of 15 customers with no one customer's load exceeding 15 percent of the group's energy consumption.

3.4.4 On-Road Transportation

Based on modeling conducted, on-road transportation in the county resulted in approximately 479,174 $MTCO_2e$ in 2019, or 39 percent of the county's emissions in 2019. The on-road transportation sector represents the largest emissions sector in the county. Annual VMT and GHG emissions from on-road transportation are shown in Table 6. Additional details and calculation methodologies and assumptions are described below.

Table 6 2019 Monterey County Community On-Road Transportation VMT and GHG Emissions

Source	Annual VMT	GHG Emissions ($MTCO_2e$)
On-Road Transportation	1,050,848,408	479,174

Notes: GHG = greenhouse gas; $MTCO_2e$ = metric tons of carbon dioxide equivalent; VMT = vehicle miles traveled.

Source: Calculated conducted by Ascent Environmental in 2022.

On-road transportation emissions are primarily the result of the combustion of gasoline and diesel fuels in passenger vehicles (i.e., cars, light-duty trucks, and motorcycles), medium- and heavy-duty trucks, and other types of vehicles permitted to operate "on road." To a smaller degree, emissions from on-road electric vehicles also result from upstream electricity generation; these emissions are represented in annual electricity emissions in the county. Due to lack of available data, emissions from the combustion of natural gas and other non-electric alternative fuels in on-road vehicles were not included in the community inventory and are assumed to have minimal contribution to total emissions.

Updates Since January 2022 Inventory Publication

AMBAG is the metropolitan planning organization responsible for regional transportation planning in Monterey, San Benito, and Santa Cruz counties. AMBAG's Regional Travel Demand Model (RTDM) provides VMT estimates for the entire region and for each of the three counties. However, according to AMBAG, VMT data provided by the RTDM is not accurate at smaller geographic scales, including at the jurisdiction-specific level. As part of its services for local agencies, AMBAG produced a 2019 GHG emissions inventory for the unincorporated county, including a VMT estimate, which was used in the January 2022 inventory publication.

The VMT estimate used in the January 2022 publication was derived from Caltrans' Highway Performance Monitoring System, which reports the average daily VMT on roadways by jurisdiction. These data were scaled by countywide VMT from EMFAC2017 to the unincorporated area by multiplying the VMT by the daily VMT associated with the County's jurisdiction (excluding military, state, and federal jurisdictions) and divided by the total daily VMT in the entire county. This method likely undercounted VMT because it excluded travel on state highways associated with trips starting or ending in the unincorporated county.

For this final October 2024 inventory report, VMT estimates specific to the unincorporated county were not available despite updates to AMBAG's RTDM. Therefore, estimates for countywide VMT (including incorporated places) were obtained from CARB's EMFAC2021 model. Using household data from the California Department of Finance, countywide VMT data were scaled to the unincorporated county using the proportion of households within the unincorporated county compared to the county as a whole. While this accounting method is not consistent with the Regional Targets Advisory Committee (also known as "RTAC") origin-destination method established through SB 375 and CARB recommendations, it is consistent with AMBAG's current approach for estimating jurisdiction-specific VMT and was chosen as the best currently available methodology.

An overall emissions rate for countywide VMT was derived from EMFAC2021. EMFAC2021 was used to generate emission rates for the county for the calendar year 2019 with all vehicle classes, model years, speeds, and fuel types. The countywide $MTCO_2e$ per mile emissions factor was calculated based on the distribution of VMT for each vehicle class and its emissions factor. The equation for estimating on-road transportation emissions is shown in Figure 4.

$$On\text{-}Road\ Transportation\ Emissions\ (MTCO_2e) = countywide\ VMT * \left[\left(CO_2\ emissions\ factor\ \left(\frac{g\ CO_2}{mile}\right) * CO_2\ GWP\right) + \left(CH_4\ emissions\ factor\ \left(\frac{g\ CH_4}{mile}\right) * CH_4\ GWP\right) + \left(N_2O\ emissions\ factor\ \left(\frac{g\ N_2O}{mile}\right) * N_2O\ GWP\right)\right] * grams\ to\ metric\ ton\ conversion\ factor\left(\frac{MT}{g}\right)$$

$$On\text{-}Road\ Transportation\ Emissions\ (MTCO_2e) = 1{,}050{,}848{,}408\ miles * \left[\left(446.9\frac{g\ CO_2}{mile} * 1\right) + \left(0.0277\frac{g\ CH_4}{mile} * 27.9\right) + \left(0.0304\frac{g\ N_2O}{mile} * 273\right)\right] * \frac{1\ MT}{1{,}000{,}000\ g} = 479{,}174\ MTCO_2e$$

Source: ICLEI 2019; calculations conducted by Ascent Environmental in 2022.

Figure 4 Sample Calculation for Estimating Carbon Dioxide Equivalent Emissions from On-Road Transportation

3.4.5 Off-Road Vehicles and Equipment

Based on modeling conducted, off-road vehicles and equipment operating in the county emitted approximately 17,616 $MTCO_2e$ in 2019, or 1 percent of the 2019 inventory. The largest emissions-generating off-road categories include construction and mining equipment and commercial harbor craft. The estimated annual emissions and scaling factors used are presented in Table 7 by vehicles and equipment type. Additional details regarding calculation methods and assumptions are discussed below.

Table 7 2019 Monterey County Community Off-Road Vehicles and Equipment GHG Emissions and Scaling Method

Off-Road Vehicles and Equipment Type	GHG Emissions ($MTCO_2e$)	Scaling Method
Airport Ground Support	215	population
Commercial Harbor Craft	4,018	employment
Construction and Mining Equipment	5,136	service population
Entertainment Equipment	58	employment
Industrial Equipment	1,860	employment
Lawn and Garden Equipment	637	population
Light Commercial Equipment	1,466	employment
Pleasure Craft	1,206	population
Portable Equipment	622	employment
Railyard Operations	394	employment
Recreational Equipment	113	population
Transportation Refrigeration Units	1,891	service population
Total	**17,616**	NA

Notes: Totals may not sum exactly due to independent rounding. GHG = greenhouse gas; $MTCO_2e$ = metric tons of carbon dioxide equivalent; NA = not applicable.

Source: Calculated conducted by Ascent Environmental in 2022, based on modeling from CARB's OFFROAD2007 and OFFROAD2021.

Emissions from the off-road vehicles and equipment sector result from fuel combustion in off-road vehicles and equipment. Data associated with this sector were available from CARB's OFFROAD2007 and OFFROAD2021 models. These models provide emissions details at the state, air basin, or county level. Monterey County emissions data from OFFROAD2007 and OFFROAD2021, which include emissions from incorporated areas of the county, were apportioned to the unincorporated county using custom scaling factors depending on the off-road vehicle and equipment type. For example, due to the likely correlation between commercial activity and employment, the county's portion of emissions from light commercial equipment in the entire county is assumed to be proportional to the number of jobs in the unincorporated county as compared to the county as a whole.

OFFROAD2007 provides emissions details for all off-road vehicle and equipment types, but OFFROAD2021 only provides details for certain types of off-road vehicles and equipment that are relevant to the county (i.e., it does not include emissions estimates for all off-road vehicle and equipment types). CARB recommends using OFFROAD2007 where desired information is unavailable from the OFFROAD2021 model, so data from both models were used (CARB 2020a). Additionally, while OFFROAD2021 provides estimates of CO_2 emissions, it does not provide estimates for CH_4 and N_2O emissions. To estimate CH_4 and N_2O emissions from the vehicle and equipment types included in OFFROAD2021, ratios of CH_4 to CO_2 and N_2O to CO_2 were obtained from OFFROAD2007 and applied to CO_2 data from OFFROAD2021 to calculate CH_4 and N_2O emissions.

3.4.6 Solid Waste

Based on modeling conducted, the solid waste sector was responsible for approximately 69,724 $MTCO_2e$ in 2019, or 6 percent of community GHG emissions. Community-generated solid waste emissions are associated primarily with the decomposition of solid waste generated by the county in landfills, while a smaller proportion of emissions are produced by the decomposition of alternative daily cover (ADC) generated by the county. Table 8 summarizes emissions from the solid waste sector. Additional details regarding calculation methods and assumptions are discussed below.

Table 8 2019 Monterey County Community Solid Waste Quantity and GHG Emissions

Source	Quantity (tons)	GHG Emissions ($MTCO_2e$)
Community-Generated Solid Waste	185,115	69,724

Notes: Totals may not sum exactly due to independent rounding. GHG = greenhouse gas; $MTCO_2e$ = metric tons of carbon dioxide equivalent.

Source: Calculations conducted by Ascent Environmental in 2022.

COMMUNITY-GENERATED SOLID WASTE

CH_4 emissions generated by community-generated solid waste occur from the decay of landfill disposed waste generated annually by residences and businesses in the county. A total of 172,514 tons of landfilled waste was reported for the county in 2019. In addition to landfilled waste, communities send ADC to landfills. ADC is non-earthen material used to cover an active surface of a landfill at the end of each operating day to control for vectors, fires, odors, blowing litter, and scavenging. This material can include compost, construction and demolition waste, sludge, green material, shredded tires, spray-on cement, and fabric. Given that ADC can also include organic material, CH_4 emissions from landfills result from organic decomposition in both waste disposal and ADC. ADC from the county was reported to be 12,601 tons in 2019. Data for landfilled waste and ADC was obtained from CalRecycle (CalRecycle 2021).

The amount of CH_4 released from community-generated waste depends on the LFG management systems of the landfills at which the waste is disposed. Information regarding the use of an LFG capture system was available from EPA's Landfill Methane Outreach Program. All facilities included an LFG capture system; therefore, the default LFG collection efficiency of 0.75 was applied to adjust emissions estimates, as recommended by the Community Protocol. Default waste characterization emissions factors obtained from EPA were used in calculations. A sample calculation for estimating emissions from solid waste is shown in Figure 5.

$$Solid\ Waste\ Emissions\ (MTCO_2e) = quantity\ of\ community\text{-}generated\ solid\ waste\ and\ ADC\ (tons) * (1 - default\ LFG\ collection\ efficiency) * (1 - default\ oxidation\ rate) * CH_4\ emissions\ factor\ \left(\frac{MT\ CH_4}{ton}\right) * CH_4\ GWP$$

$$Solid\ Waste\ Emissions\ (MTCO_2e) = (172{,}514\ tons + 12{,}601\ tons) * (1 - 0.75) * (1 - 0.1) * 0.06\frac{MTCH_4}{ton} * 27.9 = 69{,}724\ MTCO_2e$$

Source: ICLEI 2019; calculations conducted by Ascent Environmental in 2022.

Figure 5 Sample Calculation for Estimating Carbon Dioxide Equivalent Emissions from Solid Waste

3.4.7 Water Supply

Because all water is supplied from local sources within the county, it was assumed that all electricity usage associated with extracting, conveying, treating, and distributing water is captured in the building energy sector because these activities occur within the county. As discussed in Section 3.3, data for water consumption was limited and electricity usage associated with water supply could not be broken down by use type. Therefore, based on modeling conducted, water supply emissions are incorporated in the residential and nonresidential electricity-related emissions presented in Table 5 above. GHG emissions associated with water supply occur from the indirect use of energy associated with water extraction, conveyance, treatment, and distribution to the point of use (e.g., residences, businesses). Table 9 presents water supply quantity by use type for the county in 2019.

Table 9 2019 Monterey County Community Water Supply Quantity and GHG Emissions

Source	Quantity (AF)	GHG Emissions ($MTCO_2e$)[1]
Residential and Nonresidential Water Supply	25,000	—
Agricultural Water Supply	475,000	—

Notes: AF = acre-feet; GHG = greenhouse gas; $MTCO_2e$ = metric tons of carbon dioxide equivalent.

1 Water supply emissions are captured in the building energy sector. Additional information regarding water supply emissions can be found in the section above this table and in Section 3.3, "Data Quality and Accuracy."

Source: Ascent Environmental 2022.

3.4.8 Wastewater Treatment

Based on modeling conducted, wastewater treatment resulted in GHG emissions of approximately 15,586 $MTCO_2e$, which represents 1 percent of total emissions. Septic systems accounted for approximately 72 percent of emissions from wastewater treatment, while centralized WWTPs make up the remaining 28 percent of emissions from this sector. Wastewater treatment emissions are summarized in Table 10, and additional details for this sector are included below.

Table 10 2019 Monterey County Wastewater Treatment GHG Emissions

Wastewater Treatment Type	GHG Emissions ($MTCO_2e$)
Centralized WWTPs	3,749
Septic Systems	11,837
Total	**15,586**

Notes: Totals may not sum exactly due to independent rounding. GHG = greenhouse gas; $MTCO_2e$ = metric tons of carbon dioxide equivalent; WWTP = wastewater treatment plant.

Source: Calculations conducted by Ascent Environmental in 2022.

SEPTIC SYSTEMS

Onsite septic systems are used to collect wastewater in rural areas of the county. These systems collect wastewater onsite in underground tanks, which create anaerobic conditions. Microorganisms biodegrade the soluble organic material found in waste, which results in fugitive CH_4 emissions. Consistent with the Community Protocol, wastewater discharge and treatment energy intensities associated with septic tanks and other onsite systems are assumed to be negligible.

CH_4 emissions from the septic systems in the county were calculated based on population served, using Equation WW.11(alt) of the Community Protocol. Direct data for the population served by septic systems in the county was unavailable. This population was estimated by calculating the difference between the county's total population and the population served by M1W's centralized WWTP, which was obtained from M1W. This method resulted in an estimate of 97,775 individuals in the county served by septic systems. Figure 6 below shows a sample calculation for estimating emissions from septic systems.

$$Septic\ Systems\ Emissions\ (MTCO_2e) = population\ served * daily\ biological\ oxygen\ demand\ load\ \left(\frac{kg\ BOD_5}{person}\right) * maximum\ CH_4\ producing\ capacity\ for\ domestic\ wastewater\ \left(\frac{kg\ CH_4}{kg\ BOD_5}\right) * CH_4\ correction\ factor * days\ to\ year\ conversion\ factor\ \left(\frac{days}{year}\right) * kilograms\ to\ metric\ ton\ conversion\ factor\ \left(\frac{MT}{kg}\right) * CH_4\ GWP$$

$$Septic\ Systems\ Emissions\ (MTCO_2e) = 97{,}775 * 0.09\frac{kg\ BOD_5}{person} * 0.6\frac{kg\ CH_4}{kg\ BOD_5} * 0.22 * \frac{365.25\ days}{1\ year} * \frac{1\ MT}{1{,}000kg} * 27.9 = 11{,}837\ MTCO_2e$$

Source: ICLEI 2019; calculations conducted by Ascent Environmental in 2022.

Figure 6 Sample Calculation for Estimating Carbon Dioxide Equivalent Emissions from Septic Systems

CENTRALIZED WWTPS

Emissions associated with the treatment of sewage are highly dependent on the processes and components used by specific WWTPs such as lagoons, nitrification or denitrification, and digester gas or combustion devices. There are several centralized wastewater treatment providers in the county, most of which are small-scale operations that serve a minimal number of residents and obtaining data for all facilities was not feasible. The largest wastewater provider, M1W, is a centralized WWTP that collects wastewater from customers' homes and businesses. Collected wastewater enters the regional sewer system, which is operated by M1W, and is then conveyed and pumped to the facility where it is treated before being safely reintroduced to the environment. Specific data regarding the type of WWTP and associated processes, population served, digester gas production, and daily nitrogen load were available from M1W. Due to lack of available data for the other providers and the minimal number of individuals served by these providers, it was assumed that all individuals served by centralized WWTPs were served by M1W.

Stationary CH_4 and N_2O emissions from the combustion of digester gas were calculated based on the volume of digester gas provided by M1W, using Community Protocol equation WW.1a and WW.2a, respectively. These equations contain factors for the fraction of CH_4 and N_2O in digester gas. A sample equation for estimating N_2O emissions from digester gas combustion is displayed in Figure 7. Emissions of CH_4 from digester combustion were calculated using the same equation but with a CH_4 emissions factor rather than an N_2O emissions factor.

$$Digester\ Gas\ Combustion\ N_2O\ Emissions\ (MTCO_2e) = daily\ digester\ gas\ combustion\ \left(\frac{scf}{day}\right) * fraction\ of\ CH_4\ in\ biogas * default\ BTU\ content\ of\ CH_4\ \left(\frac{BTU}{scf}\right) * BTU\ to\ MMBTU\ conversion\ factor\ \left(\frac{MMBTU}{BTU}\right) * N_2O\ emissions\ factor\ \left(\frac{kg\ N_2O}{MMBTU}\right) * kilograms\ to\ metric\ ton\ conversion\ factor\ \left(\frac{MT}{kg}\right) * days\ to\ year\ conversion\ factor\ \left(\frac{days}{year}\right) * N_2O\ GWP$$

$$Digester\ Gas\ Combustion\ N_2O\ Emissions\ (MTCO_2e) = 12{,}160\frac{scf}{day} * 0.60 * 1{,}028\frac{BTU}{scf} * \frac{1\ MMBTU}{10^6\ BTU} * \left(6.3 * 10^{-4}\ \frac{kg\ N_2O}{MMBTU}\right) * \frac{1\ MT}{1{,}000kg} * \frac{365.25\ days}{1\ year} * 273 = 0.5\ MTCO_2e$$

Source: ICLEI 2019; calculations conducted by Ascent Environmental in 2022.

Figure 7 Sample Calculation for Estimating Nitrous Oxide Emissions from Wastewater Treatment Digester Gas Combustion

Process CH_4 emissions from lagoons were calculated based on population data, using Community Protocol equation WW.6(alt) for anaerobic or facultative lagoons. Equation WW.6(alt) contains factors for the maximum CH_4 production capacity of domestic wastewater and a CH_4 correction factor for anaerobic systems. Process N_2O emissions were also calculated based on population data, using Community Protocol WW.8 for WWTPs without nitrification or denitrification. These equations contain nitrogen loading factors and WWTP emission factors. Fugitive N_2O emissions from effluent discharge were calculated based on average daily nitrogen load data provided by M1W, using Community Protocol equation WW.12. A sample calculation for wastewater treatment process CH_4 emissions is shown in Figure 8. The equation for calculating both process and fugitive N_2O emissions follow the same principles but with different data inputs.

$$Process\ CH_4\ Emissions\ from\ Lagoons\ (MTCO_2e) = population\ served * commercial\ and\ industrial\ discharge\ factor * daily\ biological\ oxygen\ demand\ load\ \left(\frac{kg\ BOD_5}{person}\right) * (1 - fraction\ of\ BOD_5\ removed\ in\ primary\ treatment) * maximum\ CH_4\ producing\ capacity\ for\ domestic\ wastewater\ \left(\frac{kg\ CH_4}{kg\ BOD_5}\right) * CH_4\ correction\ factor * days\ to\ year\ conversion\ factor\ \left(\frac{days}{year}\right) * kilograms\ to\ metric\ ton\ conversion\ factor\ \left(\frac{MT}{kg}\right) *\ CH_4\ GWP$$

$$Process\ CH_4\ Emissions\ from\ Lagoons\ (MTCO_2e) = 8{,}422 * 1.25 * 0.09\frac{kg\ BOD_5}{person} * (1 - 0.325) * 0.6\frac{kg\ CH_4}{kg\ BOD_5} * 0.8 * \frac{365.25\ days}{1\ year} * \frac{1\ MT}{1{,}000 kg} * 27.9 = 3{,}128\ MTCO_2e$$

Source: ICLEI 2019; calculations conducted by Ascent Environmental in 2022.

Figure 8 Sample Calculation for Estimating Process Methane Emissions from Wastewater Treatment Lagoons

Energy-related emissions result from the energy required for wastewater treatment operations, including the energy used in wastewater conveyance as well as energy used throughout wastewater treatment processes and to provide power to the M1W facility. However, because M1W is located within the county, it was assumed that energy-related emissions from wastewater treatment are captured in the buildings energy sector emissions estimates.

3.4.9 Agriculture

Based on modeling conducted, emissions from the agriculture sector accounted for approximately 401,367 $MTCO_2e$ in 2019, or 32 percent of the county's emissions. Emissions in this sector are generated from fertilizer application, livestock management, agricultural off-road vehicles and equipment, diesel-powered irrigation pumps, and open burning. The county's agriculture emissions in 2019 are summarized in Table 11, and additional details and information about this sector are included below.

Table 11 2019 Monterey County Agriculture GHG Emissions

Agricultural Activity	GHG Emissions ($MTCO_2e$)	Percent of Total Agriculture Emissions
Fertilizer Application	204,598	51%
Livestock Management	106,512	27%
Agricultural Off-Road Vehicles and Equipment	61,564	15%
Diesel-Powered Irrigation Pumps	27,866	7%
Open Burning	827	<1%
Water Supply	0[1]	0%
Total	**401,367**	**100%**

Notes: Totals may not sum exactly due to independent rounding. GHG = greenhouse gas; $MTCO_2e$ = metric tons of carbon dioxide equivalent; NA = not applicable.

[1] Because data were unavailable for electricity usage associated with agricultural water supply, water-related emissions in the agriculture sector are included in the building energy sector. See Section 3.3., "Data Quality and Accuracy" and Section 3.4.7, "Water Supply" for additional information.

Source: Calculations conducted by Ascent Environmental in 2024.

LIVESTOCK MANAGEMENT

Updates Since January 2022 Inventory Publication

Livestock produce CH_4 and N_2O emissions through enteric fermentation (a type of digestion process) and decomposition of manure produced by these animals. The Monterey County 2019 Crop Report provided initial estimates for total heads of pasture-raised cattle and calves as well as stocker cattle in the county, which were revised based on information from local ranchers and research conducted by UCANR (County of Monterey 2020). USDA's 2017 Census of Agriculture provided total heads of sheep and lambs, goats, hogs, poultry, and horses (USDA 2019). The County of Monterey ACO and UCANR confirmed livestock heads data used in this inventory. Average months per year that livestock reside in the county were provided by UCANR and local ranchers. Emissions factors for livestock were obtained from CARB's California GHG Emission Inventory (CARB 2021).

Livestock heads and months per year data are shown in Table 12 below, along with associated data sources.

Table 12 2019 Monterey County Livestock Heads and Months per Year Data and Sources

Livestock Type	Livestock Heads	Months per Year	Source
Calves	9,601	8.5	Monterey County 2019 Crop Report; County of Monterey ACO
Replacements (0-12 months)	1,694	12	Monterey County 2019 Crop Report; UCANR
Replacements (12-24 months)	1,694	12	Monterey County 2019 Crop Report; UCANR
Cattle	12,010	12	Monterey County 2019 Crop Report; County of Monterey ACO
Bulls	601	12	Monterey County 2019 Crop Report; UCANR
Stocker Cattle	60,400	7	Monterey County 2019 Crop Report; County of Monterey ACO
Sheep and Lambs	1,200	12	Monterey County 2019 Crop Report; County of Monterey ACO
Goats	912	12	USDA 2017 Census of Agriculture
Hogs	1,600	12	Monterey County 2019 Crop Report; County of Monterey ACO
Poultry	2,229	12	USDA 2017 Census of Agriculture
Horses	1,475	12	USDA 2017 Census of Agriculture

Notes: ACO = Agricultural Commissioner's Office; UCANR = University of California, Agriculture and Natural Resources; USDA = U.S. Department of Agriculture.

Source: Compiled by Ascent Environmental in 2022.

Livestock emissions factors for enteric fermentation and manure management are displayed in Table 13. Emissions factors were obtained from CARB's California GHG Emission Inventory. Data used to estimate emissions factors for calves, replacements, cattle, bulls, and stocker cattle only apply to pasture-raised livestock in California; data for dairy and feedlot livestock, and average emissions factors for larger geographic scales, were not used in calculations.

Table 13 2019 Monterey County Enteric Fermentation and Manure Management Emissions Factors

Livestock Type	Enteric Fermentation Emissions Factor (kg CH_4/head)	Manure Management Emissions Factor (kg CH_4/head)	Manure Management Emissions Factor (kg N_2O/head)
Calves	10.7	0.56	0
Replacements (0-12 months)	61.2	0.56	0
Replacements (12-24 months)	70.6	0.56	0
Cattle	95.4	3.2	0
Bulls	98.7	3.3	0
Stocker Cattle	59.5	1.9	0
Sheep and Lambs	8.0	0.70	0.40
Goats	5.0	0.37	0.37

Livestock Type	Enteric Fermentation Emissions Factor (kg CH_4/head)	Manure Management Emissions Factor (kg CH_4/head)	Manure Management Emissions Factor (kg N_2O/head)
Hogs	1.5	16.2	0.10
Poultry	0	0.10	0.02
Horses	18.0	3.3	1.3

Notes: CH_4 = methane; kg = kilogram; N_2O = nitrous oxide.

Source: Compiled by Ascent Environmental in 2022.

Figure 9 below illustrates an example calculation for estimating livestock management CH_4 emissions from stocker cattle. This equation was used to calculate livestock management emissions for all other livestock using data for heads, average months per year, and emissions factors specific to each livestock type.

$$Livestock\ Management\ CH_4\ Emissions\ from\ Stocker\ Cattle\ (MTCO_2e) = \Bigg[\Bigg(stocker\ cattle\ heads * \left(enteric\ fermentation\ CH_4\ emissions\ factor\ \left(\frac{kg\ CH_4}{head}\right) + manure\ management\ CH_4\ emissions\ factor\ \left(\frac{kg\ CH_4}{head}\right)\right) * CH_4\ GWP\Bigg) + \left(stocker\ cattle\ heads * manure\ management\ N_2O\ emissions\ factor\ \left(\frac{kg\ N_2O}{head}\right) * N_2O\ GWP\right)\Bigg] * average\ months\ per\ year\ \left(\frac{months}{year}\right) * kilogram\ to\ metric\ ton\ conversion\ factor\left(\frac{MT}{kg}\right)$$

$$Livestock\ Management\ CH_4\ Emissions\ from\ Stocker\ Cattle\ (MTCO_2e) = \left[\left(60{,}400\ heads * \left(59.5\frac{kg\ CH_4}{head} + 1.9\frac{kg\ CH_4}{head}\right) * 27.9\right) + \left(60{,}400\ heads * 0\frac{kg\ N_2O}{head} * 273\right)\right] * \frac{7\ months}{12\ months} * \frac{1\ MT}{1{,}000\ kg} = 60{,}403\ MTCO_2e$$

Source: CARB 2021; calculations conducted by Ascent Environmental in 2022.

Figure 9 Sample Calculation for Estimating Livestock Management Methane Emissions from Stocker Cattle

AGRICULTURAL EQUIPMENT

GHG emissions associated with agricultural off-road vehicles and equipment were obtained from CARB's OFFROAD2007 and OFFROAD2021 models, as discussed in Section 3.4.5, "Off-Road Vehicles and Equipment." Emissions estimates obtained from CARB were assumed to occur entirely within the unincorporated county.

Agricultural equipment emissions also include emissions from diesel-powered irrigation pumps. MBARD provided the number of pumps in the county, and GHG emissions were estimated using MBARD-specific emissions factors obtained from CARB (CARB 2006). Activity data and associated GHG emissions from agricultural equipment are included in Table 14.

Table 14 2019 Monterey County Agricultural Equipment Data and Sources

Equipment Type	Activity Data	GHG Emissions ($MTCO_2e$)	Source
Off-Road Agricultural Equipment	—[1]	61,564	CARB
Diesel-Powered Irrigation Pumps	446 pumps	27,866	County

Notes: CARB = California Air Resources Board; County = County of Monterey.

[1] Emissions from off-road agricultural equipment were obtained directly from CARB's OFFROAD2007 and OFFROAD2021 models; no activity data were used to calculate emissions estimates.

Source: Calculations conducted by Ascent Environmental in 2022.

A sample calculation for estimating emissions from diesel-powered irrigation pumps is displayed in Figure 10.

$$Diesel\text{-}Powered\ Irrigation\ Pump\ Emissions\ (MTCO_2e) = number\ of\ pumps * CO_2\ emissions\ factor\ \left(\frac{tons\ CO_2}{day*pump}\right) * days\ to\ year\ conversion\ factor\ \left(\frac{days}{year}\right) * tons\ to\ metric\ tons\ conversion\ factor\left(\frac{MT}{ton}\right)$$

$$Diesel\text{-}Powered\ Irrigation\ Pump\ Emissions\ (MTCO_2e) = 446\ pumps * 0.189\frac{tons\ CO_2}{day*pump} * \frac{365.25\ days}{1\ year} * \frac{0.907\ MT}{1\ ton} = 27{,}866\ MTCO_2e$$

Source: CARB 2006; calculations conducted by Ascent Environmental in 2022.

Figure 10 Sample Calculation for Estimating Carbon Dioxide Equivalent Emissions from Irrigation Pumps

FERTILIZER APPLICATION

The application of fertilizers and other soil amendments produces GHG emissions. Nitrogen fertilizers produce N_2O emissions, and application of lime produces emissions of CO_2. Emissions factors and quantification methods for GHG emissions associated with application of nitrogen and lime were obtained from CARB and IPCC, respectively (IPCC 2006). Data for fertilizer and lime application is presented in Table 15 below.

Updates Since August 2022 Inventory Publication

Synthetic and organic nitrogen applications were quantified using data from the Central Coast Regional Water Quality Control Board (2022), which documents the amount of nitrogen applied, by agricultural operation and crop, in the county in 2019. In total, these data show 71,610 tons of nitrogen applied. This represents an increase from the previous estimate, which was 21,516 tons of nitrogen applied. This previous estimate was based on 2019 crop acreage data for 51 distinct crops in the county; each crop's acreage was multiplied by an assumed nitrogen application rate (in pounds of nitrogen per acre) that were compiled from a literature review. The method used in this memorandum improves on the previous method; this is because the new method is based on recorded nitrogen application within the county, rather than the previous method which relied on estimates based on assumed application rates.

Data regarding tonnage of lime were obtained from CDFA's *2019 Fertilizer Tonnage Report* (CDFA 2019).

Table 15 2019 Monterey County Fertilizer and Lime Application Data and Sources

Application Type	Application Amount (tons)	Source
Organic Nitrogen (including urea)	5,551	Central Coast Regional Water Quality Control Board
Synthetic Nitrogen (including urea)	66,059	Central Coast Regional Water Quality Control Board
Lime	20,768	California Department of Food and Agriculture

Source: Compiled by Ascent Environmental in 2024.

Emissions factors and data sources for fertilizer and lime application are shown in Table 16.

Table 16 2019 Monterey County Fertilizer and Lime Application Emissions Factors and Sources

Application Type	Fertilizer Emissions Factor (g N_2O/ton N fertilizer)	Source	Lime Application Emissions Factor (g CO_2/ton Lime)	Source
Organic Nitrogen (including urea)	14,253	CARB	NA	NA
Synthetic Nitrogen (including urea)	9,688	CARB	NA	NA
Lime	NA	NA	398,886	IPCC

Notes: CARB = California Air Resources Board; CO_2 = carbon dioxide; g = grams; IPCC = Intergovernmental Panel on Climate Change; N = nitrogen; N_2O = nitrous oxide; NA = not applicable.

Source: Compiled by Ascent Environmental in 2022.

Figure 11 below shows a sample calculation for estimating emissions from synthetic fertilizer application. The same equation was used to estimate emissions from organic nitrogen fertilizer and lime application using application type-specific data and emissions factors.

$$Synthetic\ Nitrogen\ Fertilizer\ Application\ Emissions\ (MTCO_2e) = quantity\ of\ synthetic\ nitrogen\ fertilizer\ applied\ (tons) * N_2O\ emissions\ factor\ \left(\frac{g\ N_2O}{ton\ N\ fertilizer}\right) * grams\ to\ metric\ tons\ conversion\ factor\ \left(\frac{MT}{g}\right) * N_2O\ GWP$$

$$Synthetic\ Nitrogen\ Fertilizer\ Application\ Emissions\ (MTCO_2e) = 66{,}059\ tons * 9{,}688 \frac{g\ N_2O}{ton\ N\ fertilizer} * \frac{1MT}{1{,}000{,}000g} * 273 = 174{,}713\ MTCO_2e$$

Source: CARB 2021; calculations conducted by Ascent Environmental in 2024.

Figure 11 Sample Calculation for Estimating Carbon Dioxide Equivalent Emissions from Fertilizer Application

OPEN BURNING

Open burning refers to agricultural and non-agricultural burning of vegetative matter, hazard reduction and ditch/road maintenance burning, and other burn activities that are permitted by MBARD. Tons of vegetative matter burned were obtained from MBARD, and CO_2 and CH_4 emissions factors were obtained from NWCG's *2018 Smoke Management Guide for Prescribed Fire* (NWCG 2018). It is important to note that MBARD was unable to provide a full dataset for all open burning operations, so emissions estimates for this source are likely underreported. Table 17 below shows data and emissions factors for open burning, including associated data sources.

Table 17 2019 Monterey County Open Burning Data, Emissions Factors, and Sources

Open Burning	Quantity (tons)	Source	CO_2 Emissions Factor (g CO_2/ton)	CH_4 Emissions Factor (g CH_4/ton)	Source
Vegetative Materials	497	MBARD	1,454,670	7,530	NWCG

Notes: CH_4 = methane; CO_2 = carbon dioxide; g = grams; MBARD = Monterey Bay Air Resources District; N_2O = nitrous oxide; NWCG = National Wildfire Coordinating Group.

Source: Compiled by Ascent Environmental in 2022.

A sample calculation for estimating open burning emissions is displayed in Figure 12.

$$Open\ Burning\ Emissions\ (MTCO_2e) = quantity\ of\ vegetative\ materials\ burned\ (tons) * \left[\left(CO_2\ emissions\ factor\ \left(\frac{g\ CO_2}{ton}\right) * CO_2\ GWP\right) + \left(CH_4\ emissions\ factor\ \left(\frac{g\ CH_4}{ton}\right) * CH_4\ GWP\right)\right] * grams\ to\ metric\ tons\ conversion\ factor\ \left(\frac{MT}{g}\right)$$

$$Open\ Burning\ Emissions\ (MTCO_2e) = 497\ tons * \left[\left(1{,}454{,}670 \frac{g\ CO_2}{ton} * 1\right) + \left(7{,}530 \frac{g\ CH_4}{ton} * 27.9\right)\right] * \frac{1MT}{1{,}000{,}000g} = 827\ MTCO_2e$$

Source: NWCG 2018; calculations conducted by Ascent Environmental in 2022.

Figure 12 Sample Calculation for Estimating Carbon Dioxide Equivalent Emissions from Open Burning

3.4.10 Additional Community Inventory Greenhouse Gas Emissions Sources

Additional GHG emissions sources were evaluated for the County's community inventory. Importantly, these sources are not included in the total community GHG emissions for the inventory and will not be considered in the CCAAP; however, they have been included in this report as informational items to provide additional context for understanding emissions in the county. Details regarding GHG emissions from regulated stationary sources are discussed below.

PESTICIDE APPLICATION

Updates Since August 2022 Inventory Publication

Methyl bromide and sulfuryl fluoride are pesticides used for commodity fumigation and structural pest control, respectively. Data on the quantity of these pesticides applied in the county in 2019 was obtained from the California Department of Pesticide Regulation's (CDPR's) Pesticide Information Portal (CDPR 2024). These quantities were multiplied by their respective CARB emissions factors to calculate emissions for these sectors, as shown in Table 18 below. Pesticide-related emissions were not included in the previous publications of the unincorporated county GHG inventory. Pesticide use is regulated by CDPR and therefore, is not included in the unincorporated county's total GHG emissions. CDPR is responsible for reducing the emissions associated with the application of pesticides, including methyl bromide and sulfuryl fluoride. Emissions shown in Table 18 are informational only.

Table 18 2019 Monterey County Pesticide Application Data, Emissions Factors, and Sources

Pesticide	Quantity (metric tons)	Source	GWP	Source	GHG Emissions ($MTCO_2e$)
Methyl Bromide	1.073	CDPR	2.43	CARB	3
Sulfuryl Fluoride	19.015	CDPR	4,630	CARB	88,041

Notes: CARB = California Air Resources Board; CDPR = California Department of Pesticide Regulation; GHG = greenhouse gas; GWP = global warming potential; $MTCO_2e$ = metric tons of carbon dioxide equivalent.

Source: Calculations conducted by Ascent Environmental in 2024.

REGULATED STATIONARY SOURCES

GHG emissions are generated from a variety of regulated stationary sources operating within the county. As shown in Table 18 below, many facilities include two types of GHG emissions estimates: those considered "Covered" and those considered "Non-Covered." "Covered" emissions are those that are regulated by CARB under the California Greenhouse Gas Cap-and-Trade Program (Cap-and-Trade). "Non-Covered" emissions are associated with the facilities regulated under Cap-and-Trade but are separate from the allowance budget. Cap-and-Trade establishes an aggregate GHG allowance budget on covered entities and provides a trading mechanism for compliance instruments (allowance or offset credit). Facilities regulated under Cap-and-Trade may purchase allowances to emit GHG emissions from facilities that reduce GHG emissions (e.g., solar farms) or sell emission offset credits to regulated facilities that need to reduce their emissions to meet CARB's industry-wide emissions cap. Currently, CARB gives such allowances to facilities that emit more than 25,000 $MTCO_2e$ per year. These entities primarily involve heavy industrial activities that consume large amounts of natural gas and are eligible purchasers of Cap-and-Trade emissions allowances because the facility emits more than 25,000 $MTCO_2e$ per year. Due to the involvement of many facilities located in the county in Cap-and-Trade, the State, and not the County, is responsible for reducing emissions from this sector. For the purposes of developing the community inventory, emissions associated with Cap-and-Trade covered facilities, including the non-covered emissions, are excluded.

Table 19 2019 Monterey County GHG Emissions from Regulated Stationary Sources

Facility Name	Industry Description	Covered GHG Emissions ($MTCO_2e$)	Non-Covered GHG Emissions ($MTCO_2e$)	Total GHG Emissions ($MTCO_2e$)
Aera Energy Coastal Basins	Crude Petroleum and Natural Gas Extraction	405,706	1,501	407,207
Chevron AAPG 740 Coastal Basin	Crude Petroleum and Natural Gas Extraction	229,859	2,128	231,988
Dynegy Moss Landing, LLC	Fossil Fuel Electric Power Generation	1,940,437	0	1,940,437
Eagle Petroleum - Lynch Canyon Field	Crude Petroleum and Natural Gas Extraction	27,871	409	28,280

Facility Name	Industry Description	Covered GHG Emissions ($MTCO_2e$)	Non-Covered GHG Emissions ($MTCO_2e$)	Total GHG Emissions ($MTCO_2e$)
Lhoist North America - Natividad Plant	Lime Manufacturing	82,662	13	82,675
Matsui Nursery, Inc.	Floriculture Production	0	12,803	12,803
Monterey Regional Waste Management District	Solid Waste Landfill	0	16,984	16,984
Salinas River Cogeneration Facility	Fossil Fuel Electric Power Generation	221,314	0	221,314
Total	**NA**	**2,907,849**	**33,838**	**2,941,688**

Notes: Totals may not sum exactly due to independent rounding. GHG = greenhouse gases; $MTCO_2e$ = metric tons of carbon dioxide equivalent; NA = not applicable.

Source: Data obtained from CARB; compiled by Ascent Environmental in 2022.

OIL AND GAS

Similar to the Cap-and-Trade covered facilities discussed above, the oil and gas sector is highly regulated by the State. The Greenhouse Gas Emission Standards for Crude Oil and Natural Gas Facilities (Methane Regulation) adopted by CARB in 2017 aims to reduce fugitive and vented emissions of methane from new and existing oil and gas facilities. The Methane Regulation established uniform control requirements for methane sources, including those from oil and gas facilities. Additionally, the County's GHG inventory follows the Community Protocol, which recommends that local agencies report on "GHG activities and sources over which [the] local government has significant influence" (ICLEI 2019:20). Because the County has limited authority over existing oil and well facilities, and the fact these facilities are highly regulated by the State, this sector is excluded from the inventory total. The data below is provided for informational purposes only. It should also be noted that there is likely overlap between the emissions data in this section and the stationary sources data presented in the previous section. Because the emissions estimates provided in this Oil and Gas section were calculated by the project team, they cannot be separated from the stationary source entities listed in Table 18 above. Regardless, both the stationary sources and oil and gas sectors will not be included in the countywide inventory nor will these sectors be included in the CCAAP due to the highly regulated nature of both sectors.

Based on modeling conducted, emissions from the oil and gas sector accounted for approximately 83,245 $MTCO_2e$ in 2019. Emissions from oil and gas are associated with the onsite combustion of fossil fuels (e.g., diesel, crude oil byproducts) as well as fugitive (i.e., "leaked") emissions resulting from the processing and extraction of oil and gas. Onsite fuel combustion accounted for approximately 20 percent of emissions from this sector, and fugitive emissions contributed approximately 80 percent of emissions. The county's oil and gas emissions in 2019 are summarized in Table 20, and additional details and information about this sector are included below.

Table 20 2019 Monterey County Oil and Gas GHG Emissions

Source	GHG Emissions ($MTCO_2e$)
Onsite Fuel Combustion	16,402
Fugitive Emissions	66,843
Total	**83,245**

Notes: Totals may not sum exactly due to independent rounding. $MTCO_2e$ = metric tons of carbon dioxide equivalent.

Source: Calculations conducted by Ascent Environmental in 2022.

Onsite Fuel Combustion

According to CARB, onsite fuel combustion emissions included in CARB's California GHG Emission Inventory consist of GHG emissions generated by equipment burning fuel for energy. To estimate the county's emissions from this sector, statewide oil and gas production data by county obtained from the California Department of Conservation were used to calculate the county's proportion of production for various types of oil and gas operations in the state. These proportions were applied to statewide oil and gas emissions data available from CARB's California GHG

Emission Inventory to scale emissions to the county. This inventory does not include emissions related to the combustion of products sold by the oil and gas producers, such as vehicular fuels or other petroleum products, nor does the inventory include supply chain-related emissions, such as the transport of oil via rail or maritime tankers.

Fugitive Emissions

Fugitive emissions, or unintentional releases of vapors to the atmosphere, from oil and gas operations are typically attributed to equipment leaks, process venting, evaporation losses, disposal of waste gas streams (e.g., by flaring), and accidents or equipment failures. Fugitive emissions were estimated using the same methods described above for onsite fuel combustion.

4 SUMMARY OF INVENTORY RESULTS

4.1 2019 COMMUNITY INVENTORY

Based on the modeling conducted, community activities in the county generated 1,235,855 $MTCO_2e$ in 2019. The largest emissions-generating sectors include on-road transportation, agriculture, and nonresidential building energy. The 2019 inventory will be the County's GHG emissions baseline for the CCAAP and will be used to forecast emissions and set emissions reductions targets. Table 21 and Figure 13 present the results of the County's 2019 community GHG emissions inventory by sector. Descriptions of each emissions sector, including key sources of emissions, are provided in further detail above in Section 3, "Data, Methods, and Assumptions."

Table 21 2019 Monterey County Community GHG Emissions Inventory

Sector	GHG Emissions ($MTCO_2e$)	Percent of Total
On-Road Transportation	479,174	39%
Agriculture	401,367	32%
Nonresidential Building Energy	170,639	14%
Residential Building Energy	81,750	7%
Solid Waste	69,724	6%
Off-Road Vehicles and Equipment	17,616	1%
Wastewater Treatment	15,586	1%
Water Supply[1]	0	0%
Total	**1,235,855**	**100%**

Notes: Totals may not sum exactly due to independent rounding. GHG = greenhouse gases; $MTCO_2e$ = metric tons of carbon dioxide equivalent; NA = not applicable.

1 Water supply emissions are estimated to be 0 $MTCO_2e$ because electricity consumption associated with extraction, conveyance, treatment, and distribution are captured in the building energy sectors (both residential and nonresidential).

Source: Calculated by Ascent Environmental in 2024.

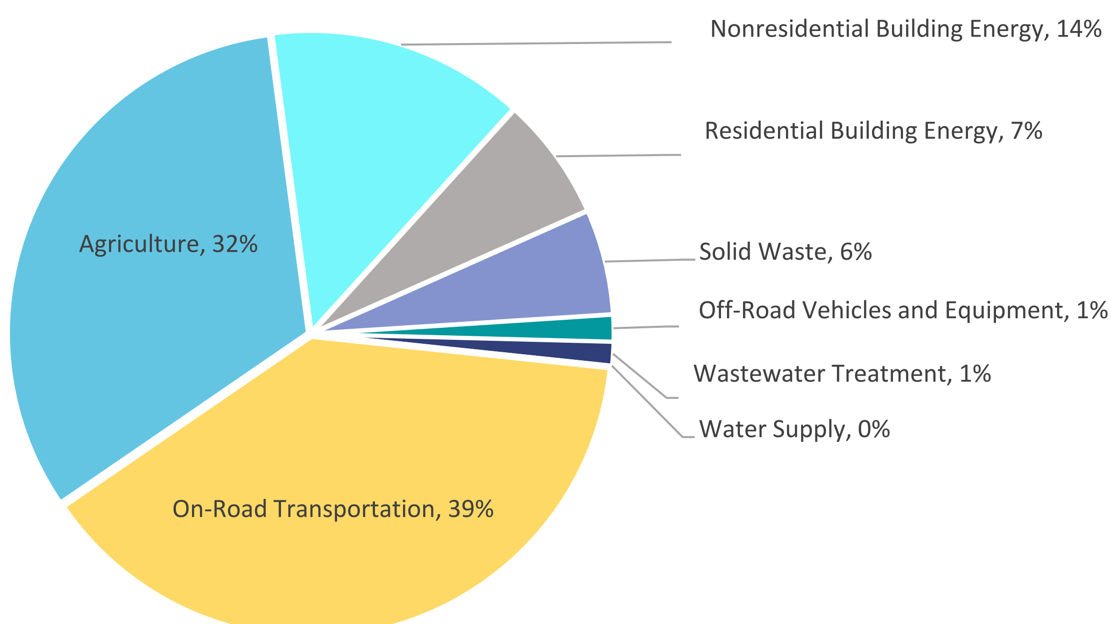

Figure 13 2019 Monterey County Community GHG Emissions Inventory

Note: GHG = Greenhouse gas.

Source: Data modeled by Ascent in 2024.

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Appendix A

GHG Inventory

Data and Calculations

MT CO2e results, by sector and subsector

Total:	1,235,855

Sector	Subsector	Utility	Detail (utility only)	2019
Building Energy	Electricity	PG&E	Residential	1,158
Building Energy	Electricity	PG&E	Non-Residential	142
Building Energy	Electricity	3CE	Residential	979
Building Energy	Electricity	3CE	Non-Residential	3,789
Building Energy	Natural Gas	PG&E	Residential	79,613
Building Energy	Natural Gas	PG&E	Non-Residential	166,526
Building Energy	Diesel	NA	Backup Generator	169
Building Energy	LPG	NA	Backup Generator	13
Building Energy	Natural Gas	NA	Backup Generator	0
On-Road Transportation	On-Road Transportation			479,174
Agriculture	Agricultural Offroad			61,564
Agriculture	Livestock			106,512
Agriculture	Open Burning			827
Agriculture	Fertilizer Application			204,598
Agriculture	Pesticide Application (including fumigation)			0
Agriculture	Irrigation Pumps			27,866
Off-Road	Airport Ground Support			215
Off-Road	Commercial Harbor Craft			4,018
Off-Road	Construction and Mining			5,136
Off-Road	Entertainment Equipment			58
Off-Road	Industrial			1,860
Off-Road	Lawn and Garden Equipment			637
Off-Road	Light Commercial Equipment			1,466
Off-Road	Pleasure Craft			1,206
Off-Road	Portable Equipment			622
Off-Road	Railyard Operations			394
Off-Road	Recreational Equipment			113
Off-Road	Transport Refrigeration Units			1,891
Wastewater	WWTP			3,749
Wastewater	Septic System			11,837
Waste Generation	Waste Generation			69,724
Water Supply	Water Supply			0

Building Energy

Year	Emissions Sector	Calculation Sector	Fuel Type	Utility (if applicable)	Sub-Sector	Fuel Use	Unit	Notes	Energy Use (kBTU)	MT CO2	MT CH4	MT N2O	MT CO2e
2019	Building Energy	Building Energy	Electricity	PG&E	Residential	12,721,900	kWh	Data for PG&E and 3CE provided by AMBAG.	43,408,923	1,146	0	0	1,158
2019	Building Energy	Building Energy	Electricity	PG&E	Non-Residential	1,555,799	kWh	Data provided by AMBAG. Some data may be excluded due to 15/15 Rule. Assumed to be de minimis and that all nonresidential electricity was supplied by 3CE.	5,308,606	140	0	0	142
2019	Building Energy	Building Energy	Electricity	3CE	Residential	183,797,633	kWh	Data for PG&E and 3CE provided by AMBAG.	627,143,527	833	2	0	979
2019	Building Energy	Building Energy	Electricity	3CE	Non-Residential	711,294,813	kWh	Data for PG&E and 3CE provided by AMBAG.	2,427,038,536	3,223	9	1	3,789
2019	Building Energy	Building Energy	Natural Gas	PG&E	Residential	14,959,603	therm	Data provided by PG&E.	1,495,603,132	79,376	7	0	79,613
2019	Building Energy	Building Energy	Natural Gas	PG&E	Non-Residential	31,290,974	therm	Data provided by PG&E. Industrial natural gas usage in 2019 was excluded due to 15/15 Rule. Alternative method used: calculated percent change in nonresidential consumption in entire county for 2013-2019 using CEC data. Applied this percent change to unincorporated county consumption in 2013 provided by PG&E (which includes industrial and commercial) to estimate total nonresidential consumption in 2019.	3,128,350,357	166,030	15	0	166,526
2019	Building Energy	Building Energy	Diesel	NA	Backup Generator	16,536	gal	Data provided by MBARD.	2,283,482	169	0	0	169
2019	Building Energy	Building Energy	LPG	NA	Backup Generator	81,409	scf	Data provided by MBARD.	204,825	13	0	0	13
2019	Building Energy	Building Energy	Natural Gas	NA	Backup Generator	7,585	scf	Data provided by MBARD.	7,782	0	0	0	0

On-Road Transportation

Year	Emissions Sector	Calculation Sector	Sub-Sector	EMFAC Categories	Annual VMT	Notes	g CO_2 per mi	g CH_4 per mi	g N_2O per mi	MT CO_2	MT CH_4	MT N_2O	MT CO_2e
2019	On-Road	On-Road	Countywide	All Other Buses, LDA, LDT1, LDT2, LHD1, LHD2, MCY, MDV, MH, Motor Coach, OBUS, PTO, SBUS, T6 CAIRP heavy, T6 CAIRP small, T6 instate construction heavy, T6 instate construction small, T6 instate heavy, T6 instate small, T6 OOS heavy, T6 OOS small, T6 Public, T6 utility, T6TS, T7 Ag, T7 CAIRP, T7 CAIRP construction, T7 NNOOS, T7 NOOS, T7 POAK, T7 Public, T7 Single, T7 single construction, T7 SWCV, T7 tractor, T7 tractor construction, T7 utility, T7IS, UBUS	1,050,848,408	Countywide VMT and emissions factor data for Monterey County, including incorporated areas, were obtained from CARB's EMFAC2021 model. Unincorporated county VMT was estimated using the proportion of households in the unincorporated county compared to the entire county. Households data were obtained from the CA Department of Finance.	446.92	0.0277	0.0304	469,641.23	29.11	31.94	479,174

Off-Road Vehicles and Equipment

Year	Emissions Sector	Calculation Sector	Sub-Sector	Jurisdiction Scaling Method	Jurisdiction Scaling Factor	Notes	CO2 (tons/day)	CH4 (tons/day)	N2O (tons/day)	MT CO2	MT CH4	MT N2O	MT CO2e
2019	Agriculture	OffRoad Equipment	Agricultural Offroad	None	1	Source: CARB's OFFROAD2007 and OFFROAD2021	184.8707366	1.35E-02	2.01E-03	167.7119592	1.23E-02	1.83E-03	61,564
2019	Off-Road	OffRoad Equipment	Airport Ground Support	Population	0.241919611	Source: CARB's OFFROAD2007 and OFFROAD2021	0.633939416	6.26E-05	4.42E-05	0.575100329	5.68E-05	4.01E-05	215
2019	Off-Road	OffRoad Equipment	Commercial Harbor Craft	Employment	0.247997207	Source: CARB's OFFROAD2007 and OFFROAD2021	11.6856033	3.60E-03	1.25E-03	10.60100403	3.27E-03	1.13E-03	4,018
2019	Off-Road	OffRoad Equipment	Construction and Mining	Service Population	0.244064784	Source: CARB's OFFROAD2007 and OFFROAD2021	15.44563111	1.16E-03	8.36E-05	14.01204486	1.05E-03	7.58E-05	5,136
2019	Off-Road	OffRoad Equipment	Entertainment Equipment	Employment	0.247997207	Source: CARB's OFFROAD2007 and OFFROAD2021	0.174090931	6.51E-06	0.00E+00	0.157932681	5.91E-06	0.00E+00	58
2019	Off-Road	OffRoad Equipment	Industrial	Employment	0.247997207	Source: CARB's OFFROAD2007 and OFFROAD2021	5.487526369	1.60E-03	3.02E-04	4.97820161	1.45E-03	2.74E-04	1,860
2019	Off-Road	OffRoad Equipment	Lawn and Garden Equipment	Population	0.241919611	Source: CARB's OFFROAD2007 and OFFROAD2021	1.579436095	2.33E-03	1.02E-03	1.432840734	2.11E-03	9.22E-04	637
2019	Off-Road	OffRoad Equipment	Light Commercial Equipment	Employment	0.247997207	Source: CARB's OFFROAD2007 and OFFROAD2021	4.213478401	1.02E-03	6.63E-04	3.822404403	9.22E-04	6.02E-04	1,466
2019	Off-Road	OffRoad Equipment	Pleasure Craft	Population	0.241919611	Source: CARB's OFFROAD2007 and OFFROAD2021	3.373348701	2.41E-03	7.24E-04	3.060251341	2.19E-03	6.57E-04	1,206
2019	Off-Road	OffRoad Equipment	Portable Equipment	Employment	0.247997207	Source: CARB's OFFROAD2007 and OFFROAD2021	1.808448578	5.57E-04	1.93E-04	1.640597423	5.05E-04	1.75E-04	622
2019	Off-Road	OffRoad Equipment	Railyard Operations	Employment	0.247997207	Source: CARB's OFFROAD2007 and OFFROAD2021	1.188524893	6.44E-05	0.00E+00	1.078211955	5.85E-05	0.00E+00	394
2019	Off-Road	OffRoad Equipment	Recreational Equipment	Population	0.241919611	Source: CARB's OFFROAD2007 and OFFROAD2021	0.242049708	6.88E-04	2.95E-04	0.219583864	6.24E-04	2.67E-04	113
2019	Off-Road	OffRoad Equipment	Transport Refrigeration Units	Service Population	0.244064784	Source: CARB's OFFROAD2007 and OFFROAD2021	5.686242309	4.21E-04	3.66E-05	5.158473729	3.82E-04	3.32E-05	1,891

Agriculture - Livestock

Year	Emissions Sector	Sub-Sector	Livestock Type	Heads	Percent on Pasture	Months Per Year	Enteric Fermentation Factor (kg CH4/head)	Manure Management (kg CH4/head)	Manure Management (kg N2O/head)	Notes	MT CO2	MT CH4	MT N2O	MT CO2e
2019	Agriculture	Livestock	Calves	9,601	100	8.5	10.7	0.56	0.00	Livestock heads and months per year (in Monterey County) data were developed based on information from the 2019 Monterey County Crop Report, Monterey County Agricultural Commissioner's Office, and Devii Rao at UCANR. Emissions factors were derived using CARB's 2019 California GHG Emission Inventory and reflect data for pasture-raised livestock only (not dairy or feedlot livestock).	-	76.81	-	2,143
2019	Agriculture	Livestock	Replacements (0-12 months)	1,694	100	12	61.22	0.56	0.00	Livestock heads and months per year (in Monterey County) data were developed based on information from the 2019 Monterey County Crop Report, Monterey County Agricultural Commissioner's Office, and Devii Rao at UCANR. Emissions factors were derived using CARB's 2019 California GHG Emission Inventory and reflect data for pasture-raised livestock only (not dairy or feedlot livestock).	-	104.68	-	2,921
2019	Agriculture	Livestock	Replacements (12-24 months)	1,694	100	12	70.56	0.56	0.00	Livestock heads and months per year (in Monterey County) data were developed based on information from the 2019 Monterey County Crop Report, Monterey County Agricultural Commissioner's Office, and Devii Rao at UCANR. Emissions factors were derived using CARB's 2019 California GHG Emission Inventory and reflect data for pasture-raised livestock only (not dairy or feedlot livestock).	-	120.50	-	3,362
2019	Agriculture	Livestock	Cattle	12,010	100	12	95.45	3.19	0.00	Livestock heads and months per year (in Monterey County) data were developed based on information from the 2019 Monterey County Crop Report, Monterey County Agricultural Commissioner's Office, and Devii Rao at UCANR. Emissions factors were derived using CARB's 2019 California GHG Emission Inventory and reflect data for pasture-raised livestock only (not dairy or feedlot livestock).	-	1,184.64	-	33,052
2019	Agriculture	Livestock	Bulls	601	100	12	98.69	3.30	0.00	Livestock heads and months per year (in Monterey County) data were developed based on information from the 2019 Monterey County Crop Report, Monterey County Agricultural Commissioner's Office, and Devii Rao at UCANR. Emissions factors were derived using CARB's 2019 California GHG Emission Inventory and reflect data for pasture-raised livestock only (not dairy or feedlot livestock).	-	61.25	-	1,709
2019	Agriculture	Livestock	Stockers	60,400	100	7	59.50	1.948	0.00	Livestock heads data were developed based on information from the 2019 Monterey County Crop Report, Monterey County Agricultural Commissioner's Office, and Devii Rao at UCANR. Emissions factors were derived from CARB's 2019 California GHG Emission Inventory and reflect data for pasture-raised livestock only (not dairy or feedlot livestock).	-	2,164.97	-	60,403
2019	Agriculture	Livestock	Sheep and Lambs	1,200		12	8.00	0.70	0.40	Livestock heads data were obtained from the 2019 Monterey County Crop Report and Agricultural Commissioner's Office. Emissions factors were derived using CARB's 2019 California GHG Emission Inventory.	-	10.45	0.48	423
2019	Agriculture	Livestock	Goats	912		12	5.00	0.37	0.37	Livestock heads data were obtained from USDA's 2017 Census of Agriculture. Emissions factors were derived using CARB's 2019 California GHG Emission Inventory.	-	4.90	0.34	230
2019	Agriculture	Livestock	Hogs	1,600		12	1.50	16.22	0.10	Livestock heads data were obtained from the 2019 Monterey County Crop Report and Agricultural Commissioner's Office. Emissions factors were derived using CARB's 2019 California GHG Emission Inventory.	-	28.35	0.16	834
2019	Agriculture	Livestock	Poultry	2,229		12	0.00	0.10	0.02	Livestock heads data were obtained from USDA's 2017 Census of Agriculture. Emissions factors were derived using CARB's 2019 California GHG Emission Inventory.	-	0.21	0.05	21
2019	Agriculture	Livestock	Horses	1,475		12	18.00	3.29	1.34	Livestock heads data were obtained from USDA's 2017 Census of Agriculture. Emissions factors were derived using CARB's 2019 California GHG Emission Inventory.	-	31.40	1.98	1,416

Agriculture - Other

Year	Emissions Sector	Sub-Sector	Activity	Activity Level	Units	g CO_2 per Unit	g CH_4 per Unit	g N_2O per Unit	Notes	MT CO_2	MT CH_4	MT N_2O	MT CO_2e
2019	Agriculture	Open Burning	All Vegetative Burning	497	tons	1,454,670	7,530		*MBARD*	722.86	3.74	-	827
2019	Agriculture	Fertilizer Application	Lime	20,768	tons	398,886			*CDFA 2019 Fertilizer Tonnage Report (https://www.cdfa.ca.gov/is/ffldrs/pdfs/2019_Tonnage.pdf) (All Nitrogen)*	8,284.07	-	-	8,284
2019	Agriculture	Fertilizer Application	Nitrogen - Organic	5,551	tons			14,253	*Central Coast Regional Water Quality Control Board*	-	-	79.13	21,601
2019	Agriculture	Fertilizer Application	Nitrogen - Synthetic	66,059	tons			9,688	*Central Coast Regional Water Quality Control Board*	-	-	639.97	174,713
2019	Agriculture	Pesticide Application (including fumigation)	Methyl Bromide (CH_3Br)	2,365	pounds	1,102			*CDPR CALPIP 2019 Pesticide Report.* ***Not included in inventory total.***	2.61	-	-	3
2019	Agriculture	Pesticide Application (including fumigation)	Sulfuryl Fluoride (SO_2F_2)	41,922	pounds	2,100,131			*CDPR CALPIP 2019 Pesticide Report.* ***Not included in inventory total.***	88,041.43	-	-	88,041
2019	Agriculture	Irrigation Pumps	Diesel Irrigation Pumps	446	number of pumps				*County provided number of diesel agricultural pumps. Used 2006 CARB study to estimate emissions.*	27,866.12	-	-	27,866

Water

Note: emissions from water are zero because all the water is sourced from inside the county and those electricity-related emissions are accounted for in the building energy sector.

Year	Emissions Sector	Sub-Sector	Water District/Provider	Location	Extraction and Conveyance	Treatment	Water Use (AF/year)	Percent of Source Inside Jurisdiction	Utility (if applicable)	Notes	Fuel Use	Unit	Energy Use (kBTU)	MT CO2	MT CH4	MT N2O	MT CO2e
2019	Water	Water	Local Groundwater	Central Coast	Groundwater	Conventional Potable Treatment	475,000	100%	PG&E	*From the County website: "An estimated 95 percent of water used in Monterey County is extracted by wells from groundwater aquifers. With nearly 200,000 acres of land under cultivation in the Salinas Valley, total water pumped in the valley is approximately 500,000 acre-feet per year, of which about 450,000 acre-feet are used for agriculture." Based on other sources, assuming the remaining 5% is sourced from local surface waters. https://www.co.monterey.ca.us/government/government-links/water-resources-agency-old/programs/groundwater-level-monitoring/overview#wra From the Greater Monterey County IRWM Plan: the Greater Monterey County IRWM region receives no "imported" water (except for Salinas River water that originates in San Luis Obispo County). According to the 2015 MCWRA Ground Water Extraction Data Summary Report, total groundwater pumping from the Salinas Valley Groundwater Basin in the 2015 reporting year was 514,714 acre feet.*	-	kWh	-	-	-	-	-
2019	Water	Water	Surface Water	Central Coast	State Water Project	Conventional Potable Treatment	25,000	100%	PG&E	*From the County website: "An estimated 95 percent of water used in Monterey County is extracted by wells from groundwater aquifers. With nearly 200,000 acres of land under cultivation in the Salinas Valley, total water pumped in the valley is approximately 500,000 acre-feet per year, of which about 450,000 acre-feet are used for agriculture." Based on other sources, assuming the remaining 5% is sourced from local surface waters. https://www.co.monterey.ca.us/government/government-links/water-resources-agency-old/programs/groundwater-level-monitoring/overview#wra From the Greater Monterey County IRWM Plan: the Greater Monterey County IRWM region receives no "imported" water (except for Salinas River water that originates in San Luis Obispo County). According to the 2015 MCWRA Ground Water Extraction Data Summary Report, total groundwater pumping from the Salinas Valley Groundwater Basin in the 2015 reporting year was 514,714 acre feet.*	-	kWh	-	-	-	-	-

Wastewater Process Emissions

Year	Emissions Sector	Sub-Sector	WWTP Name	WWTP Process	WW Equation
2019	Wastewater	WWTP	Monterey One Water	Combustion of digester gas	WW.1.a
2019	Wastewater	WWTP	Monterey One Water	Combustion of digester gas	WW.2.a
2019	Wastewater	WWTP	Monterey One Water	Process Methane Emissions from Wastewater Treatment Lagoons (population method)	WW.6 (alt)
2019	Wastewater	WWTP	Monterey One Water	Process Nitrous Oxide Emissions from Wastewater Treatment Plants without Nitrification or Denitrification	WW.8
2019	Wastewater	Septic System	Septic Systems	Fugitive Methane Emissions from Septic Systems (population method)	WW.11(alt)
2019	Wastewater	WWTP	Monterey One Water	Fugitive Nitrous Oxide Emissions from Effluent Discharge	WW.12
2019	Wastewater	WWTP	Monterey One Water	Energy-related Emissions Associated with Wastewater Collection and Treatment	WW.15

WW Equation	Digester Gas (ft3/day)	Fraction of CH4 in Biogas	Population Served	BTU Content of biogas	Mass of incinerated biosolids	FP	BOD5 Load (kg BOD5/day)	N Load (kg N/day)	Methanol Load (MT CH3OH/day)	Sludge Treatment Type	F_ind-com	EF_effluent	N uptake	Natural Gas (therms)	Electricity (kWh)	Utility (if applica
WW.1.a	12,160	60%														
WW.2.a	12,160	60%														
WW.6 (alt)			8,422								1.25					
WW.8			8,422								1.25					
WW.11(alt)			97,775													
WW.12								1,560				0.0025				
WW.15																

WW Equation	Notes	MT CO2	MT CH4	MT N2O	MT CO2e
WW.1.a	Source: Data provided by M1W.	-	0.009	-	0.24
WW.2.a	Source: Data provided by M1W.	-	-	0.00173	0.47
WW.6 (alt)	Source: Data provided by M1W.	-	112.125	-	3,128.29
WW.8	Source: Data provided by M1W.	-	-	0.03	9.20
WW.11(alt)	Source: Number of OWTS provided by the County.	-	424.262	-	11,836.92
WW.12	Source: Data provided by M1W.	-	-	2.24	611.17
WW.15		-	-	-	-

WW Equation	WW.1.a	WW.1.b	WW.1.(alt)	WW.2.a	WW.2.b	WW.2.(alt)	WW.4	WW.5	WW.6	WW.6 (alt)	WW.7	WW.8	WW.9	WW.11	WW.11(alt)	WW.12	WW.12(alt)	WW.15	WW.152	WW.153
WW.1.a	0.01																			
WW.2.a				0.00																
WW.6 (alt)										112.13										
WW.8												0.03								
WW.11(alt)															424.26					
WW.12																2.24				
WW.15																		0.00E+00	0.00E+00	0.00E+00

Waste Generation

Year	Emissions Sector	Sub-Sector	Landfill Name	Annual Waste Tonnage Delivered from Jurisdiction	Annual ADC Tonnage Delivered from Jurisdiction	Percent of year under LFG collection	LFG Collection Efficiency	Oxidation Rate	Notes	MT CO2	MT CH4	MT N2O	MT CO2e
2019	Solid Waste	Waste Generation	Community-Generated Solid Waste Disposed of Outside Jurisdiction	8,713	0	100%	75%	10%	Source: CalRecycle 2021. (https://www2.calrecycle.ca.gov/LGCentral/DisposalReporting/Destination/DisposalByFacility)		117.63		3,282
2019	Solid Waste	Waste Generation	Community-Generated Solid Waste Disposed of Inside Jurisdiction	163,801	12,601	100%	75%	10%	Source: CalRecycle 2021. (https://www2.calrecycle.ca.gov/LGCentral/DisposalReporting/Destination/DisposalByFacility)		2,381.43		66,442

Demographics

County of Monterey Greenhouse Gas Inventory and Forecasts

	Population						Employment						Service Population					
Subarea	**2015**	**2019**	**2020**	**2030**	**2040**	**2045**	**2015**	**2019**	**2020**	**2030**	**2040**	**2045**	**2015**	**2019**	**2020**	**2030**	**2040**	**2045**
Unincorporated County	104,009	106,197	106,744	109,976	110,277	110,326	55,762	59,387	60,293	61,553	63,396	64,395	159,771	165,584	167,037	171,529	173,673	174,721
Total County	430,310	438,976	441,143	467,068	483,884	491,443	225,268	239,466	243,015	249,613	258,553	263,437	655,578	678,442	684,158	716,681	742,437	754,880

Source: AMBAG 2022 Subregional Population and Employment Growth Forecasts

	Population						Employment						Service Population					
Growth Rates	**2015**	**2019**	**2020**	**2030**	**2040**	**2045**	**2015**	**2019**	**2020**	**2030**	**2040**	**2045**	**2015**	**2019**	**2020**	**2030**	**2040**	**2045**
Percent Growth from 2019	NA	0	0.52%	3.56%	3.84%	3.89%	NA	0.00%	1.53%	3.65%	6.75%	8.43%	NA	0.00%	0.88%	3.59%	4.89%	5.52%
Percent of Total County	24.17%	24.19%	24.20%	23.55%	22.79%	22.45%	24.75%	24.80%	24.81%	24.66%	24.52%	24.44%	24.37%	24.41%	24.41%	23.93%	23.39%	23.15%

Assumptions and Emission Factors

Conversion Factors	Value	Source/notes
g/MT	1000000	
g/ton	907184.74	
g/lb	453.592	
lb/ton	2000	
lb/MT	2204.622622	
kg/MT	1000	
lb/kg	2.20462	
MT/ton	0.907185	
kWh/MWh	1000	
MWh/GWh	1000	
Btu/therm	100000	
kBTU/MMBTU	1000	
MMBtu/therm	0.1	
MMBtu/MWh	3.41214148	Onlineconversion.com
gal/cubic foot	7.480519481	Onlineconversion.com
gal/Liter	3.785411784	Onlineconversion.com
Liter/gal	0.264172052	
gallon/acrefoot	325851.429	Onlineconversion.com
million gal/acre-feet	0.325851429	Onlineconversion.com
gal/barrel	42	Onlineconversion.com
kBTU/MJ	0.947817078	Onlineconversion.com
days/year	365.25	
therm/scf	0.01037	

Energy Type	KBTU	per Unit	
Electricity	3.41	kWh	Onlineconversion.com
Electricity	3412.14	MWh	
Natural Gas	99.98	therm	Onlineconversion.com
Natural Gas	1.03	scf	https://www.theclimateregistry.org/wp-content/uploads/2021/05/2021-Default-Emission-Factor-Document.pdf?mc_cid=4b45d12237&mc_eid=5f
CNG	99.98	therm	Onlineconversion.com
LPG	91.33	gal	
LPG	2.52	scf	https://www.theclimateregistry.org/wp-content/uploads/2021/05/2021-Default-Emission-Factor-Document.pdf?mc_cid=4b45d12237&mc_eid=5f
Propane	91.00	gal	
Diesel	138.10	gal	Calculated from Table 13.1 in 2017 Climate Registry Default Emission Factors
Gasoline	125.00	gal	Calculated from Table 13.1 in 2017 Climate Registry Default Emission Factors
Hydrogen	113.74	kg	
Renewable Diesel	122.88	gal	CARB LCFS Quarterly Summary April 2018 (129.65 MJ/gal)
Heating Oil	139.00	gal	https://www.engineeringtoolbox.com/energy-content-d_868.html
Fuel Wood	1000.00	MMBTU	
B2	137.90	gal	Calculated from Diesel and B100 energy densities, assuming 2 percent biodiesel
B5	137.60	gal	Calculated from Diesel and B100 energy densities, assuming 5 percent biodiesel
B20	136.10	gal	Calculated from Diesel and B100 energy densities, assuming 20 percent biodiesel
B100	128.10	gal	Calculated from Table 13.1 in 2017 Climate Registry Default Emission Factors

GWP Factors	Value	Comment				
CO2	1	Carbon Dioxide				included in CARB Inventory
CH4	27.9	Methane	Short Lived Climate Pollutant			included in CARB Inventory
N2O	273	Nitrous Oxide				included in CARB Inventory
SF6	22800	Sulphur Hexafluoride				included in CARB Inventory
NF3	17200	Nitrogen Trifluoride				included in CARB Inventory
C2F6	12200	Hexafluoroethane (PFC-116)				included in CARB Inventory
C3F8	8830	Octafluoropropane (PFC-218)				included in CARB Inventory
C4F8	10300	Octafluorocyclobutane (PFC-318)				included in CARB Inventory
CF4	7390	Tetrafluoromethane (PFC-14)				included in CARB Inventory
HFC-125	3500	Hydrofluorocarbon 125	Short Lived Climate Pollutant			included in CARB Inventory
HFC-134a	1430	Hydrofluorocarbon 134a	Short Lived Climate Pollutant			included in CARB Inventory
HFC-143a	4470	Hydrofluorocarbon 143a	Short Lived Climate Pollutant			included in CARB Inventory
HFC-152a	124	Hydrofluorocarbon 152a	Short Lived Climate Pollutant			included in CARB Inventory
HFC-227ea	3220	Hydrofluorocarbon 227ea	Short Lived Climate Pollutant			included in CARB Inventory
HFC-23	14800	Hydrofluorocarbon 23	Short Lived Climate Pollutant			included in CARB Inventory
HFC-236fa	9810	Hydrofluorocarbon 236fa				included in CARB Inventory
HFC-245fa	1030	Hydrofluorocarbon 245fa	Short Lived Climate Pollutant			included in CARB Inventory
HFC-32	675	Hydrofluorocarbon 32	Short Lived Climate Pollutant			included in CARB Inventory
HFC-365mfc	794	Hydrofluorocarbon 365mfc	Short Lived Climate Pollutant			included in CARB Inventory
HFC-43-10mee	1640	Hydrofluorocarbon 43-10mee	Short Lived Climate Pollutant			included in CARB Inventory

BC	900	Black Carbon		Short Lived Climate Pollutant		*CARB uses AR5 values.*		included in CARB Inventory
SO_2F_2	4630	Sulfuryl Fluoride		Short Lived Climate Pollutant (unofficial)				***Not in CARB Inventory***
CH_3Br	2.43	Methyl Bromide						***Not in CARB Inventory***
CFC-11	4660	Triflurochloromethane						***Not in CARB Inventory***
Source for GWP factors except for CH_4 and N_2O: https://ww2.arb.ca.gov/ghg-gwps (100-year IPCC AR4 GWP Values)								
Source	**CO_2 GWP**	**CH_4 GWP**	**N_2O GWP**					
IPCC Fourth Assessment Report (w/o climate carbon	1	25	265					
IPCC Fourth Assessment Report (with climate carbon	1	34	298					
IPCC Fourth Assessment Report (Avg)	1	25	298					
IPCC Fifth Assessment Report (Avg)	1	28	265					
IPCC Third Assessment Report	1	23	296					
IPCC Second Assessment Report	1	21	310					
IPCC Sixth Assessment Report	1	27.9	273	Source: https://www.ipcc.ch/report/ar6/wg1/downloads/report/IPCC_AR6_WGI_Chapter_07_Supplementary_Material.pdf				

Building Energy Efficiency Assumptions

Sector	% Reduction	Code	Notes	Source
Residential	25%	Energy efficiency improvement of 2013 code above 2008 code		http://www.energy.ca.gov/releases/2014_releases/2014-07-01_new_title24_s
	28%	Energy efficiency improvement of 2016 code above 2013 code	Lighting, heating, cooling, ventilation, and water heating	http://www.energy.ca.gov/title24/2016standards/rulemaking/documents/201
	53%	Energy efficiency improvement of 2019 code above 2016 code	Includes onsite solar requirement	
Commercial	30%	Energy efficiency improvement of 2013 code above 2008 code		http://www.energy.ca.gov/commission/accomplishments/2014_cec_accomplis
	5%	Energy efficiency improvement of 2016 code above 2013 code		http://www.energy.ca.gov/title24/2016standards/rulemaking/documents/201
	30%	Energy efficiency improvement of 2019 code above 2016 code		

Combined % Reduction from 2008 code	
Residential	75%
Non-Residential	53%

Change in Energy Consumption for 2022 Title 24 Compared to 2019 Title 24

Sector	Energy Type	Climate Zone	Adjustment Factor	Projected New	Climate Zone	Adjustment Factor	Projected New	Weighted Adjustment Factor
Residential - Single-Family	*Electricity*	*3*	*124.9%*	*336*	4	*121.9%*	*26*	
	Natural Gas	*3*	*60.7%*		4	*61.6%*		
Residential - Multifamily	*Electricity*	*3*	*103.3%*	*29*	4	*102.3%*	*2*	
	Natural Gas	*3*	*90.6%*		4	*91.5%*		
Residential - Weighted Avg (SF and MF)	Electricity	3	*123.2%*	365	4	120.5%	28	123.0%
	Natural Gas	3	*63.1%*		4	63.8%		63.1%
Nonresidential	Electricity	3	90.5%	787,400	4	90.5%	59,267	90.5%
	Natural Gas	3	89.0%		4	89.0%		89.0%

Agricultural Emission Factors

Activity

Lime Fertilizer

Emission Factor MT C/MT lime	0.12
Molecular Mass of CO2	44.01
Atomic Mass of C	12.01
Molecular Mass Ratio	3.66
g CO2 per Ton of Lime Applied	398,886.47

Source: IPCC 2006 Equation 11.12 and 11.13. Note, the IPCC 2019 Refinement did not update these equations or emission factor

Nitrogen Fertilizer

Nitrogen Volatilization (g N2O/g N)	0.0125	(IPCC 2019)= using direct, leaching, and volatilization
g N2O per ton of Nitrogen applied	17,819.70	
Organic Nitrogen Applied as Fertilizer (g N2O)/ton N)	14,253	https://ww2.arb.ca.gov/sites/default/files/ghg-inventory-doc/doc/docs3/3c4_agsoilmanagement_direct_fertilizernitrogen_organicfertilizers_n2o_2019.htm
Synthetic Nitrogen Applied as Fertilizer (g N2O)/ton N)	9,688	https://ww2.arb.ca.gov/sites/default/files/ghg-inventory-doc/doc/docs3/3c4_agsoilmanagement_direct_fertilizernitrogen_syntheticfertilizers_n2o_2019.htm

Source: CARB 2019 GHG Inventory Query Tool.

Open Burning

g CO2 per ton of open burning	1,454,669.54
g CH4 per ton of open burning	7,529.63

Source: Emission factors from National Wildfire Coordinating Group, 2018, Smoke Management Guide for Prescribed Fire

Diesel Irrigation Pumps

MBARD Emissions (CO2 tons/day) (CARB 2006)	122
MBARD Number of Pumps (CARB 2006)	647
MBARD Emission Factor (avg tpd/pump)	0.1886

Source: California Air Resources Board 2006. Rulemaking to Consider Proposed Amendments to the Stationary Diesel Engine Control Measure - Appendix D: Emission Inventory Methodology Agricultural Irrigation Pumps - Diesel. Available at: http://www.arb.ca.gov/regact/agen06/append.pdf. Table D-2

Waste Emission Factors

Table SW.5 CH_4 Yield for Solid Waste Components

Waste Component	Emissions Factor, EF_i (mt CH_4/wet short	Source
Mixed MSW*	0.06	U.S. EPA AP-42

* – Mixed MSW factor may be used for entire MSW waste stream if waste composition data is unavailable. U.S. EPA AP-42 – U.S. EPA Emission Factor Database, Chapter 2.4 Municipal Solid Waste Landfills (1998) WARM—Documentation for Greenhouse Gas Emissions and Energy Factors Used in the Waste Reduction Model (WARM) 2006					

Note: To use a custom waste emissions factor unique to the jurisdiction, calculate the factor separately using emission rates in EPA's WARM model, and waste characterization rates from CalRecycle. Then, replace the values above in the beige cells.

Waste Diversion Targets

Estimating Monterey County Stationary Source Emissions from Oil and Gas

		Monterey County Em
Main Activity	**Activity Subset**	**Monterey County Scaling Factor**
Fuel combustion	Associated gas	Associated Gas (Mcf)
Fuel combustion	Associated gas	Associated Gas (Mcf)
Fuel combustion	Associated gas	Associated Gas (Mcf)
Fuel combustion	Distillate	Oil Produced (bbls)**
Fuel combustion	Distillate	Oil Produced (bbls)**
Fuel combustion	Distillate	Oil Produced (bbls)**
Fuel combustion	Natural gas	Non Associated Gas (Mcf)
Fuel combustion	Natural gas	Non Associated Gas (Mcf)
Fuel combustion	Natural gas	Non Associated Gas (Mcf)
Fuel combustion	Residual fuel oil	Oil Produced (bbls)**
Fuel combustion	Residual fuel oil	Oil Produced (bbls)**
Fuel combustion	Residual fuel oil	Oil Produced (bbls)**
Fugitive emissions	NA	Overall production
Fugitive emissions	NA	Overall production
Fugitive emissions	NA	Overall production
Fugitive emissions	NA	Overall production
Fugitive emissions	NA	Overall production
Fugitive emissions	NA	Water Produced (bbls)

Notes: Assumes 2018 can be used as a proxy for 2019 (2019 data unavailable).
Scaled to Monterey County based on the county's proportion of production in the state.
Note that non-associated gases are generally natural gas. Associated gases are unwanted byproducts of crude oil productio

issions

County percent of state emissions	Monterey County Emissions (MMT)*	Monterey County Emissions (MT)*	Monterey County Emissions (MTCO2e)*
1%	2.24E-07	0.2	6.24
1%	1.46E-02	14,562	14,562.41
1%	2.24E-08	0.02	6.11
5%	7.39E-08	0.1	2.06
5%	1.82E-03	1,821.27	1,821.27
5%	1.48E-08	0.01	4.03
0%	0.00E+00	-	-
0%	0.00E+00	-	-
0%	0.00E+00	-	-
No Data	No Data	No Data	No Data
No Data	No Data	No Data	No Data
No Data	No Data	No Data	No Data
3%	1.74E-04	174	4,847.23
3%	5.20E-03	5,201	5,200.99
3%	1.48E-03	1,482	41,352.47
3%	9.96E-03	9,964	9,963.78
3%	1.79E-04	179	4,982.32
5%	1.78E-05	18	496.21
TOTAL	3.34E-02	33,401	**83,245**

n.